FORMER GROSMONT IRONWORKS, GROSMONT, NORTH YORKSHIRE

PHASE 1 ARCHAEOLOGICAL SURVEY

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EXECUTIVE SUMMARY

In February 2007, Ed Dennison Archaeological Services Ltd (EDAS) were commissioned by Mr Graham Lee, Senior Conservation Archaeologist of the North York Moors National Park Authority (NYMNPA), to undertake a programme of Phase 1 archaeological survey and recording at the former Grosmont Ironworks, Grosmont, North Yorkshire (NGR NZ8271505342 centred). The survey was required to provide information to assist with the formulation of management and interpretation proposals for the site.

The Grosmont ironworks were established in 1862 by Charles and Thomas Bagnall, members of a well-established family of ironworkers and colliery owners. They also controlled the neighbouring iron mines, and made use of the recently constructed railways to bring in raw materials and move out the processed ore. An account written in 1863 describes the complex as comprising two blast furnaces, hot blast stoves, an engine house and boiler house with chimney, a bank of calcining kilns, and a steam lift, with a number of railway sidings and associated infrastructure. The works achieved their highest output between c.1865 and 1875, with 40,000 tons of pig iron being produced each year and about 500 people employed directly or indirectly. A third blast furnace was added in c.1875. However, a decline in the price of pig iron, coupled with industrial unrest, led to the works closing in 1891 and most of the plant was demolished. The site experienced a second phase of activity at the turn of the 20th century, when the extensive slag dumps were reworked and re-processed to produce road stone. New railway lines and structures were built to facilitate this reworking, which ceased around the time of the Second World War.

Almost nothing remains above ground of the Grosmont ironworks today, partly due to the reworking of the area in the 20th century. The main visible elements are the chimney base and the lower part of the third and latest blast furnace in the upper NYMNPA car-park, and a tramway bridge to the north which brought iron ore over the river Esk from the adjacent mines. Several other railway bridge abutments survive, as well as a wharf structure on the river. However, it is likely that the remains of all three of the blast furnace bases survive below the upper car-park; the 1863 description of the works describes their substantial nature and depth, together with associated flues and pipes. It is possible that the largest surviving structure on the site, two 4.4m high ruined brick pillars on the north side of the upper car-park, represents a remnant of the ironworks railway gantry which took material to the calcining kilns or perhaps is part of the steam lift engine house itself. However, it is clear that the structure was extensively modified after c.1900 to be used as part of the slag re-processing operations. Further research into the scale and scope of the re-processing work might shed further light on this phase of activity.

1 INTRODUCTION

Reasons and Circumstances of the Project

1.1 In February 2007, Ed Dennison Archaeological Services Ltd (EDAS) were commissioned by Mr Graham Lee, Senior Conservation Archaeologist of the North York Moors National Park Authority (NYMNPA), to undertake a programme of Phase 1 archaeological survey and recording at the former Grosmont Ironworks, Grosmont, North Yorkshire (NGR NZ8271505342 centred).

1.2 The scope of the work was defined by discussions between EDAS and the Senior Conservation Archaeologist of the NYMNPA; no formal brief or specification was prepared. In summary, the project comprised a detailed archaeological survey of the core of the remains, supplemented by a walkover survey of a wider area. The resulting descriptive report would provide sufficient information to assist with the formulation of management and interpretation proposals for the site.

Site Location and Description

1.3 The former Grosmont ironworks and its associated remains are located within the village of Grosmont in the valley of the river Murk Esk in North Yorkshire (see figure 1). The ironworks occupied a site on the western edge of the village, adjacent to the former Castleton to Grosmont railway line (now partly formed by the North Yorkshire Moors Railway), at an elevation of c.33m AOD. The site lies within the North York Moors National Park but currently has no statutory protection.

1.4 The site complex is accessed via a rough metalled trackway leaving the north side of Front Street, the main route out of Grosmont to the west. At the time of the survey, the detailed survey area was an unofficial car-park and was partly overgrown with saplings and scrub. The area is separated from the adjacent railway line by a curving 1.6m high boundary wall, c.0.5m wide at the base and built of neatly coursed squared sandstone set in a lime mortar surmounted with semi-circular coping.

1.5 The detailed survey area was sub-rectangular in plan and measured c.150m long (north-east/south-west) by c.76m wide (north-west/south-east) (see figure 2); the area corresponded to the National Park Authority's upper car-park adjacent to the railway station. Following the initial site survey work, it was agreed that a walkover survey would be carried out over an expanded area to the north and north-east, as far as the river Esk and a former bridge crossing the main Whitby to Pickering line. This enlarged area, which included the National Park Authority's lower car-park, covered most of the former ironwork's slag tips as well as a number of other features apparently associated with other industrial enterprises, such as the brickworks formerly located to the east of the railway line.

Objectives of the Project

1.6 The aims and objectives of the project can be summarised as follows:

- to gather sufficient information to establish the extent, nature, character, condition, quality and date of any surviving archaeological and historical features within the survey area;

- to establish the functional relationships between the archaeological and historical features;

- to provide a basis for the preparation of detailed management proposals by the National Park's Senior Conservation Archaeologist;

- to provide a detailed, pre-intervention record of the site;

- to provide information for display and interpretation purposes.

Survey Methodology

1.7 As noted above, the scope of the archaeological survey work was defined through discussion between EDAS and the Senior Conservation Archaeologist of the NYMNPA. Three main elements were involved:

Documentary research

1.8 No detailed primary documentary research was required to be undertaken as part of the project. The basic history of the ironworks has already been established by Counsell as part of a wider history of Grosmont (Counsell 1981) while Chapman has produced an excellent booklet on Grosmont ironstone mines and ironworks, reproducing much valuable primary documentation (Chapman 2002). Other readily available material, including historic maps and secondary sources have also been consulted. A full list of the sources consulted, together with their references, is given in the bibliography below.

Detailed site survey

1.9 A detailed topographic survey of the whole of the survey area was carried out to record the position and form of all features considered to be of archaeological and/or historic interest.

1.10 The survey was undertaken at a scale of 1:250 by Benchmark Surveys of Leeds using EDM total station equipment. Sufficient information was gathered to allow the survey area to be readily located through the use of surviving walls, wall junctions and other topographical features. The survey recorded the position at ground level of all structures, wall remnants and revetments, earthworks, spoil and waste tips and any other features considered to be of archaeological or historic interest. The survey also recorded any differences in the exposed surface detritus, such as concentrations of stone or brick rubble, as well as differences in coarse vegetation, as these features may aid the functional differentiation and interpretation of the site.

1.11 The site survey was integrated into the Ordnance Survey national grid by resection to points of known co-ordinates. Heights AOD were obtained by reference to Ordnance Survey benchmarks in the field wall to the west of the site. A temporary bench mark was established and left on site using a ground marker approved by the National Park Authority. Control points were observed through trigonometric intersection from survey stations on a traverse around and through the site. The maximum error in the closure of the traverse would be less than +/- 25mm. The locations, descriptions and values of the Bench Marks and control points are stated in the final survey data. The EDM survey was undertaken on 21st-22nd March 2007.

1.12 On completion of the EDM survey, the field data was plotted at a scale of 1:250 and re-checked on site as a separate operation, on 13th March 2007. Detailed amendments and additions were made using hand-measurement techniques, and the results digitised back into the electronic survey data. Brief descriptive records incorporating location, dimensions, plan, form, function, possible date, and sequence of development of the identified sites were made, and this information is contained in the gazetteer of sites which appears as Appendix 1.

Walkover survey

1.13 Modern Ordnance Survey map bases at scales of 1:1250 and 1:2500 were supplied by the NYMNPA for the enlarged survey area. This area was then subject to a detailed walkover survey, locating the remains of features marked on the historic maps, and also those which were not. Their locations were sketched onto the Ordnance Survey bases as accurately as was possible, although the dense late winter/early spring vegetation, and the poor preservation of some of the remains, meant that they could only be located approximately.

1.14 Brief descriptive records incorporating location, dimensions, plan, form, function, possible date, and sequence of development of the identified sites were made, and this information is contained in the gazetteer of sites which appears as Appendix 1. The walkover survey was carried out on 21st May 2007.

Photographic record

1.15 A general photographic record of the site and its significant parts, together with close-up photography of significant details, was undertaken. The photographic guidelines produced by the RCHME were followed and each photograph was provided with a scale and an identifier where appropriate. Photographs were taken using digital and 35mm colour print film; due to the nature of the remains on site, only a limited number of photographs were taken. A selection of the site photographs have been reproduced for illustrative purposes to accompany this report.

1.16 All photographs have been clearly numbered and labelled with the subject, orientation, date taken and photographer's name, and are cross referenced to film and negative numbers. All photographic film was exposed and processed to ensure high quality definition, and was processed to archival standards according to manufacturer's specifications.

Report and Archive Production

1.17 This report forms a detailed written record of the site complex, prepared from the readily available documentary sources and the data gathered on site, and analyses its form, function, history, and sequence of development, as far as is possible given the limitations of the survey methodologies. The site is also placed within its historical, social and industrial context, where possible. Two copies of the survey report have been provided to the NYMNPA, including an electronic version. Copyright of all survey material and the report had passed to the NYMNPA.

1.18 A properly ordered and indexed project archive (paper, magnetic and plastic media) was deposited with the NYMNPA at the end of the project, in accordance with the standard set by the National Archaeological Record. The archive contains field and final ink drawings, written accounts, structured catalogues and indices,

and project management records. Drawn records have been presented as wet ink plots on standard “A” size matt surface stable polyester film sheets.

2 HISTORICAL BACKGROUND

Introduction

2.1 As noted above, no new documentary research was required as part of the archaeological survey work, and so the following chapter is drawn almost entirely from the historic map coverage and readily-available secondary publications.

Early Transport Links and Ironstone Mining

The railway network

2.2 The genesis of the Grosmont ironworks lay in two events, the improvement of the railway network in the immediate area and the start of commercial ironstone mining in the Murk Esk/Esk river valley. A horse railway connecting Whitby with Pickering had first been proposed in 1826 but it was only in the early 1830s that the project began to gather momentum. A report by Thomas Storey in 1833 concluded that the commercial possibilities of the line were favourable, including the extraction of ironstone along the route, and another pamphlet by William Thompson in the same year made the same case (Chapman 2002, 6 & 15). However, it is probable that far more weight was attached to the positive assessment given by George Stephenson, after which sufficient funds were raised and an Act of Parliament obtained, on 6th May 1833 (Hoyle 1978, 66). Detailed surveying of the proposed route started soon after and construction began at the Whitby end in September 1833 (Joy 1969, 10-12).

2.3 The single track line, initially horse-drawn throughout, ran up the valley of the river Esk from Whitby, through the vale of Goathland and reaching the village itself via a water-powered inclined plane. From Goathland, it crossed Newtondale and then onto Pickering. At Grosmont, the route included a tunnel beneath Lease Rigg, linking the Esk valley to the vale of Goathland, and a wooden bridge over the Murk Esk. The Tunnel Inn was built adjacent to the bridge on the north side of the Murk Esk to allow horses to be changed and to provide refreshments for travellers. A settlement then grew up around the inn, which was locally known for some time as “Tunnel” rather than “Grosmont” (Chapman 2002, 6-7); it is so named on the Ordnance Survey 1853 6” map (see figure 3).

2.4 By May 1835 the section from Whitby to Grosmont (including the 120 yard long Grosmont tunnel) was complete, and in June of the same year regular services between Whitby and the Tunnel Inn at Grosmont began. The line carried both passengers and also industrial traffic, with 10,000 tons of stone being conveyed from the Whitby Stone Company’s Lease Rigg sandstone and whinstone quarries near Grosmont in the first year. The whole line was completed in 1836, being formally opened on May 26th (Joy 1969, 10-15; Chapman 2006, 6).

2.5 Initially, the Whitby and Pickering (hereafter W&P) Railway was not a commercial success, the losses being attributed to the continued use of horse-haulage into the 1840s, although it did stimulate some local industrial development; for example, a battery of four large limekilns was erected at Grosmont before 1840 by the Whitby Lime Company and the railway was used to bring limestone in from Pickering (Joy 1969, 21 & 25). The W&P was then purchased by George Hudson in 1844 and amalgamated with the York and North Midland Railway. Soon after, between 1845 and 1847, the whole length of the former line was converted to double-track locomotive haulage, including the provision of a new station at Grosmont, as well

as a tunnel and stone bridge across the Murk Esk (Chapman 2002, 15; Joy 1969, 24). The final piece of the local network fell into place in October 1865, when the North Yorkshire and Cleveland (NYC) Railway opened, creating a junction at Grosmont (Chapman 2002, 28); the NYC had actually been absorbed by the North East Railway in 1858, who had completed the majority of the line, although it retained the title of the NYC (Rounthwaite 1997, 31).

Ironstone mining

2.6 As mentioned above, the commercial viability of ironstone deposits along the length of the W&P had been highlighted by its promoters as early as 1833. Chapman notes that, although it is commonly stated that ironstone deposits were first discovered at Grosmont during the driving of the original tunnel, there is an account given by geologist Joseph Bewick stating that they were in fact first seen in the bed of a stream in the *vicinity* of the tunnel works by a Mr Wilson, one of the partners of the Tyne Iron Company (Chapman 2002, 7). Ironstone mining at Grosmont may have been commenced by the Whitby Stone Company, and in May 1836, very soon after the railway had opened, the firm sent a trial cargo of 55 tons of ironstone to the Birtley Iron Company and another to the Tyne Iron Company. Although the first assessments were not favourable, due to shale impurities, later samples were of better quality. This led to a contract between the Whitby Stone Company and the Birtley Iron Company, for the former to supply the latter with ironstone (Counsell 1981, 24-25; Chapman 2002, 7-8).

2.7 The two main ironstone seams worked at Grosmont were the Avicula and the Pecten beds, although limited attempts were also made to work the Top or Dogger ironstones. Following their contract with the Birtley Iron Company, the Whitby Stone Company leased land in 1839 from Thomas Hay, a prominent local landowner, and started mining there, on the east side of the railway line and south of the Esk. In 1840, the Birtley Iron Company then leased land further to the north-east at Carr House Farm to mine their own ironstone; the farm was consequently re-named Birtley Farm. Between the two aforementioned mines, further mining took place on land owned by Mrs Mary Clarke (Counsell 1981, 24-25; Chapman 2002, 8-12).

2.8 Despite a drop in trade in 1842 due to the improved availability of Scottish ironstones, combined with the invention of the hot blast process at blast furnaces, matters improved again between 1843 and 1846 as a result of the erection of new blast furnaces in Cleveland. However, trade was again affected by the discovery of the Cleveland Main Seam of ironstone at Eston in 1850, which was more easily accessible and therefore cheaper to extract than the Grosmont deposits. The solution to this problem, or so it seemed to those concerned, was to build blast furnaces closer to the site of the Grosmont mines, which still had a combined annual output of 70,000 tons in 1859; this total was made up from the Whitby Stone Company mines (30,000 tons), Mrs Clarke's Hollins House Mine (30,000 tons) and the Birkley Iron Company's mine at Eskdale (10,000 tons) (Shill & Minter 1994, 289). Although several schemes were proposed or reported upon in local newspapers, only two came to fruition; the ill-fated blast furnaces at nearby Beck Hole and the far more successful ironworks at Grosmont itself (Chapman 2002, 15-20).

The Grosmont Ironworks

Construction and opening

2.9 The future site of the Grosmont ironworks, to the north of the aforementioned battery of limekilns and on the west side of the railway line, is shown as enclosed agricultural land on the Ordnance Survey 1853 6" map (see figure 3). The land on which the ironworks was built was bought by Thomas and Charles Bagnall in 1861. The Bagnalls were a well-established family of ironworkers and colliery owners, having erected ironworks in Shropshire during the early 19th century and then moved to Staffordshire (Shill & Minter 1994, 288-289). In order to secure a future supply of ironstone, Charles and Thomas had also purchased the Hay estate at Grosmont, which included the mines operated by the Whitby Stone Company, and started building back-to-back workers' cottages in the village in May 1862 (Counsell 1981, 28; Chapman 2002, 18-21).

2.10 The contactors for the construction were Thomas Perry and Sons, and the foundation stone for the first blast furnace was laid on the 14th June 1862, reported on as follows in the *Whitby Gazette*:

The foundation stone of the first blast furnace for the Grosmont Iron Co was laid on Wednesday last (14th June) and was the occasion of great rejoicing. Flags were flying in all directions and formed a beautiful contrast with the green trees … T Bagnall Esq, one of the proprietors being over to inspect the nature of the foundations for 2 furnaces, it was resolved … to lay the first stone. Under the stone was placed a parchment roll. This roll named various officials as: Charles and Thomas Bagnall; Thomas Perry Manager; W Henry Talbot, Cashier; Thomas Perry and Son, Contractors for the Iron Works; Coulthard and Son, contractors for the engine; William Wilde, Builder.' (Chapman 2002, 21-23).

2.11 The first cargo of firebricks and blocks for the furnaces arrived at Whitby from Newcastle soon after, and the works appear to have been completed in 1863, when they were the subject of an article published in the *Proceedings of the Institution of Mechanical Engineers* (Coulthard 1863; see Appendix 2). This article provides a valuable and detailed description of the ironworks as they were when first built, given by Mr Hiram Coulthard of Blackburn, who had designed the engines and boilers on the site, and who had also been responsible, with the works manager Mr Barnes, for the general working arrangements of the site. The layout of the site is shown on a plan accompanying the article. Coulthard noted that the ironworks were served by a siding from the main W&P line. Coke was brought in from the Newcastle and Durham coalfields and, at the height of its operation, two coke trains a day arrived at Grosmont to feed the furnaces. The limestone used as a flux was derived from Pickering, whilst the ironstone was mined locally (Counsell 1981, 28).

2.12 The two blast furnaces that were initially erected were described as being constructed on "a very efficient and economical plan" and, allowing for Sunday stoppages, each could produce 250 tons of pig iron a week. Each furnace measured 18 feet in diameter at the boshes, and rose to a height of 63 feet from ground level to the charging floor; when fully charged, each weighed c.1200 tons. The stone and concrete foundations of each furnace supported the firebrick hearth, whilst the superstructure above was carried on ten cast-iron pillars; the pillars incorporated integral brackets to support the pipes conveying the blast and water to the five tuyeres of each furnace (Coulthard 1863, 225-227).

2.13 The throat of each blast furnace was equipped with a wrought-iron tube to collect the waste gases, which were then conveyed via a large gas main to the boilers of the engine house, located to the south-west of the furnaces. The engine house was built of red brick with mouldings of white brick with a large water tank on the roof supplying water to the tuyeres and the pig-beds; the water was taken from the river Esk by two lift pumps. The engine house contained three direct-acting high pressure engines, the third being provided in case of the failure of one of the other two - these type of engines were preferred to a single large beam engine due to the much higher cost of the foundations and frame for the latter. The engine house was also provided with a travelling crane to cater for the examination of the engines or replacement of parts. The five boilers were each 73 feet long and of plain egg-ended form, and exhaust gases were taken into an adjacent 180 feet high chimney (Couthard 1863, 227-229).

2.14 The high pressure engines provided the blast for the furnaces. The blast was conveyed via the large diameter blast main to hot-blast stoves located on the north-west side of the furnaces. Each furnace was equipped with three hot-blast stoves, built of common brick (described as being “made on the estate”) lined with refractory firebrick. The stoves raised the temperature of the blast to between 600 to 700 degrees Fahrenheit, and from here it passed to the tuyeres at the base of each furnace. Although the works were finished by the end of 1863, the blast furnaces were not “blown in” until the beginning of 1864, the Whitby Gazette of the 9th January reporting that the first tapping “was highly satisfactory, the metal being of a very superior quality” (Chapman 2002, 28-29).

2.15 In the area to the north-west of the hot-blast stoves, there was also a bank of calcining kilns, for calcining the iron ore delivered to the site. The railway siding leading into the site passed beneath an unidentified structure and then through the calcining kilns, terminating at a steam lift to their south-west, which was used to raise the iron ore from the railway to the level of the kilns (Coulthard 1863, 227-229). A 19th century photograph, reproduced by Chapman (2002, 23), shows the base of three of the brick-built calcining kilns, each equipped with a tall semi-circular draw arch within which probable cast-iron lintels over the draw eye/eyes can be seen. In front of the kilns, equipped with two wheeled hand-carts, are the workmen who drew out the calcined ore standing by several furnace fillers.

2.16 Although the plan accompanying the 1863 article (see Appendix 2) clearly shows that there was a desire to increase the capacity of the site from two to four furnaces, and that provision had been made for such an eventuality from the start, the extra furnaces were not added immediately. The amended 1853 Ordnance Survey 6” map (probably dating to c.1860) shows only the original two furnaces to be present, as does the plan of 1864 (see figure 4a and plate 3). The 1853 OS plan shows a siding leaving the W&P, curving around to the south-west to join the NYC, and there are two other sidings further to the north, curving round from the W&P and running south-west and west across the site; one branch runs around the north side of the calcining kilns to the steam lift while the other leads to a building adjacent to the Grosmont Bridge road. Only some of these lines are shown on the 1864 plan. To the east, a smaller length of railway siding runs north, running to a “tramway” shown on the 1864 map which then crosses the river Esk.

2.17 The two 1860s maps also show a walled or enclosed space to the south of two furnaces, with the large engine and boiler house clearly visible to the south-west. On the OS plan, a single railway track loops around in a broad curve from the furnaces to run north-west, crossing over the line to the calcining kilns and the

siding leading to the building close to the Grosmont Bridge road. A small rectangular structure stands to the north-east of the eastern furnace, with further roofed buildings to the east; only the latter buildings are shown on the 1864 plan. The hot-blast stoves (five on the OS map, six on the 1864 map) described in 1863 are indicated to the north of the furnaces, with two buildings beyond, one of which represents the calcining kilns; a long rectangular structure on the north-east side of these might be another unidentified building.

2.18 It is believed that four standard gauge locomotives were employed on and around the ironworks site, including one or two Black Hawthorns, and an engine with a vertical-boiler which pulled the slag trucks; some of these might also have been narrow gauge engines. They were assisted by a NER saddletank, built in 1866, and whose final duty on the site was to assist in the demolition of one of the furnaces (see below) (Joy 1969, 24-25; Rounthwaite 1997, 32).

Operation and Expansion

2.19 In the period immediately following the opening of the ironworks, Charles and Thomas Bagnall continued to acquire ironstone mines in the Grosmont area. They bought the former estates of Mary Clark to the east of the W&P line in 1864 for £40,000, taking over the mines operating there and probably constructing a girder bridge which formerly led over the main line and into the ironworks site. They also purchased land to the north of the river Esk around Priory Farm, where a further mine was developed (Chapman 2002, 28-30). According to the *Whitby Gazette*, the ironworks were operating successfully:

… *one of the furnaces turned out last week 280 tons of iron. The quality and cost is such that the proprietors are enabled to ship it to the iron district of South Wales, a vessel having taken in a cargo for Cardiff* … (Chapman 2002, 30).

2.20 In 1865, the *Whitby Gazette* also reported on plans to erect additional plant at the ironworks, to extract petroleum from the Grosmont shales, although the proposed scale of the operation appears to have been much exaggerated by the paper, with little being done beyond small scale experiments (Chapman 2002, 30).

2.21 The ironworks were at their peak of production between c.1865 and 1875, with 40,000 tons of pig iron being produced per annum, and about 500 people being employing directly or indirectly (Bulmer & Co 1890, 930-933); it has been suggested that they, along with the mines, turned in an annual profit of some £20,000 for the Bagnalls during this period (Whitworth 2006, 69). In 1864, the Grosmont mines produced almost 80,000 tons of ironstone, of which 45,000 tons was used at the ironworks (Counsell 1981, 28). Other industries were also founded locally in the same period, such as a brickworks in 1870 (Counsell 1981, 28-29).

2.22 This industrialisation, and in particular the presence of the ironworks, had a profound impact on the social and physical structure of the village, the population of which peaked at c.1,600 in 1880; this was five times the population in 1981. As well as erecting workers' housing, the Bagnalls provided a working men's institute in 1871. In conjunction with Mrs Mary Clark, they also enlarged St Matthew's Church - between 1875 and 1884, the church was rebuilt in the Early English style, although the tower still remained incomplete in 1937; the reredos was erected as a memorial to Charles Bagnall (Kelly & Co 1937, 104). Other institutions typical of industrial settlements arose during the same period, for example the Grosmont Co-

operative Society was founded in 1867 and the Grosmont Methodist Church the following year. At a later date, the ironworks had its own brass band, whilst local mines also fielded cricket teams (Chapman 2002, 49-50).

2.23 In 1871, the *Journal of the Iron and Steel Institute* was able to report that:

Mr Charles Bagnall said that there were two furnaces at Grosmont which were open topped, the gas was used for all requirements, the coke rate was as much as 23 ½ cwts per ton of pig iron, this large amount he attributed to the poor quality of the coke. The ironstone used was lean and did not average 27½ percent in its raw state. The average when calcined was not known because they used a little Rosedale and 25 percent of raw stone (Chapman 2002, 36).

2.24 The Grosmont ironworks were relatively unaffected by the widespread industrial unrest which affected the Cleveland area in 1874, and indeed the early 1870s had been a prosperous time generally for the British iron trade, partly as a result of the Franco-Prussian War. In anticipation of continued good business, the Bagnalls had expanded the scale of their mines at Grosmont and in c.1875 began construction of a third and taller blast furnace at the ironworks, which was "blown in" on the 3rd July 1876; the earlier pair of furnaces was subsequently raised in height to match it (Chapman 2002, 40-43). However, a lithograph of Grosmont, made in c.1874 (Chapman 2002, 42; see plate 2), appears to show the third furnace under construction (its site marked by a cluster of upright features, probably scaffolding), with the west of the original pair already raised in height. Comparison with a later photograph of c.1880 (see below) suggests that the east furnace was still being charged by the original 1863 incline, described as comprising:

… two longitudinal wrought-iron girders 4 feet and 3 feet deep respectively, the larger one prepared to receive the wrought iron beams that form the roadway of the incline up which the materials for smelting are drawn by means of a pair of fixed horizontal engines (Coulthard 1863, 227).

2.25 On the lithograph, the western furnace appears to be already served by a vertical lift, raising raw materials to the heightened charging floor from the original incline. A 19th century engraving, perhaps based in part on the lithograph but showing all three furnaces, also shows the west furnace as being taller than the east, although the depiction is rather crude and nowhere near as detailed as the lithograph (Whitworth 2006, 72). The arrangement of the ironworks after the completion of the third furnace is most clearly shown on a photograph of c.1880 (Counsell 1981, 25; Joy 1969, 34; Chapman 2006, 45); Whitworth (2006, facing page 61) captions this photograph as 1911, which is clearly wrong as the furnaces were demolished by 1892.

2.26 The c.1880 photograph (see plate 4) is taken from the area to the immediate south of Grosmont station, looking north, with the three blast furnaces rising from the centre. The rings of cast-iron columns supporting the superstructure of each furnace are clearly visible, as is the girder structure described in 1863 linking the original furnaces, with the incline rising to it from the rear. Above the girders, the framework of the vertical lift shown on the lithograph rises to the charging floor, which links the top of all three furnaces. Unfortunately, little else can be made out of the associated structures; the blast main is just visible to the rear of the furnaces, whilst the engine house chimney rises above the smoke to their left.

However, the photograph does give an excellent impression of the extent to which the ironworks dominated the skyline of the village.

Decline, Closure and Demolition

2.27 Almost immediately after the third furnace was "blown in", the price of pig-iron began to fall markedly again, decreasing by 75% between 1873 and 1879. In December 1878, the *Whitby Gazette* reported that one of the furnaces at Grosmont was to be shut down owing to the "dullness of trade in the iron market". Matters worsened in 1879, when the entire staff of the works were apparently under notice of discharge due to a long strike in the Durham coalfield. The works and mines at Grosmont were struck by industrial unrest over union membership in 1880, which was eventually settled in court at Whitby (Counsell 1981, 29-30; Chapman 2002, 46). In addition, although output generally remained high, several of the local ironstone mines began to close from the late 1880s onwards.

2.28 The ironworks finally closed, rather suddenly, in July 1891, although as Chapman notes, given the quality of the local ironstone, the higher transport charges for raw materials and pig iron, and competition from elsewhere in Cleveland, it is perhaps remarkable that they lasted as long as they did (Chapman 2002, 51). The works, and also the mines owned by the Bagnalls, were put up for sale at the end of 1891; the auction notice in the *Whitby Gazette* noted that the fixtures and fittings, including engines, cranes, pumps and other items, were to be divided into 930 lots, perhaps indicating that there was no serious attempt to sell the works as a going concern (Counsell 1981, 29-30). Chapman (2002, 51-52) reproduces the sale notice for the ironworks which, as it contains much useful information regarding the site, is given in Appendix 2.

2.29 The works were not sold in 1891and were offered for auction again in January 1892, but could only attract a top bid of £5,800. They were finally sold privately about week later, for the sum of £7,000, to Arthur Gladstone, of the firm Gladstone and Cornforth in West Hartlepool (Rounthwaite 1997, 31; Shill & Minter 1994, 293). The estate was then sub-divided into three lots, which Gladstone offered for sale in August 1892. Land to the north-west of the Esk was bought by Mary Chapman, the slag banks between the railway and the Esk were bought by William Oliphant, and the land to the east of the W&P line was bought by John and James Dunwell of the brickworks (Chapman 2002, 53). Just as the opening of the ironworks had had a profound effect upon the village, so did its closure, with the population falling by a half to 872 by 1901 (Counsell 1981, 29-30).

2.30 Although Rounthwaite (1997, 31) states that "several years were necessary to clear the equipment and strip the furnaces", the dismantling and demolition of the works appears to have started quickly, and by December 1892 the *Iron and Coal Trades Review* was able to report that the three furnaces had been "raised to the ground" (Chapman 2002, 53). One of the furnaces was demolished using a railway engine, the No 2262 saddletank formerly employed on the site (Rounthwaite 1997, 33). Writing many years later, Jack Cook recalled that:

One of the three furnaces was pulled down by an Engine with a long rope and when it fell there was a cloud of dust for quite a long time. (Chapman 2002, 53).

2.31 The scale of the demolition is amply demonstrated by the Ordnance Survey 1893 25" map (see figure 4b). The map marks the site as "Grosmont Iron Works (Disused)" and no furnaces are shown. It appears that the boiler house and

engine house had also been completely demolished, with only the chimney stack still remaining. An L-shaped range of buildings to the north-west of the chimney may have formed part of the ironworks, as it appears on a late 19th century engraving of the site (Whitworth 2006, 72) as a central two storey structure flanked by single storey buildings to either end, perhaps representing the "fitting shop, bolt store and iron store" of the 1891 sale description. A long rectangular structure to the north of the former blast furnaces may represent either the calcining kilns or the hot blast ovens marked in 1863, or a new structure. Most of the railway sidings formerly serving the furnaces had been taken up, apart from a single line on a north-east/south-west alignment crossing the site to their north. A large area to the north and north-west of the railway line was formed by waste tips, with a further very large tip on the north side of the Esk. The earliest tip shown on the amended 1853 6" map had by now been superseded by others, with earthworks suggestive of former tram lines crossing over its path. The site is similarly depicted on the Ordnance Survey 1895 6" map.

Post-closure slag re-processing

2.32 The closure of the ironworks did not mark the end of industry on the site; in fact, it heralded an era of industrial activity that was to have as great an effect on the landscape as the preceding 27 years of ironworking. In March 1902, the area of slag heaps bought by William Oliphant was leased to William Schofield, who commenced extraction of the slag, crushing and grading it for use as road stone; similar reprocessing of the slag heap on the north side of the Esk began in about 1906. Rounthwaite estimated the combined volume of the two areas of slag tipping to be over one million tons and, in order to aid extraction, two new standard gauge lines were laid down across the site (Rounthwaite 1997, 31). In the surrounding area, attempts were made by Arthur Gladstone to re-open some of the old ironstone mines which had been closed for more than ten years, and between 1906 and 1915 some production resumed. The brickworks on the east side of the railway were expanded in the early 20th century, including the addition of a new 120 feet tall chimney in 1902. At a later date, in 1923, a large annular Hoffman kiln was built, and the works did not finally cease production until 1957 (Chapman 2002, 54-58).

2.33 As well as having interest in ironstone mining, Arthur Gladstone must also have undertaken slag re-processing himself, as in 1913 both Gladstone and Company and Wm Schofield and Son are listed as slag merchants at Grosmont (Kelly & Co 1913, 108). As well as being crushed for roadstone, some of the slag was later used to manufacture slag wool as a fire-proof packing for boilers (Counsell 1981, 31). The 1913 Ordnance Survey 25" map (see figure 5a) shows significant changes to have taken place since 1893, particularly in the area of former slag tipping to the north of the ironworks. Virtually the only remnant of the ironworks surviving at this date was the boiler house chimney (marked as "Chy"). Although three "Old Shafts" are shown, these are in the wrong place to be the blast furnace bases, and so may perhaps relate to the former calcining kilns. The L-shaped range shown to the north-west of the chimney had been reduced in size slightly since 1893, but several new buildings had been erected to its north, adjacent to the north-east/south-west railway siding crossing the site. A siding leading from these new buildings into the area of slag tips to the north had been re-established, and the pattern of the tips themselves had changed since 1893 as a result of the extraction of slag for processing. The site is similarly depicted on the Ordnance Survey 1916 6" map.

2.34 In c.1928, Gladstone and Company appear to have been replaced by George Hodsman and Sons, merchants for tarred slag (Kelly & Co 1933, 106; Joy 1969, 57-58). Although Chapman states that Schofield's slag reprocessing operation closed in 1932, both Hodsman and Schofield still appear as slag merchants at Grosmont in 1937 (Kelly & Co 1937, 104).

2.35 Extraction of slag probably finally ceased some time around the Second World War, almost certainly because all economically viable supplies had been exhausted. The 1952 Ordnance Survey 6" map shows many of the structures on the former ironworks site to be unchanged since 1913 but, apart from a very small remainder, all slag heaps between the works and the river Esk had disappeared, as had the very large tip on the north side. Almost the last relic of the ironworks to be removed was the very tall boiler house chimney, which was not demolished until 1957, and by 1969, Joy was able to describe the former ironworks site as a "grass grown area" (Joy 1969, 57-58).

2.36 The site was leased (for 42 years) by the National Park Authority in 1976 from Scarborough Borough Counci for use as a car-park. Cars are visible on an aerial photograph using the lower part of the car-park in September 1973. The upper area, containing the main ironworks complex, is shown as more overgrown, with fewer tracks (although the chimney base is clearly visible), and its access is completely different from the present arrangements.

3 SITE DESCRIPTION

Introduction

3.1 A summarised description of the features identified within the site complex is given below, based on the more detailed information contained within the gazetteer of numbered components which appears as Appendix 1. A more detailed discussion of the features in relation to the development of the site is given in Chapter 4 below.

3.2 A total of 24 archaeological sites and features was identified in the survey area, as follows. These sites are depicted on figures 6 and 8. It should be noted that the identified sites are based on the surviving earthworks, rather than the "sites of" structures as depicted on the historic maps.

Site No	Site Name
1	Chimney base, south edge of detailed survey area
2	Hoist/lift base, south-west part of detailed survey area
3	Earthworks, south part of detailed survey area
4	Site of engine house/boiler house, south part of detailed survey area
5	Earthworks, central part of detailed survey area
6	Blast furnace base, central part of detailed survey area
7	Blast furnace base, central part of detailed survey area
8	Blast furnace base, central part of detailed survey area
9	Railway cutting, north-east and central part of detailed survey area
10	Earthworks, north-east part of detailed survey area
11	Former railway track, north part of detailed survey area
12	Possible ruined structure, north edge of detailed survey area
13	Possible ruined structure, north edge of detailed survey area
14	Hollow/disturbance, south-west corner of walkover survey area
15	Railway line and bridge, south-west corner of walkover survey area
16	Possible ruined structure, east side of walkover survey area
17	Linear depressions, east side of walkover survey area
18	Ruined buildings, north-east corner of walkover survey area
19	Bridge abutments, embankment and bridge pier, north end of walkover survey area
20	Tramway and bridge, north part of walkover survey area
21	Ruined structure, north part of walkover survey area
22	Wharf structure, east bank of river Esk
23	Area of spoil tipping, north of track leading to sewerage treatment plant
24	Area of spoil tipping, south of track leading to sewerage treatment plant

Site Description

The former ironworks complex

3.3 Very little survives above ground of the ironworks complex. Of the three furnace bases, the best preserved is that of the easternmost (and latest) base, namely the third furnace (**Site 8**) built in 1875 and "blown in" in July 1876. The remains comprise a section of the base of the shaft, standing to a maximum height of

1.60m, and stepping inwards from the base to the upper part (see plate 6). The surviving part of the base is not perfectly circular in plan but is slightly flattened, measuring a maximum of c.6m north-south by c.5.2m east-west. It is built of segmental refractory bricks (average dimensions 360mm by 160mm by (160mm?)); no remains of either tuyere openings or the tapping hole were visible at the time of the survey. In section, the walls of the shaft appear to be at least four bricks deep, suggesting that they were slightly thicker than those of the original furnaces. The original pair of furnaces (**Sites 6 and 7**) (now the central and western of those on the site) are now marked by little more than slag scatters and poorly defined earthworks (see plate 5). At the site of the central furnace (**Site 7**), refractory bricks are visible eroding out of the north side of one of the earthworks, suggesting that at least part of the outer curve of the base survives. Close by, a 1.40m long straight edge, apparently structural, can be seen. The apparent length of the edge corresponds closely with that shown for the tuyere openings in 1863, and this is most probably what the edge represents; if so, it suggests that there are further remains of the furnaces's substantial base surviving below ground, perhaps including the tapping hole and hearth. The mound forming the furnace base is being ridden over by mountain bikes, and quite a bit of erosion and rutting is occurring.

3.4 Almost all other buildings and structures associated with the ironworks have completely disappeared, the only exceptions being the large brick hoist/lift base located on the north side of the detailed survey area, and the chimney base to its south; the first appears to largely post-date iron production on the site, and so is described as part of the remains relating to slag reprocessing (see Site 2 below).

3.5 The chimney (**Site 1**) formerly served the boilers in the boiler house adjacent to the engine house, and was originally 180 feet (54.8m) high. The chimney remained intact long after the rest of the ironworks had been demolished; the upper 50 feet (15.2m) were taken down in March 1935 for safety reasons, but it was only finally completely demolished on the 13th March 1957. The base was heavily overgrown at the time of the survey. It is c.7.40m long (north-west/south-east) by 6.60m (north-east/south-west) wide, comprising a 1.20m high mound, with large coursed squared stone blocks partly visible along the west and south sides; no traces of the circular chimney shaft could be seen in the surface of the mound. Some c.16m to the west of the chimney base, the remains of a concrete foundation, c.4m long and 1m high, are visible, with a lower concrete footing curving around its west side; this presumably forms the only surviving remnant of an L-shaped range of buildings once standing to the west of the engine/boiler house complex.

3.6 Elsewhere, there are minor earthworks possibly representing the remains of the engine/boiler house complex itself (**Site 4**), an associated building (**Site 5**) and a further smaller, possibly short-lived, structure (**Site 3**) closer to the railway line. In the north corner of the detailed survey area, discrete earthworks and brick scatters may represent isolated buildings shown on late 19th century maps (**Sites 12 and 13**), while there is another ruined structure (**Site 16**) within a sub-rectangular earthwork just to the east.

Transport connections

3.7 As has been stated in Chapter 2 above, the Bagnalls purchased several local ironstone mines in order to secure a reliable supply of source material for their ironworks. Ironstone from the mines to the east of the W&P line was brought into the ironworks complex via a girder bridge (**Site 19)** which crossed the main line.

This bridge is believed to have been in use between c.1870 and 1890, and it is shown on the c.1874 lithograph (see plate 2); the bridge was also used to transport shale waste from the mines to be dumped in the area to the north. The bridge structure has been demolished since 2002, but the coursed squared sandstone abutments still survive.

3.8 To the west, in c.1864, new ironstone mines were sunk in the vicinity of Priory Farm on the north side of the Esk. Ironstone was carried from these mines south-east down an inclined tramway on an embankment, crossing the Esk on a bridge and then rising again in a southern curve to reach the ironworks. The bridge (**Site 20**) still survives and is supported on stone abutments and two stone piers (see plate 9). The piers stand c.5m tall and are built of rock-faced ashlar. They rise from substantial cut-waters surmounted by chamfered stonework; the chamfers act as plinths for the upper parts of the pier, which taper inwards as they rise. The upper c.0.50m of each pier is raised in machine-made red brick. Rolled steel I-section girders run between the piers and the abutments, supporting the sleepers forming the track bed, but all rails have been taken up. It is possible that an earlier bridge crossed the river to the south, perhaps also bringing stone from the mine, as suggested by the 1864 plan of the works, although nothing now remains of this structure.

3.9 Apart from these bridges, very little survives of the transport network in the immediate area of the ironworks, the last piece of surviving trackway having been taken up in 1954. To the north and west of the blast furnaces, there is a railway cutting (**Site 9**), represented as a linear depression c.12m wide at the base. This cutting may be on the line of a railway track shown on the amended 1853 6" map, or on the line of the long linear structure shown in 1864 to the north-west of the calcining kilns, it was almost certainly re-cut in the early 20th century to facilitate slag reprocessing (see below). The south side of the cutting is formed by a 0.50m high scarp, which has been somewhat disturbed by modern metalling of the former track bed to make it suitable for use by vehicles. This has had the effect of raising the base of the cutting; the actual former ground surface may be represented by a steep-sided gully, up to 1.2m deep, running along the bottom of the north side. As it runs south-west, the cutting becomes better defined; the south side stands up to 1.60m in height, whilst the north side is slightly higher at 1.80m. Both sides are steeply sloping and appear to contain a high proportion of stone rubble/slag.

3.10 Approximately mid-way along the cutting, there are earthworks (Site 11) probably representing another railway track which might be the one shown on the amended 1853 6" map although it is difficult to be certain. These tracks originally continued south-west, crossing the Grosmont Bridge road and joining the NYC line. They were carried across the road on a substantial bridge (**Site 15**), although only the west abutment still survives. It is 6m wide, stands a maximum of 2.15m high and is built of coursed squared large sandstone blocks with prominent herringbone tooling. A partly collapsed brick and stone roadside wall runs south-east from the abutment, whilst the former track line follows the top of a substantial north-facing scarp above the pavilion of Grosmont Cricket Club. Elsewhere, at the north-east end of the detailed survey area, another line (**Site 10**) survives as a steep east-facing scarp, up 1.60m high and perhaps representing part of a cutting for the railway track shown here on the historic maps.

3.11 It is clear from the map evidence that the tipping of the slag from the ironworks had started in the area to the south of the river by the time that the amended 1853 6" map was published. By the time the ironworks closed in 1891, a huge slag bank,

in the form of flat-topped spoil heaps, had built up between the works and the Esk (**Sites 23 and 24**); these spoil heaps covered buildings previously depicted adjacent to the Grosmont Bridge road in the 1860s. There was a further huge slag bank on the north side of the Esk, beyond the area of the current survey. This appears to have overlain and disrupted the incline leading from the Priory Farm mines across the bridge (Site 20) described above. It is assumed that this bridge either became disused or was latterly used itself for tipping slag. However, the majority of the slag bank on the north side of the Esk appears to have been tipped from a second bridge (**Site 19**) a short distance to the north, also shown in 1893. This bridge had gone by 1913 but might perhaps have been re-instated to allow re-working of the slag bank (see below), as the surviving remains appear too modern to be the structure shown in 1893. They comprise, to the east bank of the river, the remains of a stone and concrete abutment, some 4m high, whilst in the centre of the river, there is a c.10m tall concrete bridge pier (see plate 8). The pier is approximately hexagonal in plan, with sides tapering gently inwards towards the top; wrought-iron or steel strapwork survives around the upper part.

Slag reprocessing

3.12 The reprocessing of the slag banks in the first half of the 20th century brought about massive changes to the survey area's topography but, as with the ironworks, traces of associated structures are few and far between.

3.13 Slag was extracted via two main points. The first was via railway lines laid into the area of the slag banks between the former ironworks and the river Esk. These lines diverged either side of a ruined structure (**Site 2**) on the north-west side of the detailed survey area, which now represents the largest surviving structure within this part of the survey area. A more detailed discussion of the possible function of this structure is given in Chapter 4 below, but it appears to be in the same general location as the "Steam Lift" marked in 1863, which was used to raise ironstone from the line of the railway to the top of the calcining kilns. However, the structural evidence indicates that the structure remained in use long after the ironworks had been demolished, and that it was altered as late as 1927.

3.14 The ruined structure comprises two substantial brick pillars, rising to a maximum height of 4.40m (see plate 7 and figure 7). Both are rectangular in plan, the east pillar being slightly smaller than the west, but both have battered north and south faces and both are built of handmade reddish-brown and yellow bricks, incorporating bands of large refractory bricks. The east pillar has been subject to more alteration than the west, including a large irregularly-shaped area of repair or alteration, crudely carried out in re-used refractory bricks to the east face. To one side of the repair, a sub-oval "shaft" has been cut down through the body of the pillar. The shaft is c.0.60m deep and open to the east side, sloping downwards at a slight angle from north to south There also appear to be the remains of a circular shaft in the east face. It is difficult to determine exactly how the shaft was cut into the brickwork; it has the appearance of being worn away in several stages by rubbing or friction, but this is not clear. The gap between the two pillars was once crossed by several beams or girders, the uppermost of which was a later insertion, and which bears the date "1927" above its former east end. The ground falls away very sharply to the north of the pillars, with the gap between the two now forming a footpath. A number of features are visible in plan only in the immediate area of the pillars, including concrete bases/beds and ruined structures of machine-made brick.

3.15 The second point of extraction was from the large slag bank on the north side of the Esk. Map evidence demonstrates that by 1913, a tramway had been re-instated across the bridge (**Site 20**) formerly taking ironstone from the Priory Farm mines to the furnaces, and this led to two conjoined buildings adjacent to the W&P line. The former tramway cutting becomes visible a short distance to the east of the bridge, and can be traced south-east for c.40m, sloping gently upwards from west to east. It survives as a linear depression, 2.5m wide at the top, with a 1.60m wide flat base and near vertical sides rising to 1.80m in height. At the west end, the sides are revetted with drystone walls incorporating river cobbles, but to the east, they comprise slag blocks laid to a slightly battered profile. Beyond the cutting, it may be possible to trace the former line of the tramway shown in 1913 as a very low north-east facing scarp containing a high proportion of slag.

3.16 To the south of the bridge, there are the remains of a wharf (**Site 22**). This appears to have been built by 1913, and was therefore presumably associated with the slag reprocessing operations, although it has not been possible to recover any documentary information supporting this proposal. The wharf is accessed via a flight of concrete steps leading down from a footpath above at the north end. The wharf structure itself is built of concrete throughout, and is c.50m long, 2.0m wide and 1.2m high; it was in use by a private fishing club at the time of the survey (see plate 10). At the north end, a second flight of steps leads down to a narrow landing platform. Approximately half way along the wharf, the shaley rock outcrop above has been revetted with concrete, and has a crude angle-iron canopy over a low concrete bench. To the south of the canopy, a crude recess c.2m deep has been cut into the shaley rock; it may have a small alcove hollowed into the rear (east) face. The opening into the recess is covered by a crude but substantial concrete and brick frame once fitted with a door. To the south of the wharf, the river bank angles sharply to the south-west and is revetted with sandbanks.

3.17 Above the wharf, on the top of the shaley outcrop, there are the remains of a ruined structure (**Site 21**) which does not appear on any of the historic maps consulted for the survey work. At its north end, there is a short section of collapsed angle-iron and railing fence. Where the fence returns to the south, its former line is marked by a 0.30m high slag block revetment wall, which can be followed south from the return for a distance of c.10m-12m. To the west of the wall, between it and the rock outcrop, there are a series of small ruined structures, or perhaps more likely a single structure with internal divisions. There appears to have been a set of steps leading up from an adjacent footpath at the north end, with the entrance to the building presumably located at this end. The remnants of box hedging survive along one edge of the steps, whilst there are conifers to the west and a line of hawthorns to the east.

3.18 There were also other ruined structures noted within the survey area which, although they appear on the 1893 25" map, appear from their surviving remains to belong to the slag reprocessing period rather then the ironworks. The concrete bridge pier in the centre of the river Esk (Site 19) has already been described.

3.19 In addition, at the north-east corner of the walkover survey area are the remains of a pair of buildings (**Site 18**), also shown in 1913 and surviving as late as 1952. Of the two, slightly more survives of the east building than the west, although both have largely been dismantled above ground. The east building is associated with an isolated and substantial mass concrete base which remains within the undergrowth. This base is 3.13m long (north-south) by 2.12m wide (east-west) and stands 2.20m high; it is built of roughly cast concrete with a high percentage of

crushed slag and has shuttering marks to all four sides. The base is overgrown with ivy and the upper surface could not be examined. Some 10m to the north, there is another concrete base of a similar form and composition but covering a slightly larger area. This has the remains of a ruined brick wall on its north side, perhaps formerly enclosing a yard. There is a pit, reminiscent of a vehicle inspection pit, to the east of the former yard area. This pit is 2.92m long (north-south) by 0.90m wide (east-west) and is c.1m deep, although the base is partly backfilled. The sides of the pit are built of machine-made red bricks (average dimensions 240mm by 110mm by 80mm) with a shallow frog to the upper surface and set with a cement mortar. To the west of the former yard area, a low south-facing scarp with a high slag content is visible running westwards for some distance into the woods. The above ground remains of the west building comprise a single concrete base, measuring 2.95m long (east-west) by 2.50m wide (north-south) and standing 1.20m high. It is set on a bed of machine made bricks, and, like the other bases described above, is built of concrete containing a very high proportion of crushed slag. There are original central openings in both short walls. That to the west is wider, and leads into the interior of the base; a pair of substantial iron bolts are set into the sides of the interior a short distance in from the opening. The interior walls then curve inwards, so that the opening in the east end is quite narrow to the exterior.

3.20 The extent of re-working was such that by 1952 the site had attained its existing topography. Although there are a number of areas where earthworks perhaps associated with the re-working survive (for example, **Site 17**), they may just as easily be more recent. Large-scale disturbance clearly continued even after re-working had ceased, as shown by the large hollow (**Site 14**) adjacent to the Grosmont Bridge road, which was excavated after 1952.

4 DISCUSSION AND CONCLUSIONS

4.1 The Phase 1 archaeological survey uncovered no evidence for the pre-ironworks landscape at Grosmont, but this is hardly surprising, given the changes that took place between 1862 and c.1940. The ground level of the area between the ironworks and the river Esk rose by some c.5m to c.6m between 1862 and 1891 as a result of the tipping of slag, and then this entire landscape of industrial waste (including that to the north of the Esk) was recycled between c.1900 and 1940. Indeed, the level of demolition and re-working that was undertaken on the site has removed almost all above ground traces of the ironworks themselves.

4.2 As has been stated above, the two main factors behind the founding of the ironworks at Grosmont were the presence of the railway and the local availability of ironstone. Indeed, Grosmont owes its existing form as a settlement largely to the location of the tunnel and bridge on the Whitby and Pickering Railway, so much so that it was known locally, and named, as “Tunnel” for many years. The foundation of the ironworks had a similarly profound effect on the size, layout and social organisation of the settlement.

4.3 It is assumed that it was the railway and the ironstone, combined with knowledge previously acquired through their operation of ironworks in Shropshire and Staffordshire, that attracted Charles and Thomas Bagnall to Grosmont in the first instance. As Chapman has shown, theirs was only one of several schemes that were proposed for ironworks in the district, but it was eventually only one of two which were built and, following the failure of the works at Beckhole, the only one to attain any degree of lasting success. Slightly further afield, the Glaisdale ironworks, which came into blast in 1866, were of similar size to Grosmont, with three blast furnaces from the start, although again they were relatively short lived, lasting only until 1876 (Rounthwaite 1997, 36).

4.4 A detailed comparison of Grosmont with other ironworks within the Cleveland iron district would require further research beyond the scope of this survey but nevertheless, a few points regarding contemporary technology and techniques can be made. Grosmont formed part of the phenomenal growth in pig iron manufacture that took place in Cleveland during the mid 19th century; the 38 furnaces erected in 1850 had increased to 108 furnaces in 1863, and 130 by 1875 (Rounthwaite 1997, 21 & 52). The works underwent several important changes in the same period, typical of improvements to blast furnace operation practiced in the district. Between 1850 and 1875, there was a general trend towards an increase in the height of furnaces from around 50 feet to 80 feet or more, and also an increase in the blast temperature from 600 degrees to 1400 degrees Fahrenheit; these measures were found to greatly reduce the fuel requirements for producing pig iron (Allen 1983, 3). The original pair of furnaces built at Grosmont were 63 feet in height, comparable with furnaces built elsewhere in the Cleveland district during the late 1850s and early 1860s but shorter than the tallest furnaces being built by the mid 1860s (Allen 1983, 5). As noted in Chapter 2, although it is sometimes stated that the original pair of furnaces were raised in height in 1875-76 when the third, taller, furnace was built, a lithograph of Grosmont, made in c.1874 (Chapman 2002, 42) appears to show the third furnace under construction with the western of the original pair already having been increased in height. Whatever the exact sequence of construction, the 1891 sale notice demonstrates that all three furnaces had reached 80 feet in height. The listed greater capacity of the third furnace in 1891 as compared to the original pair suggests that the Bagnalls were also aware of the developments at the Ormesby Ironworks in the late 1860s, where

the owner, Mr C Cochrane, believed that fuel consumption declined with capacity rather than height, and so built accordingly (Allen 1983, 4-5).

4.5 The 1863 description of the works describes the hot-blast stoves in some detail; there were three to each furnace, and they were of cast-iron pipe-stove form, raising the temperature of the blast to between 600 to 700 degrees Fahrenheit. As such, they appear to have been operating at a lower temperature than was normal in Cleveland, with the average works being blown at 750 to 800 degrees Fahrenheit by 1860 and some as high as 1000 degrees Fahrenheit (Allen 1983, 6). It may be that the three pipe-stoves per furnace were not sufficient to raise the temperature high enough, and this was remedied by the addition of a fourth pipe-stove to each of the original furnaces, as evidenced by the 1891 sale notice. The same sale notice also states that the third furnace was served by four "Whitwell Stoves". Mr T Whitwell was the owner of the Thornaby Ironworks, and in 1865 he patented a regenerative firebrick stove, capable of raising blast temperatures to 1400 degrees Fahrenheit, following developments made at Ormesby Ironworks in the early 1860s (Allen 1983, 6). This suggests that the third furnace at Grosmont may have operated at a higher temperature than the earlier pair.

4.6 As has been previously noted, almost nothing remains above ground of the Grosmont ironworks. The main visible elements are the remnants of the lower part of the third and latest furnace (**Site 8**) and the tramway bridge to the north (**Site 20**) which brought iron ore from the mines located near Priory Farm. However, it is likely that the remains of all three of the blast furnace bases survive below the present NYMNPA car-park; the 1863 description of the works describes their substantial nature and depth, together with associated flues and pipes.

4.7 It is possible that the largest surviving structure on the site (**Site 2**) may not be associated with the ironworks at all. The evidence as to whether it is contemporary with the works or not can be summarised as follows:

Contemporary. Although located in approximately the same position as the "Steam Lift" described in 1863 and used to raise trucks containing iron ore from the railway to a gantry feeding the calcining kilns, it bears little resemblance to the lift as depicted on the accompanying plan. On this plan, the lift is shown as a square structure with small circles at each corner and a larger circle in the centre, a form reminiscent of some late 19th century hydraulically-operated railway wagon lifts in West Yorkshire (e.g. Dennison 1997). The undated engraving reproduced by Whitworth also shows a tall structure, apparently with a pyramidal roof, in this general location, with another structure of a similar height to the south, and the gantry running north from the pair; the form of the gantry, namely a pair of angled legs supporting the line, closely resembles examples illustrated at the Cleveland Iron and Steel Works in the early 20th century (Dorman Long & Co Ltd 1924, 351 & 363). Surveys of other calcining kilns in the Cleveland district unfortunately provide little comparative information, as by the time these were undertaken, the accompanying gantries/tramway lines had long since been demolished (e.g. Owen 1998, 65-74). The surviving structure at Grosmont does have scarring to the east face of the east pillar that could have been made by an abutting gantry being removed, and perhaps it once housed/supported either the engine powering the steam lift or the brake mechanism and drum.

Not contemporary. All the major structures on the ironworks site appear to have been comprehensively demolished soon after it was sold early in 1892, so why should this element have been left? It also incorporates refractory material into its

structure, suggesting that it was built from material re-used from elsewhere on site, although only the refractory bricks incorporated into the alteration to the east pillar bear definite signs of having come from one of the furnaces. The structure remained in use whilst slag reprocessing was undertaken on site, and was modified as late as 1927.

4.8 On the basis of current evidence, it is considered most likely that the structure is a remnant of the ironworks gantry, with the concrete footings to the north representing further pillars, as shown on the 1864 plan of the works. However, the surviving structure was extensively modified after c.1900 to be used as part of the slag re-processing on site. Perhaps there was still a need to raise slag into hoppers prior to reprocessing, or alternatively some may have been shipped out in its raw state via the adjacent railway siding, again necessitating the use of a lift/hoist to load into wagons.

4.9 The reworking of the former areas of slag tipping had as profound an effect on the immediate landscape as the ironworks had had in their time. By its very nature, the process of reworking the tips removed almost all of the surface evidence for how it was done. The larger operation appears to have been carried out by William Schofield and Sons, who may have been re-working the tips between the ironworks and the Esk, using former ironworks buildings to the south-west of the engine/boiler house location which presumably housed crushers for making roadstone. It is tempting to see the tramway re-installed across the former ironstone mine bridge (**Site 20**), and used to extract slag from the tip on the north side of the Esk, as forming a separate operation, perhaps those of Gladstone and Company who were listed in 1913. It is assumed that slag reprocessing on this scale took place on the majority of former ironworks sites, such as, for example, at Glaisdale between 1918 and 1947 (Rounthwaite 1997, 36), although it is difficult to find published secondary sources detailing comparative operations.

4.10 The major structural remnants of the slag reprocessing on the site, apart from the much altered topography, are the bridge pier (**Site 19**), the nearby wharf (**Site 22**) and the brick pillars (**Site 2**) discussed above. Of the former two sites, the construction of the pier makes it unlikely that it formed part of the bridge shown here in 1893, and therefore, based on the map evidence, it seems to post-date 1913 but had clearly become disused again by 1952. Similarly, the wharf appears to have been present at least in part by 1913, although the surviving structure has been modified and altered since – might it have served some military purpose during the Second World War? Other ruined structures within the site (such as **Site 21**) may also be associated with the slag reprocessing, but also post-date 1913, although further research would be needed to confirm this. Some structures could be much later, given that, although the slag tips had probably been exhausted by c.1945, large scale disturbance continued even after re-working had ceased, as shown by the large hollow (**Site 14**) adjacent to the Grosmont Bridge road, which dates to after 1952.

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1893 Ordnance Survey 6" to 1 mile map sheet 45NE
1913 Ordnance Survey 25" to 1 mile map sheet 45/4
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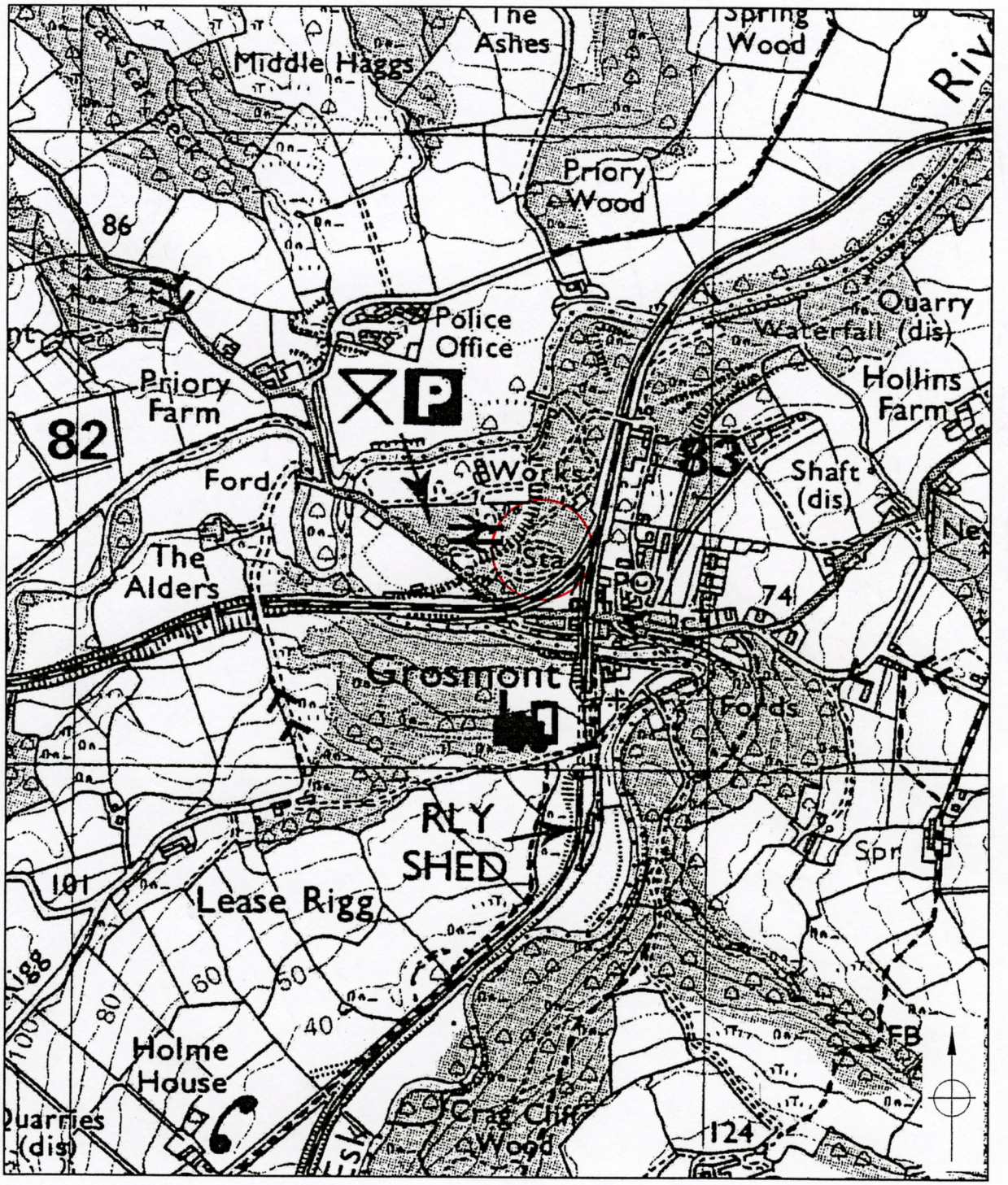
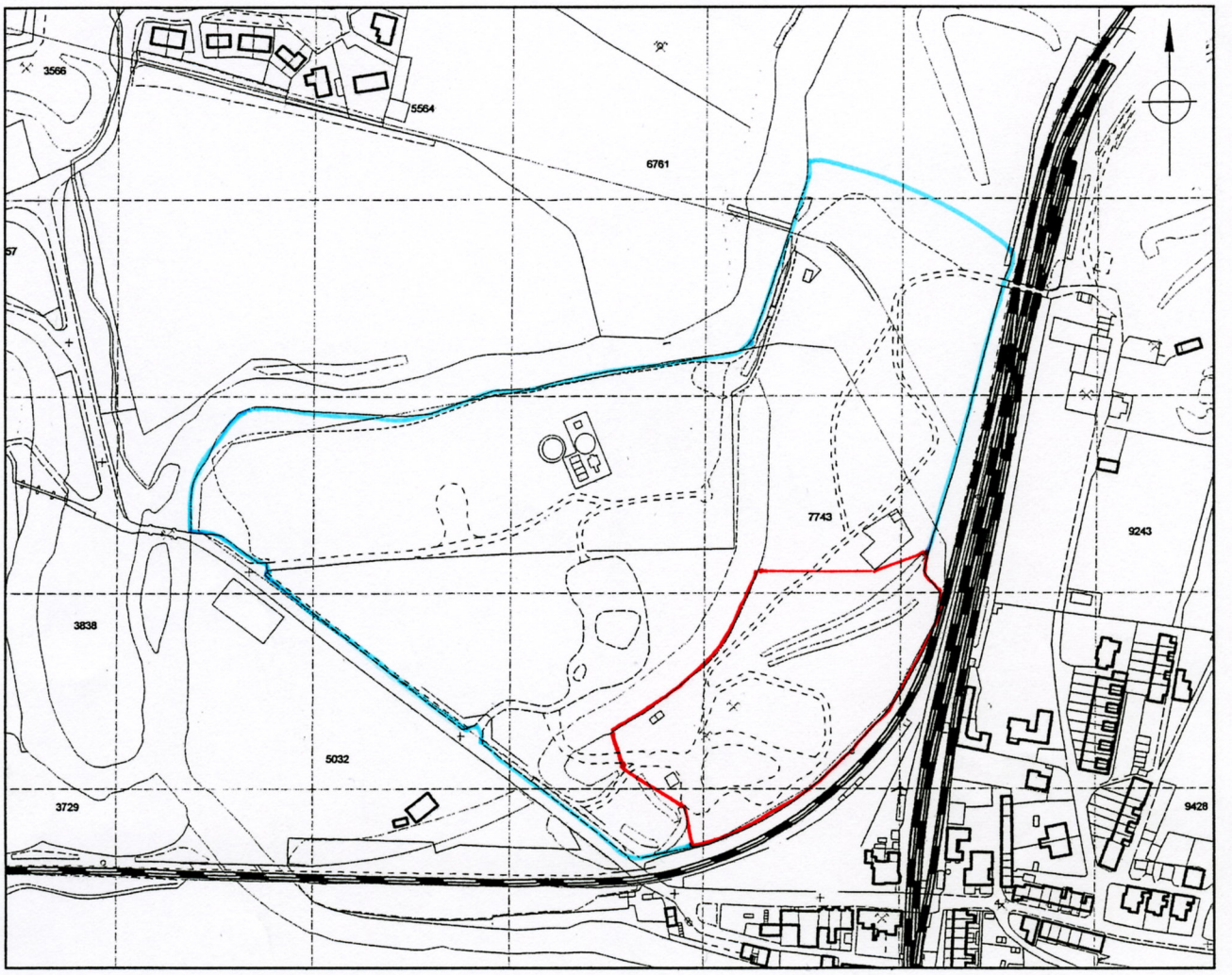
6 ACKNOWLEDGEMENTS

6.1 The Phase 1 archaeological survey was commissioned by the North York Moors National Park Authority, through their Senior Conservation Archaeologist, Mr Graham Lee. Graham Lee also provided maps and information from the NYMNPA SMR. EDAS would like to thank all concerned for their co-operation whilst carrying out the work.

6.2 The EDM survey was undertaken by Benchmark Surveys of Leeds, with additional site support from Ed Dennison and Philip Woolley. The enhancement of this survey was done by Shaun Richardson who, with Richard Lamb, also carried out the walkover survey of the expanded area. Shaun Richardson undertook the documentary research and produced the fieldwork records and a draft report. Graham Lee kindly provided comments on the draft report. The final report was produced by Ed Dennison, with whom the responsibility for any errors remains.



PROJECT	
GROSMONT IRONWORKS	
TITLE	
GENERAL LOCATION	
SCALE	DATE
NTS	JUL 2007
EDAS	FIGURE 1



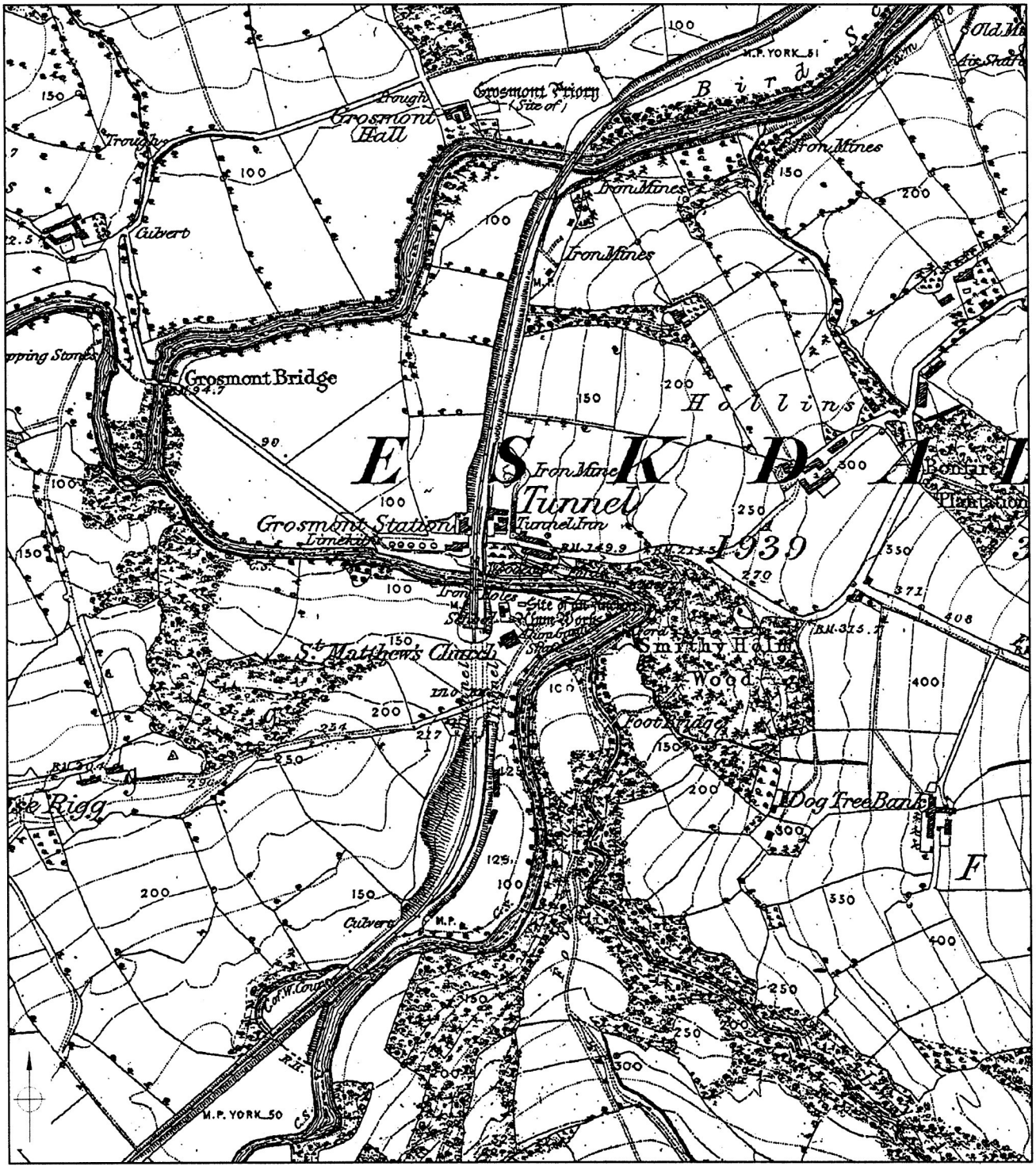
0 100m

Detailed survey area

Walkover survey arèa

Base plan provided by NYMNPA

PROJECT: GROSMONT IRONWORKS	
TITLE: SURVEY AREAS	
SCALE: AS SHOWN	DATE: JUL 2007
EDAS	FIGURE: 2



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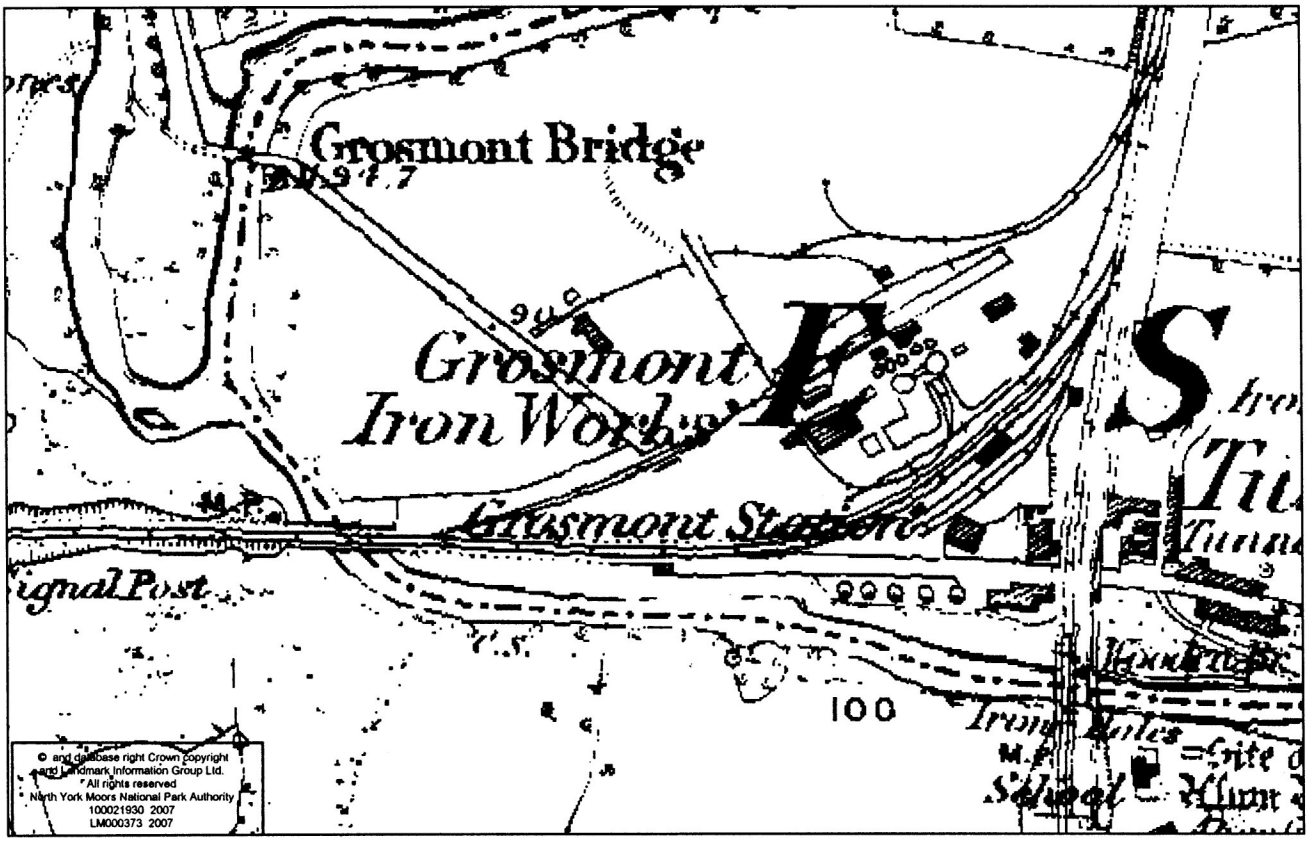
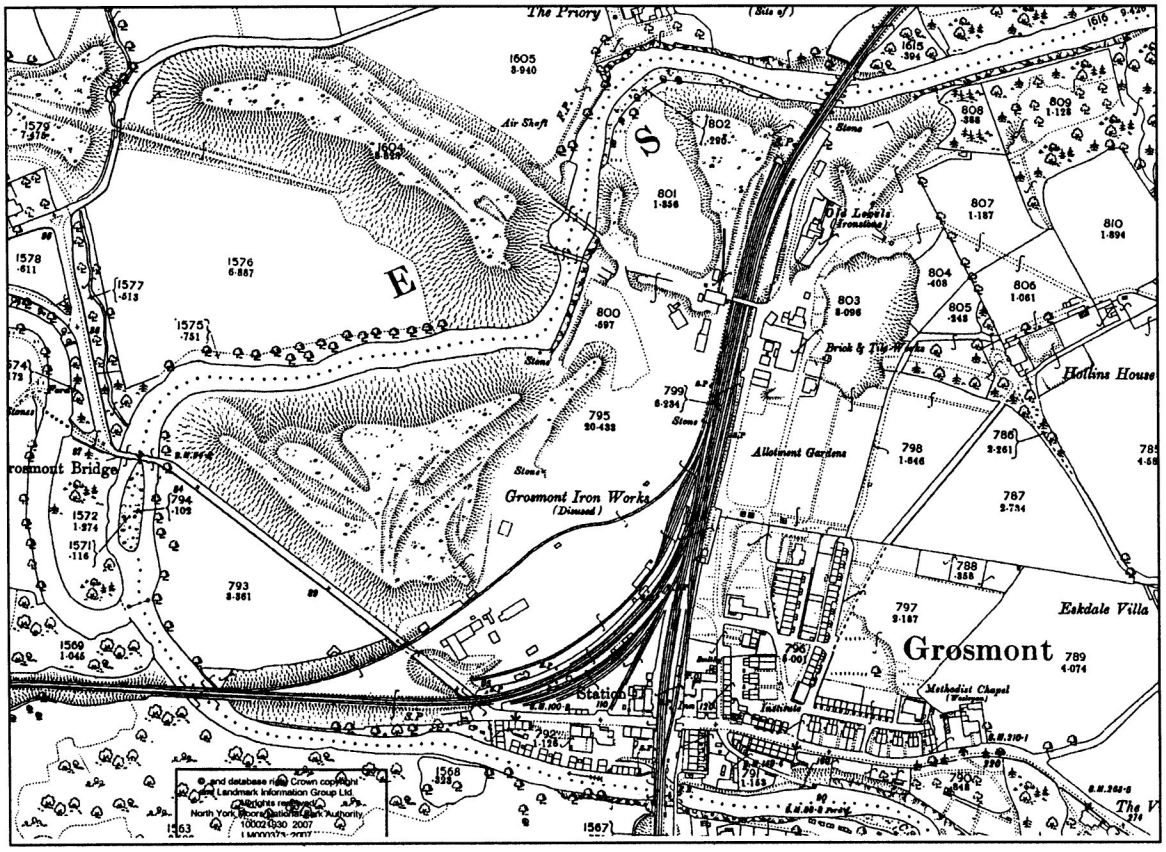
PROJECT	
GROSMONT IRONWORKS	
TITLE	
1853 ORDNANCE SURVEY MAP	
SCALE	DATE
NTS	JUL 2007
EDAS	FIGURE 3





Sources:

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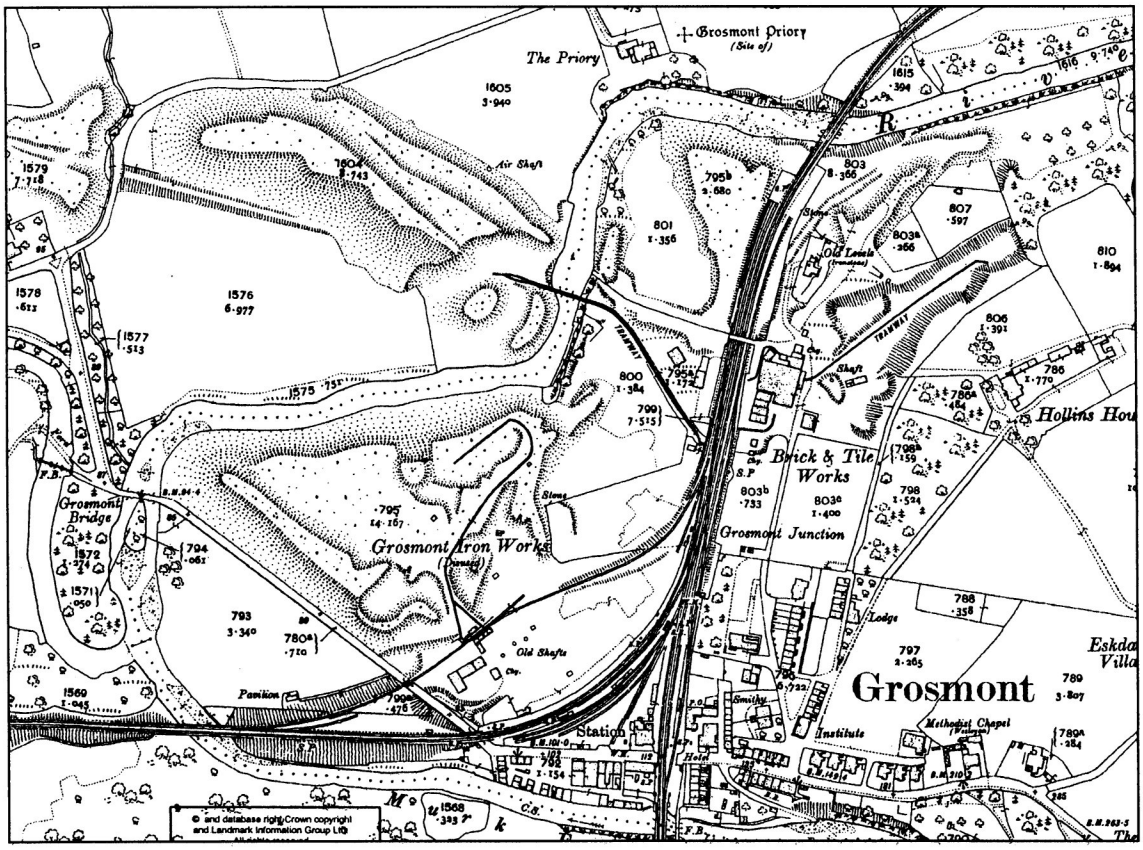
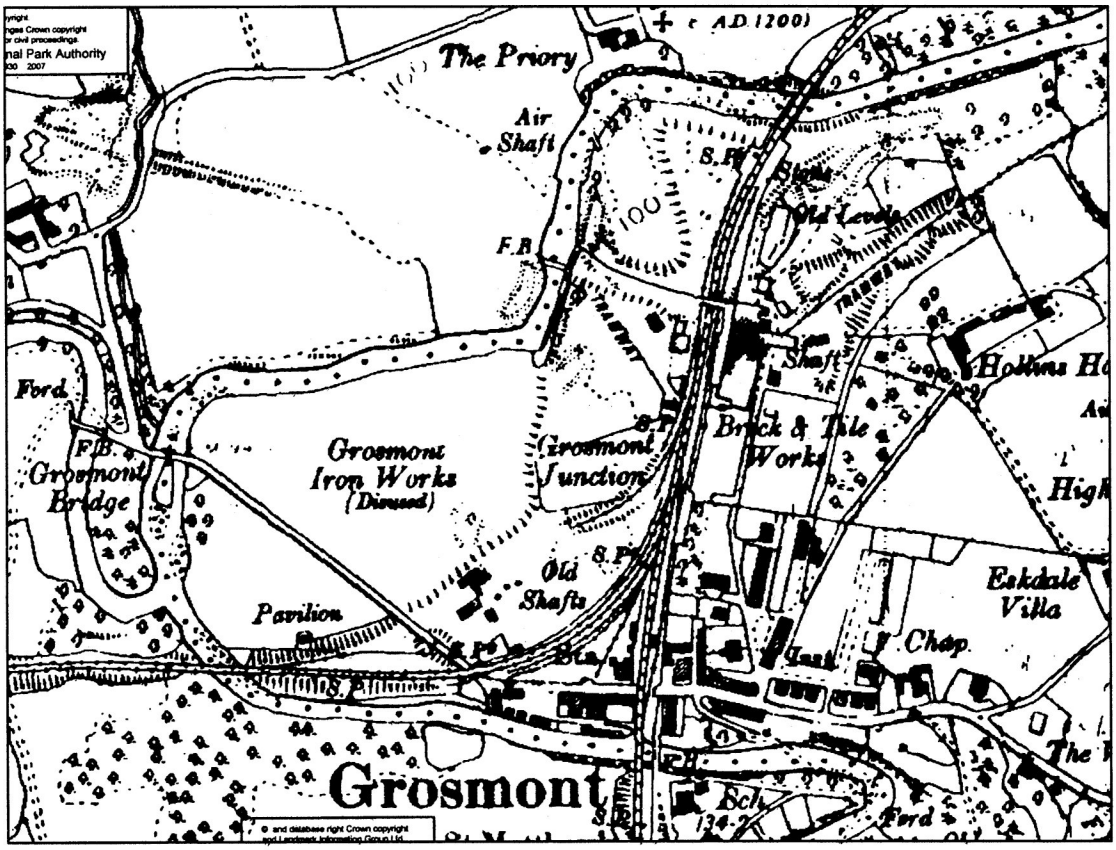
b) OS 1893 25" map sheet 45/4

PROJECT	
GROSMONT IRONWORKS	
TITLE	
HISTORIC ORDNANCE SURVEY MAPS	
SCALE	DATE
NTS	JUL 2007
EDAS	FIGURE 4



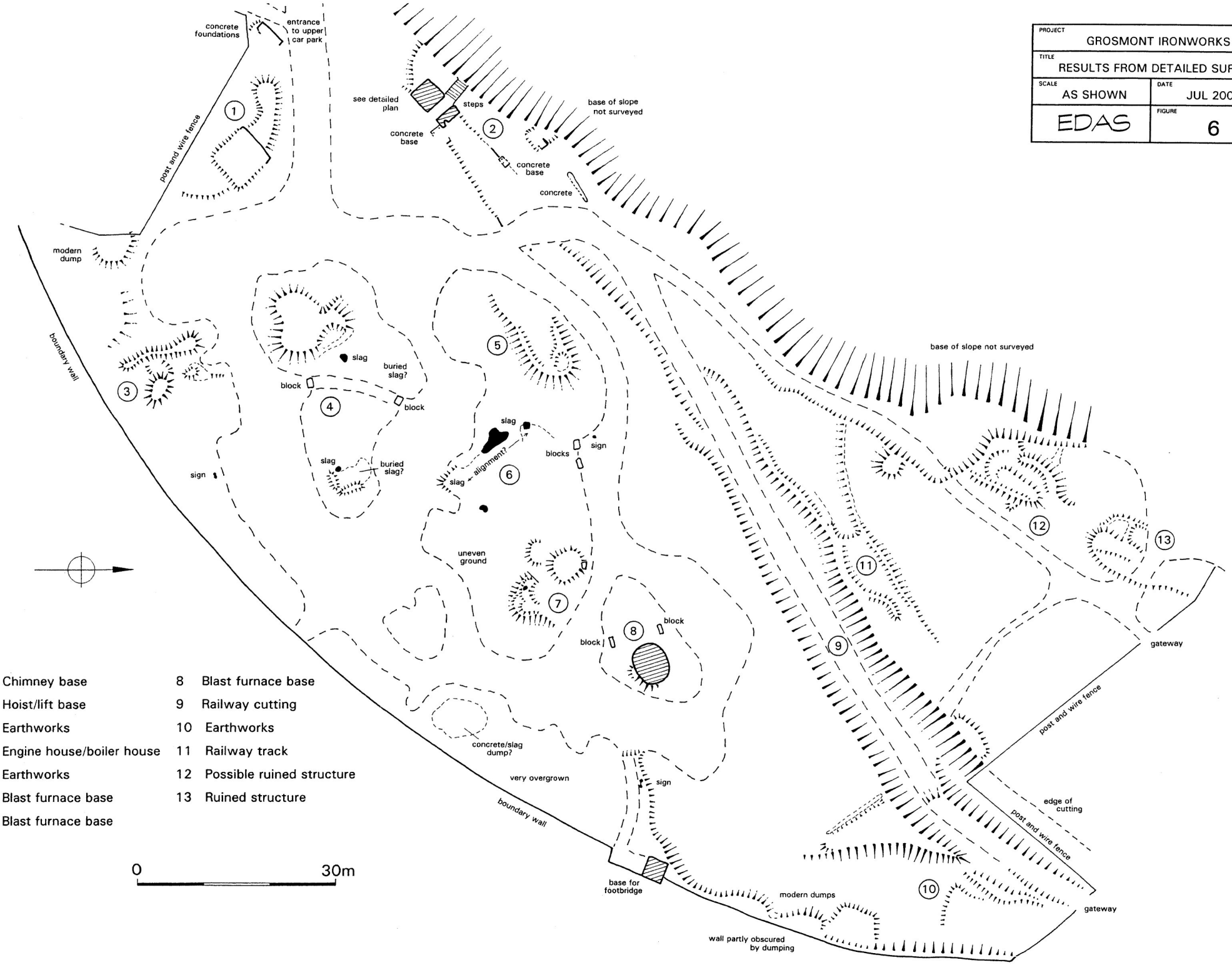


Sources:

a) OS 1913 25" map sheet 45/4

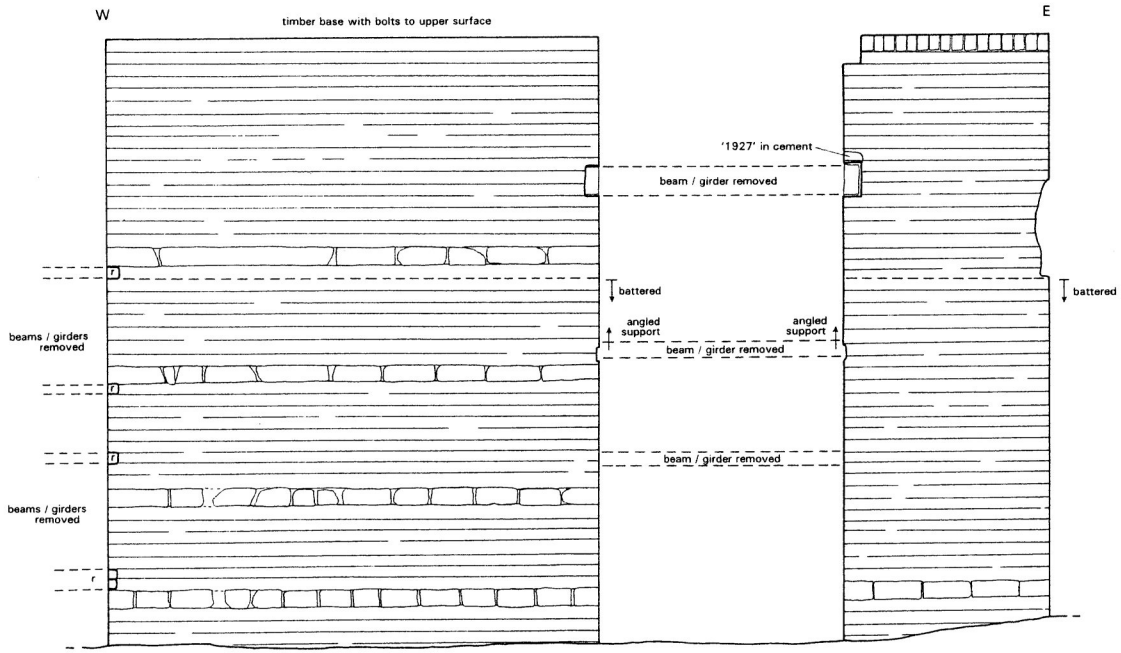
b) OS 1952 6" map sheet 45NE

PROJECT	
GROSMONT IRONWORKS	
TITLE	
HISTORIC ORDNANCE SURVEY MAPS	
SCALE	DATE
NTS	JUL 2007
EDAS	FIGURE 5

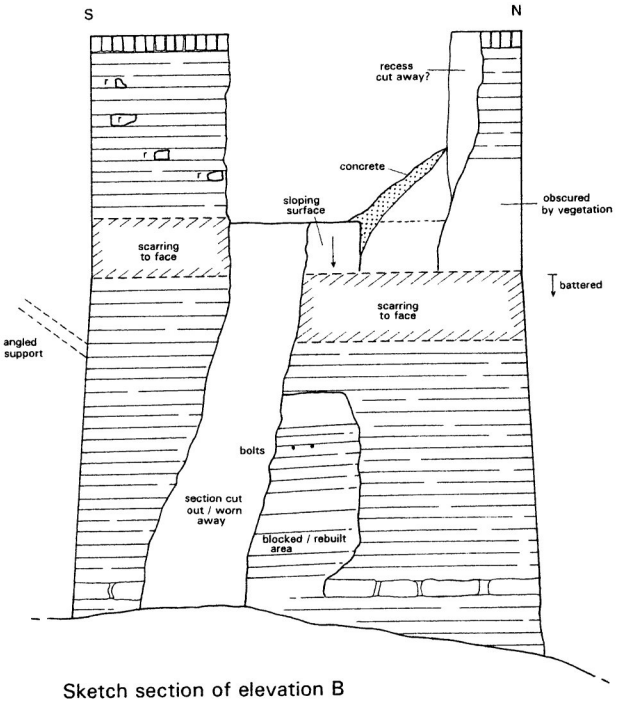


PROJECT	GROSMONT IRONWORKS
TITLE	RESULTS FROM DETAILED SURVEY
SCALE: AS SHOWN	DATE: JUL 2007
EDAS	FIGURE: 6

1 Chimney base
2 Hoist/lift base
3 Earthworks
4 Engine house/boiler house
5 Earthworks
6 Blast furnace base
7 Blast furnace base
8 Blast furnace base
9 Railway cutting
10 Earthworks
11 Railway track
12 Possible ruined structure
13 Ruined structure

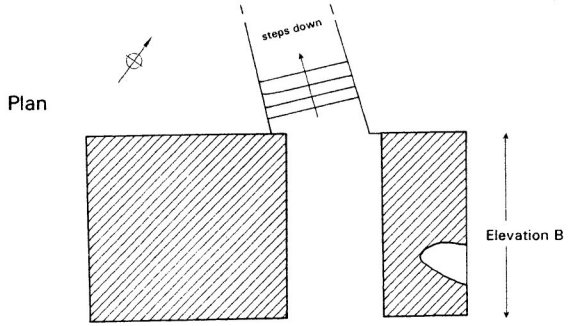


Sketch section of elevation A



Sketch section of elevation B

r = recess



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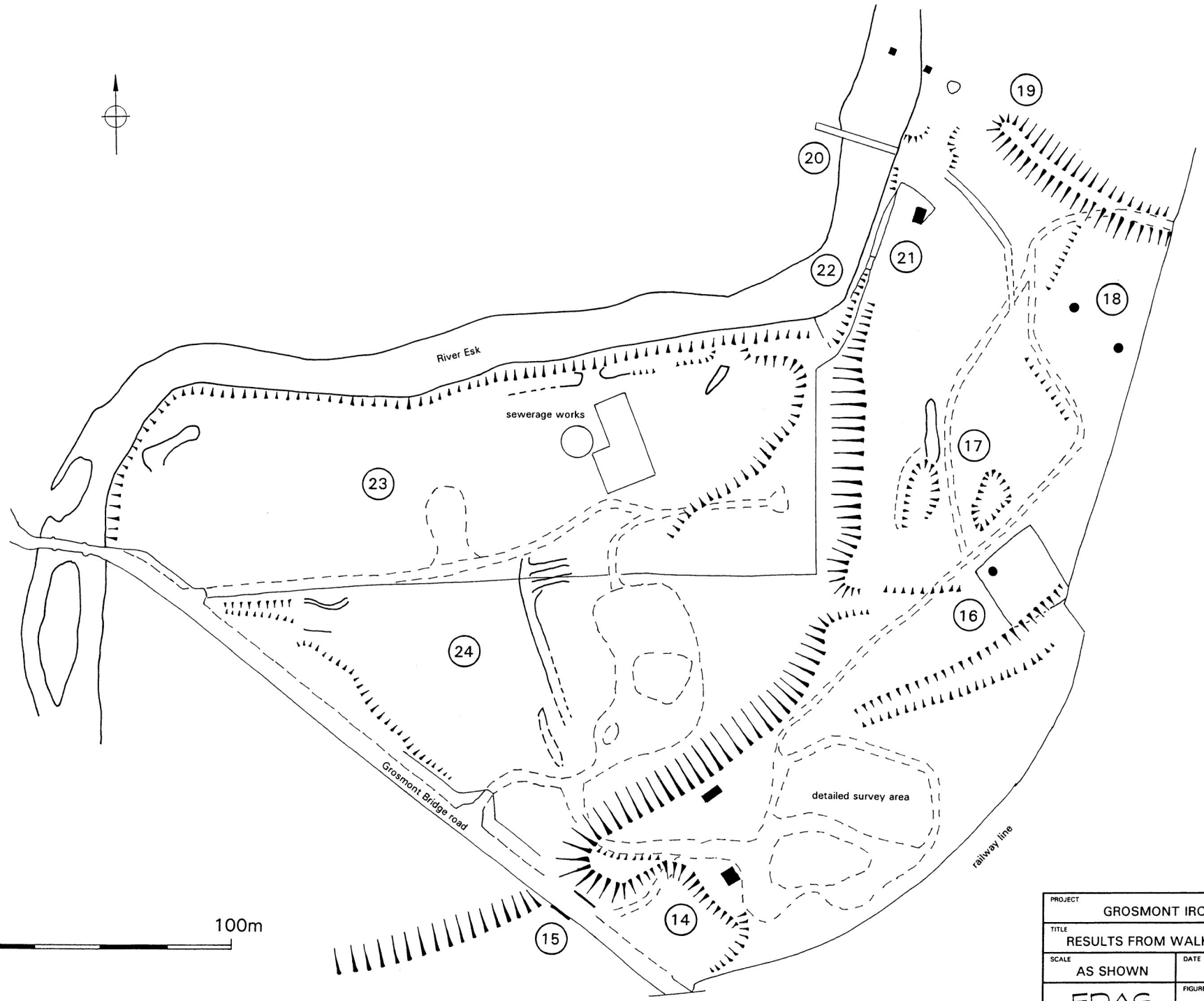
0 3m

PROJECT: GROSMONT IRONWORKS	
TITLE: SKETCH SURVEY OF HOIST BASE	
SCALE: AS SHOWN	DATE: JUL 2007
EDAS	FIGURE: 7



PROJECT	
GROSMONT IRONWORKS	
TITLE	
RESULTS FROM WALKOVER SURVEY	
SCALE	DATE
AS SHOWN	JUL 2007
EDAS	FIGURE 8

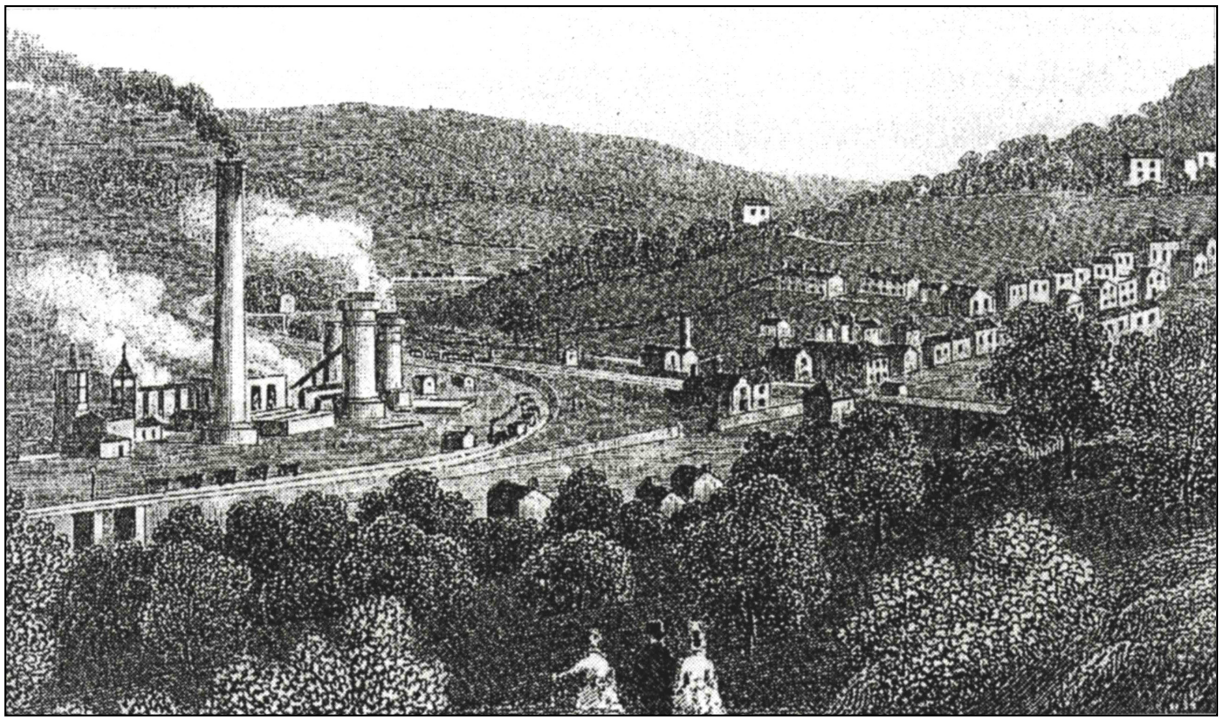


Plate 1: Engraving showing Grosmont in the 19th century with the ironworks complex (from Whitworth 2006, 72).

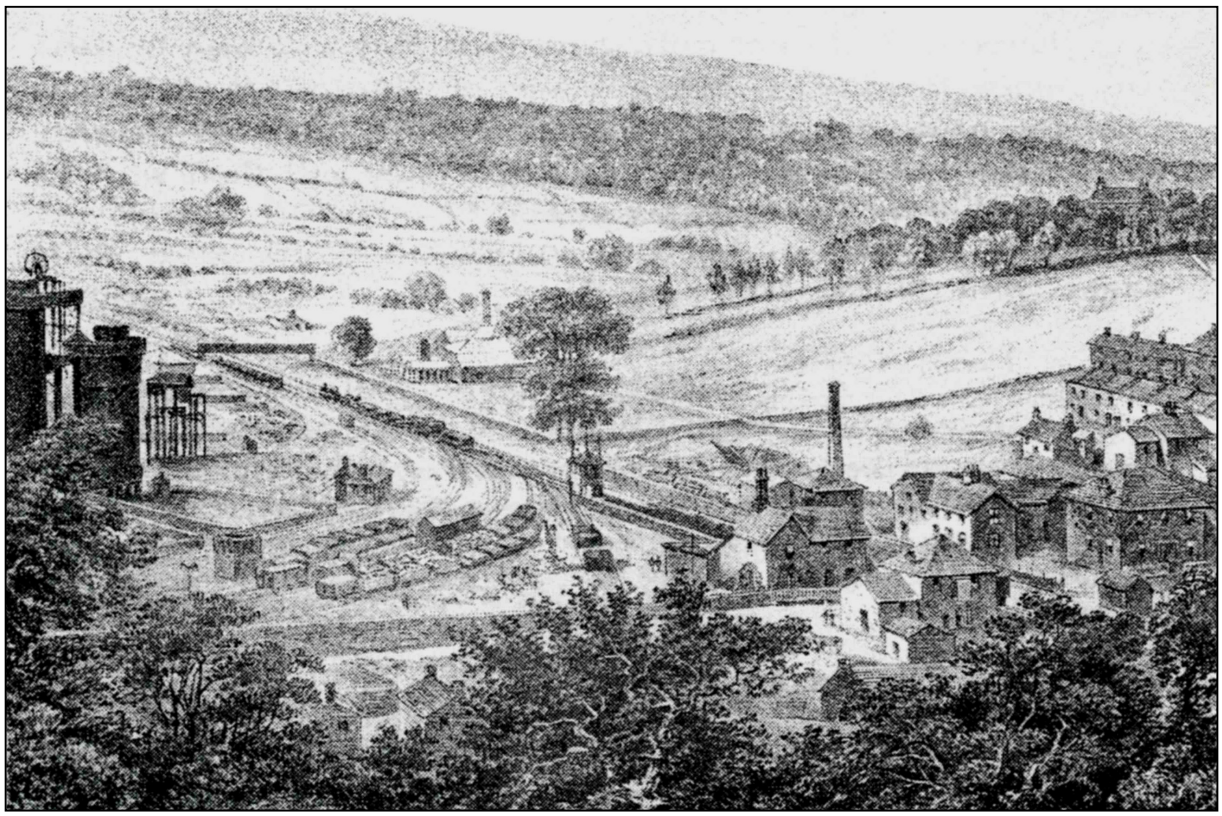


Plate 2: Lithograph showing Grosmont in c.1874 with the third blast furnace under construction (from Chapman 2002, 42).

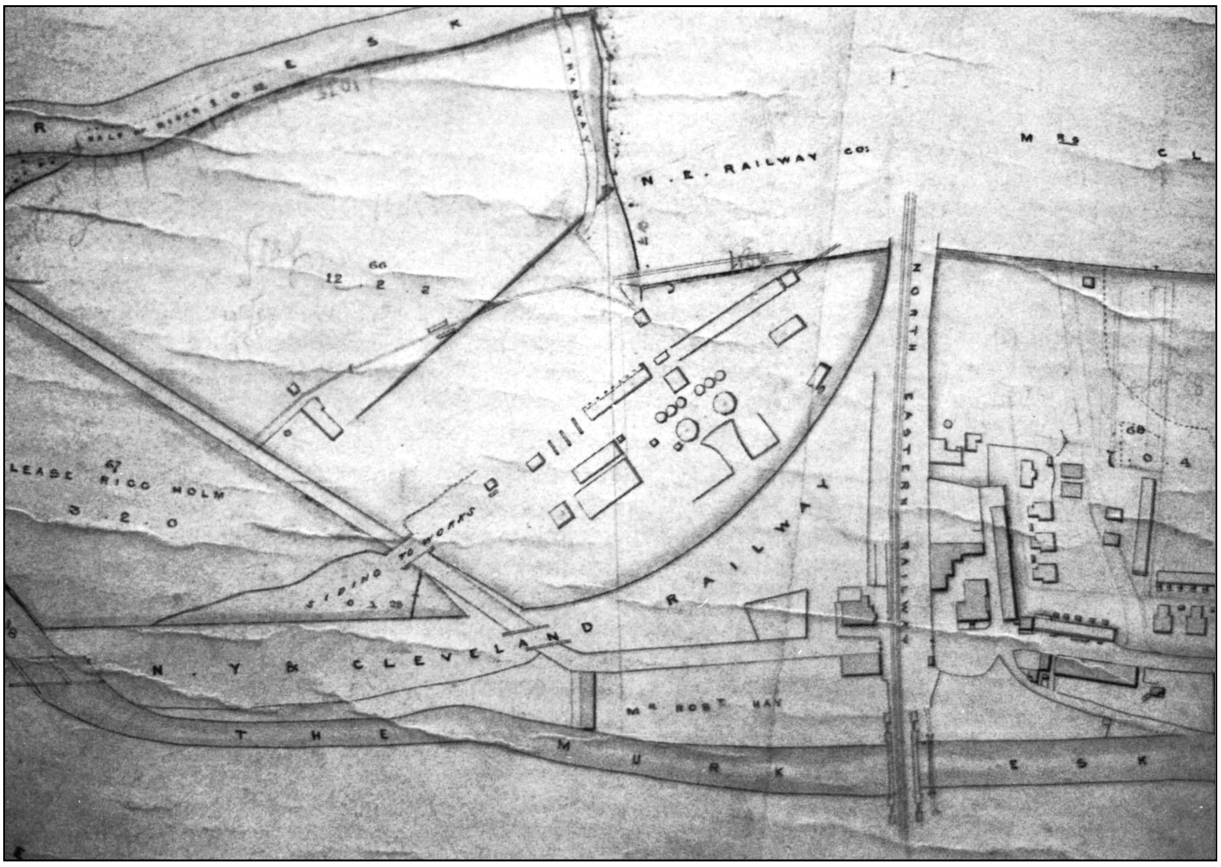


Plate 3: Plan of Grosmont ironworks in 1864 (from Shill & Minter 1994, 290).

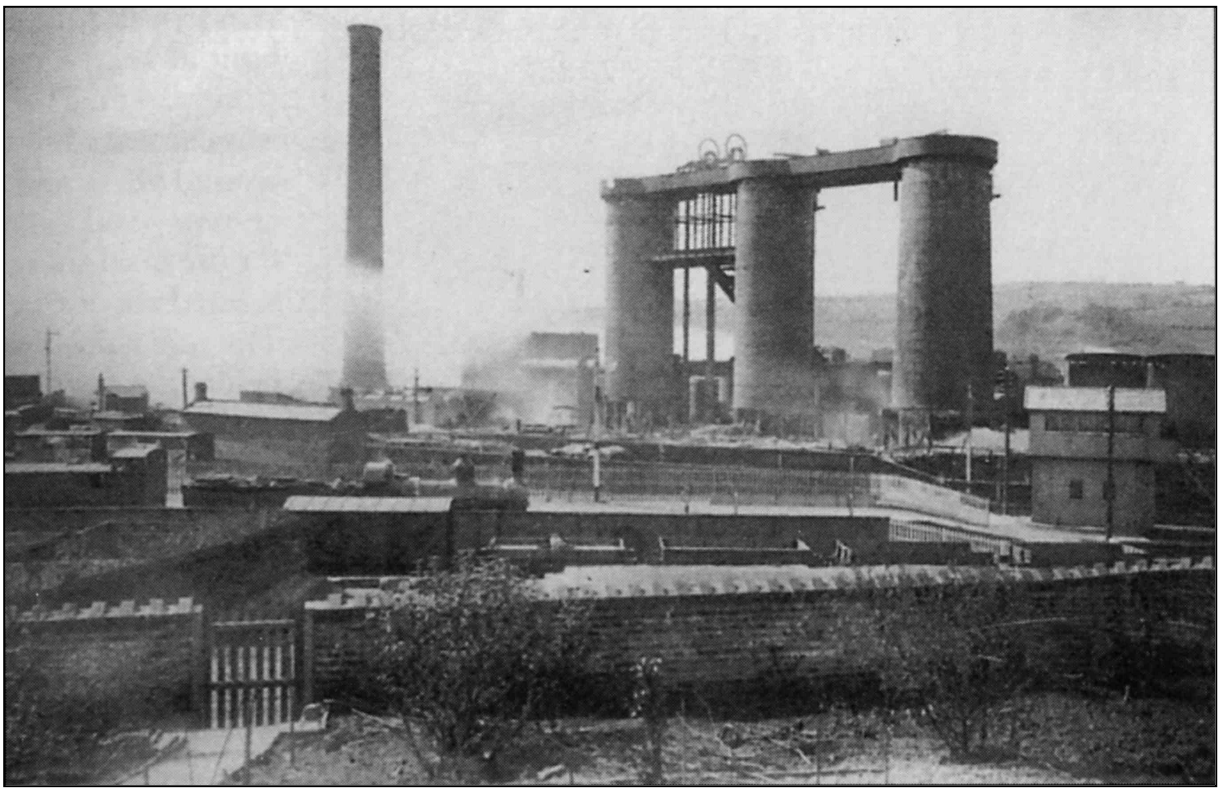


Plate 4: Grosmont ironworks in c.1880 (from Whitworth 2006, facing page 61).

Plate 5: Furnace base (Site 7), looking NW.

Plate 6: Furnace base (Site 8), looking NE.

Plate 7: Remains of hoist / lift (Site 2), looking NW.

Plate 8: Bridge pier (part of Site 19), looking N.

Plate 9: Tramway bridge (part of Site 20), looking N.

Plate 10: Wharf and related structures (Site 22), looking NE.