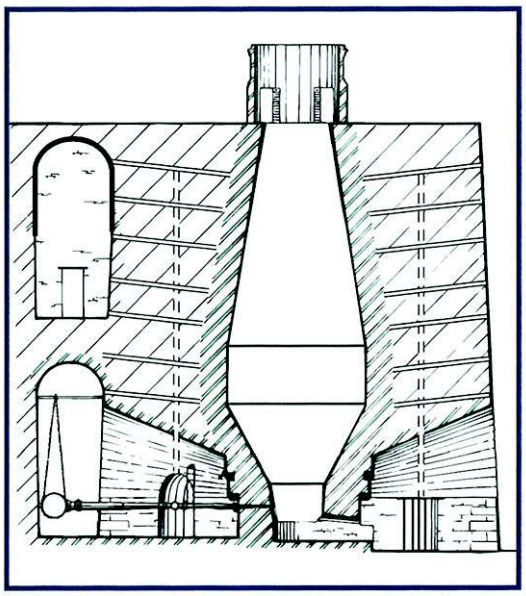
Gadlys Ironworks Aberdare Rhondda•Cynon•Taff

Proposed Consolidation of Blast Furnaces



Report on Archaeological Assessment

For:
Rhondda•Cynon•Taff County Borough Council

Oxford Archaeology

In collaboration with
James & NICHOLAS ENGINEERS ARCHITECTS

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RHONDDA-CYNON-TAFF COUNTY BOROUGH COUNCIL
JAMES & NICHOLAS

GADLYS IRONWORKS, ABERDARE

PROPOSED CONSOLIDATION OF BLAST FURNACES

ARCHAEOLOGICAL ASSESSMENT AND DESKTOP REPORT

NMR DATA	
Site Name	Gadlys Ironworks
Town	Aberdare
County	Rhondda-Cynon-Taff
N.G.R.	SO 0002 0298
Visit/Survey Dates	April-May 1999
OA Site Code	GADLYS99

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Rhondda-Cynon-Taff County Borough Council
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Summary

The Rhondda Cynon Taff County Borough Council wishes to consolidate the surviving blast furnaces at the site of the former Gadlys Ironworks Aberdare - a Scheduled Ancient Monument. The Council has commissioned James and Nicholas, Consulting Engineers to advise on the consolidation works and the Consulting Engineers have, with the prior approval of the Council, engaged Oxford Archaeology (then the Oxford Archaeological Unit) to carry out a desk top archaeological assessment of the furnaces. This report primarily deals with the archaeology of the site but includes a preliminary structural assessment of the visible fabric of the furnace (Section 6.1) by the Consulting Engineers who have also contributed to the Conclusions (Section 10) and the Recommendations (Section 11).

The four blast furnaces (centred on NGR SO 0002 0298) are located on the northern fringes of Aberdare town centre. Much of the site of the former Gadlys Ironworks is now occupied by a Tesco supermarket and car park however, the blast furnaces form part of a group of historic structures which survive on the south-western boundary of the supermarket site. One of these historic structures (a former wagon repair shop) has recently become home to the new Aberdare Museum. The blast furnace bank lies directly behind this building.

Whilst the four surviving blast furnaces are possibly the best-preserved in Britain, the land above them has for many years been cultivated as allotments, with part used as storage by a local builder. There have recently been two occasions when sections of allotment have collapsed very fortunately without fatal consequences. Because of this, and the recent investment in the local museum and enterprise centre at the foot of the furnace bank, it has been decided that action must now be taken to consolidate and conserve the blast furnace remains. This report has been commissioned to inform these consolidation proposals.

The archaeological assessment of the blast furnaces at Gadlys has proved to be a very valuable exercise. Close analysis of documentary sources and the surviving fabric of the blast furnaces has shown that the Gadlys furnaces were built in three main constructional phases between c.1827 and 1855-6. The furnaces seem to survive to full height, and on the surface they appear to be exceptionally well preserved. The apparent excellent external state of the furnaces unfortunately belies their internal structural state and it is clear that the furnaces have potentially serious structural problems that will result in eventual failure if left unattended to. Despite these problems, all of the furnaces appear to retain many of their most important technological features and it is clear that all currently bear extensive archaeological evidence of cyclical reconstruction and modernisation throughout their working lives. Much of this information is very fragile however, and it is judged to be especially vulnerable to ill-considered consolidation.

It has been shown that the Gadlys Ironworks cannot be considered nationally very important in purely historical terms as it was not one of the earliest, largest nor most technically advanced of Welsh ironworks. Nevertheless, whilst Gadlys was never notable for its size or technical virtuosity during its working life, the Gadlys site remains important as an example of a typical

second generation Welsh Ironworks, one of nearly forty that sprang up between 1820-1860 in response to the demand for iron, both for tin plate and more especially for rails. In this period Welsh iron production accounted for over 40% of the total British make and whilst many of the English and Scottish ironworks produced armour plate, structural cast- and wrought-iron and fancy goods, it was Welsh rails which shrank the continents during the railway revolution and Welsh tinplate that allowed the mass-production of light consumer durables and safely packaged food needed both at home and on the colonial frontiers. Given the international significance of British, and especially Welsh, iron, and the poor rate of survival of historic ironmaking sites, it is Gadlys' one-time typicality that should be seen as one of site's key strengths today. Comparative analysis of surviving ironmaking monuments has revealed the Gadlys furnaces to be the best-preserved substantial bank of early- to mid-19th-century coke-fired blast furnaces anywhere in Britain. It is because of this, as well as because of the global importance of the Welsh iron industry at the period that they are rightfully considered to be of high national significance.

It is clear from the above that the blast furnaces are in urgent need of consolidation, and that the consolidation works will have to archaeologically monitored. The furnaces nevertheless have the potential to be a significant local and regional asset. Their significance, and their position immediately adjacent to the Aberdare Museum and the extant blowing engine house also makes their interpretation particularly practicable and desirable. In addition, their location and their status as a Scheduled Ancient Monument would indicate that considerable grant aid might be available for such works. Unfortunately the furnaces remain as somewhat isolated structures and their function is obscured by the blocked-up tapping- and blowing-vaults and by the allotments. Excepting the surviving engine house and nearby company-provided housing, their wider context has been compromised by demolition and redevelopment of most of the ironworks over the last one hundred and twenty-five years. Nevertheless, this assessment has indicated that important remains currently lie hidden, both within the currently-obscured areas of the furnaces as well as in under-developed areas immediately adjacent, that have high potential for additional buried archaeological remains. These could add significantly to the interpretation of the furnaces and restore at least part of their lost relationship to the ironmaking process.

It is important that all of the interpretational possibilities are considered at the same time as the various strategies for consolidation and because of this a series of further archaeological and structural evaluative works have been proposed. Several proposals for interpreting the furnaces and other remains have been made in this report and it is clear that the collective group of interpreted remains could form a significant educational resource that could also enhance local pride, identity and sense of place. It should be noted that the viability of any high-profile interpretation schemes would have to seriously considered however. A balanced approach taking account of criteria such as sustainability, staff-cost / revenue, local desire for a tourism industry and the visual or physical impact of any proposed scheme on the setting or fabric of the Ancient Monument itself is urged. The blast furnaces are of undoubted great technological and historic significance, but their wider public appeal is likely to be tempered by their relatively 'modern' date, their situation overlooking Tesco's car park and the presence of other high-profile industrial-heritage sites nearby. This view should not be seen as diminishing the site's potential importance as a regional educational and recreational asset or its undoubted eligibility for substantial grant aid, but caution would be urged when it comes to developing interpretation strategies that have high staffing costs or overheads associated with them. Significant running costs may be justified by the site's potential as a community asset, but the potential liability of such a commitment must be addressed early on in the project as experience has unfortunately shown that schemes initially justified on unrealistic expectations for tourism- and revenue-generation often end up making unsustainable demands on finite local government resources and eventually founder completely.

It will also be important to ensure that whatever interpretational facilities are erected are sensitively designed and located so as not to detract from the blast furnaces and the other key structures themselves. Any new buildings should respect the furnaces by neither slavishly imitating the existing structures nor by being too busy or architecturally showy.

Rhondda-Cynon-Taff County Borough Council
James & Nicholas

GADLYS IRONWORKS, ABERDARE
PROPOSED CONSOLIDATION OF BLAST FURNACES

ARCHAEOLOGICAL ASSESSMENT AND DESKTOP REPORT

1 INTRODUCTION

1.1 The Rhondda Cynon Taff County Borough Council wishes to consolidate the surviving blast furnaces at the site of the former Gadlys Ironworks Aberdare - a Scheduled Ancient Monument. The Council has commissioned James and Nicholas, Consulting Engingeers to advise on the consolidation works and the Consulting Engineers have, with the prior approval of the Council, engaged Oxford Archaeology (then the Oxford Archaeological Unit) to carry out a desk top archaeological assessment of the furnaces. This report primarily deals with the archaeology of the site but includes a preliminary structural assessment of the visible fabric of the furnace (Section 6.1) by the Consulting Engineers who have also contributed to the Conclusions (Section 10) and the Recommendations (Section 11).

1.2 Whilst the four surviving blast furnaces remain arguably the best-preserved in Britain, the land above them has for many years been cultivated as allotments, with part used as storage by a local builder. There have recently been two occasions when sections of allotment have collapsed, fortunately without fatal consequences. A local museum and an enterprise centre have recently been established at the foot of the furnace bank and it has been decided that action must now be taken to consolidate and conserve the blast furnace remains. This report has been commissioned to inform these consolidation proposals.

2 LOCATION (Fig. 1)

2.1 The four blast furnaces (centred on NGK SO 0002 0298) are located on the northern fringes of Aberdare town centre (Fig. 1). Much of the site of the former Gadlys Ironworks is now occupied by a Tesco supermarket and car park however, a group of historic structures survive on the south-western boundary of the supermarket site. One of these historic structures (a former wagon repair shop) has recently been opened as a new museum for Aberdare. The blast furnace bank lies directly behind this building (See Plates 1 to 4).

3 HISTORICAL BACKGROUND

This section comprises a summary history of the ironmaking industry in South Wales, in the Cynon Valley and of the Gadlys Ironworks itself. A complete and fully referenced version will be found in Appendix C at the end of this report.

3.1 The South Wales Iron Industry

3.1.1 Iron making was undertaken in South Wales from pre-historic times until the late-sixteenth century using simple charcoal-fired furnaces called bloomeries. From the 1560s the ore, whether locally mined or imported, was smelted in large blast furnaces, which replaced bloomeries in the region during the second half of the sixteenth century. Blast furnaces were introduced to Britain from the continent in the early sixteenth century and this technology was in use in South Wales by 1564. Until about 1760 charcoal was used exclusively as the fuel in South Wales blast furnaces, which were blown entirely by waterpower. Whilst blast furnaces allowed the production of iron on an industrial rather than a domestic scale, they had the disadvantage of only being capable of producing the more brittle cast iron, whereas the small bloomeries directly produced malleable wrought iron, albeit in tiny quantities. Thus the secondary refining of cast iron to wrought iron remained a complex and time-consuming business.

3.1.2 By 1760-80 the Welsh forests were becoming similarly exhausted. The answer lay in Abraham Darby's successful use of coke to smelt iron, first carried out at Coalbrookdale in 1709. This technology was ideally suited to the South Wales coalfield, with plentiful supplies of good coking coal, easily accessible iron ore and under-utilised waterpower sites. The first ironworks to be built to exploit this method of smelting appears to have been that at Hirwaun, established in 1757. By about 1790 charcoal blast furnaces had been largely superseded, in South Wales as elsewhere, by coke-fired furnaces, although until the 1790s the water wheel, coupled either to traditional leather bellows or cast-iron cylinders, remained the universal method of blowing.

3.1.3 Although almost all the iron working sites in South Wales had converted to coke smelting by the end of the century, the production of wrought iron remained a time-consuming and expensive process, often still reliant on the use of charcoal despite the introduction of the potting and stamping method, in which coal or coke could be used. This situation was transformed by the adoption of Henry Cort's (coal-fired) puddling furnace, patented in 1784, which was adopted with great enthusiasm in the region. This technique once combined with Cort's rolling mill of 1783 allowed a huge growth in the local iron industry with many new blast furnaces constructed to supply the puddling furnaces with pig iron. The simultaneous development of efficient steam-powered blowing engines for the blast furnaces, combined with the demands of the revolutionary and Napoleonic wars (1793-1815) led to a massive increase in the industry and during this period South Wales rose to become the world's pre-eminent iron-making centre. The region shared in the slump after 1815 and in the wave of renewed growth in the small boom in the years 1824-5.

3.1.4 Increasing domestic demand from 1830, fuelled by the growth of railways and increased industrialisation, acted as great spurs to the industry yet despite the great prosperity of the British iron trade in the period 1835-50, the region's pre-eminence started to slowly decline. By 1830 the local sources of easily accessible ore were becoming exhausted. Richer imported ores became widely available, much to the benefit of ironworks located closer to ports. As the mineral leases under which the earliest works had been established expired, it often proved uneconomic for the lessees to seek a renewal and, from the 1850s, blast furnaces began to close in South Wales.

3.1.5 The region was still a sufficiently important element in the industry to share in the boom of the early 1870s, largely a result of an increasing worldwide demand for iron rails, but it then suffered very badly in the contraction that followed. Britain's early lead in producing Bessemer steel failed to help the national iron industry as early technical problems prevented the immediate use of most British ores for steelmaking. Thus, only about a dozen of the older South Wales works survived to be rebuilt for the new process in the 1880s. Towards the close of the century prudent iron makers were forming into large national combines and relocating to new works on the coast. By the turn of the century South Wales was responsible for no more than 10 per cent of the output of the British iron industry. This decline happily coincided with the exponential growth in the worldwide demand for Welsh steam coal, the commodity so successfully first marketed from 1837, by Thomas Wayne of Gadlys, Aberdare. Further closures followed both before the First World War and in the Depression of the 1920s and 1930s, although the major cause of distress in South Wales during the inter-war period was the decline of the coal industry, which had long been by far the more important employer. Steelmaking was re-established at Ebbw Vale in the 1930s, partly in an attempt to reduce unemployment, and the GKN Cardiff works was rebuilt in the same period. In the 1950s the South Wales steel industry enjoyed something of an Indian summer, with existing plant supplemented by a new works at Llanwern, near Newport.

3.2 Ironmaking in the Cynon Valley

3.2.1 Early iron-making on a small scale appears to have started in the Cynon Valley by the end of the sixteenth century when a few ironmasters from the more established iron working centres of Sussex and the Weald of Kent were attracted by the natural resources of the area. The richly-wooded Parish (according to Dafydd Morganwg, writing in 1876 '*...mor goediog gynt, fel y gallai gwiwer fyned o un pre i'r llall heb ddisgyn i'r llawr, o Mountain Ash hyd Gefn y Cynghor, ac oddiyno drachefu i Gwm Nedd*[1]') could supply abundant charcoal, together with good sources of water power and the ironstone which was present within the outcropping lower coal measures. Little has been researched into this industry although it has been stated that in the 19th Century evidence of bloomeries (3-foot high hand-blown furnaces) or early blast furnaces could still be seen at Blaen Cwm Dare beside the Bwllfa (Ffwrnes Cwm Dare); at Cae Luce in Llwydcoed (Ffwrnes Cae Luce); at Cwm Cynon beside the Duffryn (Ffwrnes y Dyffryn); and at Cwmaman (Ffwrnes Cwmaman). A hand-blown furnace of 1666 at Hirwaun mentioned by Llewelyn also sounds more like a bloomery than a blast furnace. Evidence has been found in more recent times of a bloomery site at the west end of Dumfries Park, Aberdare (SN 992 018) and the site of a 16th-century blast furnace is known to exist near Blaen-Canaid farm (SN 037 044).

3.2.2 There appears to be a substantial lack of documentation for the 17th- and 18th-century furnaces in the region. It appears that a charcoal blast furnace may have been established at Hirwaun in 1666 and claims have been made that another (with steam-powered blast) was built at Ffwrnes-y-Garn in 1773. Historically the most important ironworks within the Cynon Valley was the at **Hirwaun Ironworks**, established in 1757 by John Maybury of Worcestershire. Hirwaun was amongst the first to be established in South Wales in the industrial revolution period and it seems highly probable that these works were established to emulate Abraham Derby's success in smelting iron using coke rather than charcoal and it is from this technological 'quantum leap' that the site's great significance derives. Hirwaun long remained as a small, single furnace works, a second furnace only being added some time after 1805. The site was purchased in 1819 by William Crawshay, who also owned the large Cyfartha and Ynysfach works in Merthyr Tydfil, and he invested in new plant and a further two furnaces. The works were not particularly profitable and despite various attempts at modernisation, Francis Crawshay relinquished the site in 1859 and the blast furnaces were blown out for the last time in 1866.

[1] '*...so forested that a squirrel could jump from one tree to the next from Mountain Ash, along Cefn y Cynghor, and from there to Cwm Nedd*' – a distance of 12 miles. (Dafydd Morganwg, 193)

There was one last unsuccessful attempt to modernise the furnaces at Hirwaun in the early 1880s but little iron was produced and the site was used principally for foundry work.

3.2.3 The establishment of the Hirwaun Ironworks highlighted the poor communications in the area although transport remained entirely by pack-horse until 1770 when a road was made from Merthyr to Cardiff. Transport was much improved by the opening of the Glamorgan Canal (1794) and the Neath Canal in 1799. In 1793 an Act was granted for the construction of the Aberdare Canal from the Glamorgan Canal at Abercynon to Aberdare, with a tramroad extension to Hirwaun and Penderyn. Whilst much of the tramroad was soon built, completion of the canal waited until 1812.

3.2.4 The impetus to finish the canal came from John Scale of Handworth, Birmingham, co-proprietor with Samuel Homfray (of Penydarren fame) of the Aberdare Iron Company. This had been established in 1799-1800 to construct the **Aberdare Ironworks** at Llwydcoed, Aberdare, consisting of two water-blown furnaces 40ft high. The Aberdare Ironworks was almost exactly contemporary with the three-furnace **Abernant Ironworks,** built at Aberdare in 1801-7 by James Birch (a former manager of the Penydarren Ironworks) and Jeremiah Homfray (See Fig. 2). Clearly dissatisfied with the tardiness of the canal company in completing their line, the proprietors of the Abernant Ironworks finally connected Aberdare to the outside world in 1802-4 by constructing a tramroad from Abernant to Hirwaun and the Neath Canal at Glyn Neath. A manufactory to produce engines to Trevithick's patents was built at Abernant but disagreements led to the sale of the Abernant works to proprietors of the Aberdare Ironworks in 1819 and the two plants thenceforth were operated as one unit. The combined operation continued to be successful and substantial investment in the late 1840s led to the building of very substantial forges and plate and rail mills at Abernant and at Treforest. The company was highly successful and succeeded in purchasing the famous Plymouth and Penydarren ironworks in Merthyr in the early 1860s. In 1874 the collapse of the wrought iron rail trade, together with problems detailed above and common to other South Wales ironworks, led to the sudden and permanent closure of the company's ironworks, among them those at Aberdare and Abernant.

3.2.5 The last iron-making site in the Cynon Valley to be developed was that at Aberaman. In 1837 Crawshay Bailey, the important and highly successful South Wales iron master, and owner of the large Nantyglo and Beaufort ironworks (and later owner also of ironworks at Varteg and Golynos) purchased an estate rich in minerals. In 1845 he constructed the **Aberaman Ironworks**, with two furnaces. The Aberaman Ironworks was clearly a highly capitalised and relatively prosperous venture and the works (latterly with three blast furnaces and a small forge) remained in full production until sudden closure in 1867. The Powell Duffryn Steam Coal Company then purchased the estate and ironworks solely for the purposes of exploiting the underlying coal seams.

3.2.6 The timing and location of this last venture was clearly influenced by the opening up of the Cynon valley to the steam railway. In 1837 Thomas Wayne of the Gadlys Ironworks (see below) had sunk a pit to the "four foot seam" and pioneered the marketing of Welsh steam coal on the London market. This new trade and the now-mature iron trade led in 1845-6 to the opening of a branch of the Taff Vale Railway from Abercynon to Aberdare and the authorisation of the broad gauge Vale of Neath Railway, a branch of which approached Aberdare from the north-west. These developments set the stage for the boom in the coal trade for which the Cynon Valley became world famous.

3.2.7 Ironmaking was clearly of singular importance in opening up the Cynon Valley to industrialisation in the latter half of the 18th century and the first half of the nineteenth century. Whilst Aberdare never grew to the size or importance of the great iron-making metropolis of Merthyr Tydfil, 4 miles to the north-east, the establishment of the ironmaking industry there led directly to the dramatic transformation of Aberdare from an insignificant tiny market town to an important regional ironmaking centre connected to the national transport network and industrial

culture. Thus, whilst the total iron production in 1846 of three Aberdare ironworks (Gadlys, Aberdare (Llwydcoed) and Abernant was little more than one-tenth of the combined production of the four giant ironworks at Merthyr, the establishment of iron trade gave the valley the industrial infrastructure and entrepreneurial culture which enabled it to become world-famous for its steam coal trade in the latter half of the 19th century.

3.3 Gadlys Ironworks (1827-1876)

3.3.1 Gadlys Ironworks is recorded as having been established in 1827, and it was thus a relatively late addition to the ironworks of the Aberdare area. It was thus conceived at the start of the short boom that occurred in the industry after the slump at the end of the Napoleonic Wars. It was located close to the centre of Aberdare, on the north side of the town, and within a mile of both the existing Abernant and Aberdare ironworks (Fig. 2). The partners were George Rowland Morgan, Edward Morgan Williams and, the most important historically, Matthew Wayne (c.1780-1853). Wayne had been Richard Crawshay's furnace manager at Cyfarthfa. Using a legacy of £800 from Crawshay, Wayne became Joseph Bailey's partner in leasing the lucrative Nant-y-glo Ironworks. This enabled Wayne to considerably enlarge his personal wealth. Wayne retired from the partnership with Bailey c.1820 and in 1827 he used his experience and capital to co-found the Gadlys works (Davies, 1959, 1015).

3.3.2 Gadlys was unlike the other ironworks within the Cynon Valley, and most within South Wales, in that two (Morgan and Williams) of the three co-partners were local men from within the valley, with the works located on the land of several small adjacent farms, owned by each partner. Among the farms was Y Gadlys, owned by Morgan from which the new company (The Gadlys Iron Company) took its name. Agreements were made for a supply of limestone from quarries at Penderyn as well as for the cutting of a 600 yard leat from the river Cynon and the construction of 650 yards of tramroad to link the works to the Aberdare Canal. Coal was sourced from the immediate vicinity and iron stone from the Llwydcoed area some 1.5 miles from the works. A blowing engine was supplied by the Neath Abbey Ironworks (Figs. A2 to A4)

3.3.3 The Gadlys works did not enjoy a smooth and profitable first few years of existence, perhaps due to what Phillips considers Wayne's "plodding, old fashioned way, carrying on his works only when times were good in the iron trade and putting out the furnaces when business was bad". Having produced 414 tons of iron in 1828 and 559 tons in 1829 production appears to have been suspended for the following three years. The works were unsuccessfully put up for sale in 1835 and the early problems were perhaps alluded to in the particulars (Fig. A1) which stated that the works were "in full operation" and that the healthy state of the iron trade was "fast making up lee-way for unprofitable and by gone days".

3.3.4 Although the ironworks was relatively modest in size, with only a single blast furnace, the sales particulars provide a good indication of the number of elements to the site. Apart from the blast furnace the ironworks is advertised as containing a cast house, a stove room, a turning room, refinery, cupola, smith's shop, weighing machine, three calcining kilns, bridge house, carpenter's shop and coal mine together with various machines and wagons. The "powerful steam engine" is also prominently referred to "calculated to blow a furnace and a refinery". The document also stated that between 130 and 150 people were employed at the site and that it was capable of producing up to 2000 tons of iron annually. It is clear that Gadlys was principally producing cast-iron, albeit cast iron "much esteemed and particularly adapted for strong Castings and Engine purposes"...made "at once from the furnace" implying iron of such purity that it didn't require further remelting, blending and refining in the foundry. The reputation of Gadlys iron appears to have been genuine, one of Mathew Wayne's orders being from the French Government, for 500 tons of No.1 cold blast iron, for making guns, some of which were used in the Crimea.

3.3.5 The sale having failed, Gadlys passed into the sole-ownership of Matthew Wayne who retained it until his death in 1853. He was assisted from about this time by his sons, notably Thomas Wayne, who eventually succeeded him. Production seems to have picked up soon afterwards and in 1837 Thomas Wayne persuaded his father and brother William to form a partnership with the David family of Abernant-y-groes, Cwmbach, to found Wayne's Merthyr-Aberdare Steam Coal Company. The intention was to sink a pit at Cwmbach, 1.5 miles S.E. of Gadlys, for the 'four-foot seam' lately reached by Lucy Thomas of Waun-wyllt, Merthyr. The Waynes successfully exhibited their coal at London in the December of that year and Mathew and Thomas Wayne are rightly considered to be the first true pioneers of the Welsh steam coal trade which became known throughout the world and which doubtless provided the Gadlys works with important investment income. Gadlys nevertheless remained a small-scale ironmaking concern through the 1830s and 1840s and despite the success of the Aberdare/Abernant concern, the Tithe map of 1847 (Figs. 2 & 4) still shows Aberdare as a village of approximately 100 houses set amongst arable fields and meadows. Gadlys ironworks appears as a group of four somewhat schematic buildings (apparently No.1 furnace & casting house, 1 blowing-engine house and stables), with tramways radiating to the N.W. (apparently toward s ironstone patches above Robertstown and Abernant) and to the N.E. (towards a junction with both the Aberdare & Hirwaun Tramroad and the new Taff Vale Railway). A road and possible tramway is shown running to the S.W. to Gadlys Old Pit. Accommodation fo r key workers appears to have been provided at this date by four terraces on Gadlys Street supplemented by another on Old Hirwaun Road. A polite house with landscaped gardens at Gadlys Isha (company offices by 1867 and more recently a school) may have bee n the Wayne's house.

3.3.6 The growing iron trade and the success of their coal business allowed further investment in the ironworks. A second blast furnace added 1839-41, and it appears from Wayne's orders of engines[2] that a forge and rolling mill was established soon afterwards. Further investment began in 1850 with the construction of a new tin mill at Gadlys and the company started to specialise in the production of tin plate bars and ductile armour iron using a cold blast within the furnace. The armour plate iron became the distinctive product of Gadlys in contrast to the manufacture of iron rails that so dominated much of the South Wales iron industry. A further two blast furnaces had been constructed by 1856 (bringing the total to four) and a further blowing engine was supplied by Neath Abbey in 1857 (Figs. A5 & A6). In 1861 production further diversified with the construction of a small rail mill allowing the rolling of both merchant bars and rails.

3.3.9 The Ordnance Survey's 1st edition map of 1868 (Figs. 5 & 6) was produced when Gadlys Ironworks was approaching its maximum extent. The map clearly locates the four blast furnaces with casting houses to the front of them. Two blowing engine houses are shown, the original of 1827 (with hot blast stove) lying to the north-west of the blast furnaces, with that of 1856 (the surviving engine house) to the south- east. The later engine house was clearly located with further expansion in mind as it is located some 40 m from the closest furnace, allowing for a further three furnaces to have been constructed had demand allowed it (Plate 1). Above the furnace bank was located a large coke yard (possibly laid out to allow open-air coke making) as well as four mine kilns (for roasting or calcining the raw iron ore), a small bank of eighteen coke ovens and two limekilns. The layout of the works below the furnace bank shows a small but well-equipped integrated ironworks, clearly specialising in high-quality iron. Thus, the plan not only shows the usual facilities for a normal integrated works (a further bank of coking

[2] The Waynes appear to have ordered most, if not all, of their various engines from the Neath Abbey Ironworks. Fortunately many of the Neath Abbey engine drawings have been archived at the Glamorgan Record Office (Neath Abbey Ironworks Collection). The Neath Abbey archive includes 54 drawings of 7 Gadlys engines (Gadlys ironworks and coal pits) dating from 1827 to 1861as well as 27 drawings of 3 or 4 other Wayne engines (probably from other Wayne collieries), dated 1845 to the early 1860s. Those reproduced in this report thus form only a small fraction of those available.

ovens, another calcining kiln, stables, smith's shop, engine houses, fourteen puddling furnaces, a foundry with cupola furnace for ordinary secondary casting, four balling furnaces and a forge with rolling mills (trains) for puddled bars), but it also shows air furnaces for high-quality castings, a very large fitting (machining) shop, three refineries, twelve charcoal hearths, six hammermen's furnaces and rolling mills, the latter being for the production of both high-quality merchant bars and the sheet iron needed for tin-plate. The lower site was completed by a large charcoal yard for storing the expensive pure fuel needed for the processing of the premium grades of iron. The plan appears to indicate that the two blast furnaces to the north-west (Nos.1 and 2) were blown with hot blast, whereas the two to the south-east (Nos. 3 and 4) were supplied with cold blast, thought to produce higher-strength iron. The site was fed at the upper level by a tramway directly to the Gadlys pits whilst sidings at both levels allowed trams as well as broad-gauge and standard-gauge wagons to be handled. A multi-gauge incline, with steam engine and drum, connected the upper and lower levels. The recently opened tinning works (closed 1941) is shown on a separate site slightly to the north. The provision of company-provided housing had clearly expanded through the 1850s and 1860s and new terraces are shown comprising Gadlys Street, Wayne Street and Ann Street close to the ironworks, with Gadlys Terrace provided by the Gadlys pits. Aberdare Park had also been laid out by this time to the north-west of Gadlys ironworks.

3.3.11 The peak years for the Gadlys Ironworks were 1862-66 when all four blast furnaces were in operation. The works proved more resilient than its Cynon neighbours did and in 1874 (by which time all of the others had ceased iron production) it was still employing c.2000 men. Following a suspension in production in 1875 a single furnace was put back into blast in 1876 but this was presumably unsuccessful and production of iron was finally abandoned in this year. Production statistics (nil) continued to be submitted until 1885, presumably in the vain hope that iron production might resume. These hopes were destined never to be fulfilled.

3.4 Gadlys Ironworks since Closure (1876 to date)

3.4.1 Following the close of iron production, the Gadlys site appears to have remained in use as an adjunct to the Wayne company's coal and tinplate interests. By the time of the 2nd edition O.S. map (1898) (Fig. 7) much of the site had been redeveloped, a brickworks being built in new buildings on the site of the demolished former rolling mill, whilst the casting houses had been demolished and replaced with a wagon works building on a similar footprint but extending about five metres further to the north-east. Several of the structures from the ironworks survived including both engine houses, the fitting shop, the stables, the workshops and offices.

3.4.2 In 1913 Aberdare U.D.C. opened the first two miles of its 5¾-mile tramway network. A tram depot was erected at the south of the site on the site of former slag tips and a refuse dustructor was built immediately to the south-east of the bank of blast furnaces. The destructor burned domestic refuse and the heat generated was used to generate electricity which not only powered the trams but a 1½ mile trolleybus route to Abernant, opened 1914. According to Evans, this involved the adaptation of one of the blast furnaces to a rubbish incinerator and the heat used to generate power. This 'green' solution to the sanitary disposal of domestic waste was pioneered in the U.K. at the turn of the century and there was a time when virtually every town had its destructor. By the time of the 3rd edition O.S. map (1914) (Fig. 8) the ironworks stables had been demolished and the wagon works closed although the brickworks remained in production, now with a distinctive oval-shaped Hoffman brick kiln. (OS 3rd ed. 1:10560, revised 1914). The municipal electric tramway was abandoned in 1935, with the tram sheds becoming an omnibus depot.

3.4.3 Maps of the 1950s and the 1960s (Figs. 9 & 10) show that by 1949-50 the brick works had been closed and partially demolished, along with the ironworks fitting shop workshops, office, and the 1827 blowing-engine house. The destructor and power house and tram sheds remained in

use; the latter still a bus depot. Some new building had taken place by this date, principally on the site of the fitting shops, and the site latterly passed into multiple usages including Red and White garages, Co-operative Garages and Aberdare U.D.C. Transport Dept. The 1856 engine house was used for a canteen and Scout HQ. Further buildings had been added by 1958-62, by which time the powerhouse was no longer generating electricity. In 1989 the remains of the blast furnaces were scheduled as Ancient Monuments under the Ancient Monuments and Archaeological Areas Act 1979, while the 1856 blowing-engine house and wagon works building (or "casting house") were both listed (both Grade II) as buildings of special architectural or historic interest (see details in Appendix D). In 1993 much of the site was purchased by Tesco Stores Ltd for a new supermarket. Most of the remaining buildings were removed, leaving only the blast furnaces, the 1856 blowing-engine house, the wagon works building and the power house (Fig. 11 & Plates 1 to 3). These latter have remained in Council ownership and shortly before the demise of Mid Glamorgan County Council, the engine house and powerhouse were converted to offices. The destructor house was demolished and replaced with a near replica that is also used as offices. The wagon works has been converted for use as a museum. Regrettably, apart from a small archaeological evaluation carried out by OAU for Tescos, no archaeological recording work was carried out during any part of these works.

4 GENERAL DESCRIPTION

4.1 The Site Today (See Figs. 11 & S.01) (See Fig. 14 for descriptive terms used in text)

4.1.1 The four blast furnaces at the former Gadlys Ironworks, Aberdare are aligned roughly S.E. – N.W. As is usual in South Wales, they are built into a natural slope, which allowed iron ore, coke and limestone to be tipped directly into the top of the furnaces from a high level charging area, which at Gadlys lay to the south-west (Plate 3). This charging area was originally largely occupied by a large coke yard and a locomotive shed but the site of the coking yard now lies beneath the turn-of-the-century streets of Neville Terrace, Gospel Hall Terrace and Penybryn Street. The locomotive shed appears to survive however, incorporated into the house called Penybryn at the north end of Penybryn Street. The coke yard was formerly connected to Gadlys Old and New Pits by tramway, the course of which is preserved by the alignment of East Avenue. The abutments of a bridge that carried the tramway over Gadlys Road also survive. The remainder of the charging area was occupied by four calcining ('mine') kilns, eighteen stop-ended coking ovens, a pair of lime kilns, an engine house, and a large smith's shop and yard. The sites of the majority of these structures now also lie beneath the houses and gardens of Gospel Hall Terrace although it appears possible that nos. 14-19 may contain some fabric from the old smithy. The site of the coking ovens and one of the calcining kilns lie buried beneath the gardens of nos. 30-39 Gospel Hall Terrace however the two lime kilns survive to full height in the garden of no.17 Elm Grove (Plate 4). The site of three of the calcining kilns which adjoined the lime kilns remains unoccupied rough ground and the general topography implies that there is good potential for substantial buried up-standing remains. The tops of the blast furnaces were given over to allotments after closure. These have recently fallen into disuse because of the uncertain structural stability of the furnaces themselves. Several streets of company-provided housing also survive in the vicinity, notably Wayne Street and Ann Street, whilst the houses on Oxford Street, Dowlais Street, North Avenue, East Avenue, South Avenue, Morgan Street, Gadlys Terrace and Gadlys Street all date to the ironmaking period and may also have belonged to the Gadlys Iron Company. The earliest surviving ironmaking period housing, shown on the Parish Tithe Map of 1847, are nos. 35-46, 48-58 and 60-70 Gadlys Street, whilst the site of the terrace at Wern Place remains as a derelict plot at the end of Wayne Street.

4.1.2 The lower part of the ironworks site, to the north-east of the blast furnaces, is occupied principally by the Tesco supermarket and its associated car park and petrol filling station (Plate 1). The site of the rolling mills and forges lies beneath the garden and landscaped area to the south-east of the superstore buildings however, in order to provide an adequately-sized plot for the supermarket buildings, the former incline between the lower level and the charging level was removed. The most noticeable feature remaining from the ironworks is the 1857 blowing-engine house (Plate 2). This has been converted to offices but the site of its boiler house survives to its the south-west as derelict and overgrown land of good archaeological potential. Adjacent to the engine house is the high retaining wall (the furnace bank wall), against which the blast furnaces were built. The section of this wall closest to the engine house was built with it c.1857, in anticipation of the erection of a further three blast furnaces which were never built. This wall retains scars from the walls and roof of the refuse destructor and power plant buildings constructed with the municipal tramway in 1913. It also retains vestiges of several brackets that appear to have supported the blast-main that led from the blowing engine house to the blast furnaces. One power plant building still stands, converted to offices, at the foot of the furnace bank, whilst a replica of an adjacent power-plant building has been recently built for office use. Adjacent to this, and directly in front of the blast furnaces, stands the wagon repair shop of 1876-1900 (Plate 1). This overlies the sites of the casting houses, and it has been speculated that this building originated as a casting house. Its footprint is different however, and the large arched openings in its arcaded exterior do not line up with the tapping vaults of the blast furnace. It thus appears that no original fabric of the casting house survives above ground although it is possible that its composite wrought- and cast-iron trusses were reused from the old

rolling mill buildings. This building has been adapted to house the local museum. The land to the N.E. of this building, formerly the site of the earliest casting house is currently a car park (Plates 3 and 8). The site of the foundry and the original (1827) blowing-engine house and its haystack boilers has been buried beneath a large earthen bank which appears to date from the redevelopment of the coke yard and charging area at the turn of the century (Plates 3 and 5). This bank has also buried the old north end of the original furnace bank wall.

4.1.3 The principal elevation of the blast furnaces themselves currently appears as a large sloping Pennant sandstone retaining wall, punctuated by three tall sloping-sided brick vaults (Plate 3). This impression is somewhat false, as the Gadlys blast furnaces are four relatively discrete structures. The current difficulty in interpretation results partly from the fact that the spaces between the separate structures are vaulted-over, and partly because the original tapping vaults (the vaults inside which the molten iron and slag was tapped) in the principal elevation are presently infilled with brick and stone (Plates 7, 8, 18, 22 and 26). The four furnaces themselves in fact take the form of four truncated square pyramids, standing clear of the furnace bank wall and each other. The four sides of each blast furnace were originally each pierced by tapering brick vaults, which gave access to the brick-built hearth at the core of each furnace (Plates 19 and 24). A tall brick-lined shaft (the 'furnace stack') rose from the hearth to a circular-section throat (or 'tunnel head') at the top of the stack, and it was into this throat that the raw materials were tipped. The tapering brick vaults in the base of each blast furnace are/were of two varieties, serving two different functions. Those in three of the sides (the 'blowing vaults') were used to accommodate branches of the blast main, connecting to the nossles (the 'tuyeres'), through which the furnace was blown. The fourth vault (that in the principal elevation) was the 'tapping vault' or 'cinder fall', which directly communicated with the casting house. Whilst all of the tapping vaults in the principal elevation at Gadlys are currently blocked, six of the original twelve blowing vaults remain open and accessible from within the vaults. The gaps between the former charging area and the furnace stacks themselves are each spanned by two vaults or galleries, one above the other. The 'lower gallery' (e.g. Plate 29) acts as a buttress whilst the 'upper gallery' at the upper level (e.g. Plate 15) supported the 'charging bridge' over which the raw materials were barrowed, to be tipped into the furnaces. As stated above, at Gadlys the spaces between each blast furnace are also vaulted-over (e.g. Plates 17 and 21). Thus, at the upper level (the charging level) the spaces between the four separate furnaces, and between the furnaces and the furnace bank wall, are completely covered over, forming the large 'charging platform' currently occupied by the out-of-use allotments.

4.1.4 Close analysis of the surviving fabric shows that the four furnaces were constructed in three separate phases. The first furnace to have been built (c.1827-8) was that at the N.W. end, hereafter referred to as No.1 Furnace (plates 5 to 16). This was obviously built freestanding, apart from its connections to the furnace bank wall via the upper and lower galleries and the charging bridge. This furnace was clearly constructed together with the (now-demolished) N.W. blowing-engine house. The adjacent furnace to its south-west (hereafter No.2 Furnace) (Plates 18 to 20) was clearly the next to be constructed (c.1839-40), again originally built as a free-standing structure apart from the upper and lower galleries between it and the furnace bank wall. The two furnaces at the south-eastern end (No.3 Furnace and No.4 Furnace) (Plates 21 to 29) were clearly built as a pair (c.1855-6) and dating evidence and stylistic similarities confirm that they were built at the same time as the extant south-east blowing-engine house. These two furnaces are similar in most respects to the earlier furnaces except that the vaults of the upper and lower galleries are constructed in brick. The furnaces differ from No.1 and No.2 Furnaces in one crucial respect however. This is that they were constructed with the high brick-built vaults connecting them to each other (and to No.2 Furnace), at the upper level (Plate 21). The high brick-built vault between No.1 Furnace and No.2 Furnace (Plates 7 and 17) would also appear to be of the same phase. All four external faces of each of the furnaces, and the furnace bank wall behind, are all faced with similar squared and coursed Pennant sandstone blocks. The detailing and treatment of the quoins differs slightly between the three phases of work however, and the stylistic differences can be used to link these structures to other structures surviving

both on- and off-site. All of the facing stonework of the furnaces, as well as of the furnace bank wall, are punctuated with a series of square holes (c.150 x 150mm). These holes have the appearance of 'putlog' holes, which result from the building-in of the wooden scaffolding during construction. The holes in the Gadlys furnaces were deliberately left open upon completion of each structure. Such holes are described by Truran in his treatise of 1855, as a *'precaution against fracture' 'in order to give vent to any aqueous vapour or gasses that may arise from the masonary during the drying and working of the furnace'*[3]. Most of these 'air holes' are in straight horizontal courses, spaced at roughly the 3 foot intervals recommended by Truran. The distance between each course may also reflect the height of each scaffold staging, indicative of the constructional procedures. Some of the upper holes appear to be smaller (c.80 x 150mm) and less regularly spaced. There is a stepped redbrick wall at the top of the furnaces (plate 26). This is a secondary (post-ironmaking) feature, designed to safely enclose the allotments.

[3] Truran WCE, 1855, 20

5 DETAILED DESCRIPTION OF THE BLAST FURNACES (See Figs. 12 & 13)

(The similarities and differences between the fabric of the blast furnaces are tabulated at the end of this section)

5.1 No.1 Furnace (built 1827-1828) (See Plates 5 to 17) (See Fig 14 for descriptive terms used)

5.1.1 ***North-east elevation***. This was the first blast furnace to be constructed and a very high proportion of its fabric appears to survive as built to full height although the highest parts are obscured by ivy. As with all of the blast furnaces, the walls are built of coursed Pennant sandstone. As elsewhere, the walling is punctuated with a series of coursed 'air holes' measuring c.150 x 150mm. A substantial tree is growing from one of these (Plate 6). As elsewhere, some of the upper 'air holes' holes appear to be smaller and less regularly coursed. The wall is braced with tie-bars (Plate 8). These are of two phases. The earlier (which nevertheless occur throughout all four furnaces, and therefore probably contemporary with the construction of the last furnace) are regularly placed and have oval cast-iron tie-plates (Plate 9). The later ties have circular tie plates (Plate 10) and are only used here, and between furnace nos. 2 and 3, to control localised failures. Eight of the latter type survive here with at least a further two missing. The poor condition of the masonry is very apparent in the form of a substantial bulge in the stone facework (Plate 6).

There are several features that characterise this earliest furnace from both No.2 and Nos.3/4. One of the most obvious is the style of the quoins (corner stones). These quoins, which continue as a straight structural joint above the later high vault between this and the adjacent No.2 Furnace (Plate 7), are well squared and relatively smooth-faced. They are notably variable in depth and length, and some are very long indeed. Unlike the other three furnaces, it is apparent that little remains of the tapping vault (Plate 8). The brick voussoirs have all but disappeared from the principal elevation, and internal inspection reveals that both this vault, and the three blowing vaults, have completely collapsed internally (Plates 11 and 12). It is still nevertheless discernible that this furnace once had a unique double vault on this principal elevation (Fig. 12). It is clear from a small fragment of surviving brickwork that the (probable inner) vault was formed from 230x120x75mm ordinary yellow bricks. The quoins are also completely missing and the whole vault has been fully blocked (in two phases) (Plate 8). Both of the in-fill phases are of a buff-yellow brick which is similar not only to that used for blocking the N.E. tapping vault of No.2 Furnace, but also in the higher parts of the wagon works building (the museum). The earlier blocking lies above the later brick infill, and it preserves the line of the former outer vault. It appears likely that both infills date to the construction of a lean-to associated with the wagon works, built sometime between the closure of the ironworks and the publication of the 2nd edition O.S. map, surveyed in 1898. Evidence of this lean-to is still preserved as scars and attached ironwork on the face of the furnace itself and both phases of infill brickwork.

5.1.2 ***South-east elevation*** This elevation was substantially intact. There are several features of note. Firstly, the 'air holes' are regularly spaced and align with those on the opposing face of furnace No.2, indicating that they may have been used as scaffold support when No.2 Furnace was being constructed. Secondly, the springing of the brick-built high vaulting between this furnace and No.2 is secondary and inserted into the earlier stonework of this elevation (Plates 7 and 17). Thirdly, there is a set of shallow, roughly hewn sockets just below the vault springing. These would have been used to house the centring when the high vault was inserted, but it is also possible that they were used to house the ends of timber joists which may have supported a high-level floor beneath the vaulting. The most notable feature here is the blocked 3.07m-wide 'blowing vault' facing into the passage between this and the adjacent (No.2) furnace (Plate 13). This was built to accept one of the water-cooled jets ('tuyeres') that blew into the hearth from each blowing vault. Externally the ring of brick voussoirs is complete and constructed from 230x120x75mm ordinary yellow bricks, similar to the few remaining bricks of the tapping

(N.E.) vault and the other blowing vaults of this furnace. The vault is 3.1 metres wide and the quoins are clearly original. The blowing vault is blocked with un-coursed rubblestone laid with cement mortar and appears to be of 20th-century construction. It is unclear from inspection from within the collapsed core of the furnace whether the interior of the vault is complete although this appeared to be unlikely. Enough evidence should nevertheless survive of its construction and form to allow for the reconstruction of this vault as built. As stated above, the brick-built high vault between this furnace and the adjacent No.2 Furnace is a secondary feature. Of note are the two square chimneys rising up from its crown and the length of bullhead rail spanning the passageway between No.1 Furnace and No.2 Furnace (Plate 7). This piece of rail must have been used for suspending or supporting something, most probably the blast main.

5.1.3 ***South-west elevation*** This elevation is substantially complete although most of the inner part of the blowing vault has collapsed (Plate 11). Enough survives to indicate that the vault of the blowing vault was originally conical-shaped (i.e. not stepped in concentric rings as per the corresponding vault in No.2 Furnace). The remaining voussoir bricks of this vault are 230x120x75mm ordinary yellow bricks. The collapse of the interior of the blowing vault allows inspection of the core of the furnace. There has been a substantial collapse of the rubble corework within the furnace stack however, both the outside facework and the brickwork lining of the furnace shaft itself are both substantially intact (Plate 12), implying that the important tuyeres, tap-hole and the hearth may all be all intact and buried. Both the lower buttress vault and the higher charging bridge vault are of stone (Plate 15), and both appear to be original (1827/8). The S.E. end of the upper charging-bridge vault is walled across in roughly coursed rubblestone. There is a small vaulted opening in this wall (Plate 14), connecting with the high vaulted cross passage between this furnace and the adjacent No.2 furnace. This wall appears to be secondary and it is identical to a similar opening at the N.W. end of the charging-bridge vault of Furnace No.2, but different in detail to those at the S.E. end of No.2 Furnace charging-bridge vault or the corresponding openings in the charging-bridges of Furnaces Nos.3/4, which all have flat lintels in timber. There has been a minor collapse in a section of the upper gallery (the charging-bridge vault) (Plate 15).

5.1.4 ***North-west elevation*** This elevation is largely obscured by dumped earth and modern landscaping (Plate 5). The construction of the visible section is consistent with the other faces of this furnace, and is apparently original. The crown of the blowing vault is just visible and it is constructed of 230x120x75mm ordinary yellow bricks, consistent with the tapping vault and the other blowing vaults of this furnace. There will be two further openings in this elevation, corresponding with the lower and upper vaults between the furnace and the furnace bank wall (Plate 15). Inspection from within revealed that these are blocked with un-coursed rubblestone of apparent 20th-century construction. This elevation displays tie-plates of both identified types.

5.2 No.2 Furnace (built 1839-1840) (Plates 17 to 20)

5.2.1 ***North-east elevation*** This was the second blast furnace to be constructed and again a very high proportion of its fabric appears to survive as built to full height, although the highest parts are also obscured by ivy. Again, the walls are built of coursed Pennant sandstone, punctuated with coursed 'air holes' measuring c.150 x 150mm. Once again, the upper air holes appear to be smaller and less regularly coursed. The wall is regularly braced with tie-bars of only the earlier oval type found in all the furnaces. There are again several features that characterise this second furnace from the earlier No.1 Furnace and Nos.3/4 Furnaces. The principal difference is the style of the quoins. In this furnace these are more regular in size (as in Nos.3/4 Furnaces) yet they are neither smooth on the surface (as in No.1 Furnace) nor are they heavily hewn on the surface (as Nos.3/4 Furnaces). Instead they have a lightly picked surface. These quoins are consistent throughout this structure, both on the external corners and the reveals of the tapping / blowing vaults. The quoins on the external corners continue as straight structural joints above both of the later high vaults between this and the adjacent furnaces (No.1 and No.3), indicating

that when built this blast furnace was free-standing from the earlier No.1 Furnace (plate 21, right side).
The principal feature of this elevation is the 5.3m-wide tapping vault (Plate 18), which is largely complete, at least on the surface. This has been walled-up with a single-phase blocking composed of a mixture of rubblestone and a brick similar to that used to infill the tapping vault of No.1 furnace. It is probable that the blocking is contemporary with that of the earlier No.1 Furnace (i.e. late 19th-century). The quoins at the southern side of the former opening have been lost or cut back and the blocking extends into this area. There is a later repair of un-coursed rubblestone between this area and the southern corner of the furnace. The visible voussoir bricks of the tapping vault are c.360x155x95-70mm special wedge-shaped buff bricks and there are two areas of diagnostic wear indicative of previous use on the face of these bricks, as well as two less-significant small areas of modern repair in red brick. Because of the infill, and lack of internal access, it has not been possible to ascertain whether the tapping vault continues intact inside the body of the furnace structure.

5.2.2 ***South-east elevation*** This elevation is substantially complete. There are several features of note. Firstly, the 'air holes' are regularly spaced and align with those on the opposing face of furnace No.3, indicating that they may have been used for scaffold support when No.3 and No.4 Furnaces were being constructed. Secondly, the springing of the brick-built high vaulting on this elevation is secondary and inserted into the earlier stonework. Thirdly, there is a set of shallow, roughly hewn sockets just below the vault springing (see No1 Furnace, S.E. elevation). The 3.1m-wide blowing vault is infilled with modern red brick (as No3 Furnace, N.W elevation) and it has not been possible to ascertain whether the inner parts of the blowing vault have collapsed. It was also not possible to deduce whether the vault of this blowing vault was conical-shaped or stepped in concentric rings as per the adjacent S.W. vault. The voussoir bricks of this vault are c.360x155x95-70mm special wedge-shaped buff bricks.

5.2.3 ***South-west elevation*** This elevation is substantially complete and it retains its 5.4m-wide blowing vault intact and un-blocked (Plate 20). The blowing vault is unusual, being made of concentric rings of c.360x155x95-70mm special wedge-shaped buff bricks. This would appear to be a secondary feature as the stone-built lower reveals of the blowing vault show that the original vault was conical-shaped. The back wall of the blowing vault survives substantially intact, with two chamfered cast-iron lintels and a bent wrought-iron loop, the latter probably originally used to support the tuyere. The tuyere itself appears to be missing however. The blowing vault is connected to the S.E. and N.W. blowing vaults by narrow curved brick-built vaulted passages(plates 19 and 20). That to the S.E. blowing vault (Plate 19) is blocked with an inserted brick cross-wall, whilst that to the N.W. blowing vault is unobstructed (Plate 20). Such Passages were described by Truran in 1855. *'To expedite the drying* (of the furnace structure) *2 small arches are left in each of the pillars of masonry at the base, of a size sufficient for a fire 3 feet by 1½ feet. From the crown a flue, about 10 inches square, is carried up through the masonry to the top of the furnace. With this flue the whole, or nearly so, of the holes left in the masonry for ventilation should communicate. Where this is done, a rapid yet perfect drying of the masonry, without any of the usual unsightly fissures, may be successfully accomplished'.*[4] It is possible that these 'drying passages' were later reused for carrying the blast main to each of the tuyeres although the difficulty of getting the blast pipes into the gallery would appear to make this unlikely. A feature of particular note are the substantial cast-iron pivots, one on the floor adjacent to the S.E. reveal, the other fixed to the S.E. reveal itself. These appear to have been a pivot for a substantial door. Two bent wrought-iron rods of unknown function are fixed into the masonry adjacent. Two lengths of wrought-iron bridge rail are located in holes above the crown of the blowing vault, spanning the passageway between the furnace itself and the furnace bank wall (as Plate 29). Some very rusty wrought-iron chain remains attached to these and it appears likely that the blast main was suspended from these rails. As with Furnace No.1, both the lower and higher galleries are of stone, and both appear to be original (1839-40). Both

[4] Ibid, 22

ends of the upper gallery are walled across. The N.W. wall is of roughly coursed rubblestone, pierced by a small arched opening connecting with the cross passage between this furnace and the adjacent No.1 furnace. This wall appears to be contemporary with the rest of the furnace and the arched opening is very similar to (and probably contemporary with) that at the S.E. end of the charging-bridge vault of Furnace No.1 (Plate 14). The corresponding cross wall at the S.E. end of the charging-bridge vault is of brick, with a flat timber lintel, similar with (and apparently contemporary with) the corresponding openings in Furnaces 3/4. Additional features of interest are the length of bullhead rail placed between the small openings in the end walls of the upper galleries of No.2 Furnace and No.3 Furnace, as well as the single socket cut into the S.E. springing of the blowing vault. This corresponds with similar sockets in the S.W. elevations of No.3 Furnace and No.4 Furnace. It appears likely that both the length of rail and the sockets were probably associated with blast main support.

5.2.4 ***North-west elevation*** This elevation is substantially complete and it retains its 3.1m-wide blowing vault intact and un-blocked (Plate 19). The blowing vault is conical-shaped (i.e. not stepped in concentric rings as per the adjacent S.W. elevation). It is constructed from c.360x155x95-70mm special wedge-shaped buff bricks. The back wall of the blowing vault survives substantially intact, with two chamfered cast-iron lintels and a bent wrought-iron loop, the latter probably originally used to support the tuyere. As with the S.W. blowing vault however, the tuyere itself appears to be missing. The blowing vault is connected to the S.W. blowing vault and the N.E. tapping vault by narrow curved brick-built passages. That to the S.W. blowing vault (Plate 19) is of vaulted construction and is unobstructed, whilst that to the tapping vault is roofed with cast-iron plates and is blocked with an inserted brick cross-wall.

5.3 No.3 Furnace (built 1855-1856) (Plates 21 to 24)

5.3.1 ***North-east elevation*** This, and the adjacent No.4 Furnace were the last to be constructed and again a very high proportion of its fabric appears to survive as built to full height. Again, the walls are built of coursed Pennant sandstone, punctuated with coursed 'air holes' measuring c.150 x 150mm. Once again, the upper 'air holes' appear to be smaller and less regularly coursed. The wall is regularly braced with tie-bars of only the earlier oval type found in all the furnaces. There are again several features that characterise these later furnaces from the earlier No.1 and No.2 Furnaces. The principal difference is the style of the quoins. In No.3 and No.4 Furnaces these are more regular in size yet the surfaces are very rough-hewn, often with rock-drill marks left visible on the surface. The margins are also both drafted and rebated. These quoins are consistent throughout this structure, both on the external corners and the reveals of the tapping / blowing vaults, corresponding also to those of No.4 Furnace, the extant S.E. blowing-engine house, the surviving lime kilns and the abutments of the former Gadlys Pit tramway bridge over Gadlys Road. Unlike in No.1 and No.2 Furnaces, the quoins do not continue as straight structural joint above the high vaults between this and the adjacent furnaces (No.4 and No.2), indicating that the high vaults are contemporary with the construction of No.3 and No.4 Furnaces (Plate 21, left side).

The principal feature of this elevation is the 5.3m-wide tapping vault, which is largely complete, at least on the surface (Plate 22). This has been walled-up with a dual-phase blocking. The principal phase of blocking is composed of a mixture of buff brick similar to that used to infill the tapping vault of No.1 furnace and a large number of reused 400mm long refractory bricks. This must have had a small opening left in it, which has been blocked with modern red brick. It is probable that the principal phase of blocking is contemporary with that of the earlier furnace, and the construction/raising of the museum building (i.e. late 19th-century), as very similar refractories occur in the upper parts of this building's walls. As with No.2 Furnace, the quoins at the southern side of the former opening have been lost or cut back and the blocking extends into this area. The visible voussoir bricks of the tapping vault are c.320x115x95-70mm special wedge-shaped buff bricks. They are thus similar to those used in the S.W. and N.W. vaults of this blast furnace and the N.E., S.E. and S.W. vaults of No.4 Furnace, but they differ markedly

from those used in No.1 or No.2 Furnaces. Because of the infill, and lack of internal access, it has not been possible to ascertain whether the tapping vault continues intact inside the body of the furnace stack.

5.3.2 ***South-east elevation*** This elevation is the most substantially complete of all those currently unblocked and fully visible. It retains its 3.1m-wide blowing vault intact and unblocked (Plate 24). The blowing vault is conical-shaped (i.e. not stepped in concentric rings as per the adjacent S.W. elevation). It is constructed from c.360x155x95-70mm special wedge-shaped buff bricks, and thus differs from those used on the other three vaults within this blast furnace. The back wall of the blowing vault survives completely intact. It not only retains its two chamfered cast-iron lintels and bent wrought-iron loop, but it also retains two substantial wrought-iron vertical plates with projecting studs, and, more excitingly, the tuyere itself, intact and in-situ (Plate 24). The blowing vault is not connected to any others by the 'drying passages' noted elsewhere, although a change from stone to brick part-way along the side walls of the blowing vault implies that such passages may have existed at some time in the past. A feature of note is a length of wrought-iron bridge rail spanning the blowing vault, which again appears to have been used to suspend the blast main.

5.3.3 ***South-west elevation*** This elevation is also substantially complete. It retains its 5.4m-wide blowing vault intact and the only blocking is right at the back, below the first of the cast-iron lintels. The blowing vault is conical-shaped and the voussoir bricks are c.320x115x95-70mm special wedge-shaped buff bricks similar to those used in the N.E. tapping vault and in the N.W. blowing vault of this blast furnace and the N.E., S.E. and S.W. vaults of No.4 Furnace. As stated above, the back wall of the blowing vault has been blocked with over-burned yellow brick, laid with a cement-based mortar. This is clearly 20th-century in origin, but one of the two chamfered cast-iron lintels is still visible, complete with its wrought-iron loop. Because of this blocking, it is uncertain whether the tuyere survives. The blowing vault is not connected to any others by the curved 'drying passages' noted elsewhere, although a change from stone to brick part-way along the side walls of the blowing vault implies that such passages may have existed at some time in the past. A feature of note is a length of wrought-iron bridge rail spanning the blowing vault, which again appears to have been used to suspend the blast main. Additional features of interest are the two sockets cut into the springings of the blowing vault which correspond with similar sockets in the S.W. elevations of No.2 Furnace and No.4 Furnace, as well as a series of wrought-iron spikes driven into the furnace bank wall. Both are probably associated with blast main supports. A final feature of note is a substantial cast-iron pivot fixed into the floor at the S.E. corner of this elevation, which appears to have been a pivot, possibly for another substantial door. In contrast with No.1 Furnace and No.2 Furnace, both the lower and upper galleries are of brick, and both appear to be contemporary with the construction of this blast furnace (1855-6) (Plate 23). Both ends of the upper charging-bridge vault are walled across. These walls appear to be contemporary with the rest of the furnace and the small openings at each end, connecting with the high vaults have flat timber lintels, similar with (and apparently contemporary with) the corresponding openings in No.2 Furnace (S.E. end only) and in No.4 Furnace (N.W. end only). There has been a small collapse at the crown of the upper gallery (Plate 23).

5.3.4 ***North-west elevation*** This elevation is substantially complete. There are several features of note. As noted on the S.E. elevation of No.2 Furnace, the 'air holes' align with those on the opposing face of furnace No.2, indicating that they may have been reused for scaffold support when No.3 and No.4 Furnaces were being constructed. Secondly, the springing of the brick-built high vaulting on this elevation is secondary and inserted into the earlier stonework (Plate 21 left side). Thirdly, there is a set of shallow, roughly hewn sockets just below the vault springing (see No1 Furnace, S.E. elevation). The 3.12m-wide blowing vault is infilled with modern red brick (as No2 Furnace, S.E. elevation) and it has not been possible to ascertain whether the inner parts of the blowing vault have collapsed. It was also not possible to deduce whether this blowing vault was conical-shaped or stepped in concentric rings. The voussoir

bricks of this vault are c.320x115x95-70mm special wedge-shaped buff bricks, corresponding with those on the N.E. tapping vault and the S.W. blowing vaults of this blast furnace and the N.E., S.E. and S.W. vaults of No.4 Furnace.

5.4 No.4 Furnace (built 1855-1856)

5.4.1 ***North-east elevation*** (Plate 25) As stated above, this, and the adjacent No.3 Furnace were the last to be constructed and again a very high proportion of its fabric appears to survive as-built to full height. Again, the walls are built of coursed Pennant sandstone, punctuated with coursed 'air holes', bigger and more regularly spaced lower down. The wall is similarly braced with tie-bars of only the earlier oval type found in all the furnaces and the quoins are of the rough-hewn variety, with rock-drill marks and drafted and rebated margins, corresponding to those of No.3 Furnace, the extant S.E. blowing-engine house, the surviving lime kilns and the abutments of the former Gadlys Pit tramway bridge over Gadlys Road. The quoins do not continue as straight structural joint above the high vaults between this and the adjacent No.3 furnace, indicating that the high vault between this furnace and No.3 Furnace is contemporary with their construction.
The principal feature of this elevation is the 5.3m-wide tapping vault, which is largely complete, at least on the surface. This has been walled-up in three phases of blocking. The principal phase is composed of a mixture of buff brick similar to that used to infill the tapping vault of No.1 Furnace. This blocking appears to have had a large doorway in it, which was narrowed and lowered in more recent times (as indicated by the modern red brick used around the latter opening). This doorway was blocked very recently, using brick matching that used for the replica power-plant building lately constructed adjacent. The buff brick of the initial infill appears to be contemporary with that of the No.1 and No.3 Furnaces (i.e. late 19th-century). The visible voussoir bricks of the tapping vault are c.320x115x95-70mm special wedge-shaped buff bricks, matching those used in the N.E., S.W. and N.W. vaults of No.3 Furnace, as well as in the N.E. S.E. and S.W. vaults of No.4 Furnace. As noted above, these differ markedly from those used in No.1 or No.2 Furnaces. Because of the infill, and lack of internal access, it has not been possible to ascertain whether the tapping vault continues intact inside the body of the furnace stack. A final feature of note on this elevation is the scars left by the building of power-plant buildings adjoining in 1913. Thus, there are a series of holes left where brickwork and purlins have been keyed in. There are also several pieces of flashing still attached and the rough-hewn faces of the quoins on the S.W. corner have been cut back flush with the rest of the facing stonework.

5.4.2 ***South-east elevation*** This wall forms the southern external elevation of the blast furnace bank (Plate 26). Again, the walls are built of coursed Pennant sandstone, punctuated with coursed 'air holes' measuring c.150 x 150mm. Once again, the upper 'air holes' appear to be smaller and less regularly coursed. The wall is regularly braced with tie-bars of only the earlier oval type found in all the furnaces. The principal feature of this elevation is the 3.2m-wide blowing vault, which is largely complete, at least on the surface. This has been walled-up in at least two (possibly three or even four) phases of brick blocking, the earliest of which is the over-burned yellow brick used in the blocking of the S.W. blowing vault of No.3 Furnace. There is a blocked doorway in the centre of the blocking however, and this has been maintained consistently through all of the blocking phases, indicating that the different phases of blocking material represent minor repairs rather than fundamental changes of use. The doorway itself has a rolled steel lintel and is itself blocked with a modern yellow brick matching that used for the replica power-plant building lately constructed adjacent. The visible voussoir bricks of the blowing vault are c.320x115x95-70mm special wedge-shaped buff bricks, matching those used in the N.E., S.W. and N.W. vaults of No.3 Furnace, as well as in the N.E. S.E. and S.W. vaults of No.4 Furnace. As noted above, these differ markedly from those used in No.1 or No.2 Furnaces. Because of the infill, and lack of internal access, it has not been possible to ascertain whether the tapping vault continues intact inside the body of the furnace stack. This elevation

has two further large openings in it. These are the ends of the upper and lower galleries. The upper gallery remains open whilst the lower gallery is stopped up in two phases. The principal infill is of relatively modern red brick as used in the S.E. blowing vault and the N.E. tapping vault of No.4 Furnace, as well as in the blocking of the S.E. blowing vault of No.2 Furnace. This appears to have had an opening left in it (possibly around a then still in-situ, but out of use, blast main). This has been latterly blocked up in a mixture of buff and red brick. All of the openings and the main external corner have rough-hewn quoins with drafted margins and rebated arrisses, consistent with those of the rest of No.3 and No.4 Furnaces. A final feature of note on this elevation is the scars left by the building of power-plant buildings adjoining in 1913. Thus, there are a series of holes left where brickwork was keyed in. According to Evans, one of the blast furnaces was converted into a rubbish incinerator as part of the 1913 power plant. Whilst this appears unlikely, some credence is given to this story by the obviously-different nature of the blocking of the openings of this blast furnace, and the provision of doors in these blockings.

5.4.3 ***South-west elevation*** This elevation is substantially complete, although there has been a collapse in part of the blowing vault (Plate 27). The 5.4m-wide blowing vault remains substantially intact despite the collapse however, the collapse has all but filled the vault with rubble, making inspection of the inside of the vault difficult and dangerous. The blowing vault is conical-shaped and the voussoir bricks are c.320x115x95-70mm special wedge-shaped buff bricks similar to those used in the N.E. tapping vault and in the S.W and N.W. blowing vaults of No.3 Furnace and the N.E., S.E. and S.W. vaults of No.4 Furnace. The back wall of the blowing vault is only partially visible because of the collapse but it appears not to have any secondary blocking and both of the two chamfered cast-iron lintels are visible, the upper still complete with its wrought-iron loop. Because of the collapsed rubble, it is impossible to ascertain whether the tuyere survives. The blowing vault was clearly formerly connected to the S.E. blowing vault by a brick-vaulted 'drying passage' (Plate 28), similar to those noted in No.2 Furnace although this passage is now walled across where it intersects the S.E. blowing vault. Because of the collapsed rubble, it is not clear whether there is a corresponding passage leading to the N.W. blowing vault. A feature of note is a length of wrought-iron bullhead rail projecting from the S.E. reveal, which again appears to have been used to suspend the blast main. Additional features of interest are the two sockets cut into the springings of the blowing vault which correspond with similar sockets in the S.W. elevations of No.2 Furnace and No.3 Furnace, as well as three lengths of wrought-iron rail spanning the buttress vault and a series of wrought-iron spikes driven into the furnace bank wall (Plate 29). All of these are probably associated with blast main supports. As with No.3 furnace, but in contrast with No.1 Furnace and No.2 Furnace, both the lower and upper galleries are of brick (Plate 29), and both appear to be contemporary with the construction of this blast furnace (1855-6). This wall appears to be contemporary with the rest of the furnace. As usual, there is a small opening in this wall, connecting with the high vaults. This opening has flat timber lintels, similar with (and apparently contemporary with) the corresponding openings in No.2 Furnace (S.E. end only) and in No.3 Furnace (both ends).

5.4.4 ***North-west elevation*** This elevation is substantially complete. There are several features of note. As noted previously, the 'air holes' align with those on the opposing face of furnace No.3, indicating that they may have been used for scaffold support when No.3 and No.4 Furnaces were being constructed. Secondly, the brick-built high vaulting appears to be contemporary with the rest of No.3 and No.4 Furnaces (Plate 21), indicating that all of the high vaults are contemporary with the construction of No.3 Furnace and No.4 Furnace (1855-6). The 3.16m-wide blowing vault is infilled with stacked un-mortared rubblestone. Much of the vault appears to be intact, and it is clearly conical-shaped, but it is not possible to see the back wall or any 'drying passages'. The voussoir bricks of this vault are c.350x155x95-70mm special wedge-shaped buff bricks, differing from the norm for No.3 furnace and No.4 Furnace, and probably indicating a secondary reconstruction of the blowing vault.

5.5 SUMMARY DESCRIPTIONS OF BLAST FURNACES

5.5.1 *Furnace No.1*

	N.E. Tapping Vault	S.E. Blowing Vault	S.W. Blowing Vault	N.W. Blowing Vault
Width	Not measurable	3.07m	Not measurable	Not measurable
Quoins	Square and smooth	Ditto	Ditto	Not visible
Vault shape	Brick Conical vault (?) Collapsed	Ditto (?) Not visible	Ditto (?) Collapsed	Ditto (?) Collapsed
Vault bricks	c.230 x 120 x 75 ordinary yellow brick	Ditto	Ditto	Ditto
Keystone	Missing	Special brick	Stone	Not visible
Open/blocked	Blocked with re-used yellow/buff brick and rubblestone as wagon works / museum building	Blocked with un-coursed rubblestone	Open	As N.E.
Drying Passages	Buried if present		Ditto	
Features of note	Originally set within much higher vault (collapsed)	None	None	None

Lower gallery to rear
Stone-built vault contemporary with furnace.

Upper gallery to rear
Stone-built vault contemporary with furnace. Small collapse in roof.

High vault between No.1 and No.2 Furnaces
Brick-built vault contemporary with furnaces Nos. 3 and 4. Two small rectangular openings in crown. Spanned by wrought-iron rail inserted into putlog holes

5.5.2 *Furnace No.2*

	N.E. Tapping Vault	S.E. Blowing Vault	S.W. Blowing Vault	N.W. Blowing Vault
Width	5.3m	3.10m	5.4m	3.10m
Quoins	Pecked	Ditto	Ditto	Ditto
Vault shape	Brick conical vault (?) Not visible	Ditto (?) (Blocked)	Concentric brick rings	Brick conical vault
Vault bricks	Tapered special bricks c.360x??? x70-90	Ditto	Tapered special brick c.360x155x70-95	Ditto
Keystone	Stone	Missing	Stone	Stone
Open/ blocked	Blocked with buff brick (inc. refractories) and rubblestone	Filled with modern red brick (as no.3, N.W.)	Open	Open
Drying Passages	Secondary. To N.W.-Low sq. iron roof. (Blocked) To S.E.-Not visible		Secondary. To N.W. and S.E.-High iron and vaulted brick roof	
Features of note	None	None	Well-preserved opening to hearth. Partially obscured by coke dust and rubble. Two stop-chamfered cast-iron lintels with iron loop on upper lintel. Massive iron hinges on S.E. jamb. Large socket to S.E. Other ironwork.	Well-preserved opening to hearth. Partially obscured by coke dust and rubble. Two stop-chamfered cast-iron lintels with iron loop on upper lintel.

Lower gallery to rear
Stone-built vault contemporary with furnace. Spanned by wrought-iron rails with remains of rusty wrought-iron chain attached (support for blast main).

Upper gallery vault to rear
Stone-built vault contemporary with furnace.

High vault between No.2 and No.3 Furnaces
Brick-built vault contemporary with furnaces Nos. 3 and 4. Spanned by wrought-iron rail inserted into openings in end walls of upper charging bridge vaults

5.5.3 Furnace No.3

	N.E. Tapping Vault	S.E. Blowing Vault	S.W. Blowing Vault	N.W. Blowing Vault
Width	5.3m	3.18m	5.4m	c.3.12m
Quoins	Heavily rusticated with rebated arris	Ditto	Ditto	Ditto
Vault shape	Brick "Conical" vault (?) Not visible	Brick conical vault	Ditto	Ditto
Vault bricks	Tapered c.320x???x75-90 special bricks	Tapered special bricks c.355x155x75-90 special bricks	Tapered special bricks c.320x115x75-90	Tapered special bricks c.320x???x75-90
Keystone	Special brick	Ditto	Ditto	Ditto
Open/ blocked	Blocked with buff brick (inc. refractories)	Open	Open	Blocked with modern red brick (as no.2, S.E.)
Drying Passages	Blocked if ever present. Blocking apparently contemporary with vault. To N.W.-Not visible. To S.E.-Probably low sq. iron roof.		Blocked if ever present. Blocking apparently contemporary with vault. To N.W. and S.E.-Probably low sq. iron roof.	
Features of note	None	Very well-preserved opening to hearth. Tuyere pipe and flange visible with wrought-iron plates with three large iron dowels either side. Two stop-chamfered cast-iron lintels with iron loop on upper lintel. Vault spanned by wrought-iron rail (support for blast main).	Only upper stop-chamfered cast-iron lintel visible (later blocking of distinctive over-burned yellow brick below) with iron loop on upper lintel. Vault spanned by wrought-iron rail (support for blast main). Large sockets in brickwork to either side of vault. Massive iron pivot set in floor at S.E. corner	None

Lower gallery to rear
Brick-built vault contemporary with furnaces Nos. 3 and 4. Large wrought-iron spikes in S.W. wall.

Upper gallery to rear
Brick-built vault contemporary with furnaces Nos. 3 and 4. Small collapse in roof.

Vault between furnaces nos.3 and 4
Brick-built vault contemporary with furnaces Nos. 3 and 4.

5.5.4 Furnace No.4

	N.E. Tapping Vault	S.E. Blowing Vault	S.W. Blowing Vault	N.W. Blowing Vault
Width	5.3m	3.2m	5.4m	3.16m
Quoins	Heavily rusticated with rebated arris	Ditto	Ditto	Ditto
Vault shape	Brick conical vault (?) Not visible	Ditto	Brick conical vault – Partially collapsed.	Brick conical vault
Vault bricks	Tapered specials c.320x???x75-90	Ditto	Tapered specials c.320x115x75-90	Tapered specials c.355x155x75-90
Keystone	Special brick	Ditto	None	Special brick
Open/ blocked	Blocked with buff brick with doorway. Doorway narrowed and lowered with modern red brick. Narrower doorway blocked with very modern yellow brick as new building to N.E.	Blocked with red, engineering blue and overburned yellow bricks with small doorway with rolled steel lintel. Doorway blocked with very modern yellow brick as new building to N.E.	Open	Blocked with stacked un-mortared rubblestone
Drying Passages	Not visible		To N.W.-Not visible behind collapse. To S.E.- High vaulted brick roof. Blocked off with modern red brick after 3 metres	
Features of note	None		Well-preserved opening to hearth visible. Partially obscured collapsed section of vault. Two stop-chamfered cast-iron lintels with iron loop on upper lintel. Large sockets to either side of vault. Section of wrought-iron rail projecting from vault, possibly former support for blast main.	None

Lower gallery to rear
Brick-built vault contemporary with furnaces Nos. 3 and 4. Spanned by wrought-iron rails with remains of rusty wrought-iron chain attached (support for blast main). Large wrought-iron spikes in S.W. wall.

Upper gallery to rear
Brick-built vault contemporary with furnaces Nos. 3 and 4.

6 GENERAL ASSESSMENT

6.1 Structural Assessment of the Blast Furnaces

6.1.1 No.1 Furnace (built 1827-1828) (Plates 5 to 16)

This is the earliest blast furnace on the Gadlys site. Externally the fabric appears to survive as built to the level of the charging platform although the upper parts could not be inspected closely because they are obscured by a dense covering of ivy; the lower half of the N.W. face is concealed from view by spoil tipped against it that forms a retained bank (Plate 5). The main structure is formed in coursed Pennant sandstone, the furnace lining is of firebrick and the three blowing vaults and the tapping vault are formed of yellow brick. Visible on the outside face is a regular pattern of 'air holes' approximately 150mm square - a common feature of masonry furnaces - used to facilitate the drying out process and to provide a route to atmosphere for any gasses or vapours arising from the working of the furnace. Some relatively substantial trees have taken root in these holes, and one such tree on the N.E. face (Plate 6) and another on the S.E. face (Plate 7) are of such size that they are likely to cause serious damage to the structure. In general, the external facework is in good order although there is a distinct bulge in the stonework of the N.E. face (Plate 6). The structure is bound together by regularly spaced horizontal tie rods running through the structural element of the furnace walls, N.E. to S.W. and N.W. to S.E. (Plates 6 to 10 and 14). These tie rods are of two phases. The earlier phase of ties (those with oval cast-iron tie plates) are regularly distributed throughout the four furnaces, and were intended to resist expansive forces created during the firing of the furnace. All of the tie rods appear to be complete and intact and in general most appear to be still functioning. The later tie rods, with circular tie plates (Plates 8 & 10) are only used in this furnace and at high level between furnaces nos.2 and 3. This latter type appear to have been inserted in an attempt to control localised damage, notably in the vicinity of the bulging facework on the N.E. elevation and in the centre section of the N.W. elevation. It was noted that two of the circular tie plates on the N.E. elevation have become detached and fallen from the wall. In the lower section of the N.E. elevation quite a large section of the wall is now constructed of crudely laid brickwork in what appears to be some form of repair (Plate 8), infilling the former tapping vault. The area affected extends beyond the boundary of the tapping vault, the voussoirs of which are no longer in evidence. This repair, along with the missing circular tie plates referred to above, may be indicative of ongoing outward movement.

Internal inspection of No.1 Furnace reveals that the S.W. blowing vault has also collapsed between the facework and the refractory lining (Plate 11) as has some of the corework above it. As far as can be ascertained at the moment, the blowing vaults on the N.W. and S.E. sides and the tapping vault to the N.E. are similarly damaged. (The repair to the lower section of the N.E. elevation is probably associated with this damage). The cause of the damage to the vaults is not immediately apparent - arches/vaults are inherently strong and in such a massive structure are unlikely to have collapsed to this extent without some external disturbing influence. A large part of the refractory brick lining of the furnace is now exposed (Plate 12) and this is now providing support to a substantial portion of the furnace structure previously supported by the tapping and blowing vaults. There has also been a collapse of part of the upper stone vault supporting the charging bridge between No.1 Furnace and the furnace bank wall (Plate 15). There is also evidence of a void in the wall at the S.E. end of the this vault, extending upward towards the surface from the arch over the opening in the wall for some 1.5 to 2.0 metres (Plates 14 & 16).

It is clear that this furnace is in a relatively poor state, the collapse of the blowing and tapping arches and the displaced corework means that the significant loads are now being born by the facework and the refractory furnace lining. Unfortunately, it would appear that the main stack of the furnace has been filled with rubble so that inspection of the refractory lining will not prove possible until the fill is removed.

6.1.2 No.2 Furnace (built 1839-1840) (Plates 17 to 20)

This was the second blast furnace to have been constructed at Gadlys and again the original fabric survives more or less up to the charging platform level, but as with No.1 Furnace the upper parts are currently obscured by ivy. The general construction is very similar to No.1 Furnace - coursed Pennant sandstone, regularly punctuated with air holes, the structure bound together with tie rods (oval tie plates) and the whole appearing to be in good order. The tapping vault in the principal (N.E.) elevation (Plate 18), and the S.E. blowing vault are both walled up and inspection within has not been possible. The N.W. and S.E. blowing vaults remain open and in both cases the vaults are stable despite minor collapses at the points of intersection with the smaller vaults spanning the drying-passages (Plates 19 and 20). This furnace appears to be stable; there are not any visible signs of structural distress but because the tapping vault and the S.E. blowing vault are sealed the condition of these vaults could not be assessed. As with No.1 Furnace the stack is full of rubble and could not be examined.

6.1.3 No.3 Furnace (built 1855-1856) (Plates 21 to 24)

This furnace and the adjacent No.4 Furnace, were the last to be constructed, and as with No. 1 and No.2 Furnaces the original fabric survives to the height of the charging platforms. Except for minor detail differences the shape, materials and configuration of the furnace structures are the same as No.1 and no.2 Furnaces. Unlike that between No.1 and No.2 Furnaces, the high vaults between this and the adjacent furnaces (No.4 and No.2) are structurally integral with the furnace structure (Plate 21), indicating that all three high vaults are contemporary with the construction of No.3 and No.4 Furnaces. The tapping vault in the principal (N.E.) elevation (Plate 22), and the N.W. blowing vault are both sealed and inspection within was not possible. The S.W. and S.E. blowing vaults are accessible however (Plate 24), and in both cases the vaults are stable, as are the visible 'drying passages'. Subject to what may be concealed within the walled up tapping vault and the N.W. blowing vault, the furnace structure appears to be reasonably sound. The furnace stack itself has been filled with rubble and could not be inspected. There is evidence of a collapse at the crown of the upper gallery (charging bridge) (Plate 23) and the decayed timber lintels at the intersections between inter-furnace high vaults and the upper gallery gives rise to some concern, although this latter is more a matter of safety rather than of any significant structural defect.

6.1.4 No.4 Furnace (built 1855-1856) (Plates 25 to 28)

Constructed contemporaneously with No.3 Furnace and the high vaults, this structure survives to virtually its full height and remains reasonably sound. As with all of the furnaces, No.4 is bound together by tie rods in both N.E.-S.W. and N.W.-S.E. directions. These tie rods are of the more historic oval plate variety common to all of the furnaces (Plates 25 and 26). Trees have rooted in some of the air holes in the N.E. and S.E. elevations. The sycamore rooted in the N.E. elevation (Plate 25) and the twin-stemmed sycamore rooted in the floor at the S.E. end of the upper gallery (Plate 26) are both causing serious damage to the structure. As with all the other furnaces, the tapping vault in the principal (N.E.) elevation is sealed by walling so preventing inspection - a similar situation persists at the N.W. and S.E. blowing vaults (Plate 26). The S.W. blowing vault is accessible and there is evidence there of a major collapse of the vault and part of the corework (Plates 27 and 28). Decay of timber lintels at the intersection between inter-furnace high vault and the upper gallery (charging bridge) is similar to that seen in No.3 Furnace. Cursory inspection seems to lead to the conclusion that there are indicators of advancing deterioration, there being signs of progressive collapse in the only inspectable blowing vault (S.W.); the state of the tapping vault and the other two blowing vaults could not be accessed because of blocking up. The furnace stack has been filled with rubble so that, as with all others furnace stacks, inspection was not possible.

6.2 Archaeological Assessment of the Visible Fabric of the Blast Furnaces

6.2.1 Close analysis of the surviving fabric shows that the archaeological record and the documentary sources concur in the phasing of structures. It is clear that the Gadlys blast furnaces are a bank of four furnaces, built in three phases. The first furnace to have been built was that at the N.W. end. This must be that built c.1827, which is logical as this was closest to the now-demolished 1827 blowing-engine house. It was originally built as a free-standing structure, apart from its connections to the furnace bank wall via both the buttress vault and the charging bridge vault. The adjacent furnace (No.2 Furnace to its S.W.) was clearly the next to be constructed, c.1839-41. This was also built freestanding apart from the buttress- and charging bridge vaults. Both of these furnaces were supplied initially with blast from the now-demolished 1827 blowing engine house. No.3 and No.4 Furnaces were clearly constructed together in 1855-6. They represent a major expansion of the ironwork's production capacity under Thomas Wayne, and were built at the same time as the extant blowing engine house, the furnace bank wall extension, the extant limekilns and the tramway bridge over Gadlys Road. Both the later blowing-engine house and the furnace bank wall were built with further extension in mind and both could have accommodated a further three blast furnaces had demand merited it.

6.2.2 The four blast furnaces at Gadlys currently survive to full height, and they have the appearance of being in an unusually good state of preservation. The apparent excellent external state of the furnaces unfortunately belies their internal structural state. It is clear from inspection of the accessible internal spaces that whilst both the crucially important furnace linings have survived intact, as has the outer facing stonework, the spaces between are now almost hollow. Over time, several of the various internal vaults have suffered collapses. This has caused the rubble fill between the outer stone face and the inner brick furnace shaft to subside dangerously, as is currently most visible within No.1 Furnace. The extent of the collapses cannot currently be fully assessed because of the blocking up of the blowing and tapping vaults, but it is clear that some of the vaults of No.1 Furnace have collapsed, as has part of the S.E. blowing vault of No.4 Furnace.

6.2.3 Despite the collapse of some of the internal vaults, the important brick lining of the furnace shafts appear to be completely intact currently. The survival of the linings and the cast-iron lintels augurs well for the survival of the critically important features, notably the hearths, the tuyere (blowing) holes and the tapping holes. Inspection of the accessible areas certainly has revealed the survival of a large number of very rare features, most notably the visible tuyere, the evidence of the blast main suspension points and the large pivots for heavy internal doors. It is clear that all of the blast furnaces have seen extensive use, and all currently bear extensive archaeological evidence of normal rebuilding during their working lives. Nevertheless, it can only be a matter of time before the steady collapse of the loose rubble corework eventually weakens the structures to a state of dangerous instability.

6.3 Assessment of the Archaeological Potential of the Blast Furnaces

6.3.1 As arguably the best-preserved early- to mid-19th-century coke-fired blast furnaces in Wales the Gadlys blast furnaces retain considerable potential to contain irreplaceable archaeological information. More careful and detailed study than has been possible under the terms of this assessment could tell us much about the construction of structures of this type elsewhere, as well as about the cycles of maintenance and repair. There are clear (but currently little understood) variations between the furnaces, particularly relating to the curved passages between the blowing vaults. The remains also have significant potential for aiding our understanding of the way in which changing technologies such as blast mains and tuyeres varied over time and related to the masonry structures of the furnace stacks themselves. The furnaces are likely to retain some material within from their last charges, and this material has the

potential to tell us more about the sources of coal/coke, limestone and ore in the latter days of Gadlys as a functioning ironworks. ***All of this information is very fragile, and vulnerable to ill-considered consolidation.***

6.4 Assessment of the Archaeological Potential of the other Standing Remains

6.4.1 ***Introduction*** An important feature of the Gadlys blast furnaces is the fact that, despite some major losses, they survive in association with other features associated with the ironworks, notably the company-provided housing (and other ironmaking-period housing), the Grade II Listed 1856 blowing-engine house, the Scheduled furnace bank wall and the lime kilns. Whilst these structures are each of lesser significance in their own right, such clusters are now exceptionally rare, and whilst the losses at Gadlys (engine house interior, calcining kilns, coking ovens, casting houses, forge and rolling mills) have reduced the value of the group by comparison to Tondu or Blaenafon, they still form a highly significant group, with good remaining interpretational potential.

6.4.2 ***The company-provided housing*** Several streets of company-provided housing survive in the vicinity, notably Wayne Street and Ann Street, whilst the houses on Oxford Street, Dowlais Street, North Avenue, East Avenue, South Avenue, Morgan Street, Gadlys Terrace and Gadlys Street all date to the ironmaking period and may also have belonged to the Gadlys Iron Company. The earliest surviving ironmaking period housing, shown on the Parish Tithe Map of 1847, are nos. 35-46, 48-58 and 60-70 Gadlys Street, whilst the site of the terrace at Wern Place remains as a derelict plot at the end of Wayne Street. These have not been studied in any detail as part of this assessment, but there appears to be little doubt that the company-provided housing stock is little understood at present. Careful study would reveal important evidence of phasing, social conditions and how the housing varied with the status of the employees. A wider study would reveal important evidence as to how much the accommodation needs of the workforce were provided for by the Company, and how much they were catered for by private entrepreneurs, in an established community like Aberdare. This would form a useful study, which could be compared and contrasted to the situation at Merthyr and in the notorious ironmaking company towns elsewhere in the region.

6.4.3 ***The south-east blowing-engine house*** It is clear that the remaining blowing-engine house was that built in 1857 to supplement the original of 1827. It is Grade II Listed and it is in excellent condition, having been recently refurbished by the former Mid Glamorgan County Council. It is contemporary with No.3 Furnace and No.4 Furnace, being built by Thomas Wayne as part of a major expansion of ironmaking capacity. Drawings survive of the 45" blowing engine (which had a 104" blowing cylinder of 10ft stroke), which was built by the Neath Abbey Ironworks. Unfortunately the interior of the engine house was significantly altered during the recent conversion to offices and it is uncertain if many internal features have survived.

6.4.4 ***The south-east boiler house*** This was built against the S.W. wall of the south-east engine house and was cut into the slope against which the furnaces are built. The retaining walls of this survive, as do the lower parts of its outer walls. The interior has never been developed. It retains the potential for remains of the foundations of the four cylindrical (probably Lancashire) boilers it once contained.

6.4.5 ***The furnace bank wall*** The remains of the furnace bank wall form part of the Scheduled Ancient Monument. It is of two distinct phases, that part to the S.E. of No.2 Furnace dating to c.1827, the remainder dating to c.1856. The first phase was built for a maximum of two blast furnaces, whilst the extension could have serviced a total of a further five furnaces of which only two were ever built. It survives in excellent condition, with some attached ironwork that

appears to pertain to support brackets for the blast main. It also retains evidence of the outline of the 1913 power plant building that was built abutting the unused portion.

6.4.6 ***The limekilns*** A pair of limekilns still stands to full height in the back garden of no.17 Elm Grove. These kilns are complete and in excellent condition. They are shown on the 1st edition O.S. map and analysis of the detailing of the quoins suggests that they were built c.1856 as part of Thomas Wayne's expansion of the ironworks. These kilns were not used in the ironmaking process and it is probable that they were sited here on account of the ironworks site being a useful manufacturing nucleus, with ready supplies of both limestone and coal. The lime kilns were formerly attached to the calcining kilns, and their constructional techniques and their height are useful for assessing the probability of the survival of significant remains of the calcining kilns (see below)

6.4.7 ***The 'casting house' (museum)*** The standing building currently in use as the Aberdare museum is Listed Grade II because it had been thought to be the only roofed casting house surviving in Wales. Unfortunately detailed inspection does not bear this out as the footprint of the building does not correspond with that shown on the historic plans and the openings in the arcaded sides do not align with the tapping vaults. The composite cast- and wrought-iron construction of the trusses appears contemporary with the operational dates of the ironworks, and it is likely that the trusses are reused, probably from the rolling mills. The museum conversion works are thought to have caused significant localised impacts to any remains of the casting beds.

6.5 Assessment of Further Archaeological Potential

6.5.1 ***Introduction*** In spite of the many uses to which the wider site has been put since closure of the ironworks, there are several areas of high archaeological potential in the near vicinity of the blast furnaces. These are equally fragile, but several have the potential to contain remains which would not only be significant in their own right, but which would also have the potential to contain remains which could enhance the educational and interpretational potential of the blast furnaces and other remaining standing structures. The blast furnaces were always the most noticeable element of any ironmaking site, but further structures were also needed, both to prepare the materials for smelting, and to process the smelted iron into useful products. To assess the interpretational and educational potential of the blast furnaces, it is important to consider whether the site has the potential to contain useful evidence of these processes.

6.5.2 ***Transport*** Evidence of the early tramroads that served the site is sparse within the confines of the ironworks site itself, although the abutments of the former tramroad bridge over Gadlys Road survive, and the course of the tramroad to Gadlys pit is preserved by the alignment of East Avenue. The former incline between the lower part of the site and the coking area above the furnace bank was unfortunately swept away during the construction of the Tesco store. The course of the tramway which connected the Gadlys ironworks to the Hirwaun tramroad is preserved between the iron bridge over the Cynon and the nothern edge of the Tesco site, and it can be found at the foot of Tudor and Broniestyn Terraces. This paralleled the former leat that supplied the ironworks with water. The tramroad up the valley towards Hirwaun is well preserved, and the cast-iron bridge of 1811 which carried the tramway over the Cynon near Robertstown (SN 997 037) is a significant industrial monument. Traces of the Aberdare Canal and the Glamorganshire Canal have been almost completely eradicated by road building. Evidence of the former steam railways which superseded the canal and tramways remain abundantly apparent in the landscape and the course of the Dare Valley branch from Gadlys Old Pit to Bwllfa Dare colliery is locally designated as the Aberdare Industry Trail.

6.5.3 ***Water supply*** Water was essential to the functioning of an ironworks, in order to supply the steam engines needed to supply blast for the furnaces and powered the rolling mills and steam hammers. The course of the Gadlys ironworks leat is preserved between the Cynon and Tescos,

and can be found at the foot of Tudor and Broniestyn Terraces. This paralleled the former tramway connecting to the Hirwaun tramroad.

6.5.4 ***Coke yards and coking ovens*** One of the principal preliminary processes in ironmaking was the preparation of suitable coke. Unfortunately the site of the large coke yard now lies beneath the turn-of-the-century streets of Neville Terrace, Gospel Hall Terrace and Penybryn Street. The site of the 18 stop-ended coking ovens similarly lies buried beneath the gardens of nos. 30-39 Gospel Hall Terrace and little is likely to remain apart from the floors of the ovens themselves.

6.5.5 ***Calcining kilns*** Another essential element of a Welsh ironworks which used carbonate ores was the large calcining kilns in which the ore was roasted to drive off water and sulphur. There were latterly four of these at Gadlys, built against the surviving limekilns. The site of one of the calcining kilns lies buried beneath the gardens of nos. 30-39 Gospel Hall Terrace however, the site of three of the calcining kilns which adjoined the lime kilns has remained as unoccupied rough ground. The height of this rough ground compared to the height of the surviving limekilns implies that there is good potential for very substantial buried up-standing remains. These remains would be of very high significance nationally, if extant to any height.

6.5.6 ***Winding-engine house, smith's shop and yard*** The sites of the majority of these structures now also lie beneath the houses and gardens of Gospel Hall Terrace. Little is likely to survive apart from buried foundations although it appears possible that nos. 14-19 may contain some fabric from the old smithy.

6.5.7 ***The charging platform*** The charging platform was the area at the tops of the blast furnaces now largely defined by the allotments. A charging platform would normally have had a metalled surface over which barrows or trams of ore, limestone and coke could be wheeled easily to be tipped into the mouths of the blast furnaces. The blast furnace mouths would each have had a squat chimney structure surrounding the furnace mouth. This would have been pierced with openings to allow the tipping of the raw materials. It is currently unclear at what depth the charging platform itself will be found although it is apparent that the depth of the build up of coke waste and soil on this charging platform is substantial. Because of the recent collapses it is likely that there will be some loss of parts of the platform, but most of it should remain intact. There is a good probability that the remains of the squat chimney structures were levelled by being pushed into the furnace shafts and there is therefore the likelihood that these will survive in the infill within these shafts.

6.5.8 ***The lower site*** This part of the site to the N.E. of the blast furnaces formerly contained the casting houses, forges, rolling mills etc. These were used for the running out of the molten iron and its subsequent processing into wrought-iron sheet, bar and rail. It is apparent that much of the site of the forges and rolling mills has been covered over with soft- and hard landscaping associated with the Tesco development. Whilst these remains were located and evaluated by OAU in 1993, attempts have been made to preserve them in-situ, and it is unlikely that these remains will be investigated again in the near future. There are nevertheless several areas that retain significant potential for archaeological remains that could add significantly to the interpretation of the blast furnaces.

6.5.9 ***The casting houses*** There were four casting houses at the foot of the blast furnaces. These contained the sand-filled casting beds that, it would appear, were not only suitable for the casting of shallow pig iron but also for the substantial finished castings, direct from the furnace. Unfortunately the sites of the casting houses for No.2 and No.3 Furnaces appear to have been substantially impacted, not only by the construction of the wagon repair shop (now the museum), but also by the conversion works carried out by the old Mid. Glamorgan County Council, which involved very substantial excavations in some areas inside the museum building. The site of the casting house that served No.4 Furnace is likely to have been similarly

impacted by the old power plant buildings and the replacement replica building. The site of the earliest casting house, which served No.1 Furnace, has been little developed and it is likely to be well preserved beneath the car park at the N.W. end of the museum building. The casting houses appear not to have been physically connected to the blast furnaces, and no evidence of the outline of their roofs survives on the principal elevation of the blast furnaces.

6.5.10 ***The north-western furnace bank wall*** It is apparent from map evidence that the present extent of the furnace bank wall is not all that was built. Originally (probably as early as 1827) the furnace bank wall continued to the N.W. of No.1 Furnace, almost immediately dividing into three parts, each revetting a separate terrace. By the time of the 3rd edition of the O.S. map (1914-15), this series of walls and terraces has become completely covered over by the present substantial bank of coke waste. This event appears to have been associated with the building of Gospel Hall Terrace and the other houses on the old coking yard site. There remains a strong likelihood that the furnace bank wall and the lower revetting walls survive within the earthen bank.

6.5.11 ***The north-east blowing engine house*** This housed the original 33" 1827 blowing engine. Its two haystack boilers stood to its immediate S.W. Its site lies beneath the bank of coke waste to the N.E. of No.1 Furnace, to the immediate N.W. of the westernmost corner of the car park at the N.W. end of the museum. Its site has not been impacted by any post-ironmaking buildings and it is probable that substantial remains of foundations for the building, the engine and the boilers survive. The emplacement was revetted by the retaining wall of the lowest terrace of the north-west furnace bank wall.

7 ASSESSMENT OF THE SIGNIFICANCE OF THE BLAST FURNACES

(The significance of the site has previously been assessed by Phillip Riden as part of the desktop assessment of the site carried out by OAU for Tesco Stores (OAU & Riden P 1993). His assessment has been reproduced in full in Appendix D)

7.1 Assessment of Historic Significance

7.1.1 The Gadlys Ironworks cannot be considered nationally very important in historical terms as it was not one of the earliest, largest or most technically advanced. In terms of comparative date, iron smelting with coke had first been performed at Coalbrookdale in England in 1709, nearly 120 years before work commenced at the Gadlys site. With a founding date of 1827, it is clear that the ironworks at Gadlys, Aberdare was far from being the earliest coke-fired ironworks in South Wales. Current thinking indicates that the first ironworks in South Wales to exploit this method of smelting appears to have been that at Hirwaun, c.1757 and by the close of the 18th Century almost all of the great coke ironworks had been established (Dowlais 1758, Plymouth 1763, Cyfarthfa 1765, Penydarren 1784, Blaenafon 1789, Ebbw Vale 1790 and Tredegar and Rhymney 1800). Thus, in terms of development in Wales, Mathew Wayne's furnace lagged seventy years behind the site at Hirwaun. Similarly, by comparison with the great ironworks such as those in nearby Merthyr, the Gadlys complex with its maximum of four blast furnaces will be seen to have been a relatively small-scale enterprise. Whilst, like Maesteg, Aberdare developed into a prosperous iron-making centre, it should be recognised that individually the ironworks were small when compared with those of the great iron-making metropolis of Merthyr Tydfil, 4 miles to the north-east. Thus the total iron production in 1846 of Gadlys and the two sites of the Aberdare Iron Company was 19,175 tons, little more than one-tenth of the combined production of the four giant ironworks at Merthyr, namely Dowlais, Cyfartha, Plymouth, and Penydarren (Grant 1991 6).

Table comparing the number of blast furnaces at Gadlys with those at two of the principal Merthyr ironworks (Dowlais and Cyfartha) and at the earliest coke-fired works in South Wales (Hirwaun)

	Dowlais (includes four furnaces at Ifor after 1839)		**Cyfarthfa**		**Hirwaun**		**Gadlys**	
	Blast Furnaces		**Blast Furnaces**		**Blast Furnaces**		**Blast Furnaces**	
	Total	(No. In Use)	**Total**	(No. In Use)	**Total**	(No. In Use)	**Total**	**(No. In Use)**
Opened	**1758**		**1767**		**1758**		**1827**	
1760	**2**				**1**			
1770	**2**		**2**		**1**			
1780	**2**		**2**		**1**			
1790	**2**	(-)	**2**	(-)	**1**			
1800	**3**	(3)	**3**	(3)	**1**			
1810	**3**	(3)	**6**	(4)	**2**	(2)		
1820	**8**	(-)	**8**	(-)	**2**			
1830	**12**	(-)	**9**	(-)	**4**	(-)	**1**	**(-)**
1840	**18**	(18)	**7**	(7)	**4**	(4)	**2**	**(1)**
1850	**18**	(16)	**7**	(6)	**4**	(4)	**2**	**(1)**
1860	**18**	(15)	**7**	(7)	**4**	(0)	**4**	**(3)**
1870	**18**	(16)	**7**	(-)	**4**	(0)	**4**	**(2)**
1880	**17**	(13)	**6**	(0)	**4**	(0)	**4**	**(0)**
1890	**15**	(8)	**8**	(3)				
1900	**14**	(6)	**9**	(4)				
1910	**5**	(3)	**5**	(0)				

7.1.2 It is also useful to note that at this date Gadlys was small even in relation to its Cynon Valley neighbours. In 1852 the 6 furnaces of the Aberdare Company (3 each at Llwydcoed and Abernant) had an output of 900 tons of iron per week compared to 351 tons at Aberaman (3

furnaces) and 95 tons from one furnace in blast at Gadlys (Thomas, 1943, 44). Whilst considerable investment at Gadlys in 1855-6 latterly improved its relative position, the Cynon Valley ironworks were always dwarfed by their near neighbours at Merthyr, in terms of size, complexity. They were nevertheless very typical of the majority of Welsh ironworks elsewhere in the coalfield and at Aberdare the ironworks were clustered into an unusually compact group. Gadlys ironworks was not the first of the ironworks in Aberdare, this honour belonging to the Aberdare Ironworks at Llwydcoed, which was established almost thirty ybefore Gadlys. Similarly, prior to its enlargement during the 1850s under Thomas Wayne, it was the smallest of the five ironworks in the Cynon Valley. It should also be noted that Gadlys would not appear to have started to develop into an integrated iron works until after Thomas Wayne's take over in 1845, whereas the Aberdare/Abernant complex had developed fineries and forges for making wrought iron, and even an engine manufactory in the first decade of the 19th Century. In the latter half of the 19th century, Gadlys grew to become one of the larger ironworks in the locality. It also was the last ironworks to remain active in the valley.

Table comparing the number of blast furnaces at the ironworks of the Cynon Valley

	Hirwaun	**Aberdare**	**Abernant**	**Aberaman**	**Gadlys**
	Blast Furnaces Built (In blast)	**Blast Furnaces Built (In blast)**	**Blast Furnaces Built (In blast)**	**Blast Furnaces Built (In blast)**	**Blast Furnaces Built (In blast)**
Opened	**1757-8**	**1799-1800**	**1801-7**	**1845**	**1827**
1760	1				
1770	1				
1780	1				
1790	1				
1800	1				
1810	2 (2)	3 (3)	3 (3)		
1820	2	3	3		
1830	4 (-)	3 (-)	3 (-)		**1 (-)**
1840	4 (4)	3 (3)	3 (3)		**2 (1)**
1850	4 (4)	3 (3)	3 (2)	2 (2)	**2 (1)**
1860	4 (0)	3 (1)	3 (0)	3 (3)	**4 (3)**
1870	4 (0)	3	2		**4 (2)**
1880	4 (0)	3 (0)	2 (0)		**4 (0)**
1890		3 (0)	2 (0)		

7.1.3 Although not notable for size or technical virtuosity, Gadlys Ironworks remains important as an example of a typical second generation Welsh Ironworks, one of many which sprang up between 1820-1860 in response to the demand for iron, both for tin plate and more especially for rails. In this period Welsh iron production rose from less than 200,000 tons to nearly 1,000,000 tons per annum and at one stage accounted for over 40% of the total British make (GCH Vol 5 1980, 149). Whilst many English and Scottish ironworks produced plate, structural cast and wrought ironwork and fancy goods, it was Welsh rails which shrank the world during the railway revolution and allowed for the first time the global transportation of foodstuffs in tin cans. It is often the case that the typical is ignored in favour of the exceptional but it is the very typicality of Gadlys Ironworks that should be seen as one of its key strengths

7.2 Comparative Assessment of the Visible Elements

7.2.1 Introduction

Given the international significance of British, and especially Welsh, iron, it is surprising how poorly represented ironworks are in conservation terms in Britain, as compared to Sweden or Germany. Many monuments of international significance have been lost in the too-recent past and the archaeology of ironmaking sites is still proving to be particularly vulnerable. In addition more and more of the archaeology of the ironworks hinterlands (housing, transport, iron ore patches and coal mines) falls victim to redevelopment, landscaping and open-casting every year without proper recording being carried out. Nevertheless, whilst the heritage of the ironmaking industry in South Wales has been very much eroded during the last hundred years, the surviving historic remains are still regarded as being far more substantial than in any other ironmaking region of Britain. It is thus regarded as being very important to assess the remains at Gadlys in relationship to the other surviving remains of the industry, so as to gauge the significance of any particular monument.

Without doubt the best preserved substantially-complete ironworks remains in Wales are the 18th century, charcoal-fired Dyfi furnace near Machynlleth and the superb coke ironworks at Blaenafon, both of which are Cadw guardianship monuments. Blaenafon has also recently been designated a World Heritage Site. By comparison, what remains at Gadlys, specifically the engine house and the blast furnaces, are but fragments of the many elements which would have comprised an integrated ironmaking complex, but this is typical of most South Welsh ironmaking sites, where isolated monuments have survived, often through varying combinations of chance and circumstance. Thus the remains will need to be judged on an individual, as well as a cumulative basis. They will also require assessing on a local and a national basis.

In very local terms, the remains at Gadlys, notably the blast furnaces but also the engine house, are very well preserved and far more complete than those at the former Aberdare, Abernant and Aberaman ironworks, where little or nothing remains above ground. Because of modern development, probably the most archaeologically complete site in the valley is that at Hirwaun. This site has extremely good archaeological potential although currently only the ruinous remains of four blast furnaces and the furnace bank wall currently survive in any recognisable form. The Hirwaun remains are, without doubt, of very high historic significance as the first South Welsh coke ironworks, but currently the visible remains are in an extremely ruinous state, which makes the meaningful interpretation of the site difficult.

By comparison to other sites elsewhere in the former South Wales coalfield, the Gadlys site also scores well. Merthyr Tydfil (in the adjacent valley c.5 miles north-east of Aberdare) was once regarded as the ironmaking capital of the world but the remains there are now fragmentary and isolated. All that remains of the Dowlais Ironworks is the late 19th-century red and yellow brick blowing-engine house and the stable block of 1820 whilst almost nothing remains of either the Penydarren or Plymouth works. The Ynysfach Ironworks retains its blowing-engine house intact (and converted to a museum) and adjacent to this lie the fragmentary remains of four blast furnace stacks. Some worker's terraces also remain nearby. The most significant monument in Merthyr is the massive bank of seven stone-built blast furnaces of the former Cyfarthfa Ironworks. The site was constructed between 1767 and c.1820 and is currently undergoing a programme of conservation works. This bank is the only large collection of such structures comparable to those at Gadlys but due to their scale as well as their historical and technical significance they must be considered superior to those at Gadlys. Thus although Hirwaun and the Cyfarthfa blast furnaces are recognised as the most significant ironworking sites in the locality Gadlys is the only site to retain both well-preserved blast furnaces and a substantially complete blowing-engine house.

The general picture of the isolated monuments is typical for the rest of the country also. Blaenafon, with its ruined remains of five blast furnaces (three of which pre-date 1789), cast houses, calcining kilns, coke ovens, water balance lift tower and associated worker's housing proves to be the exception to the rule. Elsewhere in South Wales significant remains at sites retaining blast furnaces are limited to:-

- an engine manufactory, a nearby forge and two well preserved blast furnaces (of 1793), at Neath Abbey;
- the ruinous remains of two blast furnaces (of 1794-1805) at Clydach (Gwent);
- the ruinous stumps of two furnaces (of 1839), a blowing-engine house and part of a casting house and at Venalt (Bridgend County Borough Council);
- a smithy, housing, a ruinous blowing-engine house and the two well-preserved anthracite blast furnaces (of c.1845), at Banwen (Bridgend County Borough Council.);
- a truckshop, housing and the ruinous stump of a water-blown blast furnace (of c.1824) at Abercrave (Bridgend County Borough Council.);
- the well-preserved blowing-engine house (converted to a sports centre) and ruinous single blast furnace (of c.1828) at Maesteg (Bridgend County Borough Council);
- the ruinous remains of the blowing-engine house, casting house and the single blast furnace (of c. 1790), at Cefn-Cribwr (Bridgend County Borough Council).
- The most notable site which retains significant remains but lacks any blast furnace remains, is the former Tondu Ironworks (Bridgend County Borough Council). This has well-preserved calcining kilns, blowing-engine house, a water balance lift tower, truck shop and company-provided housing as well as ruinous remains of three banks of coking ovens.

In terms of both historic significance and number of surviving elements, it is apparent that the now somewhat-isolated remains at Gadlys are clearly not in the same league as those at Blaenafon, but it is also clear that no other historic coke ironworks sites are as complete as that example. It is therefore necessary to assess the Gadlys blast furnaces and engine house on their merits as individual structures.

7.2.2 ***The blowing-engine house*** The surviving 1857 blowing engine house at Gadlys, which is rightly Listed (Grade II), falls into perhaps the commonest class of 19th century ironworking monument in Wales. The building has lost some of its integrity and original fabric through its recent conversion to offices, however it is in a superb state of preservation and no significant unconverted examples survive in South Wales (Plate 2). The extant Gadlys engine house was constructed at exactly the same time as the surviving No.3 and No.4 Furnaces and it was built in the grand 19th-century tradition of imposing engine houses, probably best exemplified today by the Maesteg engine house of 1828 (now a sports centre) and the Ynysfach engine house (1801, reb.1836), now a museum. The Gadlys engine house is at least the equal of either of these examples. The only other South Wales blowing-engine house to survive relatively intact is that at Tondu, built c.1839. This is of a lesser order in terms of scale, quality of build and architectural treatment. It is also now being converted into offices. No blowing-engine houses survive anywhere in Britain with their original engines in-situ but the Gadlys example is unusual in that the original Neath Abbey Ironworks drawings, showing both the engines and the building, have survived (Figs. A5 & A6). Also, with the notable exception of the Tondu engine house, all of the principal surviving examples exist as somewhat isolated monuments in largely redeveloped settings. The Gadlys engine house at least retains the potential of being meaningfully interpreted in relationship to both the exceptionally well-preserved bank of blast furnace and the surviving company-provided and other contemporary housing.

7.2.3 ***The 'casting house' (museum)*** As stated in 5.3.7, the Grade II Listed building (Plate 3) currently used as the Aberdare museum had been thought to be the only roofed casting house surviving in Wales. Unfortunately detailed inspection does not bear out this hypothesis and it is presumed to have in fact been built as a wagon repair shop shortly after the close of ironmaking. It is feared that the earlier phase of conversion works, carried out shortly before the demise of

Mid Glamorgan County Council, will have had a detrimental impact on any remains of casting pits or the casting houses within the footprint of this building.

7.2.4 ***The blast furnaces and furnace bank*** The bank of four blast furnaces at Gadlys is without doubt the jewel of the site. Despite some minor localised collapses, all four remain complete externally to full height, and it appears likely that all four retain intact their important furnace linings to full height as well as hearths. The only other coke-fired blast furnaces in South Wales which survive in an equally good condition are the two furnaces at Neath Abbey and the bank of seven at Cyfathfa. The two at Banwen are in an almost complete, but deteriorating, state but these were fired using anthracite rather than coke, and the shape of the furnace linings and the hearths will be different. It is clear that the two 1793 furnaces at Neath Abbey and the seven at Cyfarthfa (built between 1767 and c.1820) are of significantly greater historic significance to those at Gadlys.

Like the Gadlys furnaces, those at Cyfarthfa are blocked up and vaulted but unlike those at Gadlys they lack any associated blowing engine house, which is clearly a very important element for the interpretation of the working of a blast furnace. In terms of both scale and completeness therefore, only the Cyfathfa furnaces are comparable to those at Gadlys, and the Gadlys and the Cyfarthfa furnaces thus form the best surviving large banks of 18th-/19th-century coke-fired blast furnaces anywhere in Wales. They are also the best surviving of their type anywhere in western world and, now that eastern Europe is opening up, it is likely that they will eventually prove to be the best surviving of their type anywhere in the world. Before leaving this section, it should be mentioned that the Gadlys furnaces lack the historic significance of the Blaenafon, Cyfarthfa, Hirwaun or Neath Abbey examples. This judgement is purely based on criteria of technical virtuosity and early date. The two earlier Gadlys furnaces are nevertheless significant as being typical of the many smaller ironmaking establishments that were numerically the norm throughout the 18th and 19th Centuries. The two 1856-7 blast furnaces at Gadlys are also of minor historic significance however, a result of their unusually late date for masonry blast furnaces. More usually by this date the upper portion of the furnace would have consisted of a brick-lined, iron-bound circular stack, and fully iron-bound cylindrical blast furnaces had also started to become commonplace from about 1840. Apart from one solitary 19th-century example known to have survived in Russia, these iron-bound furnaces invariably succumbed to the scrap merchant and Riden (see Appendix D.2.1.1) has asserted that, as a result, 'neither in South Wales nor any other region does any blast furnace later than about 1840 (excepting modern examples) survive in a recognisable state'. Thus the later Gadly s furnaces represent the end of the line of British masonry blast furnace technology, and they are very likely to be the most modern of their type to survive anywhere.

7.3 Comparative Assessment of Potential Buried Remains (Fig. S.01)

7.3.1 ***Introduction*** As has been established in sections 4.1.1, 4.1.2, 5.3.4 and 5.4, there remain several little-used or undeveloped areas of the site that retain good potential for significant archaeological remains which could be used to enhance the understanding and interpretation of the standing remains. These principally comprise the site of the boiler house of the 1857 blowing-engine house, the site of the 1827 blowing-engine house and its haystack boilers, the site of No.1 casting house, the site of three of the calcining kilns and the buried N.W. extension of the furnace-bank wall. The importance of these archaeological remains is difficult to assess without evaluative excavations but, apart from what is known from the archaeology of standing monuments, almost everything that is known about 19th-century ironworks comes from the study of secondary sources which in general concentrate on the above ground furnaces and machinery of the principal processes. It is considered that we still know very little about the mechanics and detail of the mid 19th-century ironworks, for example the types of foundations used for furnaces and heavy machinery, the drainage around blast furnaces, water, gas and

steam supply, details of coke quenching techniques, the ancillary processes etc. Archaeological investigation can contribute much towards our understanding of these matters but as yet no coherent thematic survey has been carried out to assess the archaeological potential of each of the various Welsh ironmaking sites. It is therefore difficult to measure the relative states of preservation of the below ground remains at different sites. Research undertaken as part of this project would indicate that the archaeological potential of the above-mentioned former structures at Gadlys is high in comparison to many integrated ironworks sites in Wales. In this instance these below ground remains have the additional attraction of being related to a good collection of upstanding structures and each has the potential to greatly enhance the understanding and interpretation of the other.

7.3.2 ***The Calcining Kilns*** Potentially, probably the most significant of the sites mentioned would be that of the calcining kilns. Any remains of these will lie buried in the waste ground between the surviving limekilns and the allotments on top of the blast furnace bank (Fig. S.01). The ground topography suggests that it is possible that some parts of these structures could survive to full height and no post-ironmaking development has occurred in this area (Plate 4). Low level foundations would represent a relatively common resource, but any such structures that survive with any significant (formerly) aboveground portion intact would be considered to be a rare and significant survival. The only other known examples are those at Blaenafon (ruined), a pair at Steppaside (good) and a pair at Tondu (good). Other possible examples are the strange tunnel-shaped structures at Cefn Cribwr and a structure at Van (Caerphilly) which may be a limekiln. By far the best-preserved range is that at Rosedale in North Yorkshire, which is located at the site of ore mines and is not associated with a particular ironmaking site. Any intelligible remains at Gadlys would be of particular relevance for the future interpretation of the blast furnaces, as the calcination (roasting) of iron ore before smelting was an essential part of the 'Welsh method' of iron production.

7.3.3 ***The No.1 casting house*** Any remains of this will be located beneath the small car park that lies to the N.E. of the museum building (see Fig. S.01 & Plate 3). The archaeological potential is likely to be mixed. There are likely to be good remains of the deep casting pits into which the molten iron was run direct from the blast furnace, but any such remains may have been partially impacted by a post-ironmaking adjunct to the wagon repair shop (the present museum building). Any remains of the casting house would not be considered to have great rarity value in itself although its significance is enhanced by its association with the intact and contemporary No.1 Furnace. Any intelligible remains would be of high interpretational potential as they would help to illustrate the functioning of a blast furnace.

7.3.4 ***The boiler house of the 1857 blowing-engine house*** The outline of this building is still easily visible to the S.W. of the standing blowing-engine house. There has been no post-ironmaking development in this area and the archaeological potential is seen as good. Any remains would not be considered to be enormously rare, and drawings exist which show the layout of the boilers as built, although the significance of any remains will be enhanced by their association with the intact and contemporary Listed blowing-engine house. Any intelligible remains would nevertheless be of high interpretational potential as they would help to illustrate the functioning of the boiler house.

7.3.5 ***The 1827 engine house, boilers and hot blast stove*** Any remains of these structures (Figs. 12 & A2 to A4) will be located beneath the substantial bank of coke waste located to the N.W. of the blast furnaces (see Fig. S.01 & Plates 3 & 5). The archaeological potential for foundations of these structures is considered to be good as no post-ironmaking development is known to have taken place in this area. Any remains would not be considered to have great rarity value in themselves although their association with the intact and contemporary No.1 Furnace that they were built to serve enhances their significance. Given that the 1857 engine house has been gutted internally and will not be accessible for visitors, any substantial or intelligible remains

that could be exposed and consolidated would be of great value in aiding the interpretation of the site.

7.3.6 ***The north-west furnace-bank wall*** Also beneath the substantial bank of coke waste located to the N.W. of the blast furnaces (Plates 3 & 5) is the site of a north-western extension of the furnace-bank wall. Map evidence (see Fig. S.01) implies that this consisted of stone-revetted terraces, lying to the rear of the 1827 engine house and its boilers. This part of the furnace-bank wall appears to have been buried soon after 1900, probably during the clearance of the former coke yard prior to the construction of Nevile Terrace, Penybryn Street and Gospel Hall Terrace. It is probable that good remains survive.

8 OPPORTUNITIES PRESENTED BY THE BLAST FURNACES & OTHER REMAINS

8.1 It is clear from this study, and from the Scheduled status of the blast furnaces, that the furnaces are of considerable national significance. It is also clear that they contain exceptionally rare archaeological information. It is very important that consolidation works are carried out sooner rather than later and such works should be eligible for Cadw grant aiding. This study has revealed that the Gadlys furnaces are amongst the most complete of their type anywhere in the Britain and they currently contain the exceptionally rare remains that could be put at risk by ill-informed consolidation strategies. Because of their completeness and their association with the intact 1857 blowing-engine house, the Gadlys furnaces are probably the most intelligible monuments of their type anywhere, and because of their lesser historic significance by comparison to the similarly well-preserved bank at Cyfarthfa, it is possible that Cadw might sanction restorative interpretation strategies which might not be considered appropriate on a monument of world-class significance such as Hirwaun or Cyfarthfa.

8.2 The opportunities for interpreting the full range of processes carried out at the integrated ironworks at Gadlys has been compromised by the Tesco development on the lower site, and by the early 20th-century housing on the upper site. Where the Gadlys remains do score very highly is the nearly-unique combination of intact blast furnaces and blowing-engine house, which together formed the central focus of any ironmaking site, whether the ironworks was an integrated one or not. The opportunity presented by having these remains within feet of a museum cannot be ignored, and conservation strategies should take care not to preclude the integration of the standing remains into the museum at some time in the future.

8.3 It is important that all of the interpretational possibilities are considered at the same time as the various strategies for consolidation. It is probable that the simplest strategy for the consolidation of the structures is to consolidate them as existing, leaving all of the various secondary blockings in place. It cannot be denied that the interpretation of the blast furnaces is currently hindered by the blocking-up of all of the tapping vaults and some 50% of the blowing vaults however. The understanding of the functioning of the furnaces is rendered doubly difficult by the furnace shafts being infilled and their mouths being covered over by allotments. The structures would benefit greatly from the uncovering/unblocking of some or all of these features and it is recommended that this be carried out before the consolidation.

8.4 There are several different interpretation options possible. The worst-preserved blast furnace is No.1 Furnace. This is the oldest (c.1827) and it lies at the extreme N.W. end of the furnace bank. Many of the tapping and blowing vaults have collapsed as has some of the rubble fill between the inner brick lining of the furnace hearth leaving sections of the inner structure exposed (Plate 12). This could be consolidated as existing, presenting the almost unique opportunity of seeing the inner construction of an otherwise-intact blast furnace. The other potential opportunity is presented by No.3 Furnace and No.4 Furnace at the S.E end of the range. These were built as an identical pair and they thus present the opportunity of reconstructing one of them to an operational state without compromising the archaeological record. This would involve the restoration of the blowing and tapping vaults, the squat chimney at the top of the furnace shaft and a conjectural reconstruction of the tuyeres and blast main, the latter connecting with the extant 1856 blowing-engine house (Fig. 13). The tuyeres and blast main might be recreated using readily available iron pipe sections or lightweight steel or G.R.P. fabrications, and the effect could be enhanced with sound and light effects.

8.5 The site presents several other interpretational opportunities, which would make use of the other buried remains nearby. The most obvious is the removal of the overburden from the allotment site, which would reduce the weight currently acting on the furnaces, allow the consolidation of the furnace tops and make the former arrangement of the charging platform immediately

apparent. This would also allow the wider site to be interpreted from the high vantage point from which the whole of the former ironworks is site fully visible, but also from which it is possible to view the town, the railway and the sites of the Aberdare and Abernant ironworks and the Aberdare and Hirwaun tramroad. This study has revealed the potential for well-preserved remains of the calcining kilns and the No.1 casting house to exist on under-used land immediately adjacent to the blast furnaces (Plate 4). Any such buried remains have the potential to widen the interpretation of the blast furnaces to include the calcination of the ore prior to charging, and the running-out of the molten iron after smelting. It is strongly suggested that these remains are evaluated to assess their potential (see below). Similarly, there is the strong possibility that the N.W. end of the original furnace bank wall and the foundations of the 1827 blowing-engine house and its haystack boilers may survive beneath the coke waste bank to the N.W. of the museum car park (Plates 3 & 5). These might also be investigated (see below) as these remains would add significantly to the completeness of the monument.

8.6 Because of the completeness of the furnaces themselves, and their close relationship with the adjacent 1857 blowing engine house and the Aberdare Museum, it is clear that the furnaces have the potential to form an intelligible and easily-interpretable museum exhibit, once sensitively consolidated. As stated above, the other remains located on or near the site (the company-provided housing, calcining kilns, casting house etc) also have significant potential to enhance greatly the interpretation of the furnaces in a wider social and technological context, whilst the Gadlys site also has interesting remains of the integrated waste incineration / electric tramway scheme of 1913-35. Taken together, their interpreted remains could form a significant educational resource that could also enhance local pride, identity and sense of place. Note has been made of the high national significance of the furnaces as a historic monument, but the viability of any high-profile interpretation schemes will have to seriously considered against criteria such as sustainability, staff-cost / revenue, local desire for a tourism industry and the visual or physical impact of any proposed scheme the on setting or fabric of the Ancient Monument itself. The blast furnaces are of undoubted great technological and historic significance, but their wider public appeal is likely to be tempered by their relatively 'modern' date and their situation overlooking Tesco's car park. On a regional and national level, the site will inevitably compete with other industrial heritage attractions, notably Tondu (Ironworks) Industrial Heritage Park, Rhondda Heritage Park, Big Pit and Blaenavon Ironworks, the latter two of which have recently gained World Heritage Site status. These sites, particularly Tondu and Blaenavon, will inevitably limit Gadlys's 'national curriculum' market, possibly to a ten mile radius, although pro-active marketing and teacher-friendly facilities could draw school parties from the Swansea/Neath and Cardiff conurbations. The national and regional recreational market could be similarly constrained, despite the site's ready appeal to a limited national industrial-heritage tourism market. Thus, while the Gadlys site and monument are of national historical and technological significance, it would seem pragmatic to view them principally as a local and regional educational and recreational asset in the short-to-medium term. This view should not be seen as diminishing the undoubted eligibility of their consolidation and interpretation for substantial grant aid, but caution would be urged when it comes to developing interpretation strategies that have significant ongoing staffing or maintenance costs associated with them. Experience has unfortunately shown that such schemes, usually justified on unrealistic expectations for tourism- and revenue-generation, often make unsustainable demands on finite local government resources and eventually founder completely.

9 SUGGESTED FURTHER ASSESSMENT WORKS

9.1 This assessment has been constrained by many important parts of the blast furnaces not being currently visible. As a result, it has not proved possible to assess ten out of sixteen blowing/tapping vaults or any of the furnace linings. Neither has it been possible to gain any impression of the state of preservation of the furnace mouths or charging platforms beneath the present allotments. It is clear that the blast furnaces possess considerable archaeological potential but, in order to fully assess these important structures from an archaeological or structural perspective, it would be necessary to open up the blocked blowing and tapping vaults and to excavate a series of archaeological trial trenches within the allotment areas. These would reveal important information about the recent collapses as well as indicating whether the furnace shafts are fully infilled with detritus. They would also answer the important question about whether the furnaces still survive to full height (See Fig. S.04).

9.2 In order to assess the further potential of the site to contain important contextual remains that could enhance the interpretation of the furnaces, a series of further archaeological evaluation trenches (Fig. S.10, 'Phase 4') has been suggested. These trenches would be excavated specifically in order to ascertain the survival of the calcining kilns, the buried retaining walls, the foundations of the 1827 blowing engine house and the cast-house of No.1 furnace. Survival of meaningful remains would significantly enhance the site's archaeological significance and educational potential.

10 CONCLUSIONS

10.1 The archaeological assessment of the blast furnaces at Gadlys has proved to be a very valuable exercise. Close analysis of the surviving fabric of the blast furnaces has shown that the Gadlys furnaces were built in three main constructional phases. The first furnace to have been built was that at the N.W. end, which was constructed c.1827, along with the now-demolished 1827 blowing-engine house. It was originally a freestanding structure, apart from its connections to the furnace bank wall via the charging bridge vaults. The adjacent furnace (No.2 Furnace to its S.W.) was constructed next, c.1839-41. This was also built freestanding apart from its own charging bridge vaults. No.3 and No.4 Furnaces were clearly both constructed in a single campaign of 1855-6, together with the connecting vaults between the furnaces. They represent a major expansion of the ironwork's production capacity under Thomas Wayne, and were built at the same time as the extant blowing engine house and the furnace bank wall extension. The blowing-engine house and the furnace bank wall were both built with further extension in mind, and they could have accommodated a further three blast furnaces had demand merited their construction.

10.2 The Gadlys furnaces seem to survive to full height, and on the surface they appear to be exceptionally well preserved. The apparent excellent external state of the furnaces unfortunately belies their internal structural state and it is clear that all of the furnaces, most especially No.1, have potentially serious structural problems that will result in eventual failure if left unattended to. The extent of these collapses is not currently fully understood because of the blocking up of many of the blowing and tapping vaults, but it is clear that a major portion of the vaults of No.1 Furnace have collapsed, as has part of the S.E. blowing vault of No.4 Furnace.

10.3 Despite the collapse of several of the internal vaults, the important brick linings of the furnace shafts appear to be completely intact currently. The survival of the linings and the cast-iron lintels within the blowing vaults augurs well for the survival of the furnaces' critically important archaeological features, notably the hearths, the tuyeres (blowing holes) and the tap holes. Inspection of the accessible areas has revealed the survival of a large number of very rare features, most notably the visible tuyere, evidence of the blast main suspension points and large iron pivots for heavy internal doors. Similar features would be predicted within the blocked vaults. It is clear that all of the blast furnaces have seen extensive use, and all currently bear extensive archaeological evidence of cyclical reconstruction and modernisation throughout their working lives.

10.4 It has been shown that the Gadlys Ironworks cannot be considered nationally very important in purely historical terms as it was not one of the earliest, largest nor most technically advanced of Welsh ironworks. In terms of the use of coke as fuel, the first Gadlys furnace lagged seventy years behind the site at Hirwaun. Similarly, in terms of scale, whilst Aberdare, like Maesteg, developed into a prosperous iron-making centre, it should be recognised that the total iron production in 1846 of the three Aberdare ironworks was little more than one-tenth of the combined production of the four giant ironworks at Merthyr, namely the great works of Dowlais, Cyfartha, Plymouth, and Penydarren. Nevertheless, whilst Gadlys was not notable for its size or technical virtuosity, the Gadlys site remains important as an example of a typical second generation Welsh Ironworks, one of nearly forty that sprang up between 1820-1860 in response to the demand for iron, both for tin plate and more especially for rails. In this period Welsh iron production accounted for over 40% of the total British make and whilst many of the English and Scottish ironworks produced armour plate, structural cast and wrought-iron and fancy goods, it was Welsh rails which shrank the continents during the railway revolution and Welsh tinplate that allowed the mass-production of light consumer durables and safely packaged food needed both at home and on the colonial frontiers. It is often the case that the typical is ignored in favour of the exceptional. Given the international significance of British, and especially Welsh, iron, it is surprising how poorly represented ironworks are in

conservation terms, and in this context, it is the very typicality of Gadlys that should be seen as one of site's key strengths.

10.5 Comparative analysis of surviving ironmaking monuments in Wales has revealed the Gadlys furnaces to be the best-preserved bank of early- to mid-19th-century coke-fired blast furnaces in Britain. It is because of this, as well as because of the global importance of the Welsh iron industry in this period, that they are rightfully considered to be of high national significance. The furnaces retain considerable potential to contain irreplaceable archaeological information relating to the construction of structures of this type as well as about the periodic cycles of maintenance, repair and modernisation. There are clear (but currently little-understood) variations between the furnaces and the remains have significant potential for aiding our understanding of the way in which changing technologies such as blast mains and tuyeres varied over time and related to the masonry structures of the furnace stacks themselves. The furnaces are likely to retain some material within from their last charges, and this material has the potential to tell us more about the sources of coal/coke, limestone and ore used in the latter days of Gadlys as a functioning ironworks. ***All of this information is very fragile, and vulnerable to ill-considered consolidation.***

10.6 It is clear from the above that the blast furnaces are in urgent need of consolidation, and that the consolidation works will have to archaeologically monitored. The furnaces nevertheless have the potential to be a significant local and regional asset. Their significance, and their position immediately adjacent to the Aberdare Museum and the extant blowing engine house, should make their interpretation particularly practicable and desirable. In addition, their status as a Scheduled Ancient Monument and their location would indicate that very considerable grant aid should be available for such works. Unfortunately the furnaces remain as somewhat isolated structures and their function is obscured by the blocked-up tapping- and blowing-vaults and by the allotments. Excepting the surviving engine house and nearby company-provided housing, their wider context has been compromised by demolition and redevelopment of most of the ironworking site over the last one hundred and twenty-five years. Nevertheless, this assessment has indicated that important remains currently lie hidden, both within the currently-obscured areas of the furnaces as well as in under-developed areas immediately adjacent to the blast furnaces that have high potential for the buried archaeological remains of the 1827 engine house, its boilers, calcining kilns, a casting house and a substantial length of an impressive terraced retaining wall. These could add significantly to the interpretation of the furnaces and restore at least part of their lost relationship to the ironmaking process.

10.7 It is important that all of the interpretational possibilities are considered at the same time as the various strategies for consolidation and because of this a series of further archaeological and structural evaluative works have been proposed. Several proposals for interpreting the furnaces and other remains have been made in this report and it is clear that the interpreted remains could form a significant educational resource that could also enhance local pride, identity and sense of place. The viability of any high-profile interpretation schemes will have to be seriously considered however and a balanced assessment which takes account of criteria such as sustainability, staff-cost / revenue, local desire for a tourism industry and the visual or physical impact of any proposed scheme on the setting or fabric of the Ancient Monument itself should be undertaken. The blast furnaces are of undoubted great technological and historic significance, but their wider public appeal is likely to be tempered by their relatively 'modern' date, their situation overlooking Tesco's car park and the presence nearby of well-established and high-profile industrial heritage sites such as Rhondda Heritage Park, Big Pit and Blaenavon Ironworks, the latter two of which have recently gained World Heritage Site status. This view should not be seen as diminishing the site's importance as a regional educational and recreational asset or its undoubted eligibility for substantial grant aid, but caution would be urged when it comes to developing interpretation strategies that have significant ongoing staffing or maintenance costs associated with them. Experience has unfortunately shown that such schemes, usually justified on unrealistic expectations for tourism- and revenue-generation,

often make unsustainable demands on finite local government resources and eventually founder completely.

11. RECOMMENDATIONS

11.1 Archaeological and structural inspections have been carried out sufficient to assess the importance and the present state of the furnace structures and to allow an outline plan of action to be put forward for the consolidation and stabilisation of the structures, keeping in mind the potential to integrate the monument with the adjacent museum.

11.2 The recommended works fall broadly into four phases, and are illustrated diagrammatically in Fig.s S.04 through S.10

Phase 1 will comprise:-

- Obtaining Scheduled Ancient Monument Consent.
- Making exploratory excavations for further archaeological evaluation and to establish details of the original charging platform prior to removing overburden in the allotments area.
- Removing the overburden.
- Removing vegetation and cutting down trees growing from external faces of the furnaces.
- Cleaning out all debris and infilling from the furnace shaft, commencing at No 4 and progressing north-westwards to No 1.
- Partially removing blocking up from tapping arches, blowing arches, blast galleries and removing debris from these internal areas to facilitate access.
- Removing debris that has fallen through from allotments into upper galleries.

Materials suitable for re-use in the consolidation/reconstruction works to be labelled and stored in secure storage.

It is anticipated that extensive temporary propping/shoring/strapping systems will be required during this stage.

An archaeologist and an engineer should be in attendance recording, assessing, advising and directing as work proceeds.

Phase 2 Carry out:-

- Detailed archaeological inspection and recording
- Detailed structural inspection and recording

Phase 3 Develop proposals for consolidation, stabilisation, reconstruction involving:

- Preparing drawings, specifications, tender documentation, Health & Safety Plans, Archaeological Mitigation Statement.
- Consultation with CADW, Local Authority Departments and other interested parties.

It is anticipated that the works in this Phase will include:-

- Removing remainder of blocking up from tapping and blowing arches
- Raking out and repointing masonry

- Rebuilding/consolidating collapsed or loose masonry
- Stitch bolting to stabilise distorted or loose masonry
- Grouting of cavities/voids
- Installing permanent 'girdle' and propping system in furnace No. 1.
- Consolidating charging platform surface
- Excavating embankment adjacent to furnace No. 1 to expose concealed face of furnace structure and furnace bank wall
- Raking out and repointing joints in face of retaining wall (There may be a need to install ground anchors)
- Archaeological monitoring of all of the above

Phase 4 Further investigation by way of exploratory excavations in the areas of the Lime Kilns, Blowing Engine House (1827) and the Casting House east of Furnace No. 1.

Phase 5 If significant archaeological remains are discovered in Phase 4, further excavation consolidation and interpretation strategies may be evolved.

RM Kinchin-Smith/J Gill
Oxford Archaeology

In collaboration with

Llewelyn Nicholas
James & Nicholas, Engineers and Architects

May 2002

APPENDIX A

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Maps

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OS 25":1mile (1:2500)

1st Edition (1868)	Sheets Glam.XI.11, XI.15	(Surveyed 1868)
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End View of Engine Hous(e)…Section of Boiler Seatings…
Section of Engine house and Boilers with Steam and Feed Pipes for the 34in Engine for Messrs. Wayne & Williams. June 28th 1827
Longitudinal and Cross Section of House with Boilers etc. for the 45 Inch Steam, and 104 Inch Blowing Engine 10ft Stroke for the Gadlys Iron Company, Aberdare. Neath Abbey 10th August 1857. (GAS D/D NAI M/435/26)
Reconstructed S.W. elevation of 1827 engine house (Courtesy Doug Williams, CVHS)
Reconstructed N.W. sectional elevation of 1827 engine house (Courtesy Doug Williams, CVHS)

Abbreviations

AL	Aberdare Library
Anon.	Anonymous
CVHS	Cynon Valley History Society
Ed.	Edition
ETSU	Energy Technological Support Unit
GAS	Glamorgan Archives Service
G.E.A.	Glamorgan Education Authority
IGMTAU	Ironbridge Gorge Museum Trust Archaeological Unit
n.d.	not dated
M.S.	Manuscript
NLW	National Library of Wales
OAU	Oxford Archaeological Unit
OS	Ordnance Survey
Un-pub.	Un published

APPENDIX B

Listed Building description

and

Scheduled Ancient Monument details

Cadw
WELSH HISTORIC MONUMENTS

Tŷ Brunel, 2 Ffordd Fitzalan, Caerdydd CF2 1UY
Brunel House, 2 Fitzalan Road, Cardiff CF2 1UY
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Eich Cyfeirnod/Your Reference

Ein Cyfeirnod/Our Reference CAM 1/1/3695/1

Dyddiad/Date 30 August 1989

Director
Glamorgan/Gwent Archaeological Trust Ltd
6 Prospect Place
Swansea
West Glamorgan

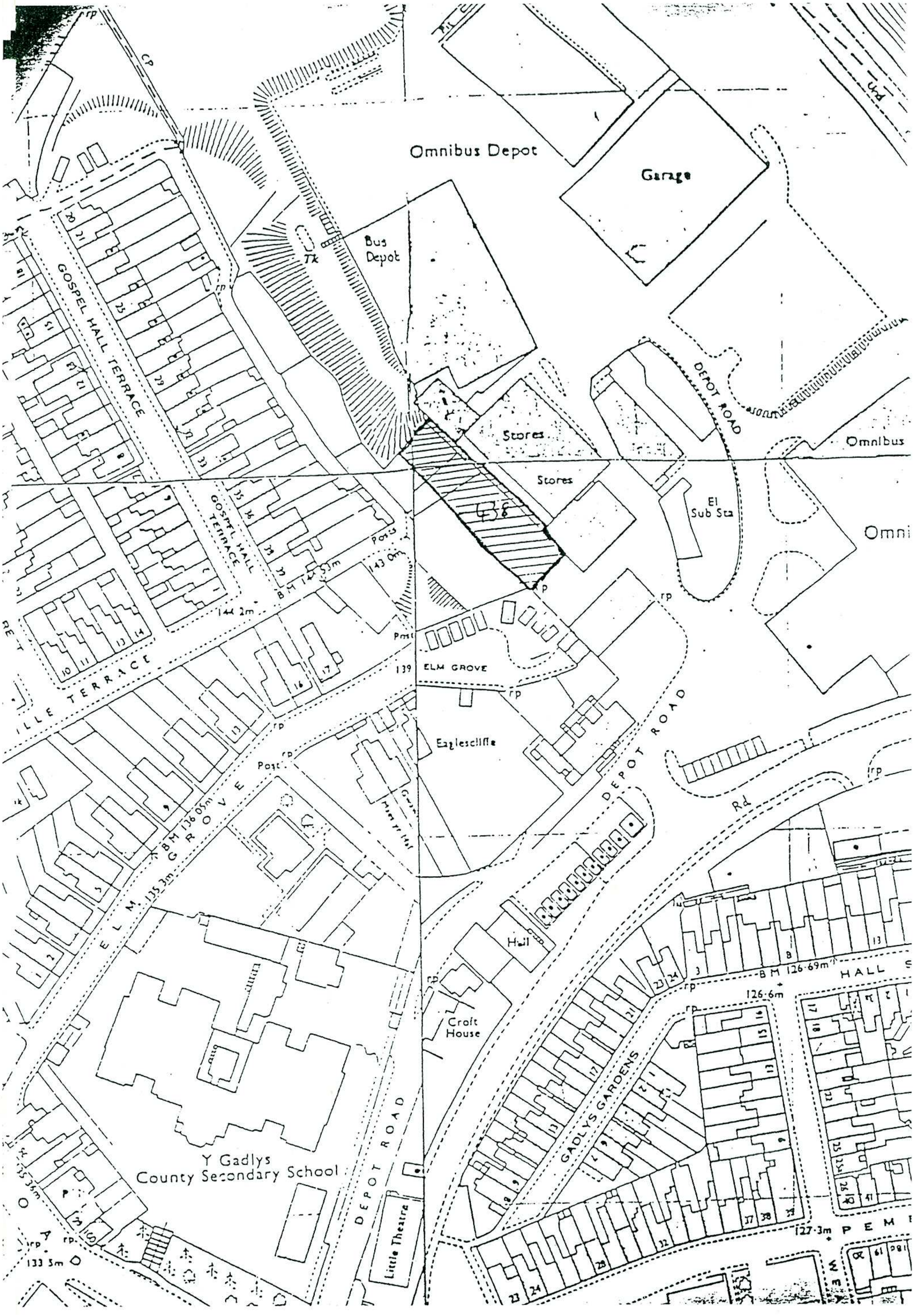
Dear Sir

MONUMENT: Gadlys Ironworks (Remains of Blast Furnace)
SCHEDULE NO: Gm 438
COUNTY: Mid Glamorgan
DISTRICT: Cynon Valley
COMMUNITY: Aberdare
OS NUMBER: 170
NATIONAL GRID REFERENCE: SO 000 030

The above monument has been scheduled under the Ancient Monuments and Archaeological Areas Act 1979. The extent of the area scheduled is shown hatched on the attached map.

Yours faithfully

SYLVIA M SALMON (MRS)
Ancient Monuments
Administration



Omnibus Depot
Garage
Bus Depot
Tk
Stores
Stores
DEPOT ROAD
Omnibus
El Sub Sta
Omni
GOSPEL HALL TERRACE
GOSPEL HALL TERRACE
Posts
143·0m
B M 144·53m
144·2m
Post
139
ELM GROVE
Eaglescliffe
DEPOT ROAD
Rd
Post
B M 136·05m
ELM GROVE
135·3m
Hall
B M 126·69m
HALL
126·6m
Croft House
GADLYS GARDENS
Y Gadlys
County Secondary School
DEPOT ROAD
Little Theatre
127·3m
133·5m

TOWN AND COUNTRY PLANNING ACT 1971 – SECTION 54

NO 7 LIST OF BUILDINGS OF SPECIAL ARCHITECTURAL OR HISTORIC INTEREST

BOROUGH OF CYNON VALLEY

1. Under section 54 of the Town and Country Planning Act 1971, the Secretary of State is required to compile lists of buildings of special architectural or historic interest. This is done for the purposes of the 1971 Act and with a view to the guidance of local planning authorities in the performance of their functions under the 1971 Act in relation to such buildings.

2. Following consultations with persons who appear appropriate to him as having special knowledge of, and interest in, such buildings, the Secretary of State has concluded that the building described in the attached schedule is of special architectural or historic interest. In view of this, the Secretary of State, under the powers of section 54 of the 1971 Act, hereby compiles the No 7 list of buildings of special architectural or historic interest described in the said schedule.

SCHEDULE

County: Mid Glamorgan

Grade: II

District: Cynon Valley

Cadw Ref No: 7/7/11

Community: Aberdare

NG Ref No: SO 001 030

Town/Village: Aberdare

Street: Depot Road (N side)

Name/Number: Cynon Valley Main Store Building
(formerly the Casting House at
Gadlys Ironworks)

Reached along old road set back from modern relief road; opposite Cynon Valley Transport Depot and Works.

Dating after 1827 when Matthew Wayne, ironmaster and coal owner of Merthyr, established a single furnace at Gadlys (in conjunction with G R Morgan and E M Williams). The former casting house building (now Main Store) may originate from 1855-6 when the last two furnaces (out of 4) were built. Blast furnaces shut down completely 1875-6.
Later C19 enlargement along NE side.

Twin gabled ranges with long flank to furnace bank. Dark rubble facings with red and yellow brick dressings, yellow brick patching to upper gable ends and under eaves possibly consistent with reroofing (?). Pitched slate roofs, boarded eaves and plain bargeboards. Brick-dressed oculi (blocked) to gable ends with twin brick-dressed arched openings, 3 with traceried fanlights to SE end. Small, later range makes part of NW gable end which retains one traciered fanlight.

7-bay long flank with arched small-pane window frames set into brick-faced arched recesses (formerly open). Bolted plates to spandrels.

Interiors with twin boarded roofs with metal-rod trusses, central arched arcade in stonework with brick dressings. Brackets to spandrels of windows (formerly supporting rails for travelling cranes?)

Important group value with furnace block and blast engine house at former Gadlys Ironworks.

References: Dictionary of Welsh Biography, Cymmrodorion Society (1959), p 1015 (Wayne Family).
Information from Mr Philip Riden, University of Cardiff.
Shown at half width on First Edition Ordnance Survey map of 1868 (sheet XI. II). Enlargement partly shown on 1880 map (sheet XI).

Dated 12.4.89

Signed by authority of the Secretary of State

E A J CARR
A Grade 5 Officer in the Welsh Office

2344m

SCHEDULE

County: Mid Glamorgan

Grade: II

District: Cynon Valley

Cadw Ref No: 8/8/12

Community: Aberdare

NG Ref No: SO 001 030

Town/Village: Aberdare

Street: Depot Road (N side)

Name/Number: Blast Engine House and Stone Revetments at Former Gadlys Ironworks

On old road set back from modern relief road; at entrance to Cynon Valley Transport Depot and Works.

Dating after 1827 when Matthew Wayne, ironmaster and coal owner of Merthyr, established a single furnace at Gadlys (in conjunction with G R Morgan and E M Williams). The engine house may be dated as late as 1855-6 when the last two furnaces (out of 4) were built. Blast furnaces shut down completely 1875-6.

Distinctive tall and narrow 3-storey plus part-basement engine-house with snecked rubble facings, bull-nosed quoins, yellow brick dressings and stone sills. Modern slated roof with wide eaves. 4 windows wide, cambered heads and long and short quoins in pale brickwork (some large blocks), modern small-pane sash and case windows (as original). Built-up brickwork quoins to ground floor centre above later external stair to red brick platform on left of front. One window side elevations with boarded door to left end and tall arched opening through 2 storeys with modern glazed infill (and proposed canopy) to right end.

Similar detailing to rear elevation linked to adjacent masonry revetment by rubble wall at W end and reached by modern high-level metal bridge through brickwork opening to centre. Bull-nosed quoins and yellow brick-voussoirs to three stepped arches (blocked) at basement level facing massive revetment wall. This revetment forms 3-sides of a rectangle and joins the corner of the main furnace bank to N of engine house.

Modernised (1989) interiors retaining original floor levels and substantial fabric of the massive transverse beam wall (originally supporting the beam for the blowing engine).

Important group value with the casting house and blast furnaces at former Gadlys Ironworks.

References: Glamorgan County History vol V
Dictionary of Welsh Biography, Cymmrodorion Society (1959), p 1015 (Wayne family)
Aberdare: Pictures from the Past, Cynon Valley History Society (1986), plate 48.
Information from Mr Philip Riden, University of Cardiff.
Shown on First Edition Ordnance Survey Map of 1868 (sheet XI II)

Dated 9.10.89

Signed by authority of the Secretary of State

E.A.J. Carr

E A J CARR
A Grade 5 Officer in
the Welsh Office

APPENDIX C

HISTORICAL BACKGROUND

This section on the historical background of Gadlys Ironworks is largely based on all the available secondary sources relevant to the site and its context. Primary sources have also been consulted as have all the available historical maps of the area. A full bibliography is provided at the end of the report.

C.1 The South Wales Iron Industry

C.1.1 Iron making was undertaken in South Wales from pre-historic times until the late-sixteenth century using simple charcoal-fired furnaces called bloomeries. Since the 1560s the ore, whether locally mined or imported, has been smelted in large blast furnaces, which replaced bloomeries in the region during the second half of the sixteenth century. Blast furnaces were introduced to Britain from the continent in the early sixteenth century and this technology was in use in South Wales by 1564 (Gale, 1979, 6). Until about 1760 charcoal was used exclusively as the fuel in South Wales blast furnaces, which were blown entirely by water-power. Whilst blast furnaces allowed the production of iron on an industrial rather than a domestic scale, they had the disadvantage of only being capable of producing the more brittle cast iron, whereas the small bloomeries directly produced maleable wrought iron, albeit in tiny quantities. Thus the secondary refining of cast iron to wrought iron remained a complex and time-consuming business.

C.1.2 The impetus for the development of the South Wales iron industry had been the plentiful supplies of timber available for charcoal making at a time when supplies in England were becoming exhausted to the point where the navy was finding it difficult to procure sufficient timber for shipbuilding. By 1760-80 the Welsh forests were becoming similarly exhausted. The answer lay in Abraham Darby's successful use of coke to smelt iron, first carried out at Coalbrookdale in 1709. This technology was ideally suited to the South Wales coalfield, with plentiful supplies of good coking coal, easily-accessible iron ore and under-utilised water power sites. The first ironworks to be built to exploit this method of smelting appears to have been that at Hirwaun, established in 1757 (IGMTAU, 1993, 1-2). By about 1790 charcoal blast furnaces had been largely superseded, in South Wales as elsewhere, by coke-fired furnaces, although until the 1790s the water-wheel, coupled either to traditional leather bellows or cast-iron cylinders, remained the universal method of blowing. Although a few charcoal blast furnaces survived in South Wales until the 1820s, their output had ceased to be significant in a regional, much less national, context, a generation earlier.

C.1.3 Although almost all the iron working sites in South Wales had converted to coke smelting by the end of the century, the production of wrought iron remained a time-consuming and expensive process, often still reliant on the use of charcoal despite the introduction of the potting and stamping method, in which coal or coke could be used. This situation was transformed by the adoption of Henry Cort's (coal-fired) puddling furnace, patented in 1784, which was adopted with great enthusiasm in the region. This technique, once combined with Cort's rolling mill of 1783 allowed a huge growth in the local iron industry with many new blast furnaces constructed to supply the puddling furnaces with pig iron. The simultaneous development of efficient steam-powered blowing engines for the blast furnaces, combined with the demands of the revolutionary and Napoleonic wars (1793-1815) led to a massive increase in the industry and during this period South Wales rose to become the world's pre-eminent iron-making centre, producing about a third of the British total. The region shared in the slump after 1815 and in the wave of renewed growth in the small boom in the years 1824-5.

C.1.4 A further slump followed which generally depressed prices up to 1830. Increasing domestic demand, fuelled by the growth of railways and increased industrialisation, acted as great spurs to the industry yet despite the great prosperity of the British iron trade in the period 1835-50, the region's pre-eminence started to slowly decline. By 1830 the local sources of ore were becoming more difficult to work easily and richer ores, imported from Cumbria or Spain were becoming widely available, much to the benefit of ironworks located closer to ports. As the ninety-nine-year mineral leases under which the earliest works had been established expired, it often proved uneconomic for the lessees to seek a renewal and, from the 1850s, blast furnaces began to close in South Wales. The region was still a sufficiently important element in the industry to share in the boom of the early 1870s, largely a result of an increasing world-wide demand for iron rails, but it then suffered very badly in the contraction which followed.

C.1.5 Britain's early lead in producing Bessemer steel should have helped the national iron industry but early technical problems prevented the immediate use of most British ores for steelmaking and only about a

dozen of the older South Wales works survived to be rebuilt for the new process in the 1880s. Towards the close of the century prudent iron makers were forming into large national combines (e.g. the Guest, Keen, Nettlefolds group) and relocating to new works on the coast, smelting imported ore using locally produced coke. By the turn of the century South Wales was responsible for no more than 10 per cent of the output of the British iron industry. This decline happily coincided with the exponential growth in the world-wide demand for Welsh steam coal, the commodity so successfully first marketed from 1837, by Thomas Wayne of Gadlys, Aberdare. Further closures followed both before the First World War and in the Depression of the 1920s and 1930s, although the major cause of distress in South Wales during the inter-war period was the decline of the coal industry, which had long been by far the more important employer. Steelmaking was re-established at Ebbw Vale in the 1930s, partly in an attempt to reduce unemployment, and the GKN Cardiff works was rebuilt in the same period. In the 1950s the South Wales steel industry enjoyed something of an Indian summer, with existing plant supplemented by a new works at Llanwern, near Newport.

C.2 Ironworking in the Cynon Valley

C.2.1 Early iron-making on a small scale appears to have started in the Cynon Valley by the end of the sixteenth century when a few ironmasters from the more established iron working centres of Sussex and the Weald of Kent were attracted by the natural resources of the area. The rich woodlands of Aberdare Parish ('*...mor goediog gynt, fel y gallai gwiwer fyned o un pre i'r llall heb ddisgyn I'r llawr, o Mountain Ash hyd Gefn y Cynghor, ac oddiyno drachefu i Gwn Nedd*[5]') could supply abundant charcoal and water power together with ironstone which was present within the outcropping lower coal measures (Grant, 1991, 1-3). Little has been researched into this industry although Dafydd Morganwg and Llewelyn stated that evidence of bloomeries (3-foot high hand-blown furnaces) could once be seen in Aberdare Parish at Blaen Cwm Dare beside the Bwllfa (Ffwrnes Cwm Dare); at Cae Luce in Llwydcoed (Ffwrnes Cae Luce); at Cwn Cynon beside the Duffryn (Ffwrnes y Dyffryn); and at Cwmaman (Ffwrnes Cwmaman) (Dafydd Morganwg, 193 & Llewelyn, 44-5). A hand-blown furnace of 1666 at Hirwaun mentioned by Llewelyn also sounds more like a bloomery than a blast furnace. Evidence has been found in more recent times of a bloomery site at the west end of Dumfries Park, Aberdare (SN 992 018) (County Sites and Monuments Record). The site of a 16th-century blast furnace is known to exist near Blaen-Canaid farm (SN 037 044) (County Sites and Monuments Record).

C.2.2 There appears to be a substantial lack of documentation for the seventeenth- and early eighteenth-century furnaces in the region. Llewelen claims that a charcoal blast furnace was established at Hirwaun in 1666 (Llewelen, 46). Whilst he states this to be Maybury's furnace which is not possible – see below) there is some evidence for an ancient furnace at this location (Ince, 1993, 33). Another intriguing site mentioned by Llewelen and Dafydd Morganwg (1876, 193) is Ffwrnes-y-garn, which Llewelen claims to have been built in the year 1773 by a man named Bownser (Llewelen, 1855, 45). This works, if it existed, would be of great significance as Llewelen claims that this ironworks was short-lived on account of its steam engine being too weak although there is no record of a blast furnace being blown directly by a steam engine until Wilkinson and Watt's machine of 1776. The interest is added to by Dafydd Morganwg who states that an old coal level, exiting adjacent to the old Ffwrnes Y Garn, was broken into by the Ysgubor Wen works in 1872 (Dafydd Morganwg, 198). Some credence is lent to these stories however, as a man by the name of Bowzer is recorded as agent at Hirwaun in 1777, and in 1803 that property was demised to four partners including Jeremiah Homfray and a Francis William Bowzer of Hendon (Ince, 1993, 33-34).

C.2.3 Historically the most important ironworks within the Cynon Valley was that at Hirwaun, 3 miles to the north-west of Gadlys. These works, established in 1757 by John Maybury of Worcestershire, were one of the first to be established in South Wales in the industrial revolution period and it is the oldest of which there are substantial remains. It seems highly probable that these works were established to emulate Abraham Derby's success in smelting iron using coke rather than charcoal and it isfrom this technological 'quantum leap' that the site's great significance derives. There is some debate as to when coke was first used seccessfully here but it was certainly being used by the mid 1760s (see Ince, 33: Riden, 1993, 19-20 & IGMTAU, 1). A second furnace was added at some time after 1805 but following an unsuccessfully sale of the site in 1813 the works closed. William Crawshay, who also owned the large Cyfarthfa works in Merthyr Tydfil, purchased Hirwaun in 1819, investing in new plant and furnaces. The works were not particularly profitable although further investment was made and the furnaces remained in blast for the

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[5] '*...so forested that a squirrel could jump from one tree to the next from Mountain Ash, along Cefn y Cynghor, and from there to Cwm Nedd*' – a distance of 12 miles. (Dafydd Morganwg, 193)

next forty years, before the Crawshay family abandoned the site. The Marquis of Bute, who owned the land, leased the works in 1864 to a new concern but this was short lived as the furnaces were out of blast by 1866, the company concentrating on coal extraction before being wound up completely in 1870. There were further unsuccessful attempts to modernise the furnaces at Hirwaun in the early 1880s but little iron was produced and the site concentrated on foundry work (Ince, 35).

C.2.4 The establishment of the Hirwaun Ironworks highlighted the poor communications in the area. Until 1770 transport had been entirely by pack-horse but in that year Anthony Bacon, then ironmaster at Cyfarthfa, made a road from Merthyr to Cardiff (Greening, n.d., 29). In 1794 the Merthyr ironmasters improved their route to the sea with the opening of the Glamorgan Canal to Cardiff, whilst communications in the west were improved with the final completion of the Neath Canal in 1799 (Gladwin, 1991, 16&34). In 1793 an Act was granted for the construction of the Aberdare Canal from the Glamorgan Canal at Abercynon to Aberdare, with a tramroad extension to Hirwaun and Penderyn. Only parts of the tramroad itself were built at first, completion of the canal waiting until 1812 (Needham, 1998, 105 : Gladwin, 7-11&57). The impetus to finish the canal had come from John Scales of Handworth, Birmingham, co-proprietor with Samuel Homfray (of Penydarren fame) of the Aberdare Iron Company (Gladwin, 9). This had been established in 1799-1800 (1799 is the date given by Dafydd Morganwg) to construct an ironworks at Llwydcoed, Aberdare, consisting of two water-blown furnaces 40ft high (Ince, 35). Dafydd Morganwg (p.198) states that the first of these was put into blast on the 26th July 1801 and the ironworks was clearly in production by 1805 as it is recorded as producing 3,586 tons of iron that year (Ince, 1993, 36).

C.2.5 The Aberdare Ironworks was immediately followed by a three-furnace ironworks at Abernant, Aberdare, built to exploit iron ore deposits at Cwm Dare. It was built 1801-7 (1800 according to Dafydd Morganwg) by James Birch (a former manager of the Penydarren Ironworks) and Jeremiah Homfray. Clearly dissatisfied with the tardiness of the canal company in completing their line, in 1802 Homfray and Birch enlisted four further partners in the ironworks. These partners were all from the banking family of Tappenden from Faversham, Kent. The Tappendens finally connected Aberdare to the outside world in 1804 by constructing a tramroad from Abernant to the Neath Canal at Glyn Neath, via Hirwaun (Evans, 1973, 4). Birch and Homfray built a manufactory to produce engines to Trevithick's patents at Abernant (Ince, 36) but continuous losses and disagreements with the Tappendens over transport rates led to the closure of the ironworks in 1815 and the dissolution of the partnership. In 1819 the Abernant works was sold to John Scales and Rowland Fothergill, then partners in the Aberdare Ironworks, and the two plants thenceforth were operated as one unit (Ince, 36).

C.2.6 The combined operation continued to be successful, operating a combined total of six furnaces at the two sites by 1823 with seven blowing engines in 1837. Further investment continued after 1846, when the two ironworks were sold to a new company headed by Thomas and Rowland Fothergill (Ince, 35-39). Despite Dafydd Morganwg's (p.198) and Llewelen's (p.46) claims that Abernant Forge was built in 1823, it appears that neither works had produced wrought iron in any quantity prior to the latter 1840s (Ince, 35-39). The Fothergills invested heavily in both works and seventy-eight puddling furnaces were eventually built at Abernant, together with very substantial forges and plate and rail mills both there and at Treforest. Unlike the works at Hirwaun the two sites at Aberdare appear to have been highly successful in the mid-nineteenth century (Ince, 35-39). They were employing 4,000 workers in 1876 (Dafydd Morganwg, 198) and, using London capital the enterprise succeeded in purchasing the Plymouth and Penydarren ironworks in Merthyr in 1863 and 1865 respectively (Riden & Owen, 1995,22-23). The collapse of the wrought iron rail trade, together with problems detailed above and common to other South Wales ironworks, led to the sudden and permanent closure of Fothergill's many ironworks in 1874[6], among them the two at Aberdare (Riden & Owen, 1, 2, 22 & 23; Ince, 35-39).

C.2.7 The Gadlys works were established in 1827 and in 1837 the Gadlys company sunk a shaft to the famous 'four-foot seam' and successfully pioneered the South Wales steam coal trade (detailed below). The final iron-making site within the Cynon Valley was developed following the purchase of the rich mineral estate of Aberaman in 1837 by Crawshay Bailey, the important and highly successful South Wales iron master, owner of the large Nantyglo and Beaufort ironworks. In 1845 he constructed two furnaces at Aberaman (Ince, 41 & Riden & Owen, 1). The timing and location of this venture were clearly influenced by the opening up of the Cynon valley to the steam railway as the same year saw the opening of the Aberdare

[6] Penydarren, closed in 1858 had briefly been revived in 1864, but it appears not to have been purchased by the Fothergills as a going concern. It was never reopened.

branch of the Taff Vale Railway as well as the building of the Aberdare Railway (promoted by Crawshay Bailey and Sir John Guest), the latter connecting Aberaman and several new pits to Aberdare Junction (Simmons & Biddle, 1997, 499 and Awdrey, 1990, 13). The following year saw the authorisation of the broad gauge Vale of Neath Railway, a branch of which terminated at Aberdare (Awdrey, 49), and the stage was then set for the boom in the coal trade[7] as well as the final flourish of the Cynon iron industry. The Aberaman Ironworks was clearly a highly capitalised venture as a beam blowing engine with a 122" cylinder testifies. The furnaces remained in full production (apart from an interruption during 1854), until 1866 when the ironworks closed. Although at the time this ironworks closed it consisted of four relatively modern furnaces, seventeen puddling furnaces, a small forge and a mill, the ironworks never reopened. The estate and works were purchased in 1867 by the Powell Duffryn Steam Coal Company for the purposes of exploiting the minerals from beneath the estate (Ince, 40-41).

C.2.8 Iron-making was clearly of enormous importance in opening up the Cynon Valley to industrialisation in the latter half of the 18th century and the first half of the nineteenth century. Whilst, like Maesteg, Aberdare developed into a prosperous iron-making centre, it should be recognised that individually the ironworks were small when compared with those of the great iron-making metropolis of Merthyr Tydfil, 4 miles to the north-east. The total iron production in 1846 of Gadlys and the two sites of the Aberdare Iron Company was 19,175 tons, little more than one-tenth of the combined production of the four giant ironworks at Merthyr, namely Dowlais, Cyfarthfa, Plymouth, and Penydarren (Grant, 6). It is also useful to note that at this date Gadlys was small even in relation to its Cynon Valley neighbours. In 1852 the 6 furnaces of the Aberdare Company (3 each at Llwydcoed and Abernant) had an output of 900 tons of iron per week compared to 351 tons at Aberaman (3 furnaces) and 95 tons from one furnace in blast at Gadlys (Thomas, 1943, 44). Whilst considerable investment at Gadlys in 1855-6 laterly improved its relative position, the Cynon ironworks were always dwarfed by their near neighbours at Merthyr, in terms of size and complexity. They were nevertheless very typical of the majority of Welsh ironworks elsewhere in the coalfield and at Aberdare the ironworks were clustered into an unusually compact group.

C.3 Gadlys Ironworks (1827-1876)

C.3.1 Gadlys Ironworks is recorded as having been established in 1827, and it was thus a relatively late addition to the ironworks of the Aberdare area. It was thus conceived at the start of the short boom which occurred in the industry after the slump at the end of the Napoleonic Wars. It was located close to the centre of Aberdare, on the north side of the town, and within a mile of both the existing Abernant and Aberdare ironworks. The partners were George Rowland Morgan, Edward Morgan Williams and, the most important historically, Matthew Wayne (c.1780-1853). Wayne had been Richard Crawshay's furnace manager at Cyfarthfa and Crawshay thought so highly of him that he left him £800 upon his death in 1810. Using this endowment Wayne had become Joseph Bailey's partner in leasing the lucrative Nant-y-glo Ironworks, which enabled Wayne to considerably enlarge his personal wealth. Wayne retired from the partnership with Bailey c.1820 and in 1827 he used his experience and capital to co-found the Gadlys works (Davies, 1959, 1015).

C.3.2 Gadlys was unlike the other ironworks within the Cynon Valley, and most within south Wales, in that two (Morgan and Williams) of the three co-partners were local men from within the valley, with the works located on the land of several small adjacent farms, owned by each partner. Among the farms was Y Gadlys, owned by Morgan from which the new company (The Gadlys Iron Company) took its name. The co-founders mutually leased to each other the mineral rights in July 1826 and each partner agreed to subscribe a basic capital of £16,000 in equal proportions. Agreements were made for a supply of limestone from quarries at Penderyn as well as for the cutting of a 600 yard leat from the river Cynon and the construction of 650 yards of tramroad to link the works to the Aberdare Canal. Coal was sourced

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[7] The boom in the coal trade in this period was outlined by Dafydd Morganwg (p.194-5) in 1876. Dates given by him for the early steam coal pits are:- 1837 - Abernant-y-Groes, Cwmbach (T.&W.Wayne); 1840 - Dyffryn Colliery, Cwmbach (T.Powell); 1843 - Lletty Shenkin pit (T.Powell), Ynys Cynon Colliery (D. Williams), Blaengarw Colliery (D.Davies), 1844 – unnamed pit near that of the Waynes *'yn agos I eiddo T & W Wayne'* (T.Powell), Aberaman pit (C.Bailey), Werfa pit (Nixon), Gadlys Old Pit - *'Hen Bwll'* (T.&W.Wayne); c.1845 - Cwmaman Colliery (Shepperd & Evans); 1849 - Sgubor Wen (T.Joseph & S.Thomas); 1850 – Duffryn Deep Colliery (D.Williams), 2 pits at Cwmpenar (T.Powell); 1851-3 – 3 pits at Cwmdar (T.Powell) (D.Williams) (T.Joseph & F.Thomas), Fforch Aman Coilliery (J.Brown), Cwmneol (not stated); 1858 – Abercwmboy Colliery (D.Davies); 1864 – Bedwlwyn Colliery, Cwmaman; 1870 Fforch Neol (D.Bevan).

from the immediate vicinity (from Cae Cwm according to Greening, 30), iron stone from sources 1.5 miles from the works (Greening (p.30) states from the Dyllas area of Llwydcoed) whilst a lease for coal and other minerals was taken out from a neighboring farm called 'the Crom' (Davies, 94). The area of mineral leases was estimated at some 350 acres, at least part of which was leased from the Marquis of Bute (Lloyd, 1906, 127). The 1847 Tithe map confirms that the land on which Gadlys stood was owned by George Rowland Morgan while also showing that Matthew Wayne and Edward Morgan Williams both owned land further to the north, close to the Aberdare Ironworks.

C.3.3 The Gadlys works did not enjoy a smooth and profitable first few years of existence, perhaps due to what Phillips considers Wayne's "plodding, old fashioned way, carryng on his works only when times were good in the iron trade and putting out the furnaces when business was bad". Having produced 414 tons of iron in 1828 and 559 tons in 1829 production appears to have been suspended for the following three years (Greening) and the works were put up for sale in 1835. The early problems are perhaps alluded to in the sales particulars (Fig. A1) which state that the works are now "in full operation" and that the healthy state of the iron trade was "fast making up lee-way for unprofitable and by gone days".

C.3.4 Although the ironworks was relatively modest in size, initially only consisting of a single furnace, the sales particulars provide a good indication of the number of elements to the site. Apart from the blast furnace the ironworks is advertised as containing a cast house, a stove room, a turning room, refinery, cupola, smith's shop, weighing machine, three calcining kilns, bridge house, carpenter's shop and coal mine together with various machines and wagons. The "powerful steam engine" is also prominently referred to "calculated to blow a furnace and a refinery".

C.3.5 Among the other useful information provided by the document is that the iron ore principally used at this time was extracted from within a mile and a half from the site, limestone was from a site 5 miles away and that the public tram road linked the site to the Cardiff and Aberdare Canal, providing an easy route for the iron to port. It also documents that between 130 and 150 people were employed at the site and that it was capable of producing up to 2000 tons of iron annually. The document makes it clear that Gadlys only produced cast-iron at this date, albeit cast iron of unusual quality. The document refers to Gadlys iron "being much esteemed and particularly adapted for strong Castings and Engine purposes". These large castings were made "at once from the furnace" which was possibly a speciality of the works rather than running all their iron into pigs before separately remelting them and casting them into moulds in the foundry. It is recorded that later one of Mathew Wayne's orders was from the French Government, for 500 tons of No.1 cold blast iron, for making guns, some of which were used in the Crimea (Thomas, 1943, 41).

C.3.6 The attempted sale of the works appears to have failed and Gadlys remained in the ownership of a company headed by Matthew Wayne until his death in 1853 assisted from about the time of the sale by his sons, notably Thomas Wayne, who eventually succeeded him. Production seems to have picked up following the attempted sale and in 1836 1291 tons of iron was sent to Cardiff by canal. The Wayne's fortunes took a turn for the better in 1837 when Thomas Wayne persuaded his father and brother William to form a partnership with the David family of Abernant-y-groes, Cwmbach, to found Wayne's Merthyr-Aberdare Steam Coal Company. The intention was to sink a pit at Cwmbach, 1.5 miles S.E. of Gadlys, for the 'four-foot seam' lately reached by Lucy Thomas of Waun-wyllt, Merthyr. The Waynes successfully exhibited their coal at London in the December of that year and Mathew and Thomas Wayne are rightly considered to be the first true pioneers of the Welsh steam coal trade which became known throughout the world and which doubtless provided the Gadlys works with an important boost after the attempted sale of the works. Thus by 1839 the Waynes were dispatching 1,081 ton of iron to Cardiff as well as 3,375 tons of coal from their pits at Pwll Newydd and Graig and the new pit at Cwm-bach. In 1845 they raised 38,000 tons from Cwm-bach and the following year 48,000 tons (Davies, 1015). Gadlys nevertheless remained a small-scale ironworks concern through the 1830s and 1840s and despite the success of the Aberdare/Abernant concern, the Tithe map of 1847 (Figs. 2 & 4) still shows Aberdare as a village of approximately 100 houses set amongst arable fields and meadows. Gadlys ironworks appears as a group of four somewhat schematic buildings (apparently Nos.1 & 2 furnaces & casting houses, 1 blowing-engine house and stables), with tramways radiating to the N.W. (apparently towards ironstone patches above Robertstown and Abernant) and to the N.E. (towards a junction with both the Aberdare & Hirwaun Tramroad and the new Taff Vale Railway). A road and possible tramway is shown running to the S.W. to Gadlys Old Pit. Accommodation for key workers appears to have been provided at this date by four terraces on Gadlys Street supplemented by another on Old Hirwaun Road.

A polite house with landscaped gardens at Gadlys Isha (company offices by 1867 and more recently a school) may have been the Wayne's house.

C.3.7 Despite the failure of the sale investment in the works increased in the following years with a second blast furnace added between 1839 and 1841, although it appears not to have come into blast until between 1849 and 1854 (Riden, 1995, 16). A 24" beam engine was supplied to Gadlys in 1845, together with a 12" engine in 1847 and a 30" cylinder engine in 1850, all from the Neath Abbey Iron Company (Ince 1993 41). A drawing also exists (Fig. A2) showing that Neath Abbey supplied Gadlys with a 45" steam and 104" blowing engine in August 1857. Unusually the beam engine is shown with a flywheel attached.

C.3.8 A further investment began in 1850 with the construction of a mill making blades for the 'Alcan' works (Dafydd Morganwg, 193). It is unclear if this was additional to, or the same as, a new tin mill built the same year at Gadlys, but it is clear that the company had started to concentrate on production of tin plate bars and ductile armour iron using a cold blast within the furnace (Ince, 40). The armour plate iron became the distinctive product of Gadlys in contrast to the manufacture of iron rails which so dominated much of the South Wales iron industry (OAU/Riden, 4). A further two blast furnaces had been constructed by 1856, bringing the total to four although there were only two in blast until 1859 and three in blast until 1862 (Riden, 16). Production further diversified in the 1860s with the construction in 1861 of a small rail mill allowing the rolling of merchant bars or rails. By 1872 the works operated fifteen puddling furnaces and two rolling mills (Ince, 40)

C.3.9 The Ordnance Survey's 1st edition map of 1868 was produced when Gadlys Ironworks was approaching its maximum extent. The map clearly locates the four blast furnaces with casting houses to the front of them. Two blowing engine houses are shown, the original of 1827 (with hot blast stove) lying to the north-west of the blast furnaces, with that of 1857 (the surviving engine house) to the south-east. The later engine house was clearly located with further expansion in mind as it is located some 40 m from the closest furnace, allowing for a further three furnaces to have been constructed had demand allowed it. Above the furnace bank was located a large coke yard (possibly laid out to allow open-air coke-making) as well as four mine kilns (for roasting or calcining the raw iron ore), a small bank of eighteen coke ovens and two lime kilns. The layout of the works below the furnace bank shows a small but well-equipped integrated ironworks, clearly specialising in high-quality iron. Thus, the plan not only shows the usual facilities for a normal integrated works (a further bank of coking ovens, together with stables, smith's shop, engine houses, fourteen puddling furnaces, a foundry with cupola furnace for ordinary secondary casting, four balling furnaces and a forge with rolling mills (trains) for puddled bars), but it also shows air furnaces for high-quality castings, a very large fitting (machining) shop, three refineries, twelve charcoal hearths, six hammermen's furnaces and rolling mills for rolling both high-quality merchant bars and the sheet iron needed for tin-plate. The lower site was completed by a large charcoal yard for storing the expensive pure fuel needed for the processing of the premium grades of iron. The plan appears to indicate that the two blast furnaces to the north-west (Nos.1 and2) were blown with hot blast, whereas the two to the south-east (Nos. 3 and 4) were supplied with cold blast, thought to produce stronger iron. The site was fed at the upper level by a tramway directly to the Gadlys pits whilst sidings at the lower level allowed trams as well as both broad gauge and standard gauge wagons to be handled. An mixed gauge incline, with steam engine and drum, connected the upper and lower level. The recently-opened tinning works (closed 1941) is shown on a separate site slightly to the north. The provision of company-provided housing had clearly expanded through the 1850s and 1860s and new terraces are shown comprising Gadlys Street, Wayne Street and Ann Street close to the ironworks, with Gadlys Terrace provided by the Gadlys pits. Aberdare Park had also been laid out by this time to the north-west of Gadlys ironworks.

C.3.10 A further indication of how the works had expanded from its early years is provided by the fact that Gadlys employed c2000 men in 1874 (Dafydd Morganwg, 193; Thomas, 41) compared to the 130 to 150 people employed in 1835 (sales particulars). Perhaps a number of these men had been previously employed within the other ironworks within the Cynon Valley because by the early 1870s the other local works had all closed down or concentrated on foundry work and it was not long before Gadlys similarly succumbed to the prevailing conditions of the world iron trade. The difficulties and uncertainty in the industry during this period is reflected in the gradual reduction in the number of furnaces in blast at Gadlys. All 4 furnaces were operating in the years 1862 to 1866 but the number then oscillated between 2 and 3 before stabilising at two in blast from 1870 and 1874 (Riden, 16). Dafydd Morganwg (p.193) claimed in 1876 that the Waynes sold Gadlys to Messrs. Bird and associates in 1872, although no change in owning company name is recorded (Riden & Owen, 16). Following a suspension in production in

1875 a single furnace was put back into blast in 1876 but this was presumably unsuccessful and production of iron was abandoned in this year. Production statistics (nil) continued to be submitted until 1885 (Riden & Owen, 16), presumably in the vain hope that iron production might resume. These hopes were never to be fulfilled.

C.4 Gadlys Ironworks Since Closure (1876 to date)

C.4.1 Following the close of iron production, the Gadlys site appears to have remained in use as an adjunct to the Wayne company's coal and tinplate interests. By 1897 much of the site had been redeveloped, a brickworks being built in new buildings on the site of the demolished former rolling mill, whilst the casting houses had been demolished and replaced with a wagon works building on a similar footprint but extending about five metres further to the north-east. Several of the structures from the ironworks survived including both engine houses, the fitting shop, the stables, the workshops and offices (OS 2nd ed. 1:10560, revised 1898).

C.4.2 In 1913 Aberdare U.D.C. opened the first two miles of its 5¾ mile tramway network (Bett & Gillham, 1962, 90-91). A tram depot was erected at the south of the site on the site of former slag tips and a refuse dustructor was built immediately to the south-east of the bank of blast furnaces. The destructor burned domestic refuse and the heat generated was used to generate electricity which not only powered the trams but a 1½ mile trolleybus route to Abernant, opened 1914 (Bett & Gillham, 91). According to Evans, one of the blast furnaces was converted into a rubbish incinerator and the heat used to generate power (Evans, n.d., 9). This 'green' solution to the sanitary disposal of domestic waste was pioneered in the U.K. at the turn of the century and there was a time when virtually every town had its destructor. Most were life expired by the 1940s and were gradually closed as landfill became the preferred means of disposal (ETSU, 1990). By 1914 the ironworks stables had been demolished and the wagon works closed although the brickworks remained in production, now with a distinctive oval-shaped Hoffman brick kiln. (OS 3rd ed. 1:10560, revised 1914). The municipal electric tramway was abandoned in 1935 (Bett & Gillham, 91), with the tram sheds becoming an omnibus depot.

C.4.3 By 1949-50 the brick works had been closed and partially demolished, along with the ironworks fitting shop workshops, office, and the 1827 blowing-engine house. The destructor and power house and tram sheds remained in use, the latter still a bus depot. (OS Prov. ed., revised 1949-50). Some new building had taken place by this date, principally on the site of the fitting shops, and the site latterly passed into multiple usages including Red and White garages, Co-operaive Garages and U.D.C. Transport Dept. The 1857 engine house was used for a canteen and Scout HQ (Evans n.d.). Further buildings had been added by 1958-62, by which time the power house was no longer generating electricity. In 1989 the remains of the blast furnaces were scheduled as Ancient Monuments under the Ancient Monuments and Archaeological Areas Act 1979, while the 1857 blowing-engine house and wagon works building (or "casting house") were both listed (Grade II) as buildings of special architectural or historic interest (see details in appendix B). In 1993 much of the site was purchased by Tesco Stores Ltd for a new supermarket. Most of the remaining buildings were removed, leaving only the blast furnaces, the 1857 blowing-engine house, the wagon works building and the power house. These latter have remained in Council ownership and shortly before the demise of Mid Glamorgan County Council, the engine house and power house were converted to offices. The destructor house was demolished and replaced with a near replica which is also used as offices. The wagon works was converted for use as a museum however, because of the local government reorganisation, the opening of this museum has been delayed until now. Regrettably, apart from a small archaeological evaluation carried out by OAU for Tescos, no archaeological recording work was carried out during any part of these works.

APPENDIX D

GADLYS IRONWORKS, ABERDARE

IN ITS REGIONAL AND NATIONAL CONTEXT

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(This report was prepared for the Oxford Archaeological Unit as part of their assessment of the site of Gadlys Ironworks, Aberdare, Mid Glamorgan, for Tesco Stores Ltd. This part of the report was prepared for OAU by Philip Riden, then of the Extra-Mural Department of the University, in order to to set Gadlys in its wider regional and national context).

D.1 The Rise and Fall of the South Wales Iron Industry

D.1.1 Iron has been made in South Wales since prehistoric times. Since the 1560s the ore, whether locally mined or imported, has been smelted in blast furnaces, which replaced bloomeries in the region during the second half of the sixteenth century. Until about 1760 charcoal was used exclusively as the fuel in South Wales blast furnaces, which were blown entirely by water-power. Between then and about 1790 charcoal blast furnaces were largely superseded, in South Wales as elsewhere, by coke-fired furnaces, although until the 1790s the water-wheel, coupled either to traditional leather bellows or cast-iron cylinders, remained the universal method of blowing. Although charcoal blast furnaces survived in South Wales until the 1820s, their output ceased to be significant in a regional, much less national, context, a generation earlier.

D.1.2 In the 1790s a second technological revolution took place in the South Wales iron industry, as a coke-fired refining process for converting pig into bar iron ('puddling') replaced both the traditional, charcoal-fired, finery-chafery method and also the potting and stamping method, in which coal or coke could be used. Puddling was adopted very extensively in South Wales, creating a demand for pig iron which was met by the building of large numbers of new blast furnaces, mostly now steam-blown. Thus was inaugurated the heyday of the South Wales iron industry, the period between about 1790 and 1830 when the region was responsible for about a third of all the iron made in Britain and was the largest single iron-producing area in the country. Until the second half of the eighteenth century, South Wales accounted for about 10 per cent of national output.

D.1.3 Like the industry as a whole, the ironworks of South Wales expanded particularly rapidly during the period of sustained economic growth, underpinned to some extent by military demand, of the Revolutionary and Napoleonic Wars of 1793-1815. The region shared in the slump after 1815 and in the wave of renewed growth in the industry of the mid-1820s.

D.1.4 New ironworks were also established in South Wales during the boom of the mid 1830s but from 1830 onwards the region's relative importance began to decline.' Initially, this was mainly a consequence of the rise of the Scottish iron industry, followed, after 1850, by competition from the Cleveland district of North East England, but by the 1850s weaknesses within the region itself were apparent. Easily accessible local ironstone was becoming exhausted and it was expensive to bring supplies from elsewhere to remote locations at the heads of the South Wales valleys, where the works themselves were often poorly laid out on cramped sites. As the ninety-nine-year mineral leases under which the earliest works had been established expired, it often proved uneconomic for the lessees to seek a renewal and, from the 1850s, blast furnaces began to close in South Wales.

D.1.5 The region was still a sufficiently important element in the industry to share in the boom of the early 1870s but then suffered very badly in the contraction which followed. Only about a dozen of the older works survived to be rebuilt for steelmaking in the 1880s, joined towards the end of the century by a handful of new works established at coastal locations to smelt imported ore using locally produced coke. By the turn of the century South Wales was once again responsible for no more than 10 per cent of the output of the British iron industry.

D.1.6 Further closures followed both before the First World War and in the Depression of the 1920s and 1930s, although the major cause of distress in South Wales during the inter-war period was the decline of the

coal industry, which had long been by far the more important employer. Steelmaking was re-established at Ebbw Vale in the 1930s, partly in an attempt to reduce unemployment, and the GKN Cardiff works was rebuilt in the same period. In the 1950s the South Wales steel industry enjoyed something of an Indian summer, with existing plant supplemented by a new works at Llanwern, near Newport. The latter, together with Port Talbot in the west of the region, remains in use today, so that South Wales can still boast two of the four surviving blast furnace plants in Britain.

D.2 The Archaeological Legacy

D.2.1 Throughout the period since the sixteenth century, the plant found at ironworks has not varied greatly in character between different regions, although in the early nineteenth century South Wales ironworks tended to be rather larger than those elsewhere. The survival (or not) of structures and landscapes associated with the industry in any particular part of the country therefore depends less on any characteristic of the works during their period of operation, than on the history of the sites themselves, and the region as a whole, after the works closed down. It is mainly because of variations in this respect that some regions are today much better endowed with visible remains than others.

D.2.2 For the period prior to the adoption of coke-smelting (c. 1560-1760) South Wales cannot claim any sites of outstanding national importance, except perhaps on the eastern edge of the region, on the Monmouthshire side of the Wye Valley. Here the three furnaces of which there are substantial remains (Coed Ithel, Tintem and Trellech) should really be treated as part of the neighbouring Forest of Dean iron industry, since they smelted Forest haematite, rather than Coal Measures ironstone. As with sites in the Forest itself, those in eastern Monmouthshire owe their survival largely to the failure of the iron industry in this region to make the transition from charcoal to coke-smelting (since Dean coal is unsuitable for coking) and to the absence of any other kind of industrial growth which, might have obliterated all trace of these furnaces. It is mainly for these reasons that important remains survive in such picturesque surroundings in this region today.

D.2.3 In the South Wales coalfield itself, where furnaces were built to exploit Coal Measures ironstone, rather less survives from the charcoal blast furnace period. Although only a few sites of this sort were taken over for coke-fired furnaces, others were more or less completely destroyed as a result of large-scale coal and ironstone by nineteenth-century iron companies, who also recovered a good deal of slag from early furnaces, which was sufficiently rich in iron to warrant re-smelting. Older furnaces might also be covered by the slag heaps of the much larger modem works in the same vicinity, so that surviving remains tend to be in remote locations and to consist, on the surface at least, of small amounts of walling, earthworks, watercourses and similar features of interest only to the specialist, rather than the general visitor. The South Wales coalfield has nothing to compare with Dyfi (nr Machynlleth) or Duddon in Cumbria or Bonawe in Scotland. Apart from the trio of sites in the Wye Valley, the only other furnace worth mentioning is perhaps that at Carmarthen, which survives largely intact and, indeed, largely unrecognised.

D.2.4 On the other hand, there were over 20 blast furnaces in South Wales during the final phase of charcoal ironsmelting (1660-1790), and, although the best preserved sites are on the edge of the region, they nonetheless form part of what is in total a very rich body of material. One of the reasons why South Wales is so important for the archaeology of the British iron industry is the sheer quantity of sites within a limited area, spanning such a long period. Other regions may have more impressive individual sites from a particular phase in the industry's history, such as the three guardianship eighteenth-century charcoal blast furnaces already mentioned, or may have a concentration of sites from one period, such as the early coke-fired furnaces of east Shropshire, but only South Wales has such a large number of furnace sites dating from the sixteenth century to the early nineteenth. The charcoal blast furnace sites, although less impressive than some elsewhere, are important as part of this overall assemblage and it is important that no further damage should occur to any of them.

D.2.5 If the position of South Wales as one of the more important elements in the early eighteenth-century charcoal iron industry has perhaps been underestimated in the past, the same cannot be said of the years between about 1760 and 1830, especially the second half of that period. The works established at the heads of the valleys which dissect the coalfield, from Hirwaun in the west to Blaenavon in the east, were amongst the largest and most famous of their day, attracting artists and writers who have left innumerable images and accounts of the South Wales iron industry in its heyday.

D.2.6 There is also a very important archaeological legacy of this period, far more substantial than in any other ironmaking region of Britain. This is partly a reflection of the sheer number of works concentrated in a comparatively small area and of the extensive scale on which the largest operated, but it is also in part a function of the subsequent history of the region. When the ironworks of South Wales began to close, slowly from about 1850, very rapidly in the 1870s and 1880s, their sites were mostly simply abandoned. This is in marked contrast with the position in the Black Country of South Staffordshire and Worcestershire, which actually had more blast furnace plants than South Wales during the first half of the nineteenth century, producing in total nearly as much pig iron, but where today virtually nothing survives of the industry. In the much more heavily industrialised Black Country, disused blast furnace sites were typically either cleared for re-use or the furnaces themselves were dismantled and rest of the works remained in use as a foundry or engineering plant.

D.2.7 In South Wales, as the iron industry declined, its place was taken in the regional economy by the coal trade; indeed, a number of iron companies switched their resources from one industry to the other during the third quarter of the nineteenth century. In general, coal companies had no use for disused ironworks, although they were happy to take over their mineral leases and, in a few cases, by-product plants or office buildings. There was never an engineering industry of any importance in South Wales, except on a limited scale on the coast, and most iron always left the region semi-finished for further working-up elsewhere. Ironworks therefore did not evolve into engineering works, as they did in the Midlands. Nor was there any pressure to clear sites to make way for new building. The valley-top communities called into existence by the ironworks declined after the furnaces shut, sustained only in part by the collieries, whose arrival led to the building of new settlements lower down the valleys. The vast areas rendered derelict by the ironworks during the first half of the nineteenth century, with furnaces and other structures left ruinous amid spoil and slag heaps, were simply abandoned and nature allowed slowly to regain the upper hand. Almost the only exception to this was the robbing of ashlar which is known to have taken place on several sites, either for house-building or, in at least two cases, the construction of churches.

D.2.8 This situation changed very little between the late nineteenth century and the 1960s, when a start was finally made on the immense task of clearing away the dereliction and pollution left by both the iron and steel industry and the coal industry and also, in the west of the region, by the tinplate and non-ferrous metal industries. Although this work began at a time when interest in the archaeology of the Industrial Revolution was also growing, such was the political determination in South Wales to sweep away all trace of a past remembered with great bitterness by those then in authority that little attention was paid for many years to suggestions that sites should be conserved rather than destroyed.

D.2.9 Despite the losses of the 1960s and 1970s, a considerable number of blast furnace sites have survived, sufficient, as we have seen, to leave South Wales with far more remains of this type than any other region of Britain. It now seems improbable that any of the surviving sites will be destroyed, nor does it seem likely that hitherto unknown sites will come to light, although it is by no means the case that adequate records have been made of all the sites that have been identified. On the other hand, it now possible to draw some general conclusions concerning what does survive and thus place individual sites within a regional context.

D.2.10 As in other parts of the country, most coke-fired blast furnace remains in South Wales date from the very late eighteenth century or the first thirty or forty years of the nineteenth. No trace appears to survive of the earliest coke-fired furnaces established in the 1750s and 1760s, since all the works in question were rebuilt and enlarged during their lifetime, in some cases several times over. Thus, although there are impressive remains at both Hirwaun (established in 1757) and Cyfarthfa (1763), these appear to post-date the foundation of the works by some years. By contrast, at the smaller Neath Abbey and Clydach works, a good deal of what one can see on the site today dates from the establishment of the works in the early 1790s. The same is true of Blaenavon, founded in 1789.

D.2.11 Other remains mostly date from one of three periods: the war-time expansion of the industry between about 1790 and 1810, the revival of the second half of the 1820s, and the boom of the late 1830s. The construction of new blast furnaces did not, of course, cease in South Wales after 1840: a handful of new works were established after this date and there was a good deal of renewal of plant at existing sites down to the 1870s. But from about 1840 the traditional stone-built blast furnace, whose basic shape had changed little since the seventeenth century, gave way to an ironbound brick structure which, although more efficient, was far less permanent. When ironworks were abandoned in the late

nineteenth century, the older masonry furnaces were generally left slowly to decay; the process might be accelerated by the removal of ashlar but few appear to have been systematically demolished. Mid-nineteenth century ironbound furnaces, on the other hand, simply collapsed once the ironwork was removed for salvage, as it normally appears to have been. Thus neither in South Wales nor any other region does any blast furnace later than about 1840 survive in a recognisable state (except, of course, for those which are still in use or mothballed against possible re-commissioning).

D.2.12 South Wales undoubtedly has by far the largest number of well-preserved blast furnaces dating from the final years of the traditional masonry structure, including those at Hirwaun, where all the visible remains seem to date from a rebuilding in the 1820s, and the isolated furnace at Cefn Cribwr, near Bridgend, where the same appears to be true. Amongst sites newly established in this period, there are well preserved furnaces at Maesteg, also near Bridgend, and at Banwen, on the anthracite coalfield of north-west Glamorgan. This, of course, is also the period which saw the establishment of Gadlys Ironworks at Aberdare.

D.3 The Importance of the remains at Gadlys

D.3.1 So far the discussion has been in general terms, with no detailed reference to what can be seen at Gadlys itself or how the site compares with others in South Wales. Before turning to this, it is worth stressing again that the importance of the blast furnace sites in South Wales lies partly in the sheer number of sites to be found within a limited area and it is therefore highly undesirable that any site, even if the features to be seen there are no in themselves especially remarkable, should be damaged or destroyed. For this reason alone, therefore, the remains at Gadlys warrant retention.

D.3.2 There are, however, several other reasons which can be adduced in support not merely of the retention of the structures at Gadlys but their conservation and re-use.

D.3.3 Firstly, the Gadlys site is relatively complete. The remains visible there today (leaving aside any other structures which might be located by excavation) include four blast furnaces, the furnace bank, a casting-house, the later of two blowing-engine houses and part of a bank of kilns. This is a far better range of features than can be found (or might be found, after considerable excavation) on other sites in South Wales, and makes it possible to illustrate most of the processes which originally took place there.

D.3.4 Secondly, the structures at Gadlys are relatively well preserved. After the closure of the ironworks, the site passed into the ownership of Aberdare Urban District Council and became the depot for their transport undertaking. The only major alteration affecting the ironworks buildings until recent years was the erection of a destructor house, which once contained plant for converting heat generated by domestic waste collected by the local authority into electricity to power their street tramways. Otherwise, occupation by the council actually facilitated the preservation of the buildings, notably the casting-house and one of the blowing-engine houses. Although two other engine-houses at South Wales ironworks (at Ynysfach and Maesteg) have been rehabilitated and re-used, as has that at Gadlys, nowhere in the region is it possible to find a casting-house still standing to eaves height with its roof on. Thus not only are structures such as the furnaces and kilns sufficiently well preserved to make them easy to interpret to non-specialist visitors, but Gadlys has the great merit of possessing a building (the casting-house) which is still in good enough condition to be used as an indoor interpretation area for the whole site, and indeed for the industrial history of the Cynon valley generally.

D.3.5 This point is perhaps worth emphasising, since it makes Gadlys a much more realistic candidate for extensive conservation than some ironworks sites in South Wales, where all the surviving structures are ruinous. Hirwaun, higher up the Cynon valley, well illustrates this problem. This is a site of considerable historical interest, occupying a large area, but to make it meaningful to the ordinary visitor would entail large-scale excavation, which at the end of the day would still leave one merely with consolidated ruins. The same is true of the much smaller Cefn Cribwr site, which has been excavated over the last twelve months but where there is no scope for creating an indoor display area. Even at Blaenavon, which has been adopted as a guardianship site with extensive interpretation, the actual ironworks is largely ruinous and nearby workers' housing has been used for indoor displays.

D.3.6 A related point is that Gadlys is not only relatively well preserved but also fairly compact. Although not as small as, say, Cefn Cribwr, Gadlys was not a large ironworks by South Wales standards, nor, since it

stood close to an existing settlement, did it spread over a very great area. Both the conservation and interpretation of the remains therefore presents fewer practical problems than in the case of the very large Heads of the Valleys sites, such as Hirwaun, Cyfarthfa or Blaenavon, where the complete clearance and consolidation of the remains will, in each case, be an enormously expensive operation, as will their subsequent upkeep.

D.3.7 The proximity of Gadlys Ironworks to the centre of Aberdare, already by the 1820s a rapidly growing market town serving the Cynon valley, is itself slightly unusual in a South Wales context, where ironworks tended to be isolated from all but immediately adjacent workers' housing. This aspect of the site arguably strengthens the case for retaining and conserving the remains, since they are readily accessible to both residents of Aberdare and visitors, and, if suitably interpreted, would add to the limited range of tourist attractions in the town.

D.3.8 Gadlys is therefore a relatively well preserved, compact example of a South Wales ironworks of the 1820s, the remains of which are worth preserving and interpreting both on academic grounds and as a tourist attraction. What of their wider significance?

D.3.9 During the first half of the nineteenth century, Gadlys was one of about half a dozen ironworks operating in the Cynon valley between Hirwaun in the north and Aberaman in the south. Only at Hirwaun and Gadlys are there any visible remains to be seen of this phase of the valley's history. Clearly, both sites merit retention and development, but, as already suggested, Gadlys is arguably the better candidate for full-scale conservation and interpretation. It is better preserved, more compact, closer to the main centre of population in the valley and, although of less historical interest than Hirwaun, a far more realistic proposition than the latter site, whose clearance and interpretation, much less subsequent maintenance, would be enormously expensive. Gadlys, with its well-preserved structures, is not only easier to interpret to the general visitor than Hirwaun, but, with its surviving casting-house, offers the ideal location for a museum devoted to the industrial history of the Cynon valley, which Hirwaun does not.

D.3.10 Gadlys also merits conservation in a sub-regional context, since it is an important element in a group of sites divided between the Taff and Cynon valleys. Although Merthyr Tydfil remains the place everyone immediately thinks of in connection with the South Wales iron industry, in reality the features to be seen there today, and actively promoted by the local authority, are in some respects a pathetic parody of what might have been. So much has been destroyed at Merthyr that the claims now made by the borough council (themselves responsible for almost all the destruction) to be the 'Iron Heritage Town' are at best only partly sustainable. In any case, the most important site in Merthyr, Cyfarthfa, remains in much the same state of suspended animation as Hirwaun, with conservation schemes being prepared against a background of disputed ownership and lack of funds, and nothing actually happening. In this situation, the conservation of the best preserved site in the neighbouring valley should be seen as part of a process of increasing the number of attractions to the visitor in the whole of north-east Glamorgan, not draining **scarce** resources away from a town in which they should be concentrated because of some special claim to consideration.

D.3.11 Finally, what of the importance of Gadlys in a regional (i.e. South Wales) or national (i.e. British) context? Clearly, it is not amongst the earliest, largest, longest lived or otherwise most important ironworks in South Wales. It was never owned by one of the major figures in the industry, nor was it the scene of any technological innovation. Gadlys was, essentially, a typical element in the South Wales iron industry of the second and third quarters of the nineteenth century, established by a family which had previously worked as managers at Cyfarthfa, who decided to set up on their own. They succeeded better than many other 'second generation' entrepreneurs in the South Wales iron industry but never joined the ranks of the leading ironmasters of their day. Gadlys was established during the boom of the mid-1820s, alongside several similar ventures, and, like so many other works, closed during the slump of the late 1870s. If anything, it is important in a regional context because of its typicality, in contrast, say, to Blaenavon or Cyfarthfa (early date of establishment, associated with major figures and important innovations), or Cefn Cribwr (unusual location, extraordinary owner), or Clydach (spectacular rural setting, late use of water-power).

D.3.12 More generally, in a regional context, Gadlys needs to be retained and developed because of 'group value' in the sense that the surviving assemblage of South Wales blast furnace sites is (despite losses) of such importance, that the number of sites and the range of periods, features and activities which they illustrate must not be jeopardised by further demolition. Gadlys is a good example of a certain kind of ironworks

and deserves to be preserved alongside other sites, which may be better known and of greater individual importance, so as to preserve the regional picture as a whole. Nationally, the ironworks of South Wales, mainly of the period 1790-1840, but more broadly stretching back to the sixteenth century, are far and away the most important concentration of such sites to be found anywhere in Britain, or indeed elsewhere in Europe. Their importance in a British context has recently been well demonstrated by the comprehensive study of the iron industry commissioned by English Heritage, in which far fewer furnaces have been located in the whole of England than can be found within the confines of the South Wales coalfield.

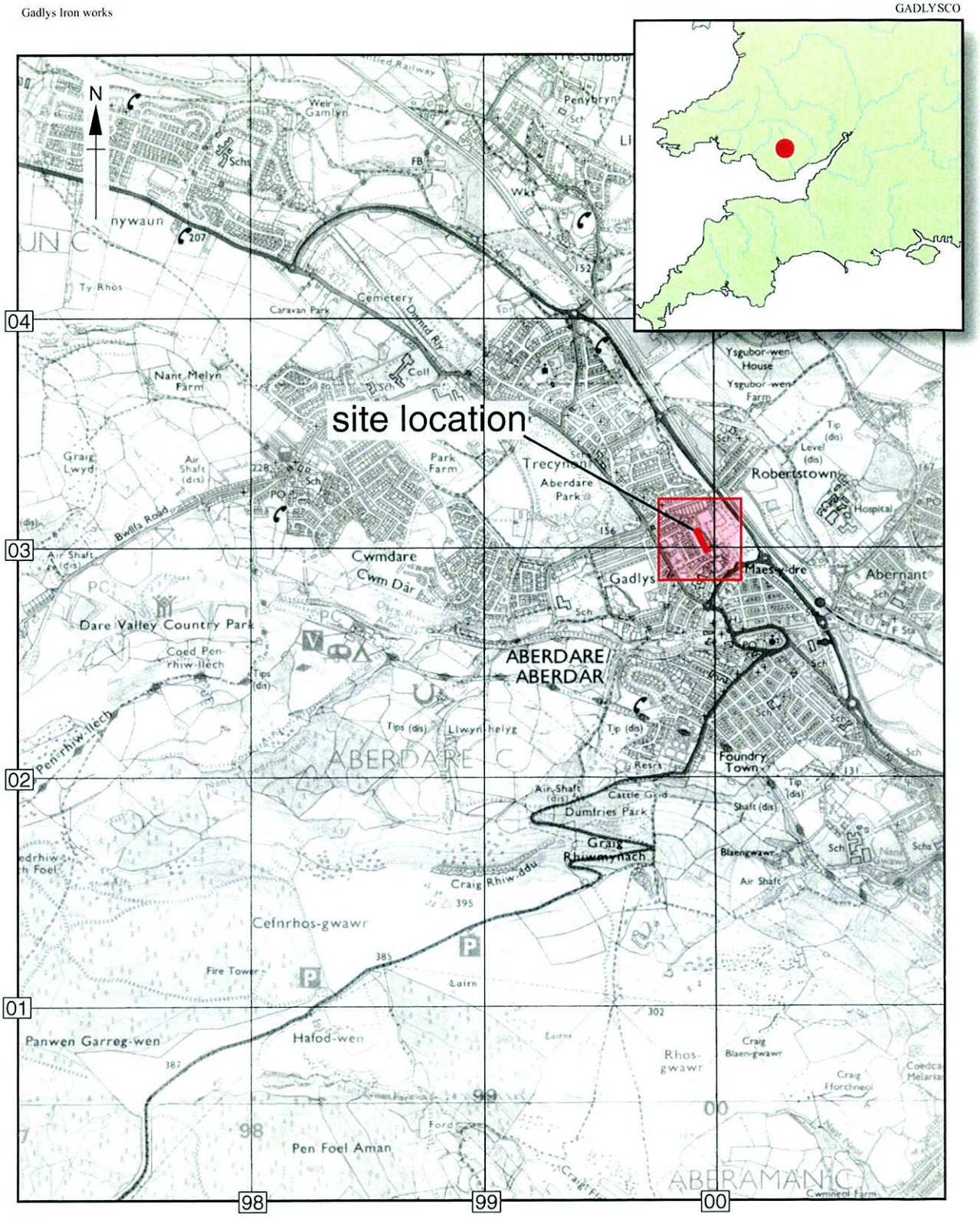


Figure 1: Site location

Fig.2: Aberdare in 1847, during the early ironmaking period. Note Gadlys Furnaces (centre), Llwydcoed Furnaces (top left) and Abernant Ironworks (centre left). Map reduced to scale consistent with Fig.3 *(From JJ Williams' Map of 1847, courtesy CVHS)*

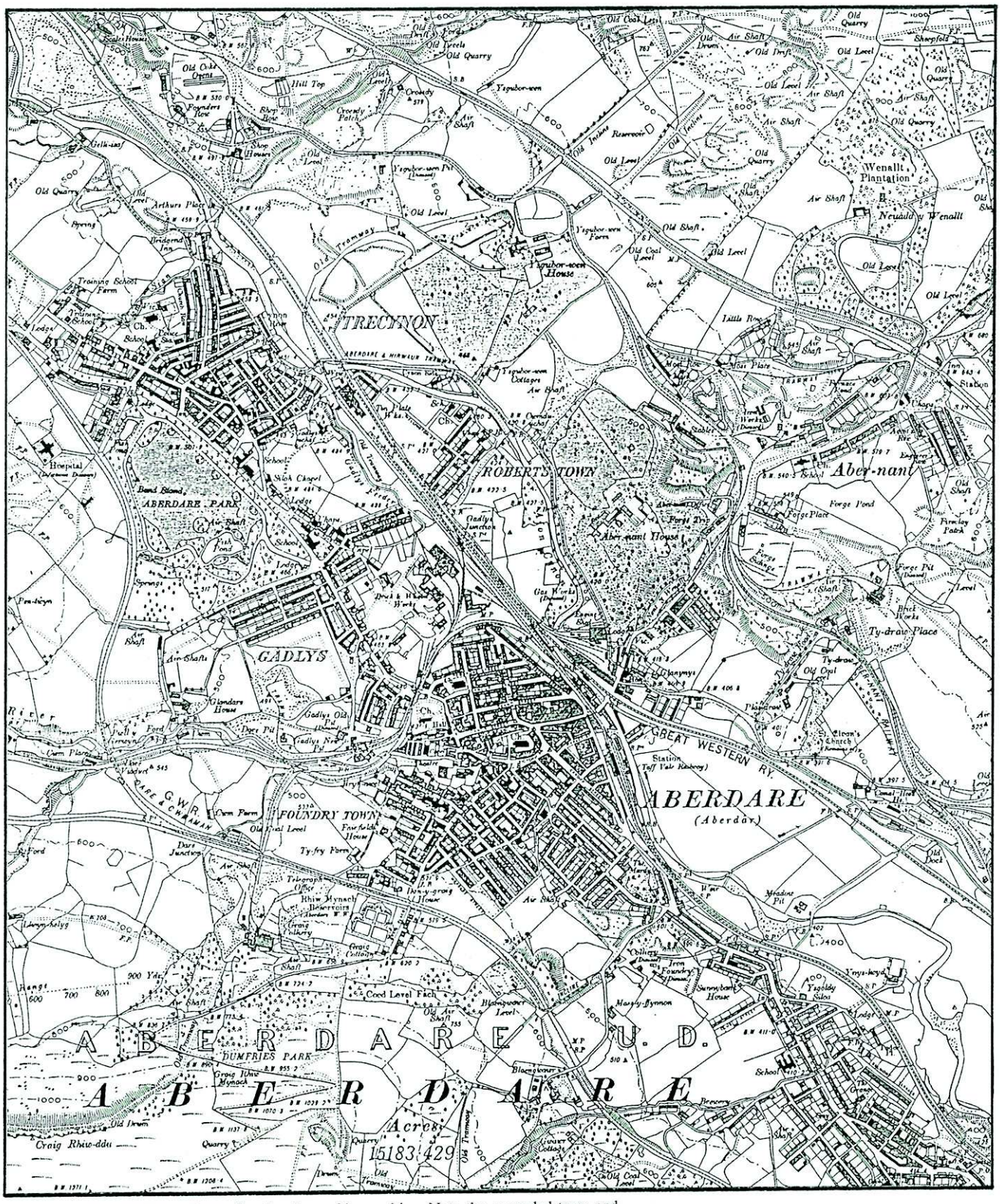


Fig.3: Aberdare in 1898, not long after the close of ironmaking. Note the expanded town and disused ironworks *(From OS 2nd (1901) Ed. 6":1mile map, Sheet Glam XI.S.E., surveyed 1898)*

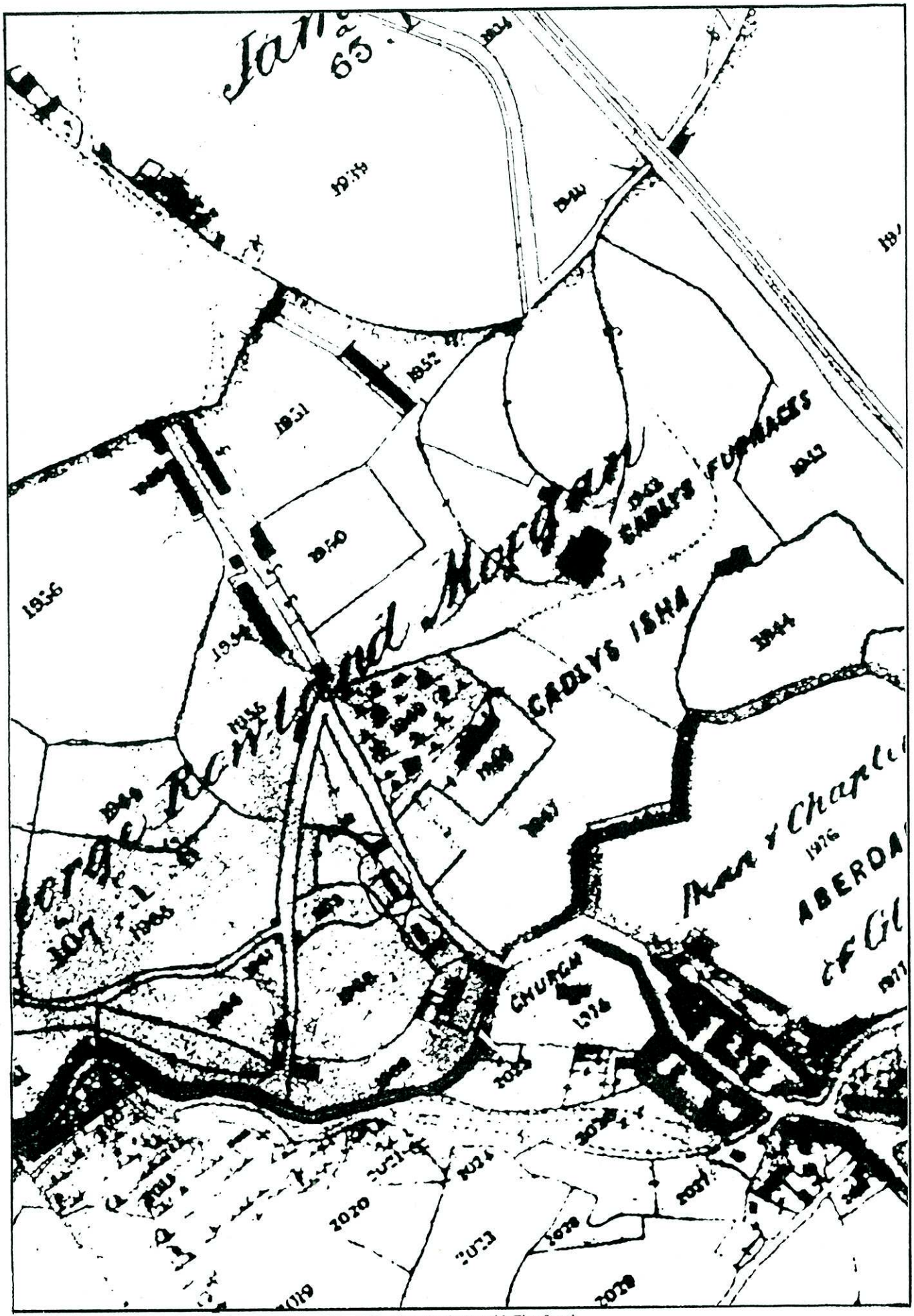


Fig.4: Gadlys Ironworks in 1847 (schematic). Map enlarged to scale consistent with Figs.5 and 7-11. *(From JJ Williams' Map of 1847, courtesy CVHS)*

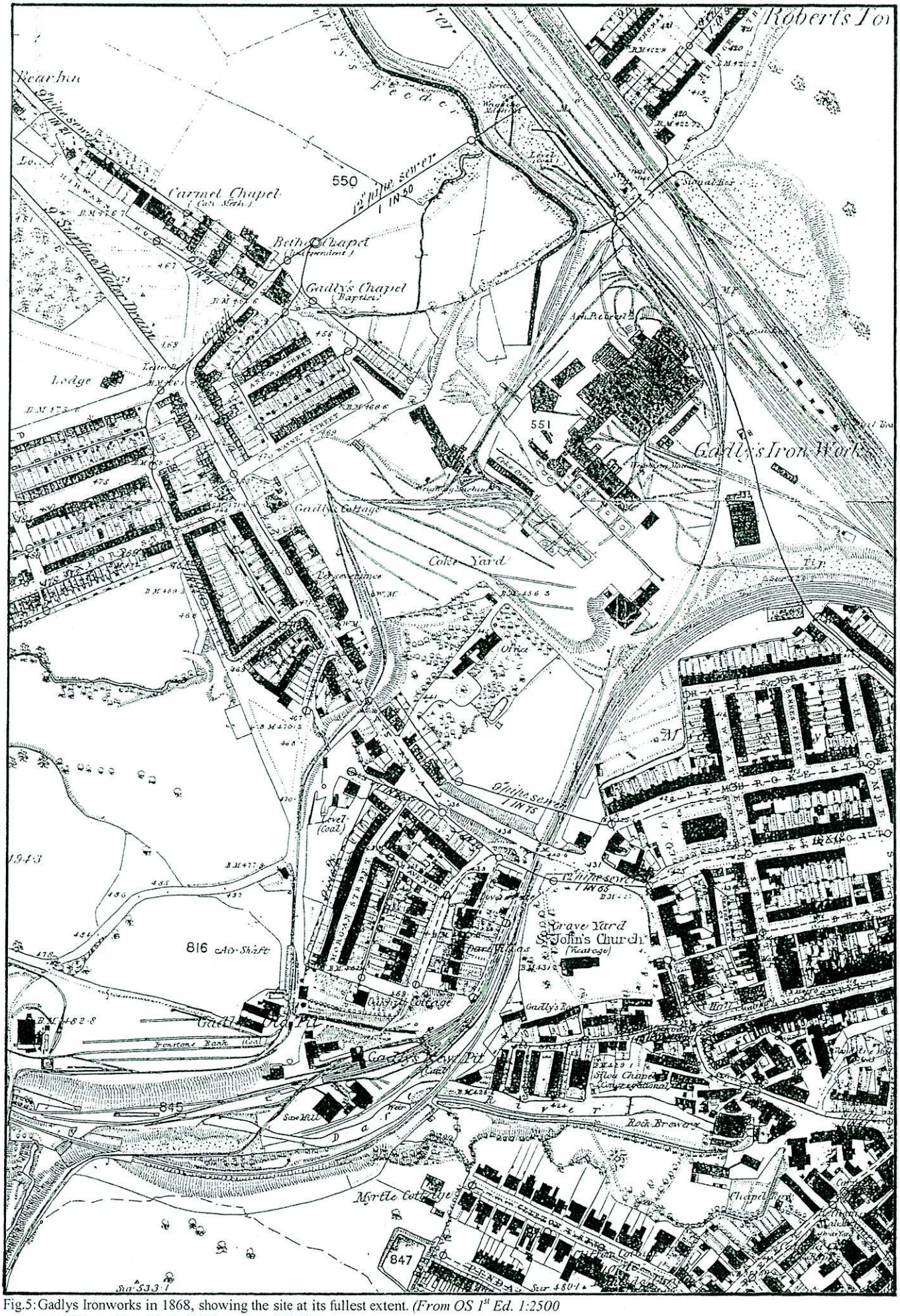


Fig.5: Gadlys Ironworks in 1868, showing the site at its fullest extent. *(From OS 1st Ed. 1:2500 map, Sheets Glam.XI.11, XI.15, surveyed 1868)*

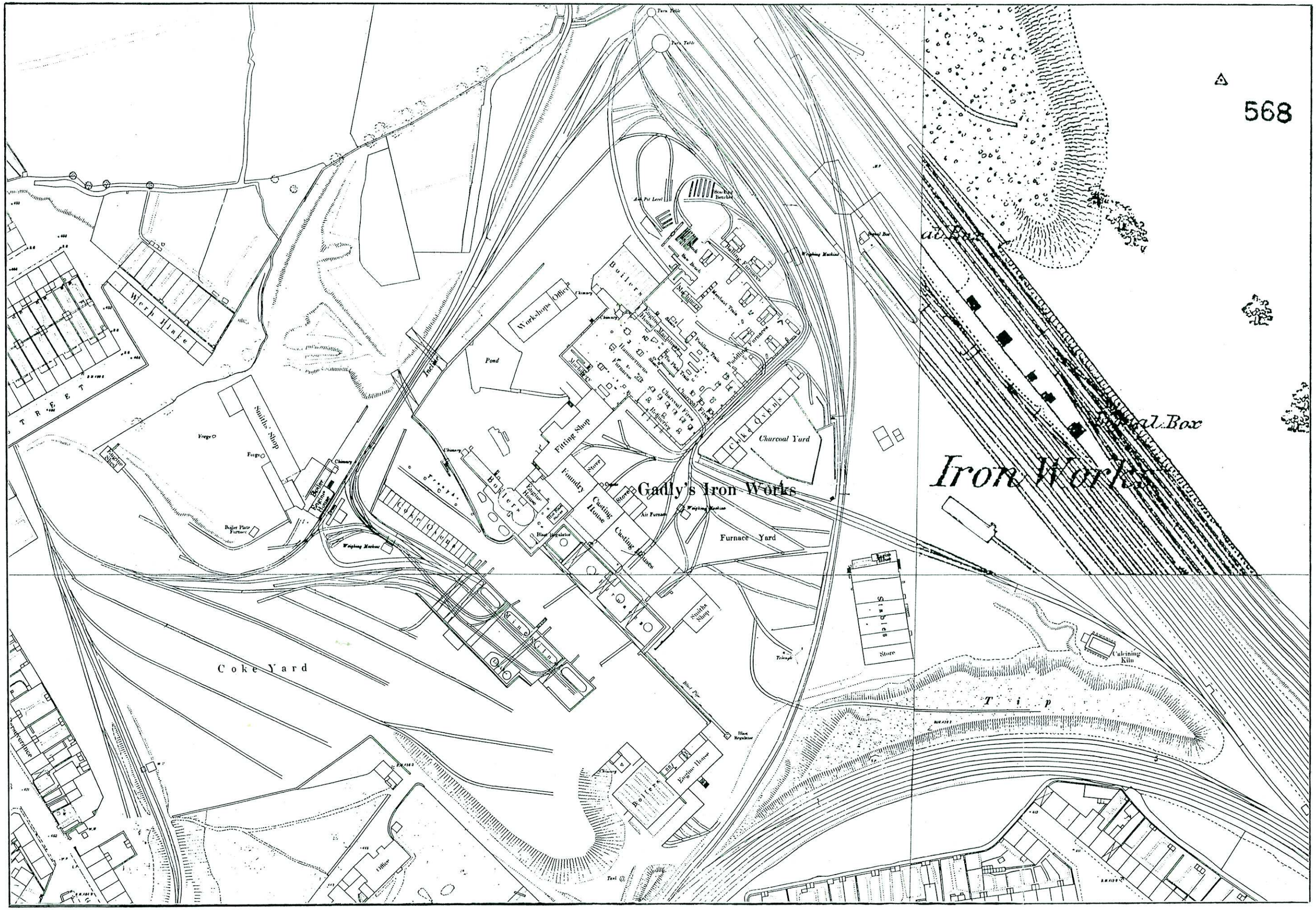


Fig.6: Detailed plan of Gadlys Ironworks in 1868, showing the mill, all four blast furnaces, both engine houses, calcining kilns and coke yard. *(From OS 1st Ed. 1:500 map, Sheets Glam.XI.11.23 and XI.15.3.(Surveyed 1868)*

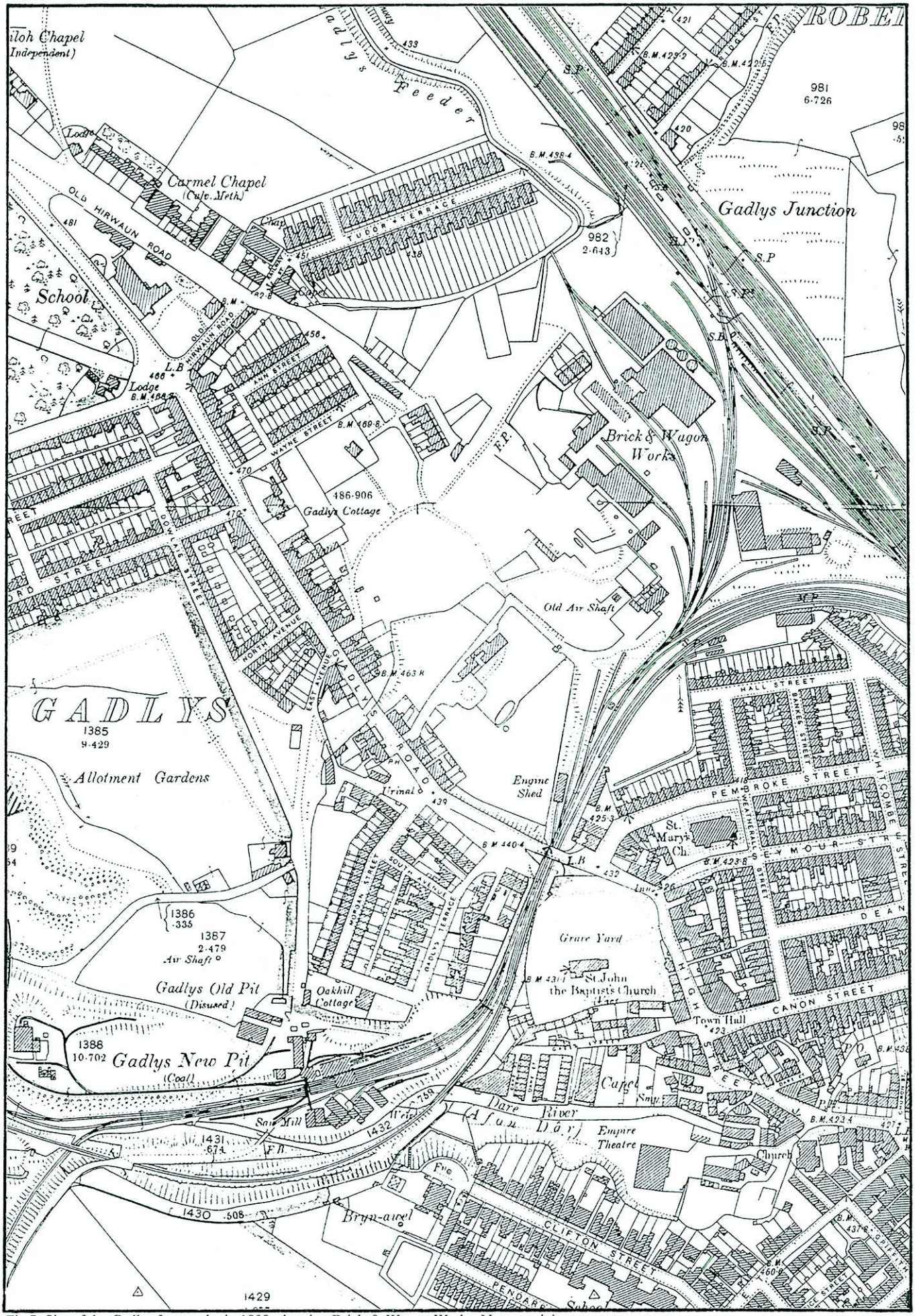


Fig.7: Site of the Gadlys Ironworks in 1898, showing Brick & Wagon Works. Note surviving Fitting Shop and 1827 Engine House. *(From OS 2nd Ed. 1:2500 map, Sheets Glam XI.11, XI.15 (Revised 1898)*

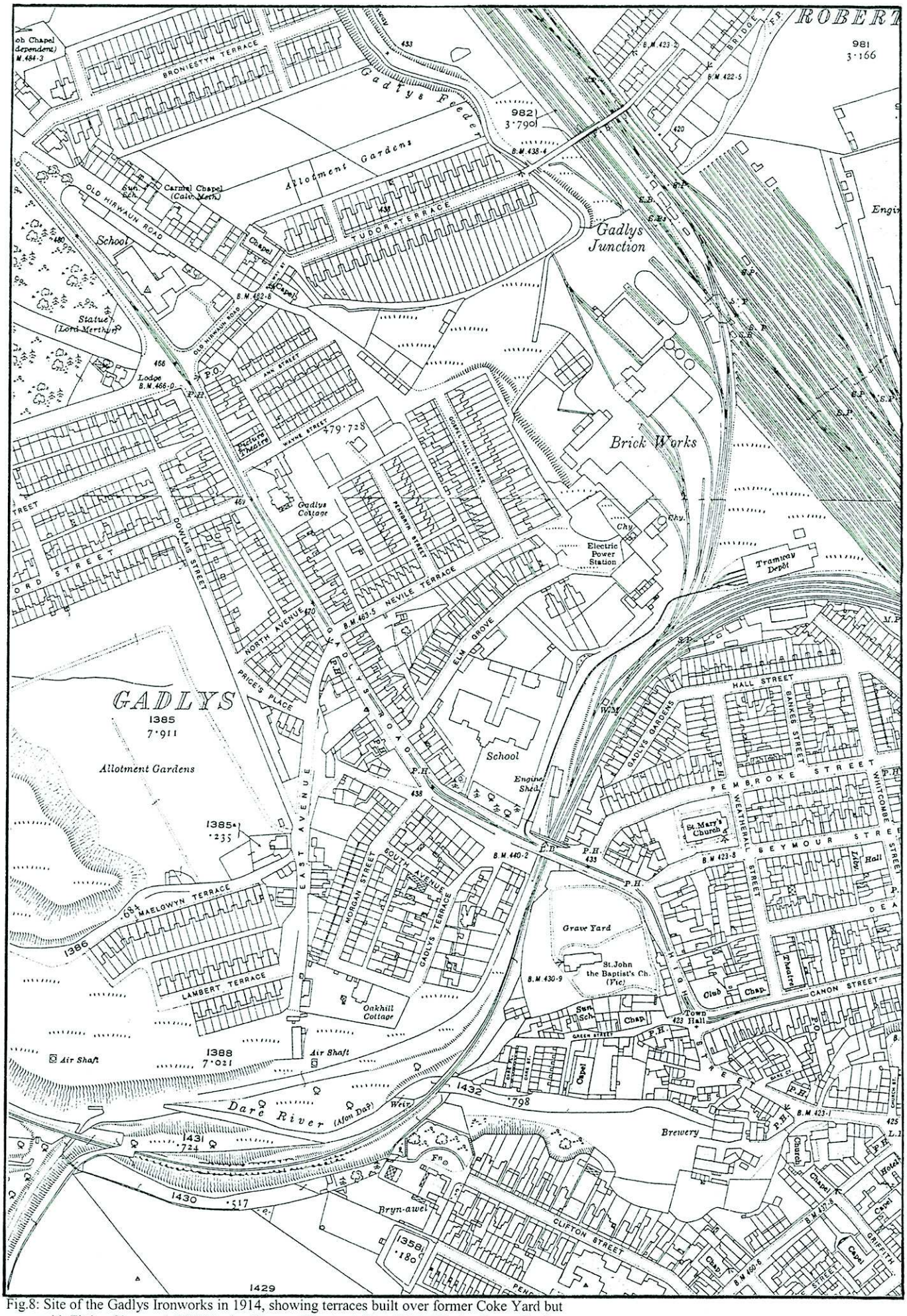


Fig.8: Site of the Gadlys Ironworks in 1914, showing terraces built over former Coke Yard but with Fitting Shop and 1827 Engine House still extant. Note Brick Works, Power Station and Tramway Depôt. *(From 3rd Ed. map, Sheets Glam XI.11, XI.15 (Revised 1914)*

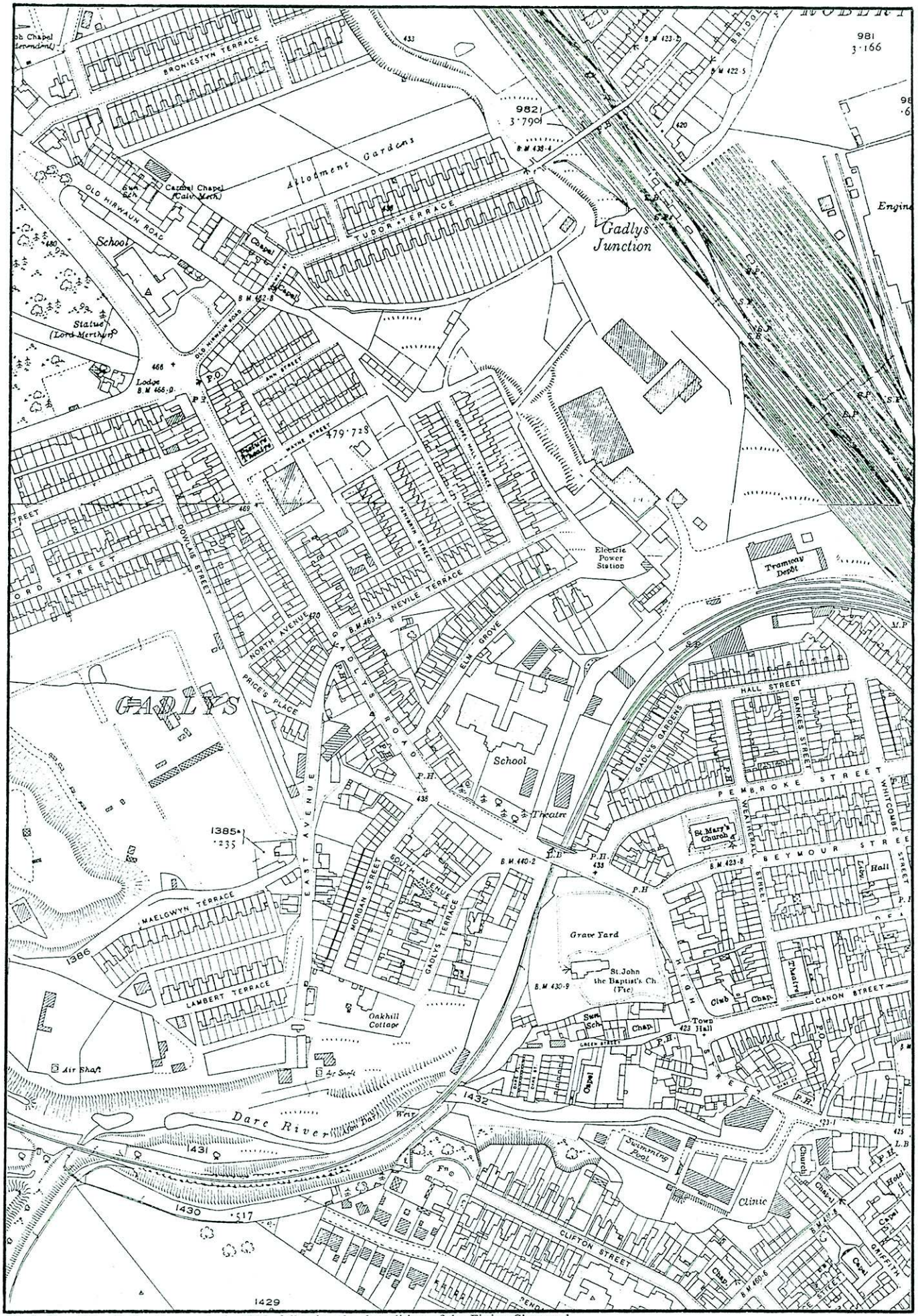


Fig.9: Site of the Gadlys Ironworks in 1950, following the demolition of the Fitting Shop and 1827 Engine House. Note Red and White Garage, Co-operative Garage and Aberdare U.D.C. Bus Depot (former Tramway Depôt). *(From Provisional Ed. 1:2500 map, Sheets Glam XI.11, XI.15 (Revised 1950)*

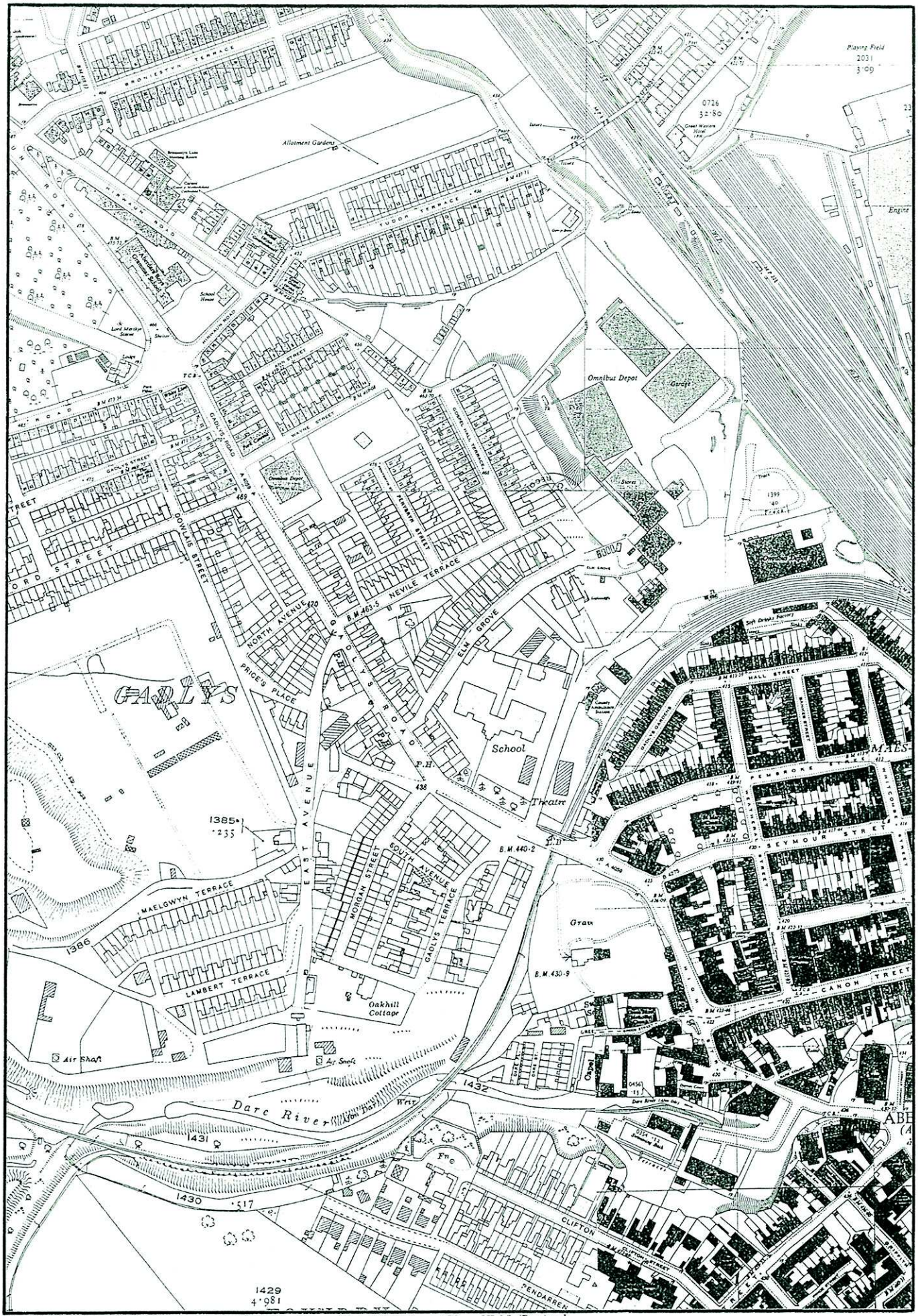


Fig.10: Site of the Gadlys Ironworks in 1950-62. *(From OS 1:2500 Sheets Glam XI.15 (Revised 1950), SN 9903 (Revised 1957), Sheet SO 0002 (Revised Oct 1956) and Sheet SO 0003 (Revised 1962)*

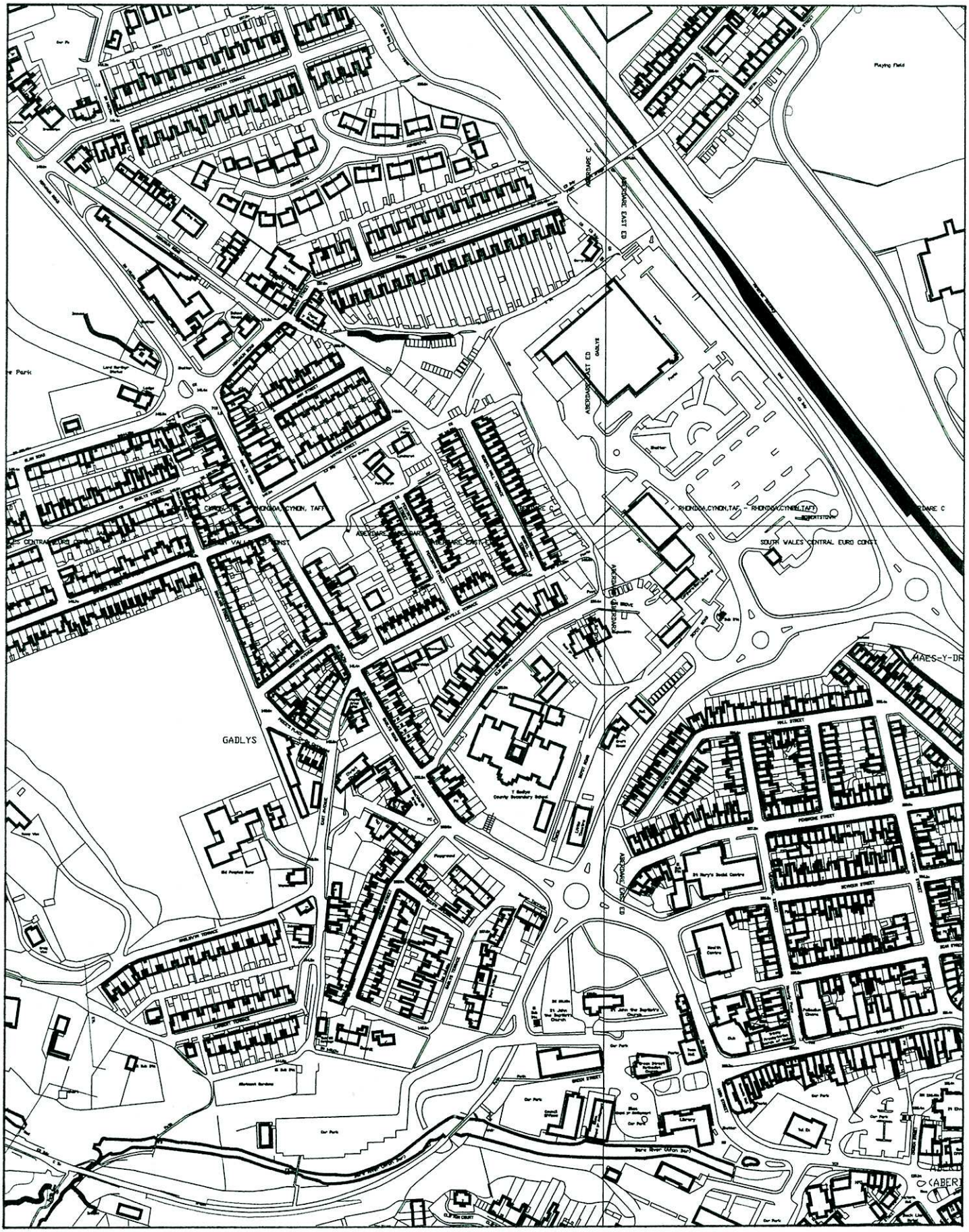
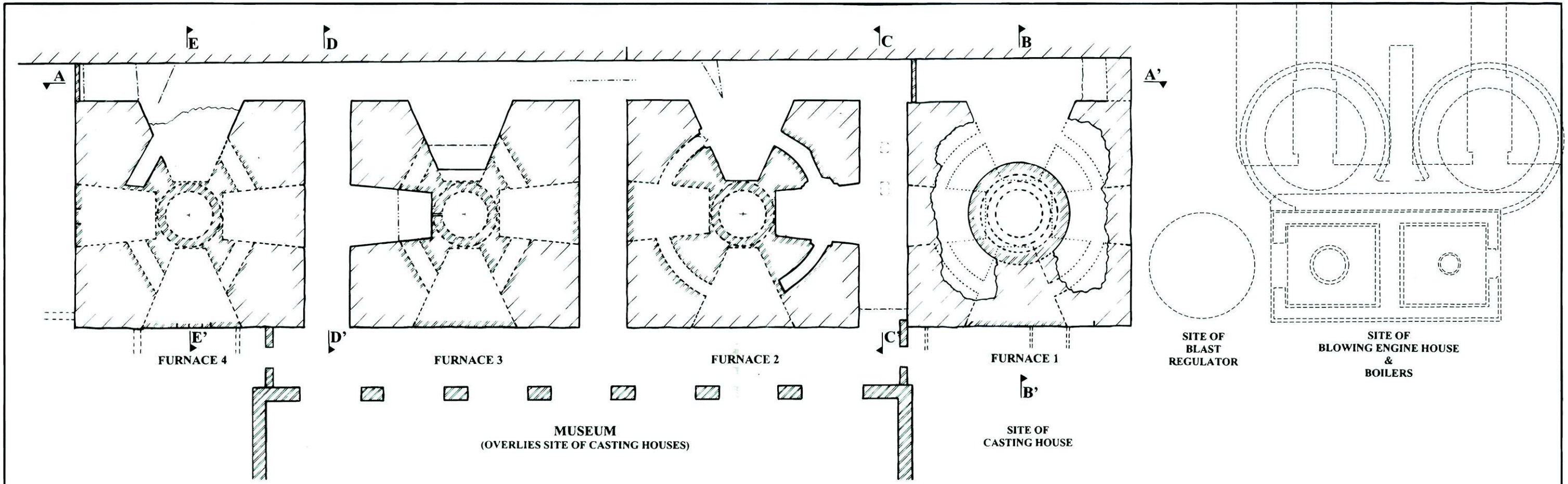
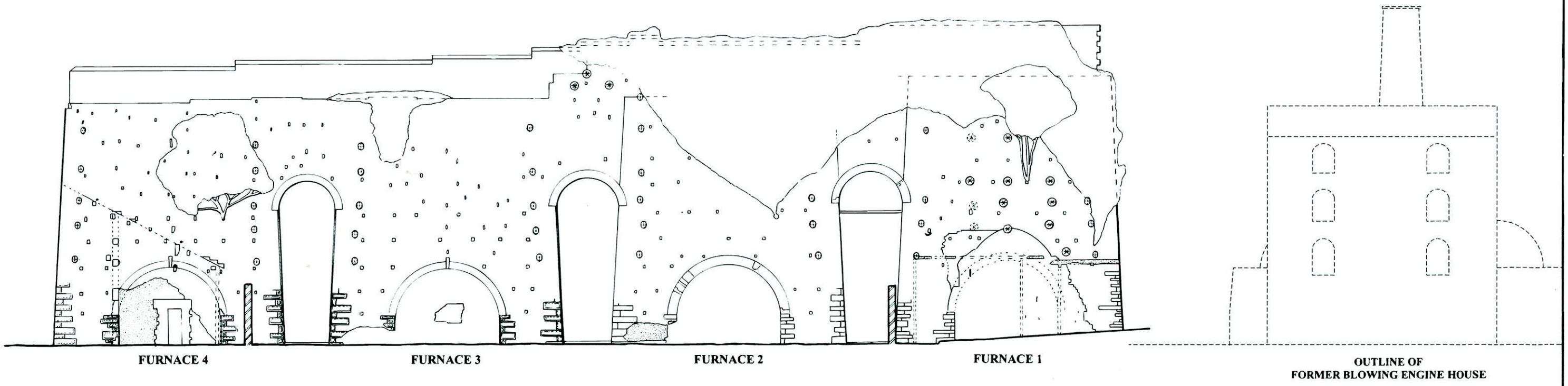


Fig.11: Site of the Gadlys Ironworks in 1999, showing Tesco superstore, museum and enterprise centre. *(From OS Digital data, supplied by RCTCBC)*



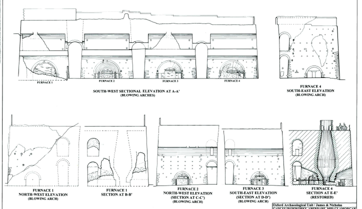
GROUND PLAN



NORTH-EAST ELEVATION
(TAPPING ARCHES)

0 20
metres

Oxford Archaeological Unit / James & Nicholas
GADLYS IRONWORKS, ABERDARE, MID-GLAMORGAN
Plan & North-East Elevation
Survey Date: April/May 1999
Surveyed by: RKS, JG; LN & RJ
Scale: 1:100 at A1, 1:200 at A3 **Figure No: 12**



Oxford Archaeological Unit / James & Nicholas
GADLYS IRONWORKS, ABERDARE, MID-GLAMORGAN
Elevations & Sections
Survey Date: April/May 1999
Surveyed by: RKS, JG; LN & RJ
Scale: 1:100 at A1, 1:200 at A3 Figure No: 13

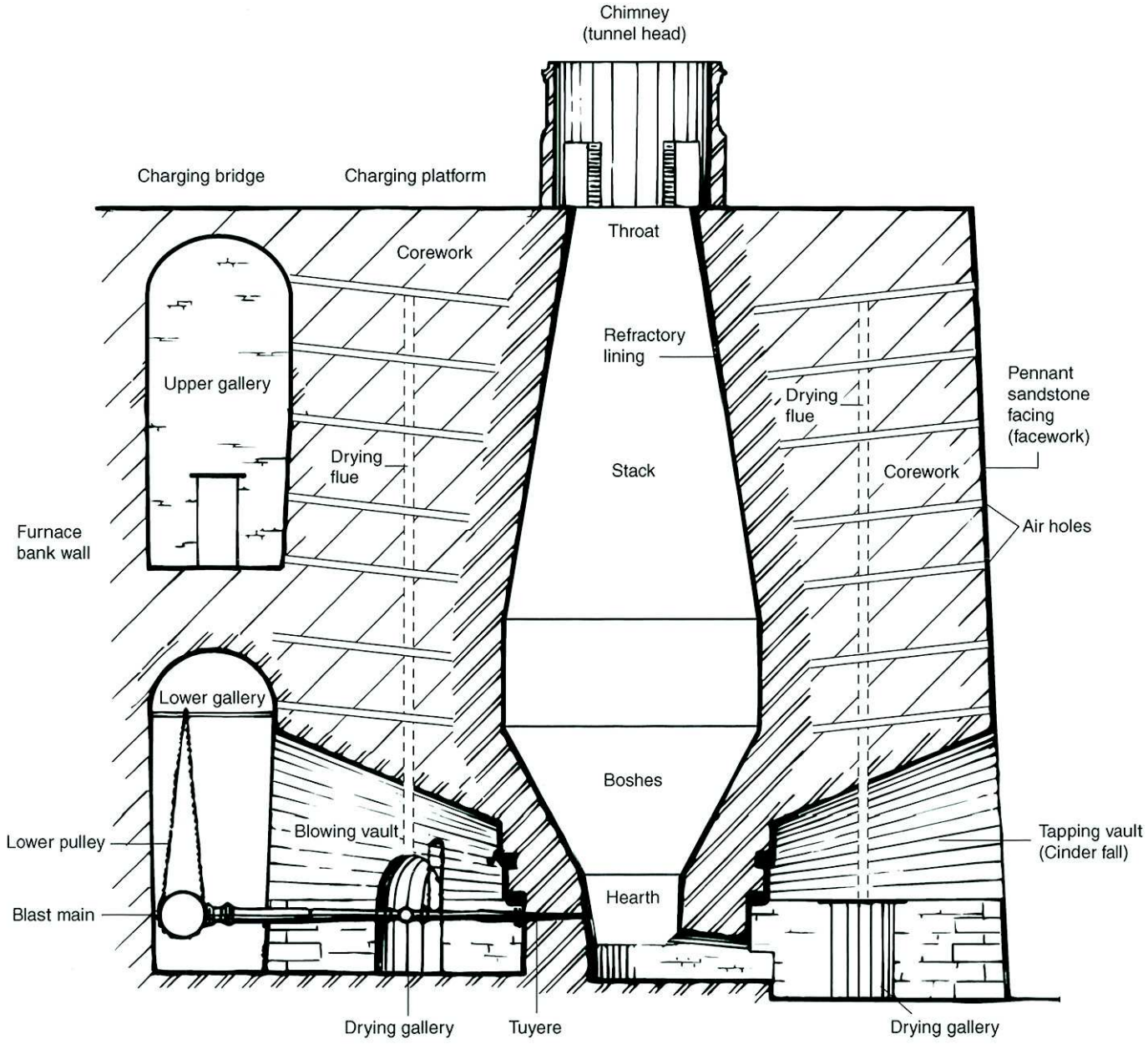


Figure 14: Diagrametic section through a typical furnace illustrating descriptive terms used in the report.

Gadly's Iron Works

job No: 98:115 FIG. 5.01
scales:

DESK STUDY

CLIENT
RHONDDA CYNON TAFF
COUNTY BOROUGH COUNCIL

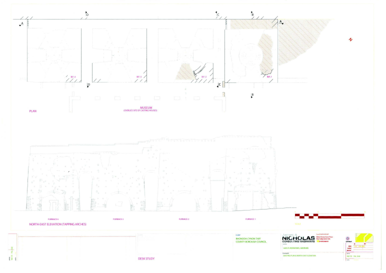
James & NICHOLAS
CONSULTING ENGINEERS
Fax (01639) 891687
Grove House Grove Place
Port Talbot SA13 1XA
(01639) 885431

Job title
GADLYS IRONWORKS, ABERDARE.

Drawing title
1999 O.S. MAP OVERLAYED ON 1868 O.S. MAP

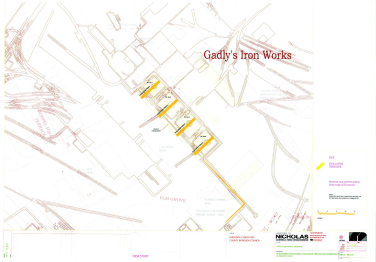
	by	date
drawn	LT	30/09/98
checked		
approved		

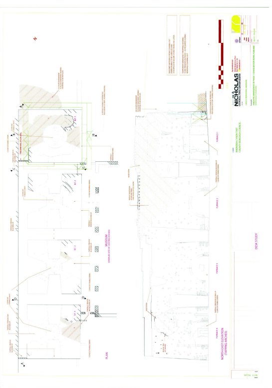
Job No:
98:115 FIG. 5.01
scales:



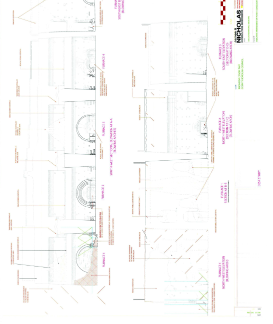
NORTH-EAST ELEVATION (TAPPING ARCHES)
FURNACE 4
FURNACE 3
FURNACE 2
FURNACE 1
NICHOLAS
RHONDDA CYNON TAFF
COUNTY BOROUGH COUNCIL
DESK STUDY


FURNACE 4
SOUTH-EAST ELEVATION
(BLOWING ARCH)
FURNACE 4
FURNACE 3
SOUTH-WEST SECTIONAL ELEVATION AT A-A
(BLOWING ARCHES)
FURNACE 2
FURNACE 1
FURNACE 3
SOUTH-EAST ELEVATION
(SECTION AT D-D)
(BLOWING ARCH)
FURNACE 2
NORTH-WEST ELEVATION
(SECTION AT C-C)
(BLOWING ARCH)
FURNACE 1
SECTION AT B-B
FURNACE 1
NORTH-WEST ELEVATION
(BLOWING ARCH)
James &
NICHOLAS
RHONDDA CYNON TAFF
COUNTY BOROUGH COUNCIL
DESK STUDY

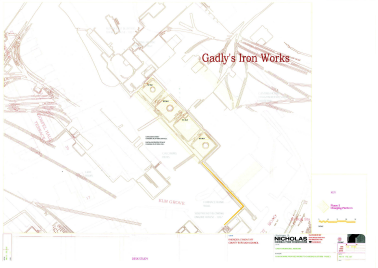

Gadly's Iron Works

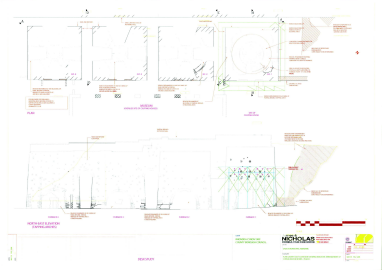


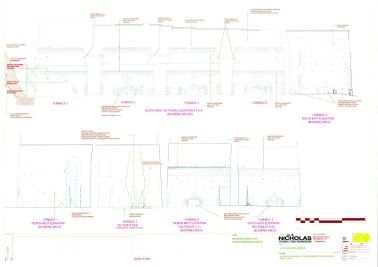
PLAN
MUSEUM
(DISPLAYS SITE OF CASTING HOUSES)
NORTH-EAST ELEVATION
(TAPPING ARCHES)
FURNACE 1
FURNACE 2
FURNACE 3
FURNACE 4
NICHOLAS
RHONDDA CYNON TAFF
COUNTY BOROUGH COUNCIL
DESK STUDY



FURNACE 1
FURNACE 2
FURNACE 3
FURNACE 4
SOUTH-WEST SECTIONAL ELEVATION AT A-A (BLOWING ARCHES)
FURNACE 4 SOUTH-EAST ELEVATION (BLOWING ARCH)
FURNACE 1 NORTH-WEST ELEVATION (BLOWING ARCH)
FURNACE 1 SECTION AT B-B
FURNACE 2 NORTH-WEST ELEVATION (SECTION AT C-C) (BLOWING ARCH)
FURNACE 3 SOUTH-EAST ELEVATION (SECTION AT D-D) (BLOWING ARCH)
James & NICHOLAS CONSULTING ENGINEERS
RHONDDA CYNON TAFF COUNTY BOROUGH COUNCIL
DESK STUDY


Gadly's Iron Works
ELM GROVE




FURNACE 1
FURNACE 2
FURNACE 3
FURNACE 4
FURNACE 5
SOUTH-WEST SECTIONAL ELEVATION A-A &
SECTIONAL ARCHES

FURNACE 1
NORTH-WEST & SOUTH
SECTIONAL ARCHES
FURNACE 2
SECTION A-A &
SECTIONAL ARCH
FURNACE 3
ARCH AND CHIMNEYS
SECTION OF C.C.
SECTIONAL ARCH
FURNACE 4
ARCH AND & SOUTH
SECTION ST.N.N.
SECTIONAL ARCH
NICHOLAS


Gadly's Iron Works
NICHOLAS
ELM GROVE
GOSPEL HALL TERRACE
DESK STUDY

Fig.A1: Sale Particulars of Gadlys Iron Works, Aberdare, July 30th 1835
(NLW / Lord Merthyr / 387)

Particulars, &c.
OF A VERY
VALUABLE PROPERTY,
For the Employment of Capital; it consists of
Gadlys Iron Works,
At Aberdare, in the County of Glamorgan.

The extent and value of these Works need no comment or remarks in the neighbourhood of
MERTHYR TYDFIL,
Or indeed for upwards of 100 Miles around the Country; their fame is stamped, and a certainty attendant on their proceedings fully established; it is for the purpose of illumining those at a distance, that the following concise and inadequate remarks are respectfully submitted.

THE IRON WORKS EMPLOY FROM
130 *to* 150 *People, constantly & successfully,*
The Iron Trade being unusually brisk; the latter observation will no doubt be fully understood and conceded; now that it is

IN FULL OPERATION.

The old Proverb of "MAKE HAY WHILE THE SUN SHINES," applies just now to the Iron Trade: it has received an invigorating impetus, and fast making up lee-way for unprofitable and by-gone days. Gadlys would form a valuable appendage to a very large Iron Foundry, being capable of making, in its present state, from
1700 *to* 2000 *Tons of Iron, Annually;*
And extensive Iron Founders will find this work
"A most valuable appendage for making their large Castings at once from the Furnace."

It possesses besides unusual facilities for sending them to a Shipping Port, by Water. The power of these Works, although in extent not to be put in comparison with
THE GREAT MYTHRHYR HARD BY,
Is quite sufficient to ensure large Annual Profits, and the matériélle to secure it is perfect, and in every respect complete.

All the Buildings essential, and every Article in Trade necessary for keeping the Works in the fullest operation, is included in the purchase;
A short List of which is here subjoined, viz.—

A POWERFUL STEAM ENGINE,
(Calculated to blow a Furnace and a Refinery), from the Neath Abbey Company, executed in their best manner; a large Blast Furnace, Coal House, Stove Room, Turning Room, Refinery, Cupola, Smith's Shop, Weighing Machine, Three Calcining Kilns, Bridge House, Carpenter's Shop and an Office, all kinds of Workmen's Tools, Coal Mine and Limestone Trams, Coke Barrows, Punching Machine, Turning Lathe, &c.; there are about 5600 Yards, or 200 Tons, of Plates, laid in and about the Works.

The Iron made is much esteemed, and particularly adapted for strong Castings and Engine purposes. The Coal is worked by a Pit close to the Works, which has besides the convenience of a Drift or Road for taking down Horses; a Balance Jet for raising Coal, Two Eight-inch Pumps, One Worked by a Water Wheel, 24 feet in diameter, the other by a High Pressure Steam Engine: the Works are well ventilated, and most advantageously situate for Working the extensive and hitherto

Untouched Mineral District of Cwm Dare.

The Ore is principally procured about a Mile and a Half from the Works, and within 500 Yards of

THE PUBLIC TRAM ROAD.

Some good veins of Ore are likewise being opened upon in the Coal Works. Limestone is about Five Miles distance. There are good Quarries of Stone, and, indeed, every thing required, close at hand. The whole of the Works adjoin the Public Tram Road, which communicates with the

CARDIFF AND ABERDARE CANAL,

From which Port they are distant only about 24 Miles; therefore the facility of dispatching the Manufactured Iron is obvious, and consequently renders a quick and lucrative sale more certain; indeed, Liverpool and Bristol have hitherto alone taken off all that can be spared.

THE PROPERTY ALTOGETHER CONSISTS OF NEARLY
350 Acres of Mineral Property,
Held on advantageous Leases, of which abstracts of the Covenants and Conditions will be produced on the day of Sale. Also,
A good Dwelling House with Stable, Beast House, and productive Gardens, &c.
Surrounded by a PADDOCK, and all kinds of Appendages in the shape of comfort, renders the Property indeed complete.

Mr. ROBINS is earnest in his appeal to all those who, having Capital, and no distaste for employing it successfully, to give their immediate attention to this most excellent opportunity to amass wealth, with a little industry, and without more than ordinary exertion to obtain it.

Any further information can be obtained on application to Mr. MORGAN, Gadly's, Aberdare, near Cardiff.

Stocks of Pig Iron, Coke and Ore, are to be taken at a fair valuation.

THE GADLYS IRON WORKS,
At Aberdare.

Particulars and Conditions of Sale
OF A VERY
VALUABLE PROPERTY,
CONSISTING OF
GADLYS IRON WORKS,
AT
ABERDARE,
IN THE COUNTY OF GLAMORGAN;
IT IS
NOW IN FULL OPERATION,
AND EMPLOYS FROM
130 to 150 People, constantly and successfully.

THE ORE is principally procured One Mile and a Half from the Works,
And only 500 Yards from
The Public Tram Road,
Altogether the Property consists of nearly
350 ACRES
OF
MINERAL PROPERTY,
WITH A GOOD
RESIDENCE, STABLING, PRODUCTIVE GARDEN, PADDOCKS, &c.
WHICH WILL BE SOLD BY AUCTION, BY

Mr. GEO^E. ROBINS

At the Auction Mart, opposite the Bank of England,

On THURSDAY, the 30th Day of JULY, 1835,

AT TWELVE O'CLOCK.

Particulars may be had Twenty-one Days prior to the Sale at the Waterloo, Liverpool; Bush, Bristol; Hen and Chickens Hotel, Birmingham; the Printer of the Manchester Times, Manchester; of Messrs. MEYRICK and DAVIES, Solicitors, Merthyr Tydfil; the Auction Mart; and at Mr. GEORGE ROBINS' Offices, in Covent Garden, London, where a Plan of the whole Property may be seen.

ALFRED ROBINS, PRINTER, 29, TAVISTOCK STREET, COVENT GARDEN.

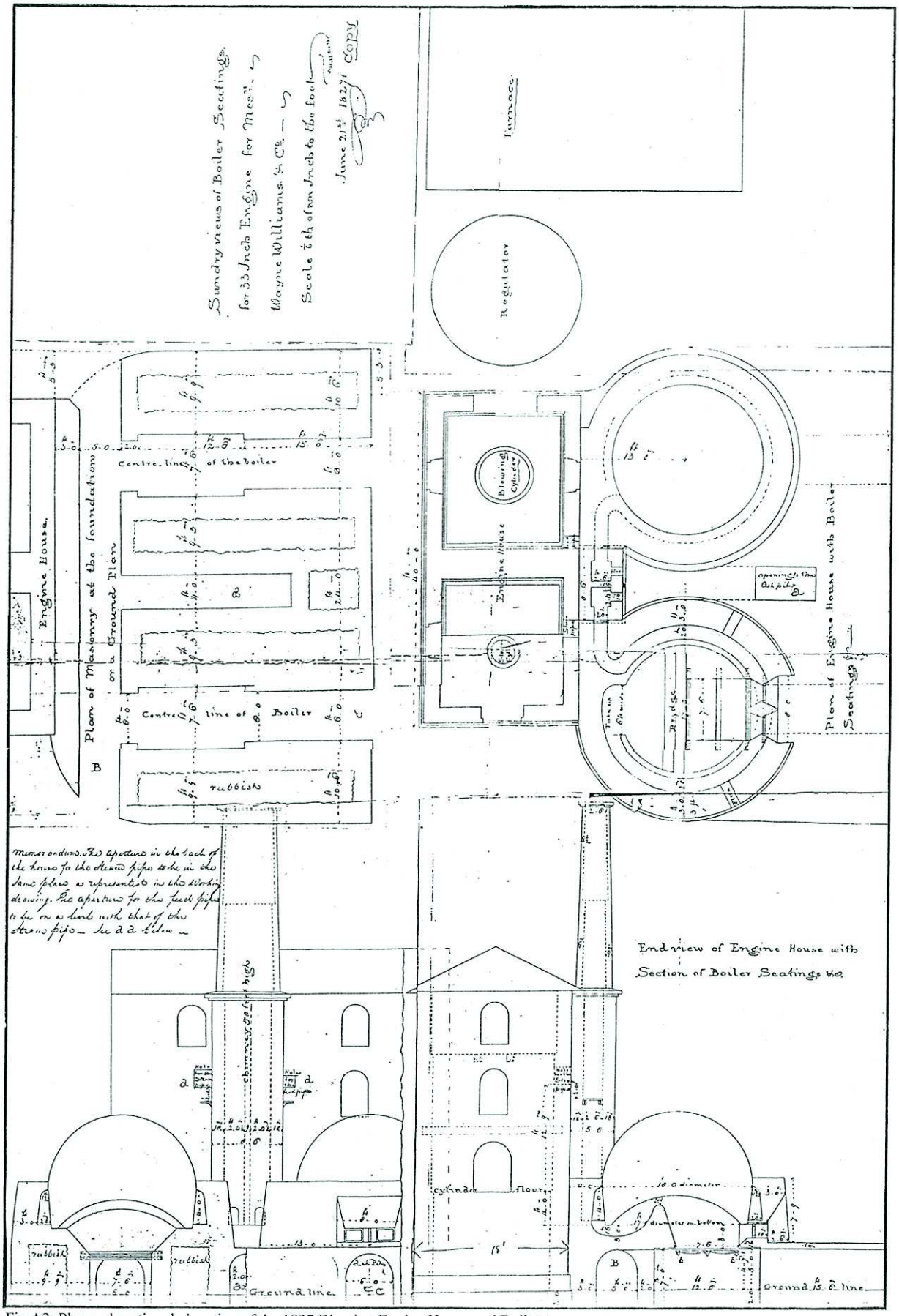


Fig.A2: Plan and sectional elevation of the 1827 Blowing Engine House and Boilers
(GAS D/D NAI M/200/1)

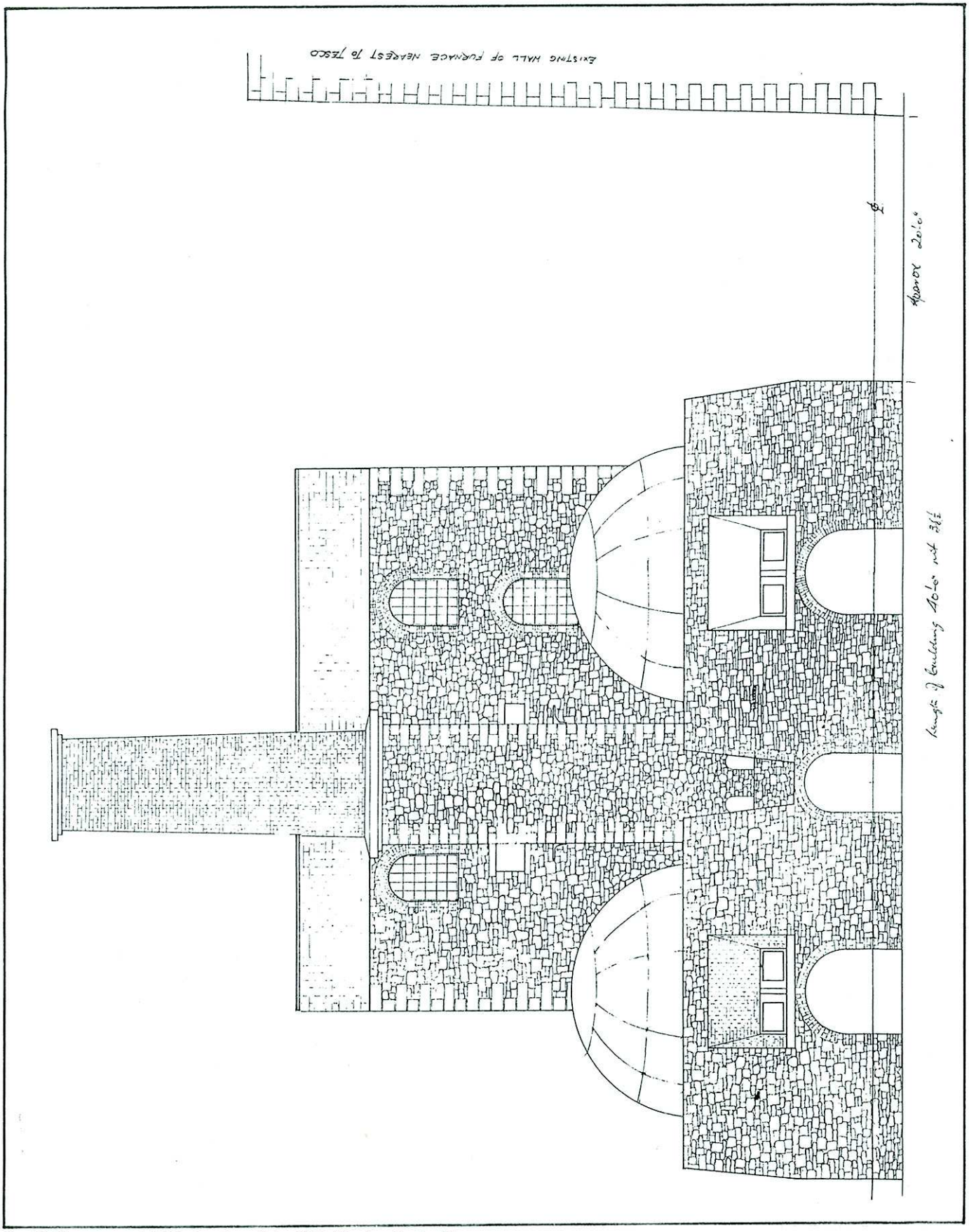


Fig.A3: Reconstructed S.W. elevation of the 1827 Blowing Engine House
(Courtesy Doug Williams, CVHS)

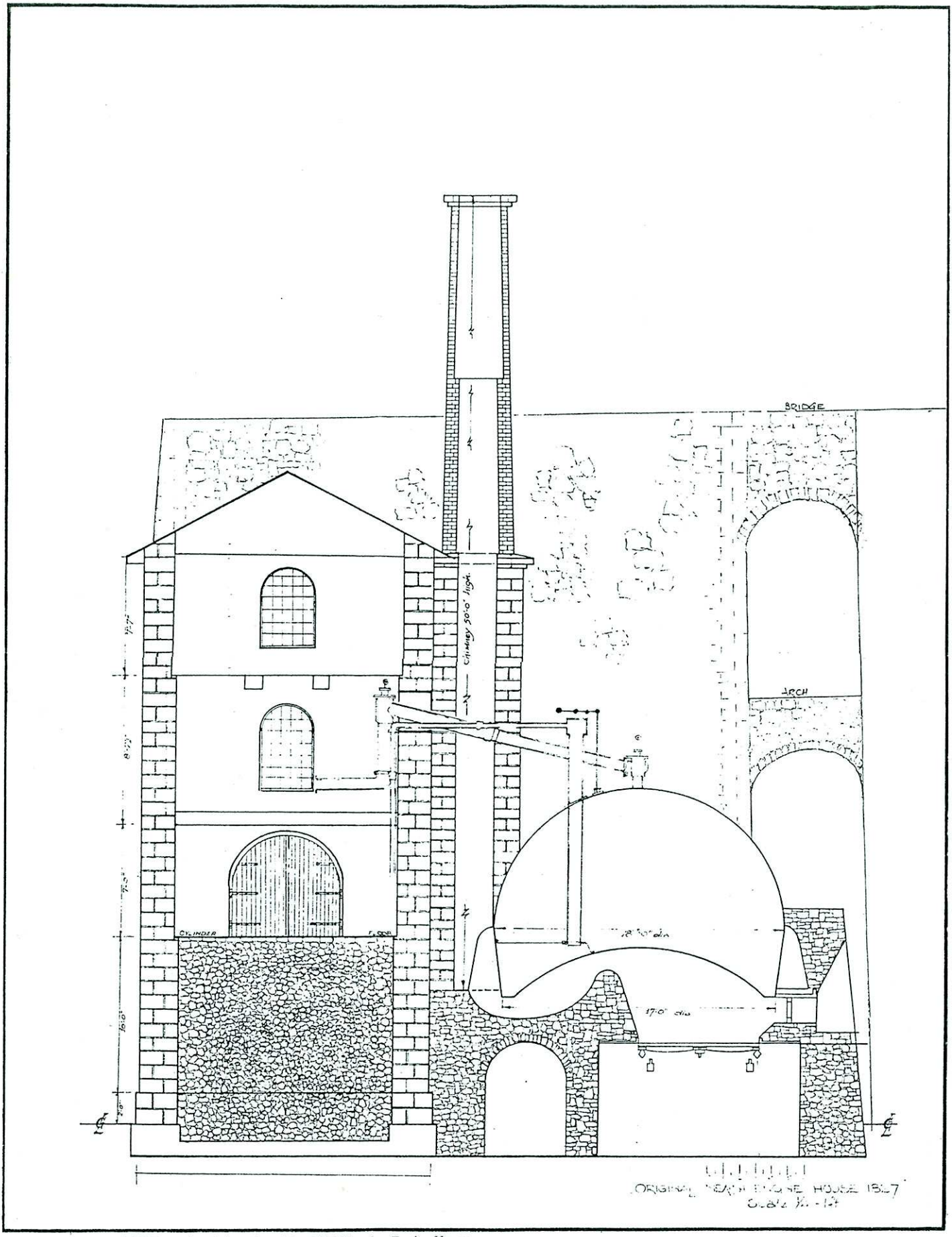


Fig.A4: Reconstructed N.W. sectional elevation of the 1827 Blowing Engine House
(Courtesy Doug Williams, CVHS)

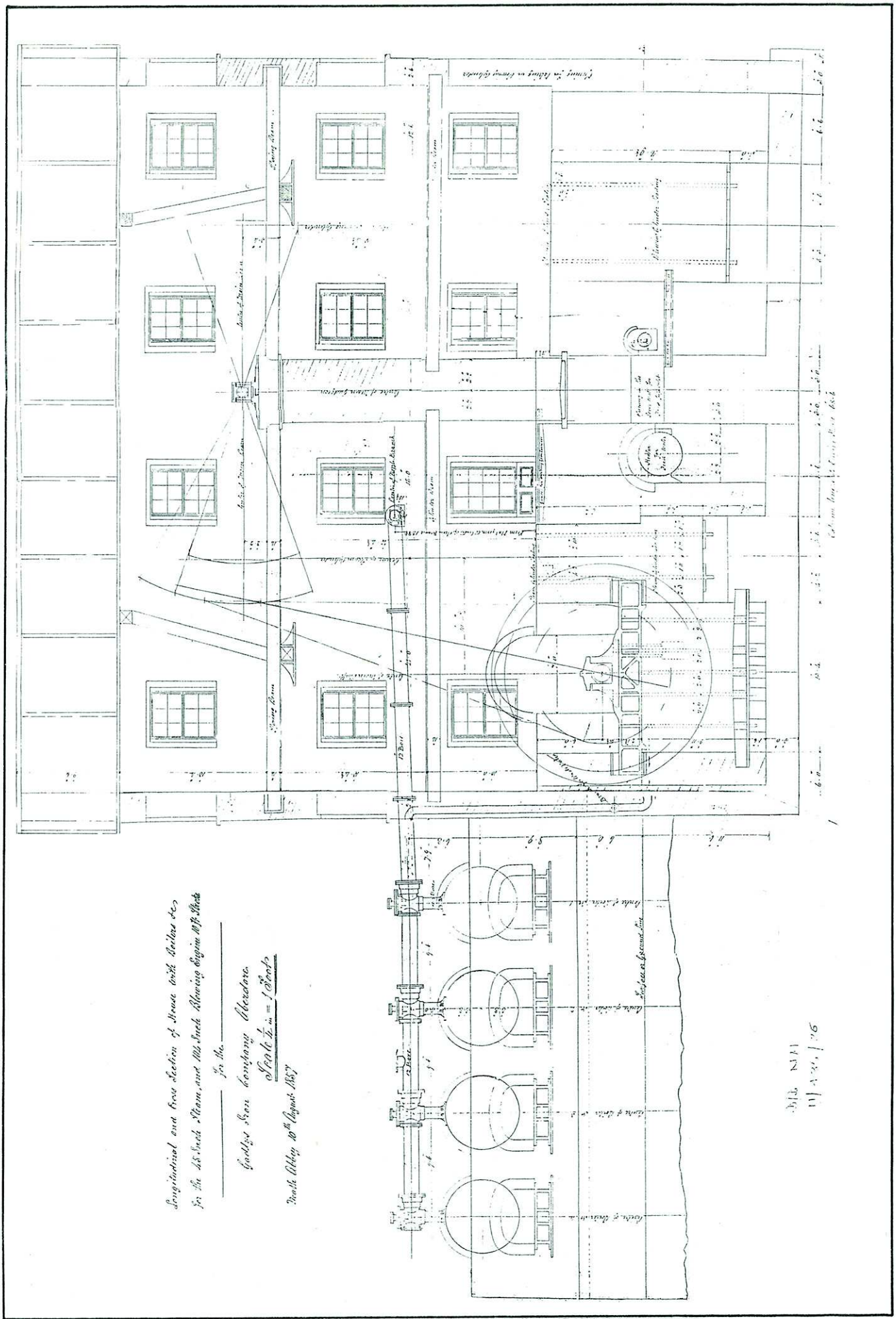


Fig.A5: Longitudinal Sectional Elevation of the 1857 Blowing Engine House and Boilers. *(GAS D/D NAI M/435/26)*

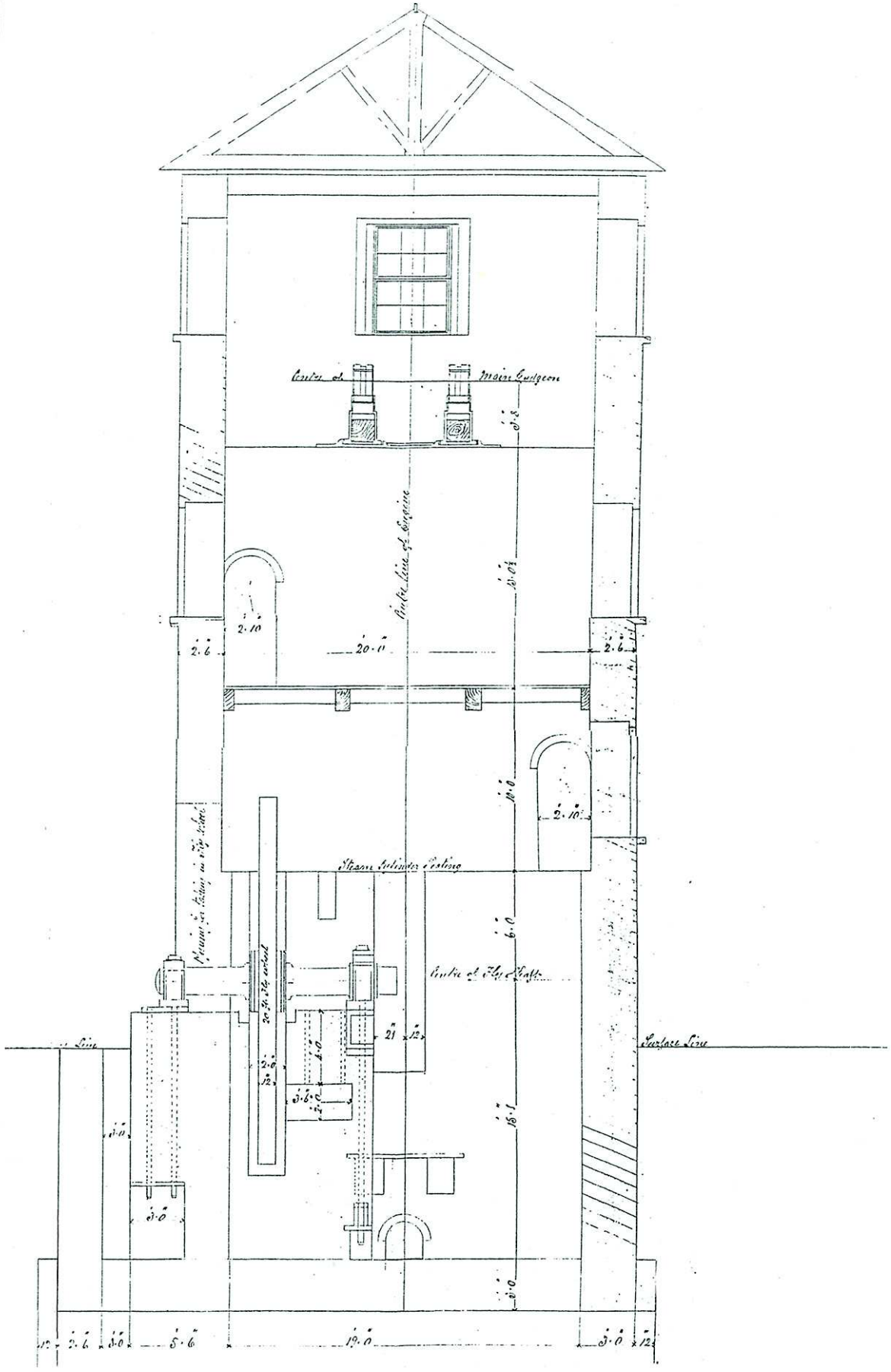


Fig.A6: Sectional Elevation of the 1857 Blowing Engine House. *(GAS D/D NAI M/435/26)*

Plate 1: General view from the N.E. Buildings (from left to right) are the 1857 blowing engine house, refuse destructor building, replica destructor building and wagon shop (museum). The four blast furnaces lie behind the museum, with space for a further three between them and the 1857 engine house.

Plate 2: General view from south, with furnace bank wall between engine house and destructor building.

Plate 3: General view from north, showing blast furnaces behind museum building. Note spoil bank to right, overlying site of original engine house and nprth-west furnace bank wall extension.

Plate 4: Surviving lime kilns to S.W. of blast furnaces. Note rising ground to rear, indicative of good preservation of calcining kilns.

Plate 5: N.W. elevation of No.1 Furnace, partially buried by spoil bank.

Plate 6: N.E. elevation of No.1 Furnace, showing tree and bulge in stonework.

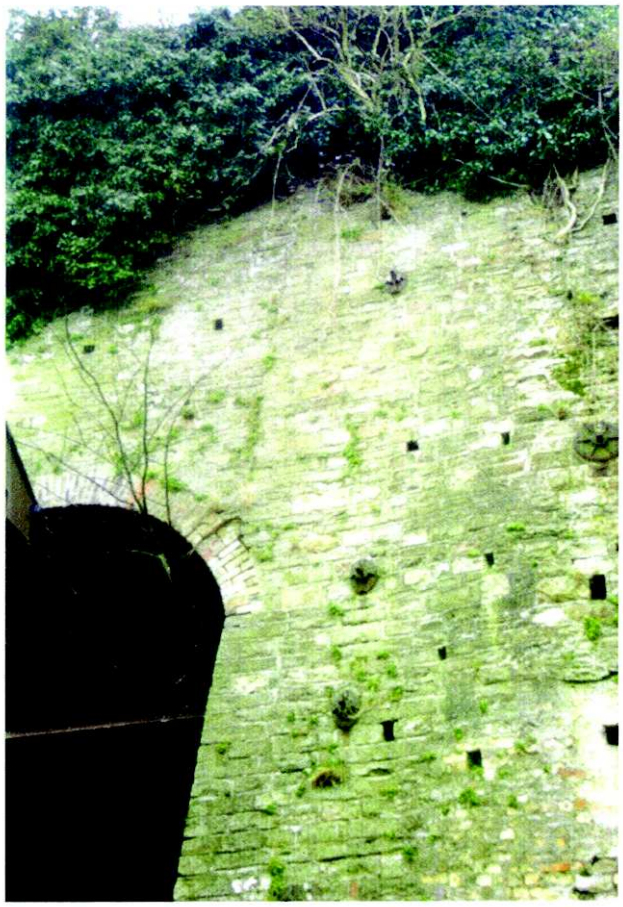


Plate 7: N.E. elevation of No.1 Furnace, showing straight joint between furnace and high vault.

Plate 8: N.E. elevation of No.1 Furnace, showing bricked-up tapping vault.

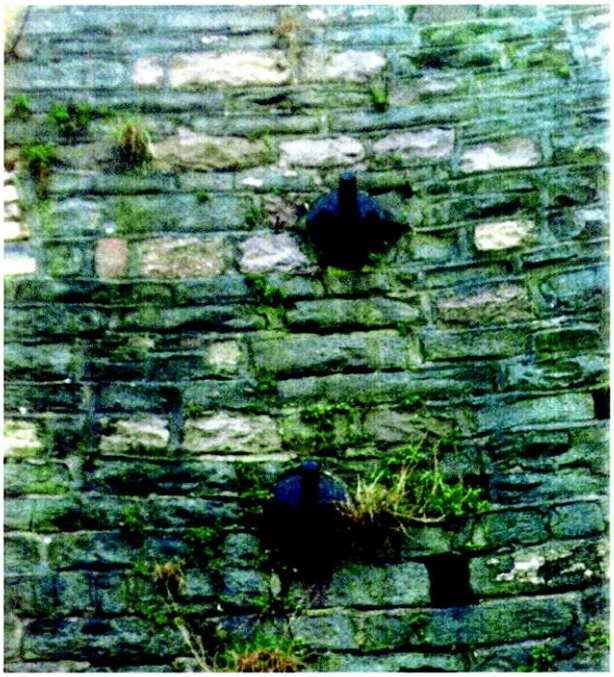


Plate 9: No.1 Furnace - earlier oval tie plate.

Plate 10: No.1 Furnace - later circular tie plate.

Plate 11: Collapsed S.W. blowing vault of No.1 Furnace.

Plate 12: Interior of No.1 Furnace showing refractory lining of furnace stack exposed by collapse of vaults and corework.

Plate 13: No.1 Furnace - sealed S.E. blowing vault.

Plate 14: No.1 Furnace - inserted wall and opening at S.E. end of upper gallery.

Plate 15: No.1 Furnace - Collapse in crown of upper gallery.

Plate 16: No.1 Furnace - hole above inserted wall at S.E. end of upper gallery.

Plate 17: Inserted brick high vault between No.1 and No.2 Furnaces.

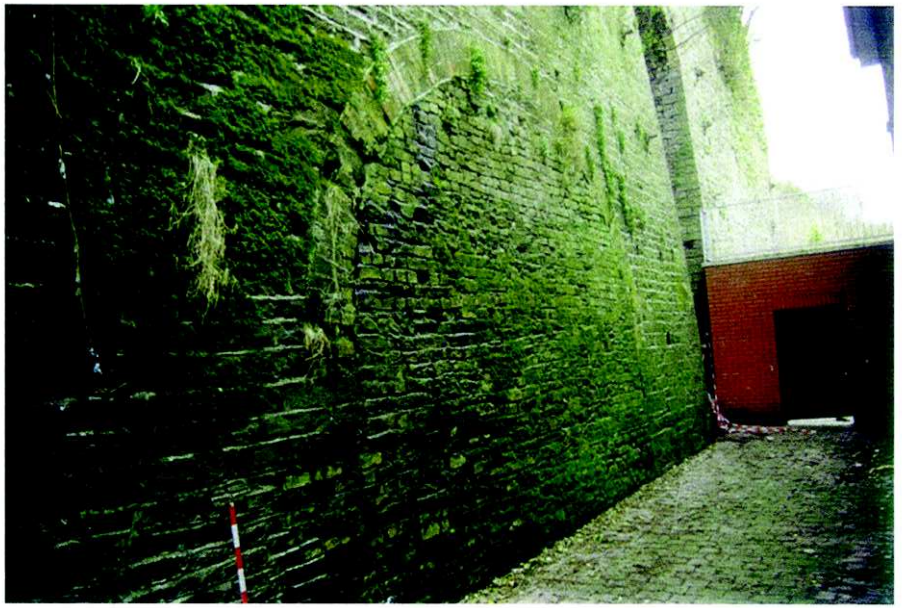


Plate 18: No.2 Furnace - scaled tapping vault.

Plate 19: No.2 Furnace - N.W. blowing vault, showing vaulted 'drying passage'.

Plate 20: No.2 Furnace - a typical 'stepped' vault.

Plate 21: High vault between No.2 Furnace (right) and No.3 Furnace (left).
Note structural joint on right side only.

Plate 22: No.3 Furnace - sealed tapping vault.

Plate 23: No.3 Furnace - collapse in crown of upper gallery.

Plate 24: No.3 Furnace - perfectly preserved blowing vault, showing tuyere at centre and suspension loop above.

Plate 25: No.4 Furnace - sycamore growing in N.E. elevation.

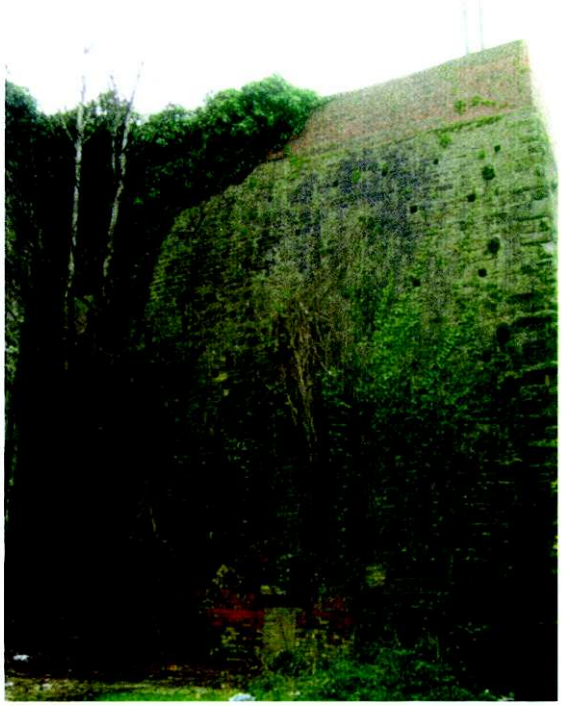


Plate 26: No.4 Furnace - S.E. elevation with sealed blowing vault and twin-stemmed sycamore growing from floor of upper gallery.

Plate 27: No.4 Furnace - collapse in S.W. blowing vault.

Plate 29: No.4 Furnace - lower gallery, showing rails from which blast main is thought to have been suspended.

Plate 28: No.4 Furnace - entrance to 'drying passage' in S.W. blowing vault.

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