

LOWWOOD GUNPOWDER WORKS, HAVERTHWAITE, CUMBRIA

Archaeological Evaluation



Client: Lowwood Products
Company Ltd

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Contents

Illustrations.....	1
Non-Technical Summary	2
Acknowledgements.....	2
1. Introduction	3
2. Methodology	5
3. Desk-Based Assessment.....	8
4. Fieldwork Results.....	12
5. Discussion and Conclusion.....	23
6. Bibliography	25
Appendix 1: Project Brief	28
Appendix 2: Project Design	34
Appendix 3: Summary Context List	42
Appendix 4: Summary Finds List.....	44
Appendix 5: Environmental Samples.....	49

Illustrations

List of figures

Figure 1: Site location	4
Figure 2: Detail of trenches and features in Areas 1, 2, and 3	21
Figure 3: Detail of trench and features in Area 4.....	22

List of plates

Plate 1: Extract from the Ordnance Survey map of 1851 showing the area corresponding to Area 2 (above the word 'Low').....	10
Plate 2 (left): Upper sluice gate, viewed from the south-west	12
Plate 3 (right): Iron work, possibly piece of a rail vehicle at the north end of the leat	12
Plate 4: Iron valve in dumped material at the north end of the leat with washout sluice in the background	13
Plate 5 (left): Sluice gates at the power house	14
Plate 6 (right): Detail of sluice gates at the power house	14
Plate 7: Trench 2 following the removal of deposits 301 and 302, with the large slab in 302 left <i>in situ</i> . Viewed from the east	16
Plate 8: Pit 308 and timber as exposed in the enlarged sondage in Trench 2, with water beginning to fill the trench, viewed from the north	17
Plate 9 (left): South-east end of the north-east facing section in Trench 3 showing dumped deposits	18
Plate 10 (right): North-west end of the north-east facing section in Trench 3 showing dumped deposits	18

Non-Technical Summary

As part of the submission of a planning application to carry out improvements to the existing hydroelectric plant at the former Lowwood Gunpowder Works, Haverthwaite, Cumbria, Greenlane Archaeology was commissioned to carry out an archaeological evaluation of four areas thought most likely to be affected, in order to assess the nature and survival of any archaeological remains. Associated with this a desk-based assessment was also carried out and a site visit in order to identify what remains if any might be present in these areas and any constraints to the evaluation. In addition, a section of building in poor condition close to the location of a new access track was also recorded to mitigate against any damage being caused to it during the movement of plant and felling of trees necessary for the improvement works.

The desk-based assessment revealed that although the wider area has evidence for human activity since the end of the last Ice Age there is little evidence for activity on the site until the 17th century. It has a complex history during the post-medieval period, having been initially the site of a bloomsmithy established at the beginning of the 17th century, followed by an iron furnace, which operated during the latter part of the 18th century, before becoming a gunpowder works in 1799. This enterprise flourished and greatly expanded during the 19th century, before gradually declining in the early 20th and closing in the 1930s, after which it was used briefly by the military during World War II before being utilised as a hydroelectric plant from 1952 onwards. It is now a Scheduled Monument and was subject to an extensive survey by English Heritage in the early 21st century. The site visit did not reveal any particularly pertinent information, although a bottle dump of probable 20th century date was revealed, and it was evident that material had been dumped on part of the site since perhaps the 19th century.

In the event only three trenches were excavated out of an intended five; one of these combining two trenches, and one in an area which was not expected to be heavily disturbed having been left out. The trench in Area 2, adjacent to the bridlepath to the east of the main site, did not reveal any features at all, despite crossing the line of two possible walls. The trench in Area 3 revealed deep deposits of dumped material overlying a re-deposited soil, which in turn covered a large pit containing waterlogged material, copper nails, iron bolts and other objects, and window glass. Other features were also present in this trench, but the rising water level of the nearby leat meant that they could not be fully examined before the trench filled with flowing water. Area 4 comprised a thick deposit of dumped material, mainly slag, which is thought to have been brought from the Backbarrow ironworks site to the north.

The evaluation demonstrated that there is clearly potential for further remains to be present in Area 3, and as this part of the site will need to be excavated to considerable depth to facilitate the alterations to the leat further excavation is recommended. Elsewhere, the impact will be less significant, but it is still recommended that groundworks are monitored by watching brief in order to fully assess the affect on buried archaeological remains, and that the structure in Area 1 be protected during groundworks.

Acknowledgements

Greenlane Archaeology would like to thank the Lowwood Products Company Ltd for commissioning and supporting the project, in particular James Barratt. Thanks are also due to Andrew Davison, Inspector of Ancient Monuments/Team Leader at English Heritage North West Region, and John Hodgson, Senior Archaeology and Heritage Advisor at the Lake District National Park Authority, for their comments during the fieldwork. Further thanks are due to Katie Tuthill, Research Department Team Advisor at English Heritage, and Eleanor Kingston, Archaeology and Heritage Advisor at the Lake District National Park Authority, for providing background information relating to the site. Special thanks are due to David Clarke who drove the excavator on site, and to Graham Brooks of the Cumbria Industrial History Society for providing information about firebrick manufacturers.

The evaluation was carried out by Dan Elsworth and Tom Mace, who also produced the report, and the rectified photography by Jonathan Ratter (JWRC). The finds were examined by Jo Dawson, who also edited the report, and the waterlogged samples were assessed by Scott Timpany of Headland Archaeology. The project was managed by Dan Elsworth.

1. Introduction

1.1 Circumstances of the Project

1.1.1 Prior to the submission of a planning application by Lowwood Products Company Ltd (hereafter 'the client') for a proposed programme of improvements to an existing hydro-electric facility at the former Lowwood Gunpowder Works, Haverthwaite, Cumbria (centred on NGR 334708 483707) English Heritage (EH) and the Senior Archaeology and Heritage Advisor at the Lake District National Park Authority (LDNPA) were consulted. Almost the entire site of the former gunpowder works, which was established in the early 19th century although the site had been utilised as iron works until the end of the 18th century, is now a Scheduled Monument (No. 27805) and so is statutorily protected. Following a site visit by LDNPA and Greenlane Archaeology, a brief for the work was issued by LDNPA, which was approved by EH. The brief outlined that the archaeological work should comprise rapid desk-based assessment, site visit of the entire development site, recording of some standing building remains that may be affected, and the excavation of evaluation trenches in four areas (Hodgson 2010).

1.1.2 The site was subject to a detailed survey by English Heritage in 2004 (Jecock *et al* 2005), as part of a wider investigation into such monuments initiated in 1999. This established that, prior to the construction of the gunpowder works, the site is thought to have been the location of a bloomery forge in the 18th century, which was subsequently developed in the 18th century with the establishment of a blast furnace, which remained in operation until at least 1785. Soon after the site was re-used for the establishment of a gunpowder works, which began operating in 1799, and continued, albeit with several phases of modification, until the 1930s.

1.1.3 Prior to carrying out the evaluation, Scheduled Monument Consent for their excavation was applied for by Greenlane Archaeology. This was granted by English Heritage on 23rd June 2010.

1.2 Location, Geology, and Topography

1.2.1 The Lowwood gunpowder works site covers an area of approximately 10 hectares, although the area examined as part of the evaluation was restricted to the south end of the site (Figure 1), where the majority of groundworks associated with the proposed improvements to the hydroelectric plant will take place. The whole site is located on a terrace on the east side of the River Leven, at approximately 13m above sea level (Figure 1). It is a short distance from the A590 and the village of Haverthwaite, to its north-west, with the village of Backbarrow approximately 1km to its north-east (Figure 1). The nearest town is Ulverston, approximately 6km to the south-west.

1.2.2 The local solid geology comprises Bannisdale slates and Coniston gritstones (Moseley 1979, plate 1), which, within the gorge formed by the River Leven, is overlain by river gravels but with occasional exposed rock outcrops (Jecock *et al* 2005, 7-8).

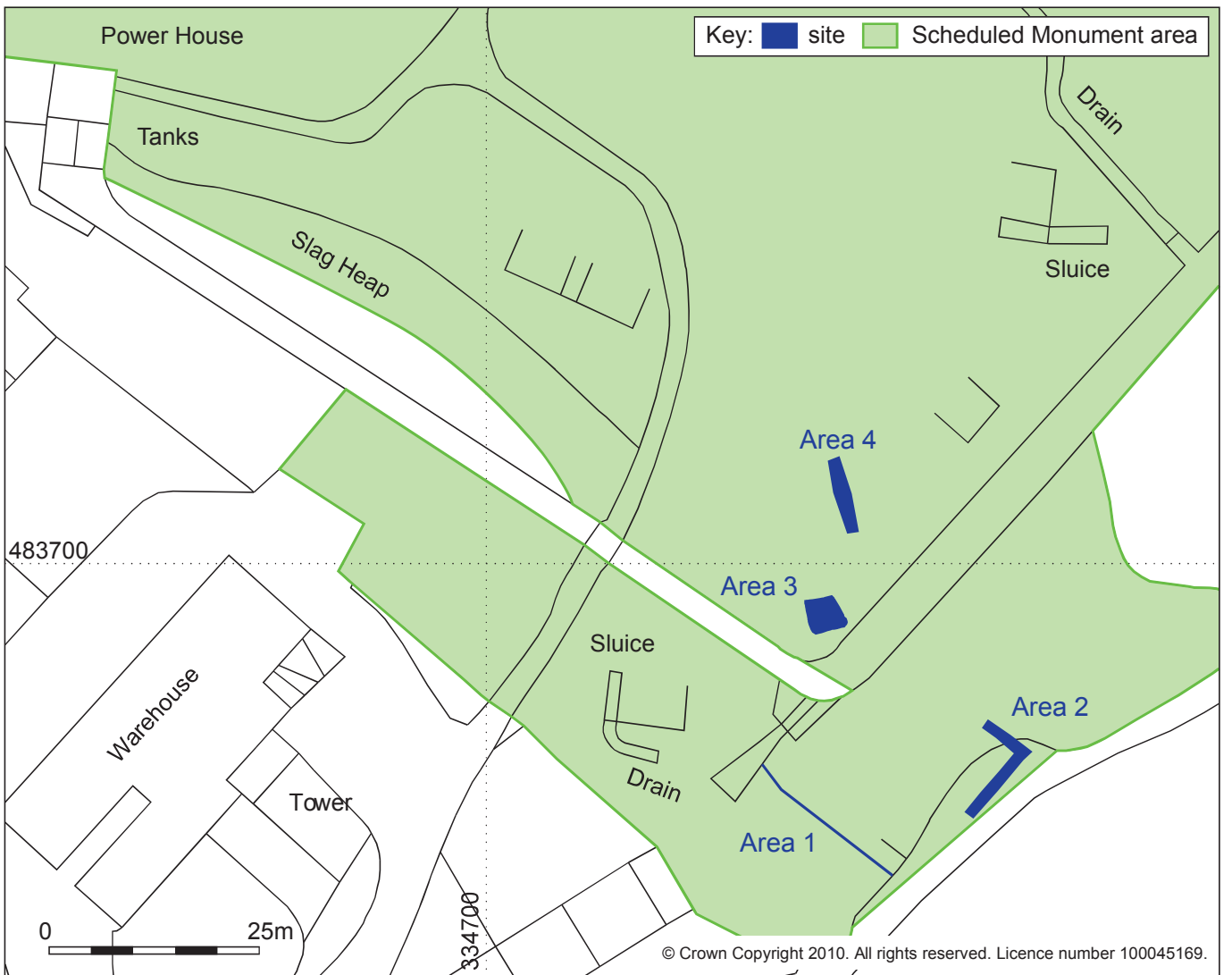
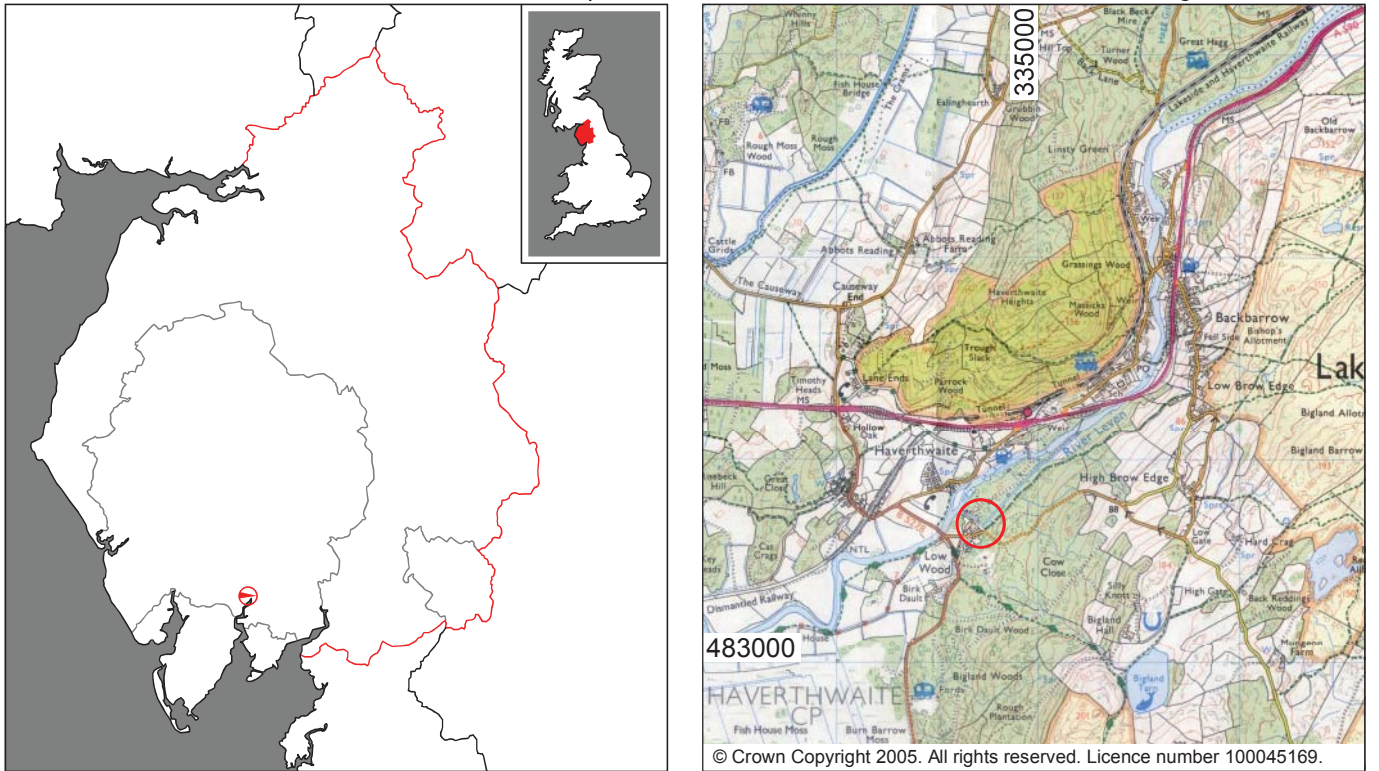


Figure 1: Site location

2. Methodology

2.1 Introduction

2.1.1 The project comprised an archaeological evaluation by trial trenching, the intention of which was to establish, where possible, whether any remains of archaeological significance are present on the site and their nature, degree of survival, extent, significance, and date. Prior to the evaluation being carried out a rapid desk-based assessment and a site visit were undertaken; the details of how all aspects of the work were carried out are outlined below, with the original scheme presented in the Project Design (*Appendix 2*).

2.1.2 All aspects of the project were carried out according to the standards and guidance of the Institute for Archaeologists (IfA 2008a, 2008b).

2.2 Desk-Based Assessment

2.2.1 This principally comprised an examination of early maps of the site, information from the Historic Environment Record, and published secondary sources, in particular the previous report by English Heritage (Jecock *et al* 2005), a copy of which was provided by the client. The intention of this element of the project was to assess the potential and nature of the deposits and finds likely to be encountered during the evaluation phase by referring to previous archaeological work carried out on the site, identify structures that might be present within the areas subject to evaluation trenching, and be able to place the results of the project in their local archaeological context. The following sources of information were used during the desk-based assessment:

- **Lake District National Park Historic Environment Record (HER):** this is a list of all the known sites of archaeological interest within the county, which is maintained by the Lake District National Park Authority and is the primary source of information for an investigation of this kind. All of the known sites of archaeological interest within 250m of the edges of the Scheduled Monument area were examined; each identified site comes with a grid reference, description and source and any additional information which was referenced was also examined as necessary. In addition, unpublished reports of archaeological of relevance to the site were examined;
- **Greenlane Archaeology Library:** additional secondary sources and copies of maps held by Greenlane Archaeology were also examined to provide information for the site background.

2.3 Site Visit

2.3.1 A site visit was carried out prior to the evaluation. This was principally in order to identify suitable locations for the evaluation trenches, but it also allowed an assessment of any constraints to the evaluation such as issues of health and safety or more recent activity that might have damaged below ground remains or features.

2.3.2 A systematic examination of the area likely to be affected by the proposed development was carried out, where practicable because of the local topography. This area essentially comprised the strip of land alongside the west side of the main north/south line of the leat, and the entire area around the east/west section of the leat (areas 3-5, see *Section 2.5* below), as well as an area to the south of the corner of the leat (comprising Areas 1 and 2, see *Section 2.4* below). In each area any features of archaeological interest were recorded using Greenlane Archaeology *pro forma* record sheets and digital photographs and located on a plan of the site.

2.4 Building Recording

2.4.1 Because of the unstable nature of the standing building remains in Area 1 and the risk of their collapse during the development due to the proximity of plant and need for tree felling in this area, the surviving section of wall (numbered building 20 on the English Heritage survey plans; Jecock *et al* 2005, figures 131-141) was recorded. This was carried out through rectified photography of the north-east

elevation based on a grid established across the wall, with an outline of the main features produced for reference by a reflectorless total station connected to a tablet computer operating AutoCAD software. The resulting photographs were then combined into a single image as a photomontage. The original photographs will be deposited with the archive as a permanent record of this elevation's appearance, should it need to be consolidated, repaired, or rebuilt.

2.5 Archaeological Evaluation

2.5.1 Initially it was intended to excavate five trenches; two in Area 2, one in Area 3, two in Area 4, and one in Area 5. Because of the topography in Area 4, the lack of likely ground disturbance during the proposed development in Area 5, and the lack of space in Area 2, the evaluation involved the excavation and recording of three trenches, although in Area 2 this essentially comprised two trenches joined together to form an L-shape. In each case the following recording techniques were used:

- **Written record:** descriptive records of all deposits and features (see *Appendix 3*) were made using Greenlane Archaeology *pro forma* record sheets. In addition, a general record was made of the day's events;
- **Photographs:** photographs in both 35mm colour print and colour digital format were taken of all archaeological features uncovered during the evaluation, as well as general views of the site, the surrounding landscape, and working shots. A selection of the colour digital photographs is included in this report and the remainder are included in the archive. A written record of all of the photographs was also made using Greenlane Archaeology *pro forma* record sheets (Greenlane Archaeology 2007a);
- **Drawings:** drawings were produced on site as follows:
 - i. trench plans were produced at a scale of 1:20;
 - ii. appropriate sections were drawn at a scale of 1:20.

2.5.2 The location of the trenches was recorded relative to the known location of nearby buildings and other structures that were evident on the previous survey plans (Jecock *et al* 2005) and Ordnance Survey maps. Heights above Ordnance Datum were recorded utilising a benchmark on the bridge over the River Leven (9.36m OD) and are shown in Figure 2 and Figure 3.

2.6 Finds

2.6.1 **Processing:** artefacts were washed (or dried and dry brushed in the case of metal and glass), naturally air-dried, and packaged appropriately in self-seal bags with white write-on panels.

2.6.2 **Assessment and recording:** the finds were assessed and identified and a list of them was compiled (see *Appendix 4*).

2.7 Environmental samples

2.7.1 Two samples were taken: Sample 1 from a waterlogged possible buried soil horizon (**304**), Sample 2 from the waterlogged fill of pit **308 (309)**. Half of Sample 1 was wet sieved, the flot kept wet as it evidently contained waterlogged material, and the retent dried and sorted by hand for artefacts and ecofacts. A c300ml sub-sample was taken from Sample 2, which was evidently waterlogged on site, and kept wet for assessment. The sub-sample and wet flot were then processed in laboratory conditions using a standard floatation method (Kenward *et al* 1980). From each sample approximately 250ml of material was taken for assessment. The sub-samples were then gently wet-sieved through 1mm and 250µm sieves. All plant macrofossil samples were analysed using a stereo-microscope at magnifications of x10 and up to x100 where necessary to aid identification. Identifications were confirmed using modern reference material and seed atlases including Cappers *et al* (2006). The details of their contents are contained in *Appendix 5* and a summary in *Section 4.2*.

2.8 Archive

2.8.1 A comprehensive archive of the project has been produced in accordance with the project design (*Appendix 2*) and current IfA and English Heritage guidelines (English Heritage 1991; Brown 2007). The archive, which comprises the drawn, written, and photographic record, will be deposited with the Cumbria Record Office in Barrow-in-Furness (CRO(B)). A copy of the report will also be provided to the client, Greenlane Archaeology will retain a copy, five copies will be provided to the LDNPA HER, and a digital copy will be provided to English Heritage. A digital copy will be provided for the OASIS scheme (English Heritage 2007).

2.8.2 The client will ultimately be encouraged to transfer ownership of the finds to a suitable museum, although at present finds will be retained by Greenlane Archaeology so that further analysis can be carried out as necessary should any further archaeological work be carried out on site. Any finds recovered during the evaluation will be offered to Kendal Museum. The museum is, however, currently at close to full capacity, and it is unlikely that it would be willing to take anything unless it is of exceptional importance. If no suitable repository can be found the finds may have to be discarded, and in this case as full a record as possible will be made of them beforehand.

3. Desk-Based Assessment

3.1 Historical and Archaeological Background

3.1.1 **Introduction:** the former gunpowder works at Lowwood have been examined in some considerable detail, not only on account of the extensive report carried out by English Heritage (Jecock *et al* 2005), but also through research into its historical development through documentary sources (eg Palmer 1998). As a result the development of the site is well understood, although the lack of excavation, until now, means that there are gaps and there is relatively little detail relating to other periods of activity in the area. This historical background is intended to place the results of the evaluation in their local and regional context, in particular that relating to the use of the site during its industrial heyday in the 18th and 20th century.

3.1.2 **Prehistoric Period (c11,000 BC – 1st century AD):** while there is some limited evidence for activity in the county in the period immediately following the last Ice Age, this is typically found in the southernmost part on the north side of Morecambe Bay. Excavations of a small number of cave sites have found the remains of animal species common at the time but now extinct in this country and artefacts of Late Upper Palaeolithic type (Young 2002). Again, the county was also clearly inhabited during the following period, the Mesolithic (c8,000 – 4,000 BC), as large numbers of artefacts of this date have been discovered during field walking and eroding from sand dunes along the coast, but these are typically concentrated in the west coast area and on the uplands around the Eden Valley (Cherry and Cherry 2002). Slightly closer to the site, however, a large number of finds of this date were discovered during excavations carried out in the park belonging to Levens Hall in the 1970s, and, although largely ignored at the time, they were subsequently published (Cherry and Cherry 2000). In addition, a small amount of Mesolithic material has been found at the north end of Windermere during excavations on the Roman fort site (see for example Finlayson 2004). These discoveries, particularly that at Levens, demonstrate that further remains of similar date are likely to exist in the local area, and conforms with the notion that river valleys, lakesides, and coastal areas are a common place for such remains to be discovered (Middleton *et al* 1995, 202; Hodgkinson *et al* 2000, 151-152).

3.1.3 In the following period, the Neolithic (c4,000 – 2,500 BC), large scale monuments such as burial mounds and stone circles begin to appear in the region and one of the most recognisable tool types of this period, the polished stone axe, is found in large numbers across the county, having been manufactured at Langdale to the north of the site (Hodgson and Brennand 2006, 45). During the Bronze Age (c2,500 – 600 BC) monuments, particularly those thought to be ceremonial in nature, become more common still, and it is likely that settlement sites thought to belong to the Iron Age have their origins in this period. These are not well represented in the area around the site, although an enclosure on Hoad hill near Ulverston perhaps has its origins in this period (Elsworth 2005), as might another one at Skelmore Heads near Urswick, although evidence for activity in the Neolithic was also associated with this (Powell 1963). Stray finds of Bronze Age date are throughout the county, however, although none are recorded within the study area. Sites that can be specifically dated to the Iron Age (c600 BC – 1st century AD) are very rare; the enclosures at Ulverston and Urswick may represent hillforts, a typical site of this period, but they have not been dated. At Levens, burials radiocarbon dated to the Iron Age have been discovered (OA North 2004a), but these remain a rarity both regionally and nationally. There is, however, likely to have been a considerable overlap between the end of the Iron Age and the beginning of the Romano-British period; it is evident that in this part of the country, initially at least, the Roman invasion had a minimal impact on the native population in rural areas (Philpott 2006, 73-74).

3.1.3 **Romano-British - Early Medieval period (1st century AD to 11th century AD):** there no known remains of Roman date in the local site environs, although masonry identified below the water at Newby Bridge has been postulated as being part of a harbour, perhaps connected to the Roman fort at Ambleside (Shotter 2004, 42). The fort at Ambleside has seen numerous phases of investigation and it is evident that it was occupied for a considerable period with the initial establishment of a turf and timber structure in the 1st century AD, perhaps later abandoned, followed by renewed activity in the early 2nd century, which continued in some form until perhaps as late as the fourth century (see summary in Drury

and Dunwell 2004, 71-73). What connection there was to the area to the south around Morecambe Bay is uncertain, although a recent reappraisal of the evidence has suggested that there was some Roman occupation of the Furness peninsula and a wider network of roads connecting sites of the period than is generally accepted (Elsworth 2007).

3.1.4 The period following the end of effective Roman administration in Britain in the 5th century is not well represented in the archaeological record of the area, which is a common situation throughout the county. Fragments of Anglian cross-shaft found at church sites, the example at Kendal is perhaps the closest (Collingwood 1904), and place-name evidence are typically all the information that there is. In this case, the place-name evidence suggests that the nearest settlement, at Haverthwaite, potentially has its origins in the Norse period comprising the words for oats and clearing (Ekwall 1922, 217). There is also fleeting evidence for early Christian activity in the area; an earlier monastery is recorded at Heversham in the 10th century when the Abbot Tildred is said to have been fleeing eastwards in advance of the approaching Vikings (Sawyer 1978), and an *eccles* place-name recorded at Conishead Priory might indicate that it too might have had much earlier Christian origins (Elsworth forthcoming). Again, at Levens, a group of burials found in 1911 century might also indicate an early Christian site on account of their orientation (McKenny-Hughes 1912).

3.1.4 **Medieval period (11th century AD to 16th century AD):** physical evidence for the medieval period proper is again poorly represented in the area, the first reference to Haverthwaite only being in 1336 when it is listed amongst demesne lands held by Furness Abbey that could be used as 'free warren' (the right to kill game without penalty within a designated area) (Ekwall 1922, 217, citing Atkinson 1886, 173). All of the nearest larger settlements and towns to the site were well established by this time, and the region was becoming known for its industry, in particular textiles, especially the woollen trade, focussed largely but not exclusively on Kendal, and the iron industry, which was well represented in Furness during this period although this resource had clearly been exploited from a much earlier date (see Bowden 2000, 6).

3.1.5 **Post-medieval period (16th century AD to present):** industrial activity comes to dominate the area around and including the site from the end of the medieval period onwards, and it is during this period that specific details relating to the Lowwood site become available for the first time. Much of this information is summarised from the previous English Heritage report (Jecock *et al* 2005). The earliest evidence, although uncertain in detail and from a now apparently lost source (or sources) indicates that a bloomery forge was erected at 'Burnbarrow' between 1603 and 1609 (*op cit*, 12). The exact location of this forge is uncertain, but there is enough evidence to suggest that it was at Lowwood. By 1614 the forge had become the property of a William Wright, who had interests in other forges in the area, but continuing problems at Burnbarrow, not least disputes over water rights, forced him to abandon it by 1620-1622 after which he sold it to the Bigland family, on whose land it stood, in 1661 (*ibid*). Subsequently, in 1728, an agreement was drawn up with Richard Ford of Cunsey forge to construct a blast furnace on what was evidently a promising site, although this came to nothing (*ibid*). Such a plan clearly retained its potential, as in 1747 a lease was agreed for 51 years for the Lowwood Company to establish a blast furnace (*op cit*, 13). The buildings required for this enterprise were duly built, and included, in addition to the furnace, charcoal barns and workers cottages (*ibid*). The furnace continued in operation throughout the majority of the 18th century, although it was sold to the company operating the rival Backbarrow furnace in 1782, which promptly closed it down in 1785 (*ibid*). The site seems to have been effectively mothballed at this time, rather than demolished, although its condition soon deteriorated (*op cit*, 14).

3.1.6 Again the potential usefulness of the site must have remained for in 1799 a lease was agreed for the manufacture of gunpowder at Lowwood, following the granting of a licence very shortly beforehand (*op cit*, 14). Indeed, buildings for the gunpowder works were evidently already under construction in 1799 and extensive alterations such as the extension of the main leat to meet a new weir to the north (*op cit*, 16-17). The works was very soon prospering and by the early decades of the 19th century a considerable number of new buildings had been constructed, including 14 additional incorporating mills (*op cit*, 18). The gunpowder works continued to operate successfully throughout the remainder of the 19th century, despite several large explosions within parts of the site, before being sold to its rival WH Wakefield & Co in 1882 for £8,000 (*op cit*, 29). They quickly made a number of improvements to the site, not least

arranging connections to the railway, and improving plant and safety, although they too suffered fatal accidents (*op cit*, 30-37). WH Wakefield and Co continued to operate the site until 1918 when it merged with other black powder manufacturers to form Explosives Trades Ltd, later Nobel Industries Ltd, before that was taken over by ICI in 1926 (*op cit*, 38). Again, improvements to the site were made at this time, in particular the conversion of the majority of the paired incorporating mills to a single suspended runner mill operation (*ibid*). Despite all this falling demand led to the closure of the works in 1935, the new incorporating mill plant was dismantled for re-use in Ardeer in Scotland, and the site was sold to Augustus While (*op cit*, 39). Following its closure the site was requisitioned by the Government during World War II, although the purpose to which it was put is uncertain, although traces of Nissan huts are evident (*op cit*, 234). From 1935 the family and trustees of Augustus While have utilised the site for energy generation, through the use of a water turbine probably already present on the site (*op cit*, 235). A replacement hydroelectric station was constructed in 1952, which involved the creation of a new section of leat formed in a huge embankment that seemingly buried some existing structures on the site (*ibid*), constructed from dumped slag (*op cit*, figure 142). Anecdotal information indicates that this material was brought from the Backbarrow Ironworks, to the north of Lowwood, which closed in the 1960s (1964 according to some sources (LUAU 1992; 1998; OA North 2004b) or 1967 according to Mike Davies-Shiel (2007)) although it is not certain whether material was brought while the ironworks were still operating or after they had closed.

3.2 Cartographic Evidence

3.2.1 A detailed map regression is included in the English Heritage report (Jecock *et al* 2005, 11-39), and this has been used to provide information towards the development history of the site contained within that report. An additional map of relevance to this project, which was not included in the previous report is the Ordnance Survey first edition map of 1851 (Plate 1). While this shows much the same detail of a plan of similar date, referred to as 'the 1846 plan' (Jecock *et al* 2005, figure 4), it shows additional detail pertinent to Area 2. This comprises what appear to be two small buildings within a small paddock, with dashed lines indicating paths (or perhaps cultivation) in the field to the north-west. These structures are not shown on the earlier plan (*ibid*) or any later plans (*op cit*, figure 7 onwards) and so must have been very short lived.



Plate 1: Extract from the Ordnance Survey map of 1851 showing the area corresponding to Area 2 (above the word 'Low')

3.3 Previous Work

3.3.1 As mentioned above (see *Section 3.1*) the site has been subject to an extensive survey by English Heritage (Jecock *et al* 2005), but there has been no other investigative work at the site.

3.4 Summary

3.4.1 The historical background shows that there is relatively minimal evidence of significant archaeology in the immediate environs of the site until the beginning of the 17th century, although Haverthwaite clearly existed by the mid 14th century and there are significant late prehistoric and Roman sites in the local area. During the post-medieval period the site was intensively used by a number of industries exploiting the water power available in the valley, initially those associated with the iron industry, but latterly a large gunpowder works, which continued to operate for over 130 years. The subsequent use of the site has also exploited the power of the river, with the installation of water turbines for electricity, culminating in an extensive remodelling 1952, which buried earlier remains at the south end of the site.

4. Fieldwork Results

4.1 Introduction

4.1.1 The fieldwork comprised three elements: a site visit, the recording of standing remains, and the excavation of evaluation trenches. The first two of these tasks were carried out before the evaluation, and the methodology of all three is described in *Section 2* above. A description of the results is presented below.

4.2 Site Visit

4.2.1 A site visit was carried out on 9th June 2010. As described in the methodology above, it comprised a rapid examination of the entire development area, extending the full length of the leat from north to south, west towards the current power house, and east, on the opposite side of the leat, to the edge of the Scheduled Monument area adjacent to the bridle path. The site visit was essentially intended to identify features of archaeological interest that might be affected by the proposed development, locate suitable positions for the evaluation trenches (to be agreed with English Heritage and the Lake District National Park Authority), and identify any practical or safety constraints to subsequent archaeological work. Proposed trench locations were identified and plotted by hand onto plans of the site. No specific constraints were noted; services were all at some distance from the proposed location of the evaluation trenches, although it was observed that the proximity of the proposed trench in Area 3 to the leat might be problematic in terms of undermining its wall, so it was decided to place this at least 2m from them.

4.2.2 In addition, a number of features of archaeological interest were observed at the north end of the leat. It was evident that material has been dumped along a large section of the west side of the leat between the top sluice gate (Plate 1) and the lower washout sluice gate. At the far north end this comprised compacted blast furnace slag, but further south it comprised more general material typically large pieces of concrete (including large numbers of what appeared to be railway sleepers) and stone, with some brick and iron (including pieces of perhaps vehicles (road or rail; Plate 3) and part of a large valve with pipe attached (Plate 4). A bridge over the washout channel was also constructed from two large sheets of cast iron).



Plate 2 (left): Upper sluice gate, viewed from the south-west

Plate 3 (right): Iron work, possibly piece of a rail vehicle at the north end of the leat



Plate 4: Iron valve in dumped material at the north end of the leat with washout sluice in the background

4.2.3 Further south, at a junction in the track, an area of obvious bottle dumping was identified, on the west side of the track (at approximately NGR 334954 483925). The bottles were all of essentially the same type, colourless glass, square in section with external screw threaded tops and a mark on the base reading '41' with '6' below. This type of bottle, on account of its external screw thread, is unlikely to date to before c1900 as the internal screw thread was still commonly used until the end of the 19th century (Fletcher 1974, 50). To the south and east, in Area 2, a collection of pottery and glass was found on the surface of the earthworks in that location. The glass was colourless and comprised a base marked 'JBK', '5A', 'FMF[?]', and '14 I[...]', indicating that it probably manufactured by Jackson Brothers of Knottingley in Yorkshire and dates from c1920-1940 (Toulouse 1971, 275). The pottery comprised white glazed white earthenware, mostly plain, but one piece with a blue transfer print, and is likely to date from the late 19th to early 20th century. A further sluice gate, with parts marked 'Gilkes Kendal' was present at the south end of the leat, where it turned to the west, and the sluices at the feed for the power house were of a similar design.



Plate 5 (left): Sluice gates at the power house



Plate 6 (right): Detail of sluice gates at the power house

4.2.4 **Conclusion:** the site visit revealed a number of features of interest, and also provided an opportunity to briefly record the extant sluice gates, which were all manufactured by Gilkes of Kendal. It demonstrated the presence of a previously unrecorded bottle dump of probable 20th century date and that topsoil finds of 19th – 20th century date were present in Area 2, perhaps indicating that deposits were dumped in this area from a relatively early date.

4.3 Evaluation

4.3.1 **Introduction:** the evaluation comprised the excavation of three trenches totalling c55m². Initially it was proposed to excavate six trenches in Areas 2-5. When it was ascertained that Area 5 would not be subject to any ground disturbance as part of the development no trench was excavated in this area. In addition, the proposed trench location in Area 4 was modified to avoid the track to the east, which was needed for access and constructed from concreted slag so considered likely to be difficult to remove. As a result of this the second trench was not excavated because the topography in the available space made it impractical and the area further west was, again, not likely to be affected by the proposed development as it was to be built up to provide an access track, rather than reduced. The proximity of two trenches proposed in Area 2 meant that it was more practical to simply excavate a single L-shaped trench to cover the same area although this was slightly narrower than the 1.7m width anticipated because of the lack of space.

4.3.2 **Trench 1, Area 2:** as mentioned above, this comprised a single L-shaped trench, one arm orientated north-east/south-west, approximately 9m long by 1.2m wide, and the other arm, orientated north-west/south-east, approximately 6.5m long by 1.2m wide. The purpose of this trench was examine earthworks recorded in the English Heritage survey, which appear to correspond to field boundaries shown to have existed on the very earliest plans of the site (Jecock *et al* 2005, Fig 142), and buildings recorded in the area in the mid-19th century (see Plate 1). The south-west end of the north-east/south-

west arm crossed the line of these extant earthworks, while the north-west end of the north-west/south-east arm crossed the line of where it was anticipated the original field boundary would extend, although the original line of this had been destroyed and the resulting rubble, forming part of the earthworks recorded by English Heritage, pulled back to the east within living memory in order to provide access to the leat from this side (James Barratt pers comm.).

4.3.3 Across the entire trench there was a dark greyish-brown loose silty sand topsoil, with occasional pieces of brick and slate, that was typically 0.3m thick (**101**). This effectively incorporated two areas of dumped material, one corresponding to the earthwork at the north-east end of the south-west/north-east arm, and one to the earthwork at the south-west end of the same area. These earthworks were clearly superficial in nature; the former sealed modern material including a plastic toothbrush and the latter included a large amount of roofing slate and pieces of 19th-20th century pottery. No evidence of any structures was identified. In addition, the north-west end of the north-west/south-east arm, which crossed the line of the former field boundary, revealed no evidence of a structure or even a foundation although a few large loose stones were present in the topsoil. Underlying the topsoil was a deposit of firm mid-orange sandy clay with 20% rounded and sub-angular cobbles and some gravels (**102**), which appeared to represent the natural clay. The north-west end of the north-west/south-east arm was noticeably drier and appeared to be different material, but a small sondage excavated through this revealed it to be the same material.

4.3.4 **Trench 2, Area 3:** this comprised an approximately square trench, 4m by 4m, and roughly orientated north/south, and was intended to examine the area that would be affected by the proposed realignment of the leat. The upper deposit comprised a loose dark brown silty clay with large quantities of concrete blocks, slag, and bricks (some marked 'Furness Brick Askam in Furness') typically 0.4m thick (**301**). Below this, also covering the whole area, was a deposit of mid grey brown sandy clay, containing large amounts of brick and slag, including some concreted slag in the north-west corner, to a typical depth of 0.4m (**302**). Included within this was a large slate slab approximately 1m wide and 1.2m long, orientated approximately north/south parallel to the trench, slightly tilted down to the east, and apparently associated with other large pieces of slate. Because it was considered that this was perhaps structural an area around it was left slightly raised (Plate 7). It was also not possible to fully excavate to the north of it, in part because of the concreted slag in the north-west corner, but also because of ground water penetration in the north-east corner, so an area of **301** remained in on this side. Below **302**, where it could be removed to the south of the slab, was a mid grey brown sandy clay comprising 50% gravel and a smaller amount of cobbles, which appeared to be subsoil (**302**). There was also an apparent feature running along the west side of the trench and seemingly incorporating the concreted slag on that side, which cut into **302** (**305**). This was filled with a very loose mid brown sandy clay with a large amount of concreted slag lumps and other concrete (**307**), and appeared to be part of the raised track built out of concreted slag to the west.



Plate 7: Trench 2 following the removal of deposits 301 and 302, with the large slab in 302 left *in situ*. Viewed from the east

4.3.5 In order to investigate whether the large slab did indeed form part of a structure and the nature of the linear feature (306) two small sondages were excavated; one against the south end of the slab and one along the west side of the trench. The sondage at the south end of the trench revealed that deposit 303 was approximately 0.25m thick in this area. Below it was a dark brown almost black sandy clay deposit up to 0.1m thick organic material peat-like and small gravels (304). Beneath this was a loose deposit of rounded gravels with some larger cobbles (305), which was not fully excavated as was assumed to be natural river gravels. On the west side of the trench 306 was found to be over 1.3m wide (it extended out of the trench to the west), with shallow sides and a flat base cutting into 303. Its fill (307) formed a raised bank, below but essentially part of deposit 302. At the south end of the west sondage a slot was taken through deposit 303 in order to determine whether its relationship to underlying deposits was the same as that in the sondage to the south of the slab. By contrast, 303 was found to be considerably deeper, and in fact appeared to form two very similar deposits, the lower (310) being slightly less stoney. Sealed beneath this was a dark deposit very similar to 304 but wetter, more organic, and extending to a depth of over 0.3m (309), and containing a large amount of copper nails and broken glass. Beneath this was a deposit of loose gravels essentially the same as 305 (314).

4.3.6 The west sondage was subsequently widened in order to investigate deposit 309 in more detail but at this point the water level in the leat had risen considerably so it was not possible to fully examine the deposits uncovered before the trench filled with running water. It was apparent that 309 was actually the fill of a very large pit or oval feature (308), at least 1.6m long (north-east/south-west) and 1m wide (north-west/south-east). Only its north-west edge was defined, but this was cut into a mid orange-brown firm sandy clay, which appeared to be a natural deposit (313). A further feature was identified to the north-west of 308, which seemed to comprise a linear feature running approximately north-west/south-east, which was at least 0.4m wide, its north edge extending out of the trench (311). This was filled with a firm mid grey silty clay with a very small amount of gravel, a lense of very firm pink clay, and some pottery and slag (312). The relationship between 311 and 308 could not be readily determined although

at the point at which they met the remains of a decayed timber post or structure of some form fixed upright into the ground was located. **311** appeared to cut through **310** and into **313** and so must be stratigraphically later than **308** but further investigation to determine this was not possible during the evaluation.



Plate 8: Pit 308 and timber as exposed in the enlarged sondage in Trench 2, with water beginning to fill the trench, viewed from the north

4.3.7 Trench 3, Area 4: this comprised a single trench orientated approximately north-west/south-east, 9.2m long by 1.3m wide, and up to 2m wide in middle where it bowed out slightly producing a coffin-like shape. This was intended to examine an area of earthworks identified during the English Heritage survey, which it is intended to level as part of the proposed development to provide a new access track. The upper deposit comprised a loose mid grey-brown silty sand with large amounts of demolition rubble including red brick and roofing slate at the south-east end, firebricks, concrete blocks, slag, and pieces of corrugated sheet metal roofing, extending across the entire trench to a maximum depth of 0.9m thick (**401**). Below this was a sequence of evidently tipped deposits, the uppermost at the north-west end (**402**) comprising a pale yellowish-brown sand with some gravel and slag. Below this, extending to the south-east, was a deposit of pale whiteish-yellow concreted slag with some lenses of looser sand (**403**), beneath which was a deposit comprising loose dark orange-brown sand and half dark purplish-brown concreted iron (smithing?) waste (**404**). This latter deposit was cut through at the south-east end by a u-shaped cut (**406**), filled with a loose deposit of red hand-made brick and roofing slate (**405**). A section was cut through these deposits with the machine using a pecker in order to assess their thickness and identify if any earlier features were buried beneath, although the trench was only excavated to the level of the road to the south-east as the proposed development is not intending to go below that level. This excavation revealed the depth of some of the deposits and that they had evidently been tipped against an initial dump of concreted slag (**408**) similar in form to **403**, but with a thin layer of soft black material

over the top of it (**407**). Either side of this initial deposit were more concreted slag to the north-west (**409** – in the place of **402**, which did not extend across the entire trench), and a sandy deposit similar to **404** to the south-east (**410**). No earlier deposits were encountered.



Plate 9 (left): South-east end of the north-east facing section in Trench 3 showing dumped deposits

Plate 10 (right): North-west end of the north-east facing section in Trench 3 showing dumped deposits

4.4 Finds

4.4.1 In total 354 finds were recovered during the evaluation, and a full list of these is presented in *Appendix 4*. As might be expected, all of the finds are of certain or likely post-medieval date, with the majority comprising pottery, although large quantities of window glass and metal artefacts (both iron and copper alloy) were recovered from context **309**. Industrial residue in the form of glassy vesicular blast furnace slag was also present in many contexts, in addition to the large deposits of concreted slag present in Trenches 2 and 3, and is likely to relate to the earlier blast furnace that was situated on the site in the 18th century, although it cannot be closely dated in itself. As has already been noted, the nature of the later development of the site means that many of the finds, particular those from Trench 3, relate more directly to the Backbarrow ironworks site to the north rather than the Lowwood site, as material was brought from the former to the latter in the 20th century to form structures relating to the hydroelectric plant. As a result, pertinent information relating to Backbarrow is included in this section and the following section.

4.4.2 The firebricks recovered from context **401** in Trench 3 are of interest as a number of marked examples were recovered, which can be dated with some degree of accuracy based on the information known about the companies that produced them. The brick marked 'NETTLE 12' was probably made by JG Stein and Co (Graham Brooks pers comm.), a Scottish company, established in Stirlingshire in 1887 (Douglas and Oglethorpe 1993, 73) so this brick cannot be any earlier than that date. They also produced bricks marked 'THISTLE' and 'BLUEBELL' (Graham Brooks pers comm.), and examples of the former were recovered during the excavation of the Barrow Steam Cornmill (Greenlane Archaeology 2007b). The brick marked 'FOSTER HG' is probably from H Foster and Co Hotspur Brickworks in Northumberland (Davidson 1986), HG standing for 'High Grade' (Graham Brooks pers comm.), while the one marked 'MOBBERLEY STOURBRIDGE' was probably produced by Mobberley and Perry of Stourbridge and is of late 19th century date (Smith 2006). These bricks are also of interest because a large proportion of the firebricks used at Newland Furnace also came from Stourbridge, and there were known trading links between the furnaces of the Furness area and the manufacturers of the Midlands, who prized the high quality iron of the region for manufacturing edge tools (Marshall *et al* 1996, 203). The date of these bricks also coincides with the period during which Harrison Ainslie and Co owned both Newland and Backbarrow (LUAU 1998, 8). In addition, bricks from context **301** in Trench 2 marked 'Furness Brick Askam in Furness' are thought to date to after World War II (Glasgow n.d), and a piece of tile recovered from context **402** in Trench 3 (plus a similar unstratified piece from the same trench)

cannot date to before 1909 on account of the year the pattern design was registered as shown by its registration number (Kowalski and Kowalski 1999, 593).

4.4.3 Context **309** is of particular interest because of its large collection of iron and copper alloy objects, the former primarily nuts and bolts and less easily identifiable objects, the latter largely nails and tacks, and window glass. While it is tempting to consider the presence of copper nails in relation to the use of the site as a gunpowder works, to prevent sparks and thus reduce the risk of explosion, it seems likely that this deposit represents the demolition of a nearby building and the relating disposal of material. Context **309** also contained at two pieces of timber, a larger one comprising part of a broken board, and a smaller one of less obvious form but apparently with red paint on one side. The original function that this might have had is not certain, but the larger one could have been part of a packing crate or similar. The dating of this deposit is difficult; it clearly predates the largely late 20th century deposits above it, even though some of these contain earlier material, but none of the finds are particularly dateable other than broadly to the 19th century (eg Bodey 1983). If the piece of milk glass does indeed suggest that **309** cannot predate 1909 (see *Appendix 4*), then it is conceivable that feature **308** might relate to the demolition of one of the nearby incorporating mills during the reorganisation of the site in the 1920s.

4.4.4 Of further interest are the iron objects recovered from context **404**, which at least partially comprised iron boring waste, the deposit itself being made up of granular iron. **404** appears to be part of the same phase of dumping of material taken from Backbarrow, and the presence of scrap metal, including iron turnings on site is recorded in 1963 (Davies-Shiel 1991). A coke-fired cupola furnace was installed in the 1950s for the recycling of scrap metal (LUAU 1998, 8), which perhaps explains the presence of this material. **404** might also in part comprise a deposit of dumped casting sand; similar gravelly sand, albeit buff coloured, was encountered during the evaluation carried out there in 1998 (LUAU 1998).

4.5 Samples

4.5.1 Samples were taken from two deposits, both in Trench 2 as outlined in *Section 2.7*; their contents are summarised in *Appendix 5*. Both samples were apparently waterlogged to some degree, Sample 2 in particular. The details of the assessment of these samples is presented in *Appendix 5* with a summary below.

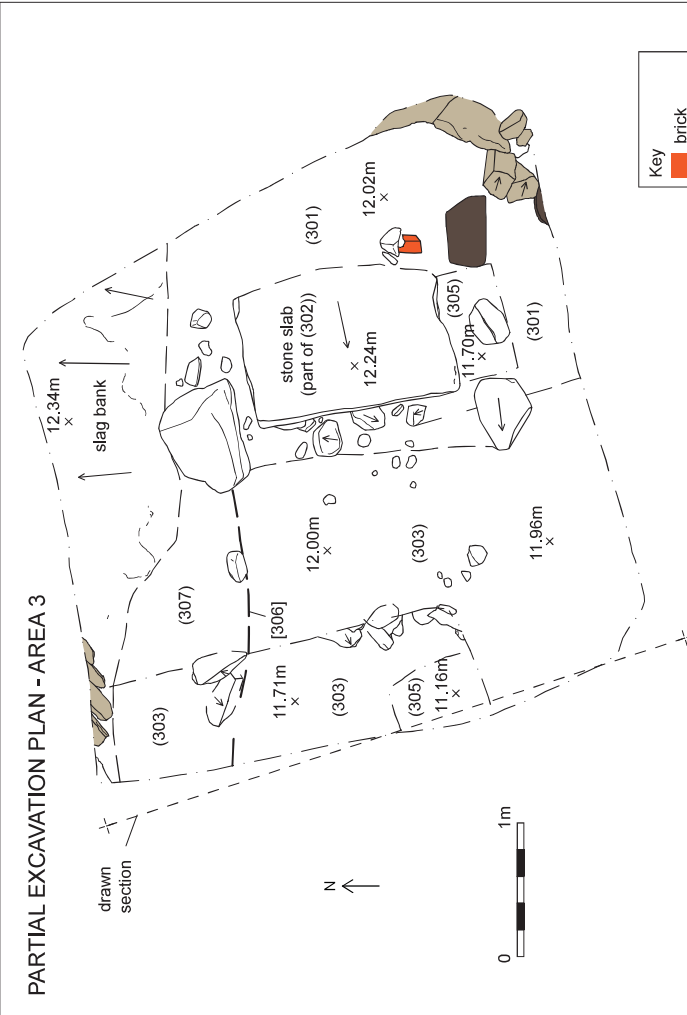
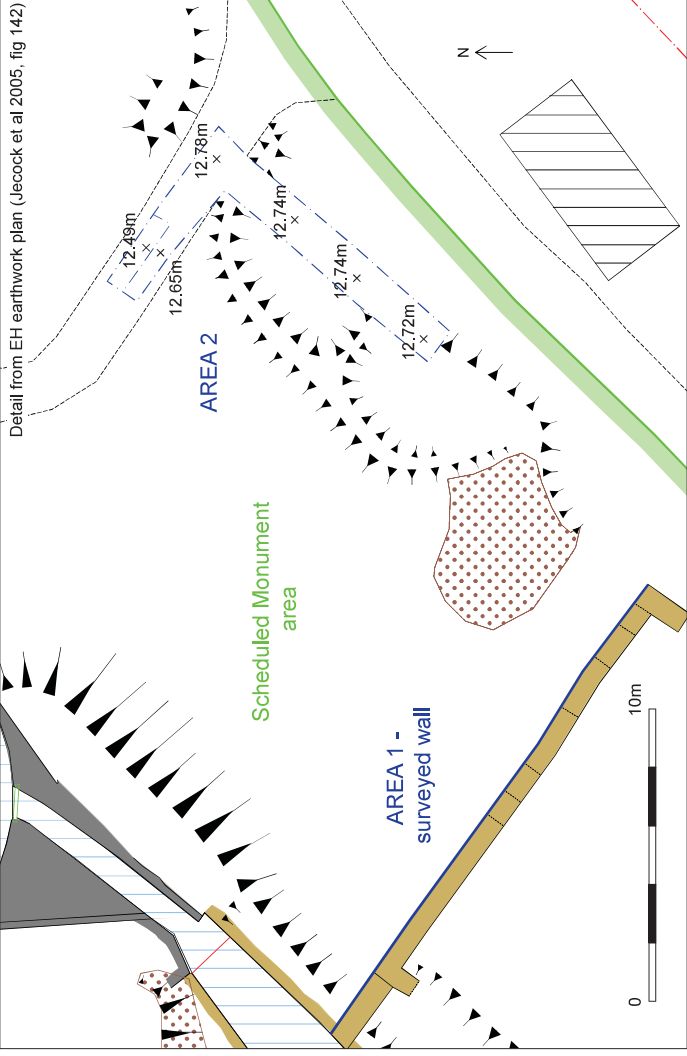
4.5.2 **Plant remains:** plant material recovered was similar in both Samples 1 and 2 (see *Appendix 5*), with each sample containing abundant quantities of plant monocotyledon fragments and wood indet fragments, together with bramble (*Rubus fruticosus*) and elder (*Sambucus nigra*) fruits. Smaller quantities of birch (*Betula* sp.) seeds and buds are present in the assemblage together with common nettle (*Urtica dioica*) seeds. A small number of charred bramble seeds were found in Sample 2, with this sample also containing a small quantity of charcoal fragments (non-oak).

4.5.3 **Other finds:** together with the plant remains the two samples also contained small quantities of metal working debris (MWD) in the form of slag and prill. An iron nail was also found in Sample 2. Burnt and unburnt bone fragments were also recovered in small amounts in both samples. Cinder was also found in Sample 1, while coal fragments were present in Sample 2 (see *Appendix 5*). The retent from Sample 1 contained large amounts of material relating to metal working, including slag, prill, and hammerscale. In addition, large amounts of fuel residue in the form of potash and burnt coal or coke were also present.

4.5.4 **Discussion:** Sample 1 contained abundant wood and plant monocotyledon fragments (e.g. grasses and sedges) together with abundant elder and bramble fruits. Other plants contained include common nettle and birch seeds. The plant material suggests an abandoned area of wasteland/overgrown vegetation with brambles, grasses and nettles possibly covering the area with birch and elder trees growing close by. Together with the plant material other material present included burnt bone, unburnt bone and cinder, which may relate to discarded food waste. The presence of prill and hammerscale probably relate to the original bloomsmithy or the forge associated with the later furnace, which is thought to have been only a short distance to the west (Jecock *et al* 2005, figure 131).

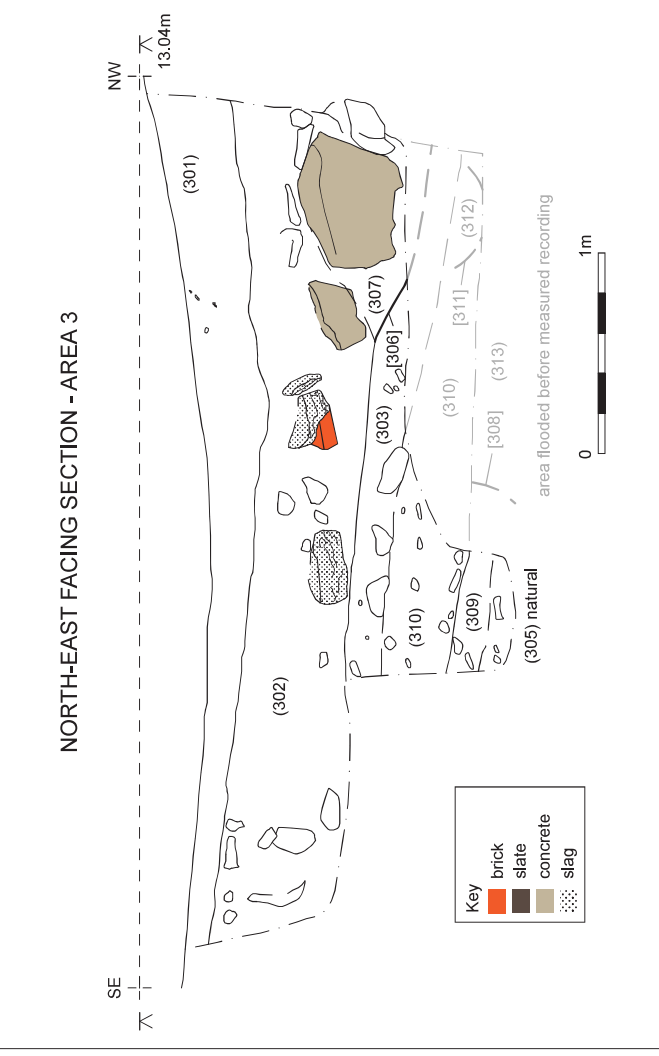
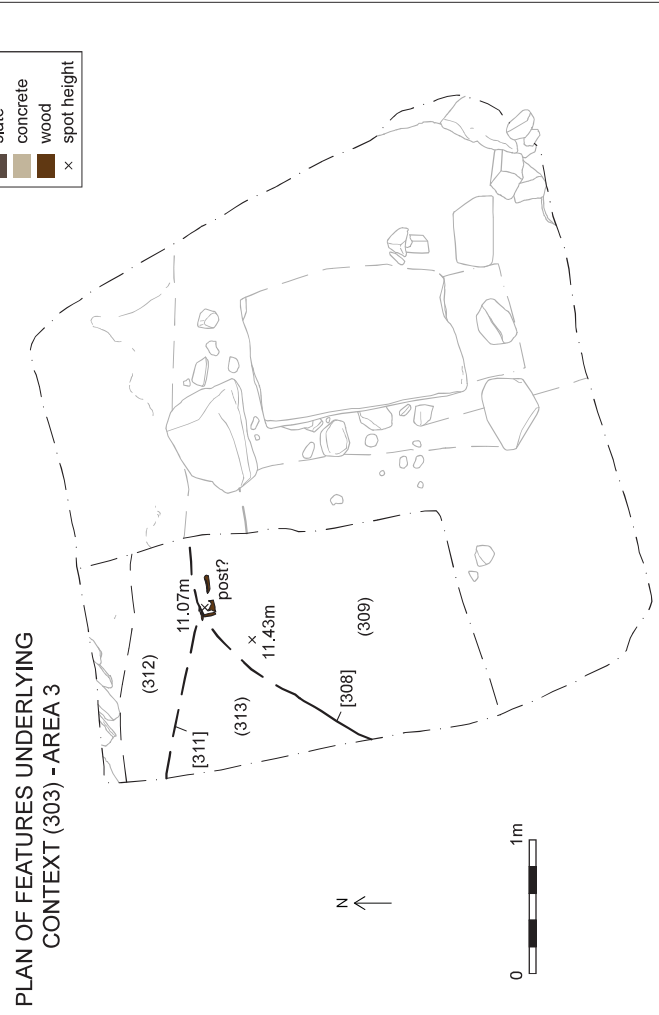
The burnt fuel residue could potentially have resulted from a number of processes taking place on the site at different times.

4.5.5 Plant remains recovered from Sample 2 produced a similar assemblage to the above, with abundant plant monocotyledon and wood fragments, together with abundant bramble and elder fruits. Other plant material recovered included buds of probably birch. The general environmental picture is the same as the above and suggests bramble and elder trees were growing in and around the pit during the time of plant matter debris accumulation in the pit itself. Charcoal (non-oak) fragments were present in the sample in small quantities and charred bramble fruits were also recovered. The latter may relate to discarded food waste. Other potential food waste was also present with bone and unburnt bone in the sample assemblage. As above there is some evidence of metalworking in the area with small amounts of slag and prill in the sample. The two samples have limited potential to provide further palaeoenvironmental information on the site. The samples contain abundant elder and bramble seeds but few other taxa to give a more complete picture of the environment. In all the samples appear represent a period of abandonment at the site rather than periods of activity.



Key

brick
slate
concrete
wood
x spot height



Key

brick
slate
concrete
slag

Figure 2: Detail of trenches and features in Areas 1, 2, and 3

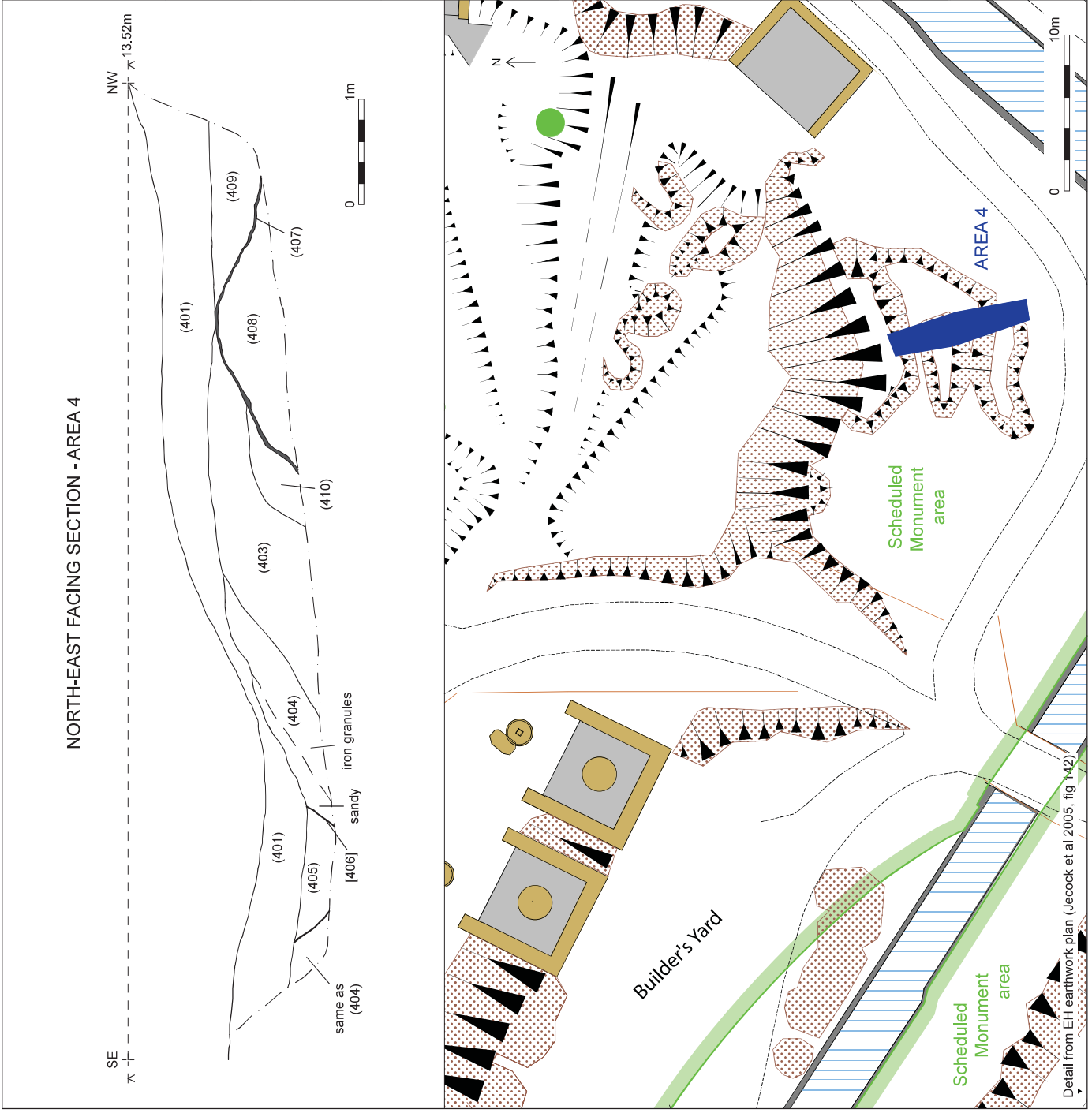


Figure 3: Detail of trench and features in Area 4

5 Discussion and Conclusion

5.1 Discussion

5.1.1 **Trench 1:** no surviving evidence of the former field boundary, shown on the early maps of the site running approximately north/south roughly parallel to the bridle way, was encountered so it must be assumed that this was completely removed when the access was cut through it in the 20th century. This event demonstrably occurred quite late in the 20th century on account of the plastic toothbrush found beneath the rubble produced by this event. In addition, no evidence of the structures shown in this area on the Ordnance Survey map of 1851 was found, suggesting that these buildings were either very insubstantial or that they had been completely removed at a later date. It is perhaps possible that the superficial dump of material in this area, which contained a relatively large amount of roofing slate, came from their demolition but material has evidently been dumped in this general area more recently. The finds from this area are perhaps suggestive of material being dumped here for some time, potentially as early as the 18th century. This may have occurred as part of agricultural activity; the area adjoining appears to be shown as gardens on the Ordnance Survey map of 1851 (Plate 1) and the settlement at Lowwood is relative close to this area, but the top soil was extremely thin so this is perhaps unlikely. The slag in this area seems most likely to have come from the 18th century furnace that stood relatively nearby and is probably a common find anywhere in its vicinity although it is not in itself closely dateable (see Jones 2001, 11-13).

5.1.2 **Trench 2:** this trench revealed a considerably more complex sequence of deposits, the upper most of which (**301-307**) are probably 20th century in origin, and most likely relate to activity on the site carried out as part of the construction of the current hydroelectric plant. There is some evidence, however, that such activity might have continued until at least the late 1970s; the only closely dateable and latest find from **307** being a balloon packet dated post-1978 (Competition Commission 1982). However, this had been evidently chewed by rodents and may have entered that deposit as nesting material. The difficult nature of excavation in this trench has, however, made interpretation of some features only tentative. The large pit **308** seems to be the earliest feature, and is probably contemporary with the possible buried soil (**304**), although the relationship between the two could not be determined. The linear feature **311** could not be examined in detail, but appeared to be straightigraphically above **308** and yet contained potentially earlier material. This situation might be explained one of two ways: either, the nature of the relationship is incorrect and they in fact are at least contemporary. Alternatively, the fill of **311** (**312**) is for some reason re-deposited from elsewhere. Whatever the situation, this trench certainly contained remains of some interest to the site, and further investigation might provide some useful information.

5.1.3 **Trench 3:** this contained only dumped deposits to the depth that was excavated, and those that could be dated are 20th century. These would appear to form material brought from the Backbarrow iron works, primarily deposits of concreted slag, which must in that case have been brought while still semi-molten and thus deposited while the iron works were still in use and therefore pre-1964/7. The only closely dateable finds suggest that these deposits post-date 1909, and so it seems entirely likely that this entire deposit was dumped in or around 1952 when the present hydroelectric plant was being constructed and material was brought to the site to build up the newly constructed east/west arm of the leat. Finds from the over burden (**401**) indicate that dumping continued to take place in this area in the later 20th century, including more material presumably also from the Backbarrow ironworks, such as fire bricks was also deposited. In addition, a dump of building rubble comprising relatively early bricks (hand made and so predating the mid 19th century; **405**) was placed in a cut (**406**) excavated into the earlier deposits. This perhaps came from a building on the Lowwood site, but could have come from a number of other places, again including Backbarrow. The dating of this deposit is not clear, although the presence of plastic cabling and sacking suggests a late 20th century date, which would correspond with the apparent date at which the track constructed from concreted slag (represented by contexts **306/307** in Trench 2) was constructed (see Section 5.1.2 above).

5.2 Conclusion

5.2.1 The results of the evaluation were relatively negative in Area 2, suggesting that little of any archaeological significance is present in this area. Area 4 revealed that the large dump of material already recorded in this area during the survey carried out by English Heritage comprised a thick deposit of concreted slag and other material undoubtedly brought from the Backbarrow Ironworks site, probably in the mid 20th century. Area 3 produced perhaps the most significant remains, comprising a sequence of deposits and features, the earliest of which most likely relate to the use of the site as a gunpowder works, although with perhaps some evidence for previous activities. A large number of stratified finds were also recovered from this area and waterlogged deposits, containing evidence relating to the local environment, and further investigation of both of these elements is likely to aid the future understanding of the site as a whole.

5.3 Recommendations

5.3.1 There is relatively minimal potential for significant archaeological remains to be present within Area 2, but those remains that are evident as earthworks are clearly relatively shallow and could still be affected by the proposed widening of the access track in this area. It is therefore recommended that ground works be monitored by an archaeological watching brief. In addition, some measures, such as appropriate barriers, should be put in place around the building remains recorded in Area 1 to reduce the risk of damage due to impacts from passing vehicles.

5.3.2 There is clearly a considerable depth of deposits, some of which are of archaeological interest, in Area 3, albeit buried beneath later material. The nature of the work in this area, which will require very deep excavation and will therefore destroy all of these remains, means that further investigation is essential. The upper deposits are of little archaeological interest, however, and can be removed by machine allowing the underlying deposits to be recorded and sampled as necessary. This will also allow the relationship between **308** and **311** to be established and the nature of the features and deposits encountered to be established.

5.3.3 It is evident that any early remains in Area 4 have been deeply buried by deposits dumped following the closure of the gunpowder works, including thick layers of concreted slag. The nature of the proposed development in this area means that any earlier features are likely to be well protected by these deposits, and, indeed, any to the north-west of Trench 3, which are likely to be even lower-lying, will be covered by the further layers of material that are proposed to be deposited here to build up the track. Nevertheless, it would be worthwhile maintaining a watching brief in this area in order to identify other finds and material relating to the former Backbarrow iron works and be certain that no structural remains do survive beneath.

5.3.4 Other areas of disturbance should also be monitored by watching brief, in particular that relating to the creation of a site compound close to the bottle dump recorded during the site visit and the potentially quite deep excavation required for the construction of a bridge for the new access track.

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Appendix 1: Project Brief



ARCHAEOLOGICAL EVALUATION

At Lowwood Gunpowder Works

26th May 2010

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Brief for Archaeological Field Evaluation

Location: Lowwood Gunpowder Works

Proposed: Refurbishment of Hydro Electric Plant

Summary

A pre-application planning enquiry has been submitted to the Lake District National Park Authority and English Heritage for refurbishment of the hydro electric generating plant at the Lowwood Gunpowder Works, Haverthwaite, Cumbria. The site of the proposed development is situated within the scheduled remains of a gunpowder works dating from the later 18th century. The site was also the location for a bloomery forge in the 17th century and a charcoal blast furnace in the first part of the 18th century. It is probable that the proposals will affect remains relating to early iron smelting and/or gunpowder manufacture.

Significant archaeological features exist on the site but little is known as to the likely effect of the proposed development in locations where groundwork, road construction and other operations may affect the remains. The National Park Senior Archaeology and Heritage Adviser and English Heritage Inspector have advised that the archaeological implications of the proposal cannot be adequately assessed on the basis of the available information and that an archaeological field evaluation should be carried out in order to assess the survival of archaeological remains and to assess the likely impact of the proposals. This information should be supplied to the Lake District National Park Authority and English Heritage.

This recommendation is in line with government advice as set out in the CLG Planning Policy Statement 'Planning and the Historic Environment' (PPS 5) and Policy NE 16 of the Lake District National Park Local Plan.

The applicant has appointed Greenlane Archaeology as his archaeological contractor to carry out this work. No fieldwork should commence until approval of a written specification, based on this Brief, has been issued by the Lake District National Park Authority and English Heritage

1. Location.

1.1 The site is centred around national grid reference SD 349 839, in the parish of Haverthwaite. The total area of the proposal affects just over 1 hectare, which is presently in mixed use, including hydro electric power generation and storage of building materials and machinery.

1.2 The underlying geology of the site is Silurian slates and shales of the Bannisdale formation.

2. Archaeological Background

2.1 The site of the proposed development lies within the area of the Lowwood Gunpowder Works which operated between 1798 and 1935. Extensive remains survive from all stages of this industrial process from storage and preparation of ingredients to final product. Earlier use of the site included a bloom smithy of the 17th century (exact location unknown) and a charcoal blast furnace that was established in 1747. The site has been subject to a detailed programme of research and survey by English Heritage (English Heritage, 2005) and is designated as a Scheduled Ancient Monument. A Conservation Management Plan for the site is being prepared and is at an advanced stage.

Further details of this site and adjacent remains can be obtained from the Lake District National Park Authority, Murley Moss, Oxenholme Road, Kendal, LA9 7RL. Tel. 01539 792712/Fax. 01539 740822/Email Eleanor.Kingston@lake-district.gov.uk

3. Requirement for an Evaluation

3.1 Elements of the proposed development have the potential to severely damage or destroy archaeological remains which survive on the site. It has therefore been recommended that an archaeological evaluation should take place to obtain further information on the presence and preservation of any archaeological deposits to inform the proposals and before any decision is reached as to whether planning consent or scheduled monument consent should be granted.

3.2 The objectives of the evaluation should be to gather sufficient information to establish presence/absence, character, extent, state of preservation, date, condition and significance of any archaeological deposits within the areas of proposed development.

3.3 An adequate representative sample of all areas where archaeological remains are potentially threatened should be studied.

3.4 The preferred option is the preservation *in situ*, wherever possible, of significant archaeological features and deposits, whether through design modification or other mitigation measures. Only where preservation *in situ* proves impracticable should the option of full excavation be considered.

4. Evaluation Techniques

4.1 Land use at the time fieldwork is carried out will influence the methods used. The techniques chosen should be selected to cause the minimum amount of destruction and should comply with all relevant health and safety regulations. It is envisaged that the following work will be required:

Stage One

4.2 A rapid review of the published and unpublished information relevant to the site and its immediate surroundings will be undertaken. This will aim to review the currently available archaeological information for the site and its locality, with particular reference to recent archaeological work in the vicinity. It will also investigate the past use of the site through an examination of the historic mapping of the area. Sources consulted should include: data held by the Lake District Historic Environment Record; maps (printed and manuscript); aerial photographs and other illustrative evidence; place and field name evidence; published and unpublished documentary sources and other relevant background material.

4.3 Visual inspection of the entire site. This should include examination of any available exposures (eg. recently-cut field ditches and geological test pits).

Stage Two

4.4 Recording and analysis of the remains of the building (possible cart shed) marked as Area 1 on the attached map.

4.5 A programme of targeted trial trenching to establish the extent, date, nature and preservation of archaeological deposits in areas of the development where groundwork or other operations have the potential to damage or destroy archaeological remains.

The precise locations and proportions of trenches should be established upon completion of the desk based work but will include the following areas which are indicated on the attached map:

- Area 2 – earthwork remains on proposed line of new track (minimum of two trenches);
- Area 3 – location of new cut for leat to alter angle of corner (minimum of one trench);
- Area 4 – Line of proposed track and crossing over leat (minimum of two trenches);
- Area 5 – On line of proposed track (minimum of one trench);

The trial trenches should be excavated with a flat-edged ditching bucket of at least 1.7 metres width. The trenches may need to take into account any live services on site, but should not neglect areas of no known archaeology. The distribution will seek to achieve a comprehensive coverage across the site. The strategy for the positioning of trenches must be agreed with the National Park Senior Archaeology and Heritage Adviser prior to the start of work. Initial topsoil removal can be undertaken by machine, but subsequent cleaning and investigation must be by hand.

4.6 A sufficient sample of features and deposits should be investigated to understand the full stratigraphic sequence in each trench, down to natural deposits. All deposits should be fully recorded on appropriate context sheets, photographs, scale plans and sections.

4.7 An assessment of the artefact content of the topsoil. Techniques might include measured surface artefact collection, a series of topsoil test pits, or sampling of the topsoil from trial trenching. The proposed strategy should be agreed with the National Park Senior Archaeology and Heritage Adviser and will be expected to take account of the prevailing ground conditions on the site.

4.8 The evaluation should include a programme of sampling of appropriate materials for environmental and/or other scientific analysis and a basic analysis of suitable deposits (restricted at this stage to establishing the presence or absence of significant material). Special attention should be paid to

sampling securely dated deposits and features and specifically any waterlogged and/or burnt deposits encountered.

4.9 The following analyses should form part of the evaluation, as appropriate. If any of these areas of analysis are not considered viable or appropriate, their exclusion should be justified in the subsequent report.

- A geophysical specialist should be consulted, to assess the viability of using survey techniques on the site. All geophysical work must be undertaken by a suitably qualified organisation and/or individuals. All geophysical work must be preceded by a sample scan to assess the effectiveness of the technique in relation to the site specific geological/topographical conditions. Any subsequent survey work must be recommended by the specialist and approved by the National Park Authority's Senior Archaeology and Heritage Adviser.
- Advice is to be sought from a suitably qualified specialist in faunal remains on the potential of sites for producing bones of fish and small mammals. If there is potential, a sieving programme should be undertaken. Faunal remains, collected by hand and sieved, are to be assessed and analysed, if appropriate.
- The advice from a suitably qualified soil scientist should be sought on whether a soil micromorphological study or any other analytical techniques will enhance understanding site formation processes of the site, including the amount of truncation to buried deposits and the preservation of deposits within negative features. If so, analysis should be undertaken.

5. Evaluation Proposal

A **detailed** evaluation proposal, including the following, should be prepared in accordance with the recommendations of the *Management of Archaeological Projects 2nd Ed.* (1991) and submitted to the National Park Senior Archaeology and Heritage Adviser and English Heritage Inspector for approval:

5.1 A consideration of the whole range of investigative techniques and a statement justifying the proposed omission of any technique.

5.2 An explanation of the sampling strategies to be used.

5.3 A description of the proposed methods of survey and excavation, and recording system.

5.4 A projected timetable for work on site, including machine hire time and staff structure and numbers.

5.5 A projected timetable for all post excavation work, including staff numbers and specialist sub-contractors.

5.6 The names of the project director, supervisors, specialists and any sub-contractors to be employed on the project (including details of qualifications and experience of the key project personnel).

5.7 A separate itemised estimate of costs (core/project staff, specialist fees, travel/subsistence, site works, equipment/materials, archive preparation and copying, report preparation, finds storage fees, overheads, contingency, specified other costs).

5.8 Any significant variations to the proposal must be agreed by the National Park Senior Archaeology and Heritage Adviser and English Heritage Inspector in advance.

6. Site Monitoring

6.1 The National Park Senior Archaeology and Heritage Adviser will be responsible for monitoring the evaluation. A minimum of one week's notice of the commencement of fieldwork must be given by the archaeological contractor to the Lake District National Park Authority so that arrangements for monitoring can be made.

6.2 Site inspections will be arranged so that the general site stratigraphy can be assessed in the initial stages of trial trenching, and/or so that the site can be inspected when fieldwork is near to completion but before any trenches have been backfilled.

7. Reporting Requirements

7.1 The evaluation should result in a report including:

- a concise non-technical summary of the results;
- a description of the methodology employed;
- a location plan at an appropriate scale;
- a summary of the historical and archaeological background;
- excavation plan(s) and section(s) at an appropriate scale showing location and position of trenches dug and features located;
- section drawings should include heights OD;
- excavation plan(s) should include OD spot heights for all principal strata and features;
- a list of and date for any significant finds recovered;
- photographs where appropriate;
- a description of archaeological features and deposits identified;
- an interpretation of the results and of their potential archaeological significance;
- a statement of the likely archaeological implications of the proposed development;
- a full bibliography of sources consulted and a list of any further sources identified but not consulted;
- an index to the project archive;
- a copy of the brief and agreed project design and an indication of any variations.

7.2 The objective account of the archaeological evidence recovered should be clearly distinguished from the interpretation of those features. The methodology used should be critically reviewed.

7.3 Any recommendations for mitigating measures should be presented in the form of a separate annexe to the main report.

7.4 5 copies of the evaluation report should be deposited with the National Park Authority, on the understanding that it will be made available as a public document after an appropriate period (not exceeding 6 months from the completion of fieldwork). Copies will be forwarded to the English Heritage Inspector and the National Monuments Record.

7.5 The results of the work should be published in an appropriate journal or other publication and should include an account of any structures located and full details of significant finds, illustrated as appropriate. Details of the place and date of publication must be notified to the National Park Authority. **Developers and archaeological contractors should be aware that fulfilment of this part of the brief is mandatory and that the Lake District National Park Authority will not issue approval for a specification that does not include details for its implementation.**

7.6 The Lake District Historic Environment Record (LDHER) supports the Online Access to Index of Archaeological Investigations (OASIS) project. The overall aim of the OASIS project is to provide an online index to the mass of archaeological grey literature that has been produced as a result of the advent of large-scale developer funded fieldwork. The archaeological contractor must therefore complete the online OASIS form at <http://ads.ahds.ac.uk/project/oasis/>. Contractors are advised to contact the LDHER prior to completing the form. Once a report has become a public document by submission to or incorporation into the HER, the LDHER may place the information on a web-site. Please ensure that you and your client agree to this procedure in writing as part of the process of submitting the report to the archaeological officer at the LDHER.

8. Deposition of Archive and Finds

8.1 The archive must be prepared in accordance with the recommendations of the *Management of Archaeological Projects 2nd Ed.* (1991) and should be deposited in an appropriate local institution, in a format to be agreed with that institution. The National Park Authority must be notified of the arrangements made. Any finds of archaeological interest should be appropriately conserved and deposited in an appropriate institution: any finds which cannot be so deposited should be fully analysed and published.

9. Further Requirements

9.1 The Code of Conduct of the Institute of Field Archaeologists must be followed.

9.2 It is the archaeological contractor's responsibility to establish safe working practices in terms of current health and safety legislation, to ensure site access and to obtain notification of hazards (eg. services, contaminated ground).

9.3 The involvement of the Lake District National Park Authority should be acknowledged in any report or publication generated by this project.

10. References

English Heritage 2005 *Lowwood Gunpowder Works and Ironworks and the workers' hamlet of Low Wood, Cumbria: an archaeological and architectural survey.*

Appendix 2: Project Design

LOWWOOD GUNPOWDER WORKS, HAVERTHWAITE, CUMBRIA

Archaeological Evaluation Project Design



Client: Lowwood Products Company Ltd

NGR 334708 483707

June 2010

1. Introduction

1.1 Project Background

1.1.1 Prior to submission of a planning application by Lowwood Products Company Ltd (hereafter 'the client') for a proposed programme of improvements to an existing hydro-electric facility at the former Lowwood Gunpowder Works, Cumbria (centred on NGR 334708 483707) English Heritage (EH) and the Senior Archaeology and Heritage Advisor at the Lake District National Park Authority (SAHA LDNPA) were consulted. Almost the entire site of the former gunpowder works, which was established in the early 19th century although the site had been utilised as an iron works until the end of the 18th century, is now a Scheduled Monument and so it is statutorily protected. Following a site visit by SAHA LDNPA and Daniel Elsworth of Greenlane Archaeology, a brief for the work was issued by SAHA LDNPA, which was approved by EH. The brief outlined that the archaeological work should comprise rapid desk-based assessment, site visit of the entire development site, recording of some standing building remains that may be affected, and the excavation of evaluation trenches in four of the five areas (Hodgson 2010).

1.1.2 Prior to carrying out any intrusive work on site, Scheduled Monument Consent must be applied for. The consent application should include a trench plan for the evaluation. This project design covers all these individual elements.

1.1.2 The site was subject to a detailed survey by English Heritage in 2004 (Jecock *et al* 2005), as part of a wider investigation into such monuments initiated in 1999. This established that, prior to the construction of the gunpowder works, the site is thought to have been the location of a bloomery forge in the 18th century, which was subsequently developed in 18th century with the establishment of a blast furnace, which remained in operation until at least 1785. Soon after the site was re-used for the establishment of a gunpowder works, in 1799, which continued to operate, albeit with several phases of modification, until the 1930s.

1.2 Greenlane Archaeology

1.2.1 Greenlane Archaeology is a private limited company based in Ulverston, Cumbria, and was established in 2005 (Company No. 05580819). Its directors, Jo Dawson and Daniel Elsworth, have a combined total of over 18 years continuous professional experience working in commercial archaeology, principally in the north of England and Scotland. Greenlane Archaeology is committed to a high standard of work, and abides by the Institute for Archaeologists' (IfA, formerly the Institute of Field Archaeologists (IFA)) Code of Conduct. The desk-based assessment and evaluation will be carried out according to the Standards and Guidance of the Institute of Field Archaeologists (IFA 2008a; 2008b).

1.3 Project Staffing

1.3.1 The project will be managed and the work supervised by **Dan Elsworth (MA (Hons), AIFA)**, with appropriate assistance as necessary. Daniel graduated from the University of Edinburgh in 1998 with an honours degree in Archaeology, and began working for the Lancaster University Archaeological Unit, which became Oxford Archaeology North (OA North) in 2001. Daniel ultimately became a project officer, and for over six and a half years worked on excavations and surveys, building investigations, desk-based assessments, and conservation and management plans. These have principally taken place in the North West, and Daniel has a particular interest in the archaeology of the area. He has recently managed a number of archaeological excavation projects in the county including an evaluation and excavation in Kendal (Greenlane Archaeology 2008a; 2008b; 2008c); building recording projects on industrial sites in Ulverston and Barrow-in-Furness (Greenlane Archaeology 2009, 2010), and desk-based assessments on numerous sites.

1.3.2 All artefacts will be processed by Greenlane Archaeology, and it is envisaged that they will initially be assessed by Jo Dawson, who will fully assess any of post-medieval date (other than industrial waste). Finds of earlier date will be assessed by specialist sub-contractors as appropriate, and in this case it is envisaged that these may include Ian Miller at Oxford Archaeology North for medieval pottery and industrial waste. The Senior Archaeology and Heritage Advisor will be notified of any other specialists, other than those named, who Greenlane Archaeology wishes to engage, before any specialist contracts are awarded, and their approval will be sought.

1.3.3 Environmental samples and faunal or human remains will be processed by Greenlane Archaeology. It is envisaged that environmental samples will be assessed by Scott Timpany at Headland Archaeology and faunal by specialists at Oxford Archaeology North depending on their timetabling constraints.

1.3.4 Specialist photographic recording of the standing building will be undertaken by Jonathan Ratter of JWRC Chartered Building Surveyors and Historic Building Consultants.

2. Objectives

2.1 Rapid Desk-Based Assessment

2.1.1 To examine information held in the Lake District Historic Environment Record (HER), early maps of the proposed development site, and any other relevant primary and secondary sources, in particular the previous survey report on the site produced by English Heritage (Jecock *et al* 2005), in order to better understand its development, set it in its historic context, and assess the significance of any existing and potential archaeological remains.

2.2 Site Visit

2.2.1 To examine the whole site, with specific attention to the areas to be evaluated, in order to identify any constraints to this and to inspect any existing areas of ground disturbance in order to gain information about the local soil and ground conditions.

2.3 Building Recording

2.3.1 To record the standing building remains (labelled Area 1 on the accompanying plan). These are in a poor and fragile condition and their proximity to the new access road, which will potentially lead to damage being caused by passing heavy vehicles both during and subsequent to the proposed development and due to the felling of nearby trees to accommodate the new access, means that a record of them is necessary in case sections suffer collapse.

2.4 Archaeological Evaluation

2.4.1 To excavate a series of evaluation trenches or test pits investigating the four areas identified in the brief (Hodgson 2010). These will assess the presence or absence of features of archaeological interest within the area, their extent, date, and significance.

2.5 Report

2.5.1 To produce a report detailing the results of the desk-based assessment and evaluation, that will outline the historic development of the site, list the known sites of archaeological interest, present the results of the evaluation, and assess the potential of the site and significance of the remains.

2.6 Archive

2.6.1 Produce a full archive of the results of the evaluation.

3. Methodology

3.1 Rapid Desk-Based Assessment

3.1.1 An examination of both primary and secondary sources, particularly maps, but also published and unpublished local histories, pieces of research, articles and studies relating to the proposed development site and a suitable area around it (the 'study area') will be carried out. These sources will be consulted at the following locations:

- **Lake District Historic Environment Record (HER):** this is a list of all of the recorded sites of archaeological interest recorded in the Lake District National Park, and is the primary source of information for a study of this kind. Each site is recorded with any relevant references, a brief description and location related to the National Grid. All of the references relating to sites identified in the HER will be examined in order to verify them and add any necessary background information. In addition, relevant secondary sources, particularly previous archaeological investigations in the immediate area, will also be examined, as will aerial photographs;
- **Cumbria Record Office (Barrow):** the majority of original and secondary sources relating to the site are deposited in the Cumbria Record Office in Barrow. Of principal importance are early maps, especially those produced by the Ordnance Survey. These will be examined in order to trace the origin and development of any buildings or other structures on the site, and, where possible, their function. In addition, information relating to the general history and archaeology will also be consulted, in order to establish the context of the sites identified within the study area, and the potential for further, as yet unknown, sites of archaeological interest;

- **Greenlane Archaeology:** a number of copies of maps, local histories, unpublished reports, and journals are held in Greenlane Archaeology's library. These will be consulted in order to provide further information about the development of the site, and any other elements of archaeological interest.

3.1.2 The results of this assessment will be used to establish the location, extent, date, and development of any sites of archaeological interest demonstrated to be present within the proposed development area and its environs. The extent of all of the sites identified will be shown on an appropriately scaled maps and areas of archaeological interest or significance will be shown and the extent or level of their potential expressed as considered necessary.

3.2 Site Visit

3.2.1 A rapid inspection of the site will be carried out primarily in order to examine the areas proposed for evaluation in order to position the evaluation trenches, but also to reveal the presence of anything that could constrain their excavation. This would particularly include issues relating to matters of health and safety such as the presence of live service or overhead cables, but also adjoining structures and the presence of trees. Any factors that would prevent or make difficult access to the site will also be identified. Brief notes will be made on the nature of the site and photographs taken as necessary. In addition, the entire site will be quickly inspected to note the presence of exposed areas of ground from previous excavation or disturbance to the site in order that these can provide information about the soil cover, ground conditions and so forth. Any finds identified during this process will be retained as considered necessary.

3.3 Building Recording

3.3.1 Prior to the excavation of any evaluation trenches, the standing building remains (labelled Area 1 on the accompanying plan) will be recorded. This will be carried out using a total station and rectified medium format photography in order to provide a detailed photographic record of the main (north) elevation with a survey of the outline and main details. The results of this will provide a detailed enough record to reconstruct any elements of the wall that might subsequently collapse or be damaged.

3.4 Archaeological Evaluation

3.4.1 The results of the desk-based assessment and site visit will be utilised to present proposed trench locations to the Senior Archaeology and Heritage Advisor at the Lake District National Park Authority. These will be intended to examine the areas that will be affected by the proposed development and any features of archaeological interest, while at the same time taking into consideration any access difficulties or issues of health and safety.

3.4.2 Four areas are required to be examined by evaluation; Areas 2-5 as shown on the attached plan. As outlined in the brief (Hodgson 2010) Areas 2 and 4 will each be examined with at least two separate evaluation trenches, while Areas 3 and 5 will each be examined with at least one (a total of at least six evaluation trenches). It is envisaged that each trench will be approximately 5-10m long and 1.7m wide (a standard excavator bucket width), depending on any constraints identified during the site visit. Each trench will be no longer than 10m, and the extent of trenching will not exceed 102 square metres, equivalent to 60m linear by 1.7m wide. These trenches will target the areas identified during the desk-based assessment as having the greatest archaeological potential, following consultation with the Senior Archaeology and Heritage Advisor at the Lake District National Park Authority. It is anticipated that the evaluation will take six days on site with two archaeologists (totalling 12 person days).

N.B. Update to project design following site visit: the proposed trench location plan has now been compiled for the Scheduled Monument Consent application (see drawing numbers 3 and 4). The trench positions on the plans are indicative, aiming to be as close as possible to their final positions. However, the site is covered in trees and tall undergrowth, and this made accurate trench locations problematic. The lengths and widths shown on the plan are also indicative. All trenches will definitely be no longer than 10m, as stated in 3.4.2, above, and the total area of the evaluation trenches will not exceed 102 square metres. Anticipated dimensions are:

- *Area 2 – two trenches 6-8m in length and one bucket width (c1.7m) wide, targeting earthworks visible on the ground, likely to be affected by new access track*
- *Area 3 – one trench 4m x 4m, in the area where the angle of the corner of the leat is intended to be changed, to check if this will affect any archaeological remains*
- *Area 4 – two trenches 10m in length and one bucket width (c1.7m) wide, designed to check whether there are archaeological remains present beneath or within spoil heap due to be affected by proposed access track*

- *Area 5 – one trench 10m in length and one bucket width (c1.7m) wide, to check if any archaeological remains will be affected by proposed alterations to access track*

3.4.3 The evaluation methodology, which is based on Greenlane Archaeology's excavation manual (Greenlane Archaeology 2007a), will be as follows:

- The site will be checked with a Cable Avoiding Tool (CAT) in order to establish the presence of live electrical services. Any existing service plans will also be consulted in order to identify the presence of other services;
- The trenches will be excavated with regard to the position of any services, focussing on the areas of high archaeological interest or potential, and avoiding areas which are likely to have been severely damaged or truncated by later activity, unless they are considered to have a high potential;
- The modern overburden will be removed by machine under the supervision of an archaeologist until the first deposit beneath it is reached;
- All deposits below the modern overburden will be examined by hand in a stratigraphic manner, using shovels, mattocks, or trowels as appropriate for the scale. Deposits will only be sampled, rather than completely removed, below the first identified level of archaeological interest, unless specified by the Senior Archaeology and Heritage Advisor at the Lake District National Park Authority, with the intension of preserving as much *in situ* as possible;
- The position of any features, such as ditches, pits, or walls, will be recorded and where necessary these will be investigated in order to establish their full extent, date, and relationship to any other features. Negative features such as ditches or pits will be examined by sample excavation, typically half of a pit or similar feature and approximately 10% of a linear feature;
- All recording of features will include hand-drawn plans and sections, typically at a scale of 1:20 and 1:10, respectively, and photographs in both 35mm colour print and colour digital format;
- All deposits, trenches, drawings and photographs will be recorded on Greenlane Archaeology *pro forma* record sheets;
- All finds will be recovered during the evaluation for further assessment as far as is practically and safely possible. Should significant quantities of finds be encountered an appropriate sampling strategy will be devised and agreed following consultation with the Senior Archaeology and Heritage Advisor at the Lake District National Park Authority;
- All faunal remains will also be recovered by hand during the evaluation, but where it is considered likely that there is potential for the bones of fish or small mammals to be present appropriate volumes of samples will be taken for sieving;
- Deposits that are considered likely to have preserved environmental remains will be sampled. Bulk samples of between 10 and 40 litres in volume, depending on the size and potential of the deposit, will be collected from stratified undisturbed deposits and will particularly target negative features (gullies, pits, and ditches) and occupation deposits such as hearths and floors. An assessment of the environmental potential of the site will be undertaken through the examination of suitable deposits by specialist sub-contractors (see *Section 1.3.3* above), who will examine the potential for further analysis. All samples will be processed using methods appropriate to the preservation conditions and the remains present;
- Any human remains discovered during the evaluation will be left *in situ*, and, if possible, covered. The Senior Archaeology and Heritage Advisor at the Lake District National Park Authority will be immediately informed as will the local coroner. Should it be considered necessary to remove the remains this will require a Home Office licence, under Section 25 of the Burial Act of 1857, which will be applied for should the need arise;
- Any objects defined as 'treasure' by the Treasure Act of 1996 (HMSO 1996) will be immediately reported to the local coroner and securely stored off-site, or covered and protected on site if immediate removal is not possible;
- Each evaluation trench will be backfilled following excavation although it is not envisaged that any further reinstatement to its original condition will be carried out.

3.4.4 Should any significant archaeological deposits be encountered during the evaluation these will immediately be brought to the attention of the Senior Archaeology and Heritage Advisor at the Lake District National Park

Authority so that the need for further work can be confirmed. Any additional work and ensuing costs will be agreed with the client and according to the requirements of the Senior Archaeology and Heritage Advisor at the Lake District National Park Authority, and subject to a variation to this project design.

3.5 Report

3.5.1 The results of the desk-based assessment, building recording, and evaluation will be compiled into a report, which will include the following sections (areas in which further work is recommended, and appropriate types of further work, will be listed in a separate document):

- A front cover including the appropriate national grid reference (NGR) and Scheduled Monument Consent application number;
- A concise non-technical summary of results, including the date the project was undertaken and by whom;
- Acknowledgements;
- Project Background;
- Methodology, including a description of the work undertaken;
- Results of the desk-based assessment including historical background, map regression and appropriate details relating to any sites of archaeological interest identified within the study area or areas of archaeological potential;
- Results of the building recording;
- Results of the evaluation including descriptions of any deposits identified, their extent, form, and potential date, and an assessment of any finds or environmental remains recovered during the evaluation;
- Discussion of the results including an assessment of the significance of any archaeological remains present within the study area, areas of further archaeological potential;
- Bibliography, including both primary and secondary sources;
- A copy of the brief and of this project design;
- Illustrations at appropriate scales including:
 - a site location plan related to the national grid;
 - a plan showing the location of the study area in relation to nearby structures and the local landscape;
 - copies of early maps, plans, drawings, photographs and other illustrations of elements of the site, annotated with the extent of the proposed development area where appropriate;
 - illustrations of the standing building remains recorded;
 - a plan showing the position of the evaluation trenches;
 - plans and sections of the evaluation trenches showing any features of archaeological interest;
 - photographs of the evaluation, including both detailed and general shots of features of archaeological interest and the trenches;
 - illustrations of individual artefacts as appropriate.

3.6 Archive

3.6.1 The archive, comprising the drawn, written, and photographic record of the desk-based assessment and evaluation, formed during the project, will be stored by Greenlane Archaeology until it is completed. Upon completion it will be deposited with the Cumbria Record Office in Barrow-in-Furness (CRO(B)). The archive will be compiled according to the standards and guidelines of the IFA (Brown 2007), and in accordance with English Heritage guidelines (English Heritage 1991). In addition details of the project will be submitted to the Online Access to the Index of archaeological investigations (OASIS) scheme. This is an internet-based project intended to improve the flow of information between contractors, local authority heritage managers and the general public.

3.6.2 A copy of the report will be deposited with the archive at the Cumbria Record Office in Barrow-in-Furness, one will be supplied to the client, and within two months of the completion of fieldwork, five copies will be provided for the LDNP Historic Environment Record (HER). A digital copy of the report will be submitted to English Heritage.

In addition, Greenlane Archaeology will retain one copy, and digital copies will be deposited with the OASIS scheme as required.

3.6.3 The client will be encouraged to transfer ownership of the finds to a suitable museum. Any finds recovered during the evaluation will be offered to Kendal Museum. However, the museum is currently close to capacity, so an alternative repository may need to be found for the finds. If no suitable repository can be found the finds may have to be discarded, and in this case as full a record as possible would be made of them beforehand.

3.6.4 A note outlining the results of the evaluation will be prepared for the *Transactions of the Cumberland and Westmorland Archaeological and Antiquarian Society*. If significant remains are encountered it is envisaged that this would lead to further work, in which case the results might be considered worth more detailed publication. In this case a new project design produced and this would be subject to a separate costing.

4. Work timetable

4.1 Greenlane Archaeology will be available to commence the project as soon as it is convenient to the client. It is envisaged that the project will comprise tasks in the following order:

- Task 1: rapid desk-based assessment;
- Task 2: site visit;
- Task 3: submission of proposed trench plan to the Senior Archaeology and Heritage Advisor at the Lake District National Park Authority;
- Task 4: submission of Scheduled Monument Consent application to English Heritage for evaluation trenching;
- Task 5: recording of building remains in Area 1;
- Task 6: evaluation trenching;
- Task 7: production of draft report including illustrations;
- Task 8: feedback, editing, and production of final report;
- Task 9: finalisation and deposition of archive.

5. Other matters

5.1 Access

5.1.1 Access to the site will be organised through co-ordination with the client and/or their agent(s).

5.2 Health and Safety

5.2.1 Greenlane Archaeology carries out risk assessments for all of its projects and abides by its internal health and safety policy and relevant legislation. Health and safety is always the foremost consideration in any decision-making process.

5.3 Insurance

5.3.1 Greenlane Archaeology has professional indemnity insurance to the value of £500,000. Details of this can be supplied if requested.

5.4 Environmental and Ethical Policy

5.4.1 Greenlane Archaeology has a strong commitment to environmentally and ethically sound working practices. Its office is supplied with 100% renewable energy by Good Energy, uses ethical telephone and internet services supplied by the Phone Co-op, has floors finished with recycled vinyl tiles, and is even decorated with organic paint. In addition, the company uses the services of The Co-operative Bank for ethical banking, Naturesave for environmentally-conscious insurance, and utilises public transport wherever possible. Greenlane Archaeology is also committed to using local businesses for services and materials, thus benefiting the local economy, reducing unnecessary transportation, and improving the sustainability of small and rural businesses.

6. Bibliography

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Appendix 3: Summary Context List

Context	Type	Area	Description	Interpretation
101	Layer	2	Dark brown loose silty sand, with small amounts of brick, slate and cobbles	Topsoil
102	Layer	2	Mid orange-brown sandy clay, with 20% cobbles	Natural
301	Layer	3	Dark brown soft silty clay, with frequent concrete locks, concreted slag, and bricks	Dumped deposit
302	Layer	3	Mid grey-brown sandy clay, with frequent brick and concreted slag	Dumped deposit
303	Layer	3	Mid grey-brown sandy clay, 50% gravel, 10% cobbles	Re-deposited subsoil?
304	Layer	3	Dark brown-black sandy clay, some small gravel	Buried soil?
305	Layer	3	Mid orange-brown gravel, 10% rounded cobbles	Natural river gravels
306	Cut	3	Linear in plan, orientated north-east/south-west, 1.3m+ wide, 0.15m deep	Cut for embanked track
307	Fill	3	Mid brown, loose sandy clay with frequent concreted slag	Fill of 306 forming embanked track
308	Cut	3	Oval, 1.6m+ long north-east/south-west, 1m wide, c0.3m deep. Extent not fully exposed	Cut of pit
309	Fill	3	Dark brown-black, sandy peat	Fill of pit 308
310	Layer	3	Mid orange-brown sandy clay, 30% rounded gravels	Re-deposited subsoil or natural
311	Cut	3	Linear, orientated east/west, 0.4m+ wide, c0.1m deep	Cut of linear feature
312	Fill	3	Mid grey silty clay, small amount of gravels	Fill of linear feature 311
313	Layer	3	Mid orange firm clay	Natural
314	Layer	3	Mid orange-brown gravel, 10% rounded cobbles	Natural river gravels
401	Layer	4	Mid grey-brown silty sand, frequent concrete blocks, bricks, iron, concreted slag	Dumped deposit
402	Layer	4	Pale yellowish-brown sand, 10% gravels	Dumped deposit
403	Layer	4	Pale whiteish-yellow concreted slag	Dumped deposit
404	Layer	4	Mid orange-brown and dark purplish-brown sand and granular iron waste	Dumped deposit
405	Fill	4	Pale off-white plaster, with local roofing slate and	Dumped deposit filling 406

Context	Type	Area	Description	Interpretation
			red hand-made bricks	
406	Cut	4	Wide U-shaped ditch (base not reached) cutting into 404	Cut
407	Layer	4	Thin layer of soft black silt or soot	Dumped deposit
408	Layer	4	Pale yellowish-white concreted slag	Dumped deposit
409	Layer	4	Pale yellowish-white concreted slag similar to 408	Dumped deposit
410	Layer	4	Dark brown sandy deposit similar to 404	Dumped deposit

Appendix 4: Summary Finds List

Context	Fabric	Qty	Description	Date range
101	Industrial residue	10	Blue vesicular glassy slag	18 th – 20 th century
101	Industrial residue	5	Green vesicular glassy slag	18 th – 20 th century
101	Plastic	4	'Search Extra' toothbrush; black BIC biro; white plant tag; Smith's crisps packet labelled 'Smiths Food Group Ltd, 111(?) Mortlake Road, Richmond, Surrey, TW9 4AH'	Late 20 th century
101	Aluminium	1	Pie wrapper/case	Late 19 th century - modern
101	Clay pipe	2	Undecorated stem fragments of a tobacco pipe with a medium/narrowish bore	Mid 18 th – early 20 th century
101	Glass	3	Flat pane fragments	18 th century – modern
101	Glass	2	Very light blue, refitting, multi-part mould bottle fragments	19 th – early 20 th century
101	Glass	1	Light blue bottle with embossed '...SPOONS' gradations on the side	19 th – early 20 th century
101	Glass	1	Dark green bottle fragment	Post-medieval
101	Glass	1	Colourless hollow-ware rim	19 th – 20 th century
101	Glass	1	Very light turquoise bottle fragment, embossed	19 th – early 20 th century
101	Glass	2	Heat-affected (from fire or similar) small colourless bottle with external screw top closure; light blue fragment	20 th century
101	Pottery	4	Bone china: 'Broseley' transfer-printed x2, red enamel-lined tea cup fragment, and relief moulded plate rim	19 th – 20 th century
101	Pottery	5	Creamware? (fragments, so can only go on colour)	Mid 18 th – early 20 th century
101	Pottery	45	White earthenware: plain x19 (including 2 enamelled), sponge printed x2, transfer printed x16 (including green transfer-printed mug fragments x3, 'Willow' x2, 'Fibre' x1, other transfers x10), late looking press-moulded plate rim x1, painted x4 (earth colours x1, blue x1, and blue and black x2), factory produced slipware x1, with some with blue decoration of unknown type x2	19 th – early 20 th century
101	Pottery	2	Stoneware: rouletted brown-glazed jar fragment and a buff/olive coloured jar bottle fragment	Late 18 th – mid 20 th century

Context	Fabric	Qty	Description	Date range
101	Pottery	25	Red earthenware: black-glazed crock fragments x8 (including 3 refitting and 2 internal fragments), brown-glazed jar bases and sides x5, unglazed refitting (flower pot?) x2, brown-glazed x10 (including bottle/jar fragments with white slip stripes and 2 others with white slip plus one fineware cup(?) rim	Late 17 th – early 20 th century
303	Industrial residue	6	Black glassy vesicular slag fragments	18 th – 20 th century
303	Industrial residue	1	Purple, light weight, vesicular slag	18 th – 20 th century
303	Plastic	1	Green painted, flat, grey fragment	Modern
303	Pottery	1	Light brown speckled glazed red earthenware	Late 17 th – early 20 th century (probably earlier part of this)
303	Animal bone	1	Butchered fragment, calcined, Fe residue	Not closely dateable
307	Pottery	1	Buff-coloured stoneware ridged jar rim with tie on lid	19 th – early 20 th century
307	Plastic	1	Ariel festive pack balloons, LRC Products Ltd, London E4 8QA	Post-1978
309	Timber	2	1 x small roughly cut or broken piece, painted orange-red on one side 1 x neatly sawn piece of board 0.31m long by 0.14m wide, not complete as broken along one long edge, and with leaves and copper staining on one side	No closely dateable/late 19 th century - modern
309	Pb	1	Folded sheet fragment with three holes pierced through it	Not closely dateable
309	Industrial residue	1	Black vesicular slag, matt finish and heavy	18 th – 20 th century
309	CBM	1	Gritty dark yellow firebrick fragment, rough and hand-finished	18 th – 19 th century?
309	Fe	8	Corroded iron rods or nails	Not closely dateable
309	Fe	6	Corroded bolts	19 th century – modern
309	Fe	2	Corroded square nuts	19 th century – modern
309	Fe	1	Corroded circular sheet with hole in centre, perhaps washer?	19 th century – modern
309	Fe	1	Corroded strip, expanded at each end, perhaps hinge?	18 th century – 20 th century

Context	Fabric	Qty	Description	Date range
309	Fe	1	Corroded bent rod, flattened at each end, perhaps part of window latch?	19 th century – modern
309	Fe	6	Corroded sheet fragments, 1 x possible gutter fragment	Not closely dateable
309	Fe	1	Curved piece, with rounded edges, perhaps piece of gutter or gutter bracket	19 th century – modern
309	Glass	1	Small fragment of mil glass with traces of gold enamelled text '-09' or '60-'	19 th – 20 th century
309	Glass	1	Turquoise bottle fragment	19 th – early 20 th century
309	Glass	57	Window glass, varying thicknesses, some with putty/paint marks around edge	18 th century - modern
309	Cu alloy	29	Cut square-section nails with 'T-heads'	19 th century
309	Cu alloy	13	Cut square-section nails with flat round heads	19 th century
309	Cu alloy	1	Long wire nail, with flat round head	Late 19 th century – modern
309	Cu alloy	1	Flat-headed tack	Post-medieval
309	Cu alloy	1	Screw	19 th century - modern
312	Pottery	1	Bone china cup rim	19 th – 20 th century
312	Pottery	6	White earthenware including pearlware fragment and factory produced slipware with cat's eye and banded	19 th – early 20 th century
312	Pottery	5	Red earthenware: brown-glazed crock rim, brown-glazed coarse bowl with white slip stripes, 3x fragments from smaller vessels e.g., bottles	Late 17 th – early 20 th century
312	Pottery	1	Soft red earthenware unglazed (glaze possibly flaked off, or flower pot)	18 th – early 20 th century
312	CBM	3	1 x dark yellow firebrick fragment, very coarse fabric, 1 x red hand-made brick fragment, partially vitrified on one side, 1 x machine-made brick fragment	18 th – 19 th century
312	Industrial residue	3	Blue vesicular glassy fragments x2; grey very glassy vesicular fragment x1	18 th – 20 th century
Trench 4 U/S	CBM	1	Yellow and green glazed wall tile with relief-moulded leaves, with mark on the back: 'R ^d N ^o 5360...' (only a quarter of the tile is present)	Post-1909
401	CBM	1	Rectangular dark yellow firebrick, marked 'FOSTER HG',	1877-1967

Context	Fabric	Qty	Description	Date range
401	CBM	1	Wedge shaped dark yellow firebrick, marked 'NETTLE 12',	Post-1887
401	CBM	1	Triangular dark yellow firebrick, marked 'MOBBERLEY [...]OURBRIDGE' (not retained)	19 th – 20 th century
401	Iron	1	Piece of a metal grill c0.5m long and c0.3m wide, perforated with round holes, apparently one part of a larger circular grill (not retained)	Post-medieval
401	Animal bone	3	Large mammal – butchered rib, butchered bone fragments, broken fragment	Not closely datable
401	Copper alloy	1	Wire loop (possible coat hook?) approximately 0.21m high	Not closely datable
401	Glass	1	Flat pane fragment, almost colourless	18 th century - modern
401	Glass	4	Light turquoise bottle fragments from multi-part moulds, including one with embossed writing for contents on the outside '...S&C ^o '	19 th – early 20 th century
401	Glass	2	Very light turquoise bottle fragment, including mouth from a drinks bottle with groove for internal rubber washer, hand finished	Late 19 th – early 20 th century
401	Glass	3	Dark green bottle fragments, including base with small diameter and straight sides, no high kick	Mid 19 th – 20 th century
401	Industrial residue	2	Black vesicular glassy lump; grey broken drip	18 th – 20 th century
401	Clay pipe	1	Unmarked heavy bowl and stem of tobacco pip	19 th – early 20 th century
401	Electrical porcelain	2	Small electrical insulator with number 42834 with corroded Fe and mineralised wood attached and glazed insulator fragment	Late 19 th – 20 th century
401	Pottery	2	Coarse red earthenware – flower pot fragment and brown-glazed crock rim	Late 17 th – early 20 th century
401	Pottery	3	Fine red earthenware - black-glazed gilded moulded tea pot handle, tea pot fragment with white slip decoration, black-glazed yellow transfer-printed fragment with gilding and painted colourer enamels (pink and white)	Late 17 th – early 20 th century
401	Pottery	5	Stoneware – refitting brown salt-glazed jar fragments (grey body, green internal glaze) x2, ridged buff-coloured jam / marmalade jar fragments x2, buff-coloured bottle / jar fragment x1	19 th – early 20 th century
401	Pottery	2	Bone china – body fragment; small tea pot spout, gilded	19 th – 20 th century

Context	Fabric	Qty	Description	Date range
401	Pottery	21	White earthenware crockery fragments: plain x7, gilded 3 stripe cup rim and gilded saucer base (underside diagnostically late), sponge-printed x3, 'Asiatic Pheasants' transfer-printed x2, 'Willow' transfer-printed x1, 'Broseley' transfer-printed x1, blue transfer prints x2 (one late), olive green transfer-printed x3 (including refitting plate rims with enamels painted)	19 th – early 20 th century
402	CBM	3	Fragments of the same type of tile as the unstratified material from Trench 4 with elements of same registration number (above)	Post-1909
402	Pottery	1	Buff-coloured stoneware jar rim with tie on lid	19 th – early 20 th century
402	CBM	1	White glazed tile	19 th century – modern
402	Glass	1	Very light turquoise flat fragment	19 th – early 20 th century?
402	Aluminium	1	Grid impressed foil	Modern
402	Iron	2	Coat hook – bent wire and sheet design and a small corroded rod	Late 19 th – 20 th century?
402	Copper alloy	1	Furniture wheel and attachment plate (e.g., trolley) with iron corrosion and plaster	19 th - 20 th century
403	Clay pipe	1	Unmarked stem of tobacco pipe with narrowish bore	19 th – early 20 th century
404	Fe	1	Thick strip	Not closely dateable
404	Fe	1	Thin strip	Not closely dateable
404	Fe	1	Circular fragment with section cut from one side and 'tang' on opposing side	Not closely dateable
404	Fe	3	Coils of boring waste	Late 19 th century - modern

Appendix 5: Environmental Samples

Sample	Context	Volume (litres)	Description
1	304	10	Buried soil?
2	309	20	Fill of pit 308

Environmental samples list

Sample number	1
Volume (litres)	4
Potash/fuel ash	++
Glassy slag	+
Charcoal	+++
Coal (burnt and unburnt)	++++
Glass	+
Hammerscale	+++
Prill	+++
Mollusc shell	+
Concrete	+
Roots	+++
Slag	+++

Volume and contents of retents (Key: + = 1-5, ++ = 6-20, +++ = 21-100, ++++ = >100)

Sample number	1
Volume (millilitres)	c300
Plant Monocotyledon fragments	++++
Wood fragments	++++
<i>Rubus fruticosus</i>	++++
<i>Sambucus nigra</i>	++++
<i>Urtica dioica</i>	+
<i>Betula</i>	+
Slag	+
Prill	++
Burnt bone	+
Unburnt bone	+
Cinder	+
Sample number	2
Volume (millilitres)	c300
Plant Monocotyledon fragments	++++
Wood fragments	++++
<i>Rubus fruticosus</i>	++++
<i>Sambucus nigra</i>	++++
<i>Urtica dioica</i>	+
Charred <i>Rubus fruticosus</i>	++
Bud cf. <i>Betula</i>	+
Slag	+
Prill	+
Burnt bone	+
Unburnt bone	+
Coal	+
Fe nail	+

Volume of flots/waterlogged sub-sample and contents (Key: as for Table 2 for charred seeds; all other remains + = 1-5%, ++ = 6-20%, +++ = 21-100%)