SOUTH YORKSHIRE TRADES HISTORICAL TRUST LTD

Forging Ahead:
A Conservation Statement for Wortley Top Forge

February 2009

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Foreword

A Conservation Plan is now regarded as a valuable tool for effective conservation of heritage sites and the Trust is therefore undertaking the preparation of a Conservation Plan for Wortley Top Forge. The Forge is a Scheduled Ancient Monument and the Trust is responsible for work at Top Forge on behalf of the owner, the South Yorkshire Industrial History Society. A necessary step is the compilation of information about the Forge, its heritage significance and the ways in which this significance might be vulnerable to change. In addition to meeting the needs of the Conservation Plan, this compiled information also has considerable value in its own right in providing a contribution to the historical and contemporary records about the Forge. For this reason, we are publishing the compiled information in this self-standing document entitled 'Forging Ahead'. We have given it the sub-title 'A Conservation Statement for Wortley Top Forge' to indicate the linkage with the Conservation Plan. The document provides a connected account of the transition from the Forge as a productive industrial enterprise spanning nearly three centuries to the Forge's rebirth as a place of significant merit in the national industrial heritage.

As far as we know, we have in Top Forge the only water-driven heavy iron forge in the world preserved in situ (as distinct from forges for making small-scale items). A great deal of information about Top Forge is available from historical records. Further information gained from research and observations by many people during the work of preservation exists in disparate documents and records or in the memories of the volunteer workers. The Conservation Statement is an attempt to bring together the information considered relevant to future conservation of the site and present it in form compatible with a Conservation Plan. It is being published as a document of reference for conservation planning and is necessarily lengthy given the complex history and characteristics of the site. In presenting the Conservation Plan, matters of fact, recollection or conjecture about the site will be referred to this Statement.

The Statement first explains the background to the site's existence and the involvement of the Society and Trust in its preservation. The history of the site and the changing industrial environment in which it operated over a period of three centuries are described in appropriate detail. An analysis is provided of the significant features of the site as it now exists. A description is also given of known features that have deteriorated or been lost over time but could be restored or replicated and of features that would, from the nature of the site, be expected to

be present but have not yet been the subject of archaeological investigation. Information is also presented on other factors that affect the overall heritage merit of the site.

The site is not in any immediate danger. However, there are many ways in which the significance and heritage merit of the site are or could henceforth be vulnerable to diminution or loss due to foreseeable changes. The nature and extent of these vulnerabilities are inevitably matters of judgement as to the value attached to particular characteristics and features. The judgements have been made using the collected knowledge of Society and Trust members and external stakeholders. The Statement describes these vulnerabilities and their potential effects. The identification of vulnerabilities leads naturally to a conservation policy for ensuring that the achievements so far will not be nullified and that the heritage merit of the site will be further enhanced. This overall policy is supported by a set of principles or ground rules to be observed in implementing the policy. The principles reflect the views expressed over time, both before and at the time of the site's acquisition and during consultation exercises conducted in recent years. Due recognition is given to the motivations of our forebears who provided funds to acquire the site and of the volunteer workers who have since given much time and effort to its preservation, restoration and maintenance. The policy principles recognise the limits to what can be done in present circumstances but nonetheless it is hoped that they provide enduring ground rules to be adhered to in seeking to fulfil an ambitious vision and aim for the site's future.

The Conservation Plan, when finalised, will include a Management Plan to guide the future endeavours of the Trust, initially over the next five years. Thereafter the Conservation Plan will be reviewed and updated at five year intervals. We expect that the preparation of the Conservation Plan should be completed during 2009.

It is the Trust's hope that the document will be found interesting and educational. It may also be inspirational, in terms of what has been achieved by sustained voluntary effort when the current state of the site is compared to its near derelict condition at the time of acquisition. 2008 was a milestone for Top Forge, marking the centenary of the end of production. It is fitting that we pause and reflect on what we have inherited from the past whilst making our preparations for the future.

Jim McQuaid
Chairman

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Annex I Draft Policy Statement for Wortley Top Forge, Sheffield Trades Historical Society, 1979

Chapter 1: Introduction

The Top Forge in its working days was a water-powered heavy iron forge on the River Don at Wortley, South Yorkshire. It operated from the early 17th century and ceased production in 1908. Top Forge was acquired during the 1950s by the Sheffield Trades Historical Society, now the South Yorkshire Industrial History Society (referred to as the 'Society' throughout the remainder of this document).

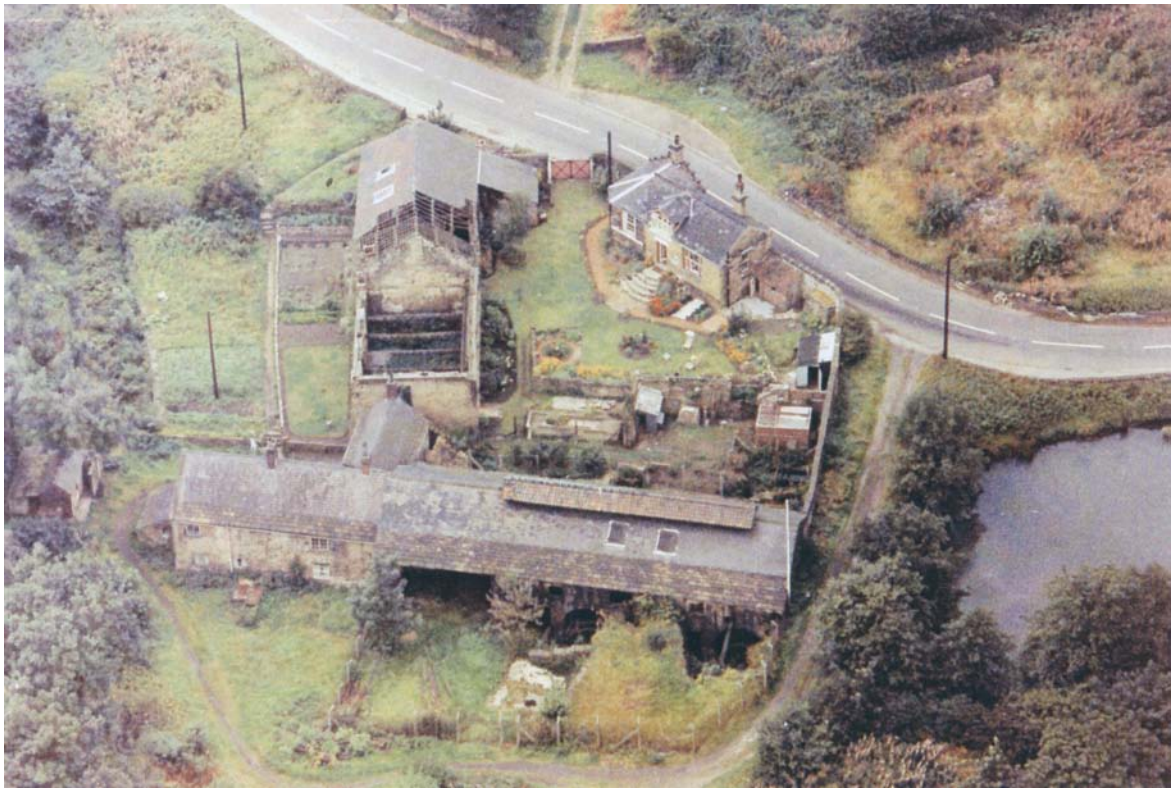


Figure 1 Aerial view of Top Forge buildings in 1963

As can be appreciated from Figure 1, the preservation and restoration of the Forge was a major undertaking for the Society. Apart from some essential repairs, work on preservation and partial restoration did not get seriously underway until the late 1960s. In 1969, responsibility for the work was transferred by the Society to a newly-constituted body, the South Yorkshire Trades Historical Trust (the 'Trust') who have subsequently organised the efforts of successive teams of volunteers, with some of the major structural work being carried out by contractors. The work of the volunteers has been undertaken as a labour of love motivated by a shared wish to care for a valued inheritance of our industrial past. This shared wish amongst the volunteer workers, backed by modest funding, has been sufficient up to now to sustain their efforts. But times have changed. In recent years, there have been moves by the responsible national bodies to have the process of caring for the historic environment, described by the umbrella term 'conservation', put on to a formal and structured basis.

A 2008 publication by English Heritage (EH) (1)[1] sets out an over-arching framework of what conservation means at the beginning of the 21st century. The definition of conservation given in the publication is:

[1] Numbers in parentheses refer to sources listed in the End Notes.

> ‘The process of managing change to a significant place in its setting in ways that will best sustain its heritage values, while recognising opportunities to reveal or reinforce those values for present and future generations.’

Furthermore, the publication introduces the use of the word ‘place’ as an all-embracing term or proxy for any part of the historic environment. The term goes beyond physical form, to involve all the characteristics that can contribute to a ‘sense of place’. It is defined as:

> ‘Any part of the historic environment of any scale, that has a distinctive identity perceived by people.’

In another 2008 publication, the Heritage Lottery Fund (HLF) (2) explains that:

> ‘What makes something part of our heritage is its value to people, which is why it needs special care. The process of caring for heritage is called conservation. Conservation involves looking after heritage in a way that makes sure it remains relevant, accessible and in good condition.’

In further explanation of what looking after heritage involves, it says:

> ‘Conservation is all of the activities needed to care for the heritage, including work such as maintenance, repair and restoration. Conservation management can include other activities such as interpretation, creating new facilities, managing visitors, providing access, setting aside resources and involving people.’

Wortley Top Forge is recognised as an important part of the nation’s industrial heritage and its conservation in accordance with nationally recognised criteria is clearly a necessary objective. Explaining to all interested parties (the ‘stakeholders’) why the conservation process is necessary and how the goal of the process is to be delivered requires a Conservation Plan. In keeping with the above adopted vocabulary, the Trust’s responsibility for Top Forge, on behalf of the Society as owner, can be summarised as the conservation of the Forge through the preparation and implementation of a Conservation Plan.

The content of a Conservation Plan for a place, as recommended in an earlier publication by HLF (3), requires the collection of information on the place, its significance and vulnerabilities. A conservation policy must also be prepared together with associated principles of implementation. These topics together provide an understanding of context for the detailed plan needed to ensure the effective conservation of the place’s heritage merit. Since value-based judgements and interpretation are involved in describing these contextual aspects, the Trust considered it important to obtain stakeholder views on them. This motivated the Trust to collect them, along with factual and evidence-based information, into a coherent description under the title of a Conservation Statement. Stakeholders were consulted at two meetings during the drafting and amendments were made in the light of comments and suggestions received. The present document represents the finalised version of the Statement and forms the basis for preparation of the Conservation Plan. Although HLF’s guidance (3) suggest that a Conservation Statement should be an outline version of, and not as detailed as, a Conservation Plan, the unique characteristics and complexity of Wortley Top Forge has required a rather more comprehensive description than envisaged by HLF. There are several reasons for this.

First, an important part of the conservation policy will be to ensure the attractiveness of the site to visitors. The attractiveness arising from the intrinsic merits of the site as a surviving remnant of an important industry will of course play a dominant role in the policy. However, there are other contributions to the attractiveness of Top Forge that the policy needs to address. These include the displayed collections that have been built up over the years at the Forge, principally of steam and internal combustion engines and engineering equipment once widely used in metal working in the industries of South Yorkshire. Indeed, it is appropriate to recall that a prime motivation for the Society's acquisition of the Top Forge site was the establishment there of a museum of forging (4). A comprehensive collection of forging machinery has been built up towards that end. Since the Plan will be concerned with capitalising on these and other attractions of the place, it is necessary for completeness that this Statement should include relevant information on them and the Plan should pay due regard to them. This would be in addition to the primary focus on the heritage merit of the place as a survival of past industry.

Secondly, Wortley Top Forge is a particular site located in the place comprising the former industrial area of the Upper River Don valley in South Yorkshire. Conservation of the Top Forge site will therefore have two interleaved strands. The first will be concerned with the Trust's responsibility for conserving the heritage merit of the site itself as reflecting its important role in iron making and iron working. The second will have regard to the need to ensure, in cooperation with others, the preservation of its setting in the historic industrial heritage of the place. The main emphasis will be on the former, in particular on sustaining the heritage values of the site, with reliance on voluntary effort and income from visitors, grants and other donations as the principal means. The Plan will thus have to take account of diverse considerations reflecting the complexity, if not uniqueness, of the site in relation to the place in which it is located. For that reason, the Conservation Statement has been produced as a self-standing reference document in which the extensive background information is separately recorded.

Thirdly, there is an unusually wide diversity of stakeholders with an interest in the future of the Forge and of the place. The Statement is primarily written for them as the audience. It was felt that stakeholders would benefit from a more comprehensive briefing about intentions and the reasons for them than would be obtained from an outline Statement. The Trust and Society are committed to a policy of openness and this is demonstrated by the consultation meetings held with stakeholders in relation to the Statement. The benefits of preparing and consulting on a comprehensive Statement in advance of the drafting of the Conservation Plan were seen by the Trust as twofold:

1. To provide the necessary basis for planning the future of the Top Forge site so as to ensure harmony with the site's neighbours and compliance with statutory requirements, and
2. To ensure transparency about the steps to be taken by the Trust so as to gain the cooperation and collaboration of stakeholders, including funding bodies, neighbours and the corps of current and future volunteers on which the eventual success of the Plan will depend.

The information in the Statement has been compiled from a variety of sources, both published and unpublished, to which references or attributions are given, other than for information in the realm of common knowledge or belief and for which the usual caveats apply. References

that have been particularly useful are the three histories of the Wortley Forges by Andrews (5), Mott (6) and Morley (7). Ken Hawley contributed from his vast store of knowledge of the site and its often hidden characteristics as well as his views, developed over a period of 30 plus years as the Society's Honorary Custodian, on priorities for conservation. David Eaton prepared the specification of requirements, drawing on the guidance from HLF (3) adapted as necessary for the special needs of the complex Top Forge site, in particular the idea of producing the self-standing Conservation Statement. Derek Bayliss undertook the distillation of the extensive discussions at two stakeholder consultation meetings. Substantial parts of the text on understanding the site and its significance are a composite of a joint contribution by David Crossley and Christine Ball with additional material from available texts written by the late Francis Evans. The connecting material throughout was written by Jim McQuaid who also had responsibility for editing the final text.

There is extensive use of photographic images in this document. Some of them have no ascertainable source and have been deposited with the Society without copyright restriction over the years. Others have been extracted from Society publications in the public domain. The remainder have been produced by Jim McQuaid for use in this document.

Throughout the exercise, the drafting has benefited from the guidance, written and oral, provided by EH, in particular by Keith Miller, Inspector of Ancient Monuments. The recognition by EH of the importance of the Top Forge site in the national list of sites and the complexity of description of its significance and heritage merit provided the Trust with the stimulus to produce this document.

Chapter 2: BACKGROUND

2.1 The Heritage Asset Associated with the Top Forge Site

2.1.1 The definition of the Top Forge site: The heritage asset on which the Conservation Plan will primarily focus is the site of the Top Forge at Wortley, South Yorkshire. However, there is no easy definition of the overall heritage asset associated with the wider place of which Top Forge is a part. The site has strictly to be defined as the area currently owned by the Society, being the chance outcome of the property acquisitions that were possible in the past. The site as such is incomplete and does not represent the full extent of Top Forge as it was at the time of the Forge's productive life. Furthermore, the site cannot be viewed in isolation from its setting in the wider place of the Upper River Don valley. It was at one time one of a geographically-compact group of interconnected industrial sites. These were set in a rural landscape and used local labour and material resources. Most importantly, they all depended on the availability of water power from the natural water supply of the River Don. They thus had to be separately located and operated in cascade rather than being concentrated on a single site. Each in succession used the quantum of energy available to it from the approximately 3 or 4m fall of the river between each site. The different works took raw materials and processed them into engineering materials of various kinds or into finished products. This integration of activities was a mark of the industrial revolution. The character of this former rural industrial area has now largely reverted to rural greenfield, with isolated historic industrial remnants in the form of former industrial buildings (some converted to houses), weirs, ponds, quarries and workers' cottages. The Top Forge is the most prominent and important survival of past industrial activity largely unaffected by modern development. It is appropriate to quote the view of B H St J O'Neil, Chief Inspector of Ancient Monuments of the Ministry of Works, and recorded in a memo in 1950 (reproduced in (4)) that '...the forge in general is a good example – and now seemingly a very rare example – of the ironworks of the 17th, 18th and 19th centuries.'

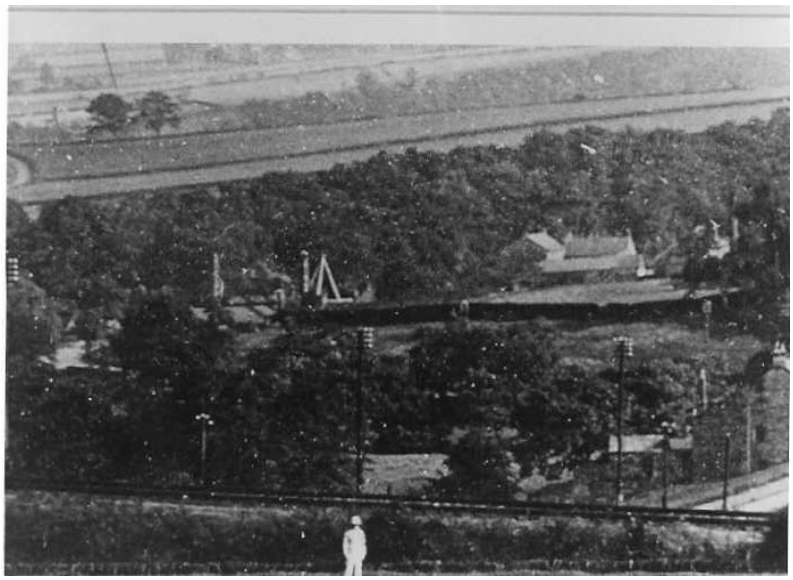


Figure 2 The rural setting of Top Forge in the late 19th/early 20th century. The location of the Forge is identifiable by the test tripod in the left centre of the photograph

Under the provisions of the current planning policies of the local authority (Barnsley MBC), the area around the Top Forge site is protected from development which would impair its 'availability, accessibility and particular qualities' (8). Moreover, these policies also promote the enhancement of the area and this provision has relevance to the potential enhancement of the Top Forge as a tourism and educational resource. The

setting of Top Forge is therefore inseparable from the Forge site itself in providing a readily appreciated overall image or 'sense of place' for the Forge's part in the transformation from rural craft to (relatively) large-scale industry. A Conservation Plan for the Top Forge needs to pay due regard to the local industrial geography during the Forge's period of operations. Inevitably, there is now a wide spread of current ownership of assets that were formerly in common ownership with the Forge or were linked in one way or another to its operations.

All of the above considerations have implications for the definition of the extent of the heritage place to which the Conservation Plan will relate. However, responsibility for conservation of the setting rests with the local planning authority and hence the scope of this Statement necessarily has to concentrate on the site or asset for which the Trust has responsibility for conservation. Reference will be made as appropriate to other assets which at one time were integral to the operation of the Forge. Nonetheless, it is hoped that the information on historical activities at the Forge and on intentions regarding the Forge's future as presented in this Statement will be useful for the purpose of planning decisions potentially affecting the setting.

The attraction of Top Forge as a heritage asset is due to the survival of most of its buildings and machinery in their original riverside setting. It is not a museum relying solely on displays imported from elsewhere and it is no longer a working forge. Since it is not a complete survival, a full realisation of its heritage merit would require additions to the current asset. These could be relevant artefacts, buildings, land and infrastructure intended to enhance the attraction of the site. They could also be in the form of reinstatements as far as is practical of original items that have been lost over time. Where faithful reinstatement is not practical, resort could be made to imaginative substitution and representation of missing features. Some additions, reinstatements and substitutions have already been undertaken and further possibilities are envisaged by the Trust. The Conservation Plan for completeness will need to include all feasible additions or acquisitions that might be made as opportunity allows. The description of the overall asset is therefore more comprehensive than, though grounded on, the asset represented by the land, buildings and machinery owned by the Society and for which the Trust is currently responsible. The Statement makes due reference to enhancement of the Society's asset by the above means.

2.1.2 <u>The former industrial geography of the area</u>: The Top Forge (also known as Upper Forge in the past) as it now exists is the surviving remains of an ancient water-powered heavy ironworks situated in a U-shaped bend of the River Don some 14.4km north west of Sheffield (National Grid Reference SK29419997). Although always referred to as Wortley Top Forge, the village of Wortley is actually located on the A629 Rotherham to Huddersfield road about 1km distant from the Forge.

Top Forge is the only substantially intact survivor of a group of mainly 17th century water-powered works that once operated on a 4km stretch of the River Don upstream and downstream of Top Forge[2]. The relevant stretch of the river is shown in Figure 3. For ease of reference, the locations of the various works along the river, from the Old Wire Mill at the upstream end to the Tin Mill at the downstream end, are identified in Figure **3**.

[2] Andrews (7) states that there were at least ten water wheels connected with the various mills and forges.

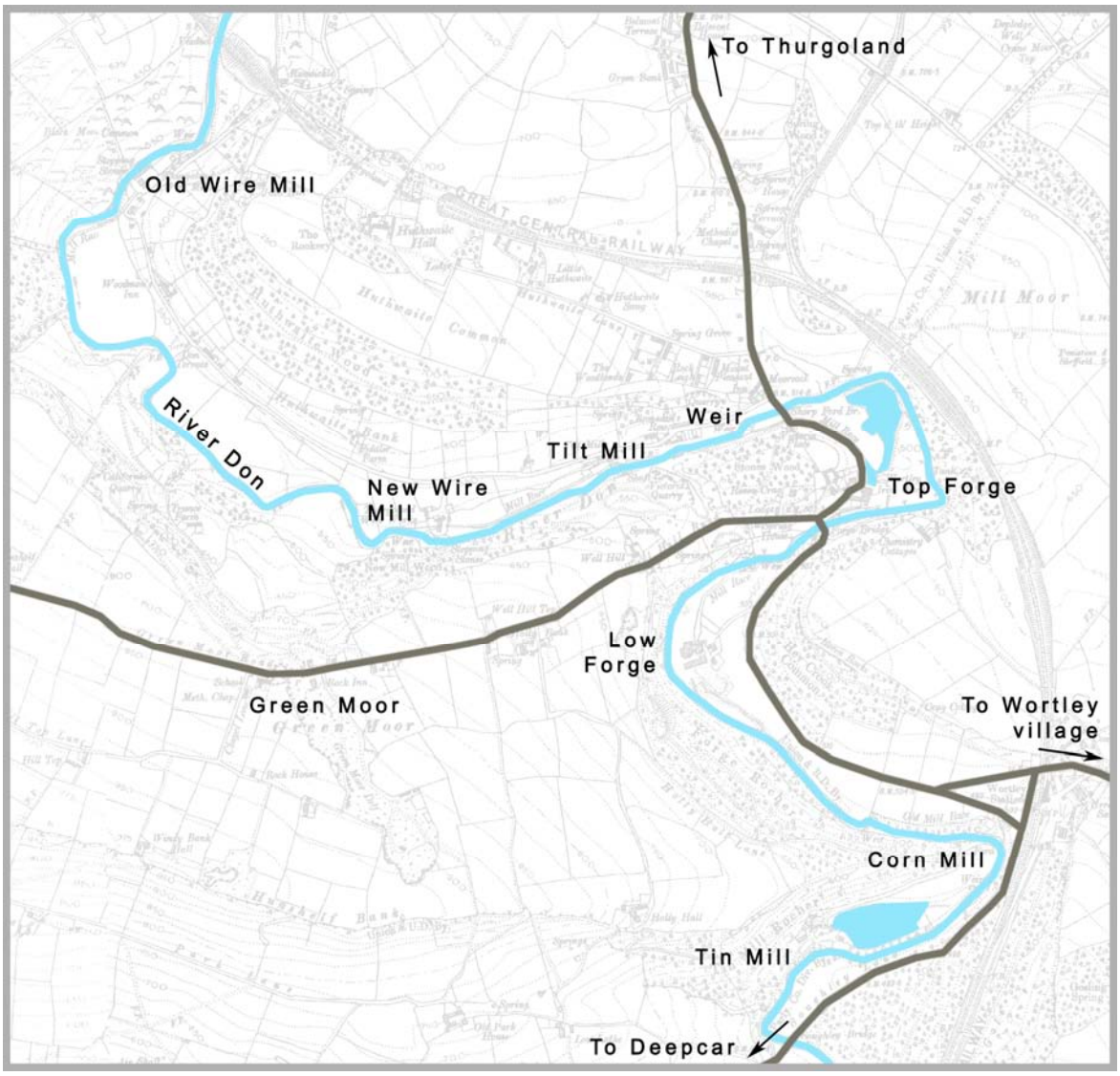


Figure 3 Locations of various works in the vicinity of Top Forge

The concentration of industry shown in Figure 3 owes its origins to the long history of iron making and working in the area. It is known that as early as 1379 there were four 'smythes' and a 'master' at Wortley while records dating to 1621 mention a bloomery[3] at Wortley (9). The Top Forge was particularly active in the first quarter of the 18th century, a period when the buildings underwent extensive alterations. The surviving buildings (to be described below) are mainly early 18th century with later alterations (9). Good building stone for the various sites was readily available nearby. Charcoal for fuel was available from the surrounding woodland and pig iron was bought in from furnaces such as at Barnby and Bank, a few kilometres to the north.

A very full description of the various sites with their dating is given in (7) and the following is a summary. Referring to Figure 3, the first site moving upstream from Top Forge is that of a tilt or slitting mill (built shortly after 1624) and now marked by Tilt Mill Cottage. Above this is the former New Wire Mill (also known as Thurgoland Wire Works), established 1727 or 1728 and converted to houses in the early 1990s. It was still in production at the time Mott wrote his history (6). Nearby is

[3] See Section 3.2 for explanation of ironmaking terms.

Figure 4 Thurgoland Wire Works

Huthwaite Hall (10), once the home of the Cockshutts who were owners of Top Forge and other sites in the late 17th /early 18th century (see later). Finally on this stretch is the site of the Old Wire Mill, first known as a bloomery in 1567 and rebuilt as the Old Wire Mill in 1624 and rebuilt again in 1850. It ceased production in the 1930s (5) and is now a residence.

Downstream of Top Forge is the site of Low Forge which was closely associated operationally as well as being in common ownership with Top Forge. They were together known as the Wortley Forges or Wortley Ironworks.

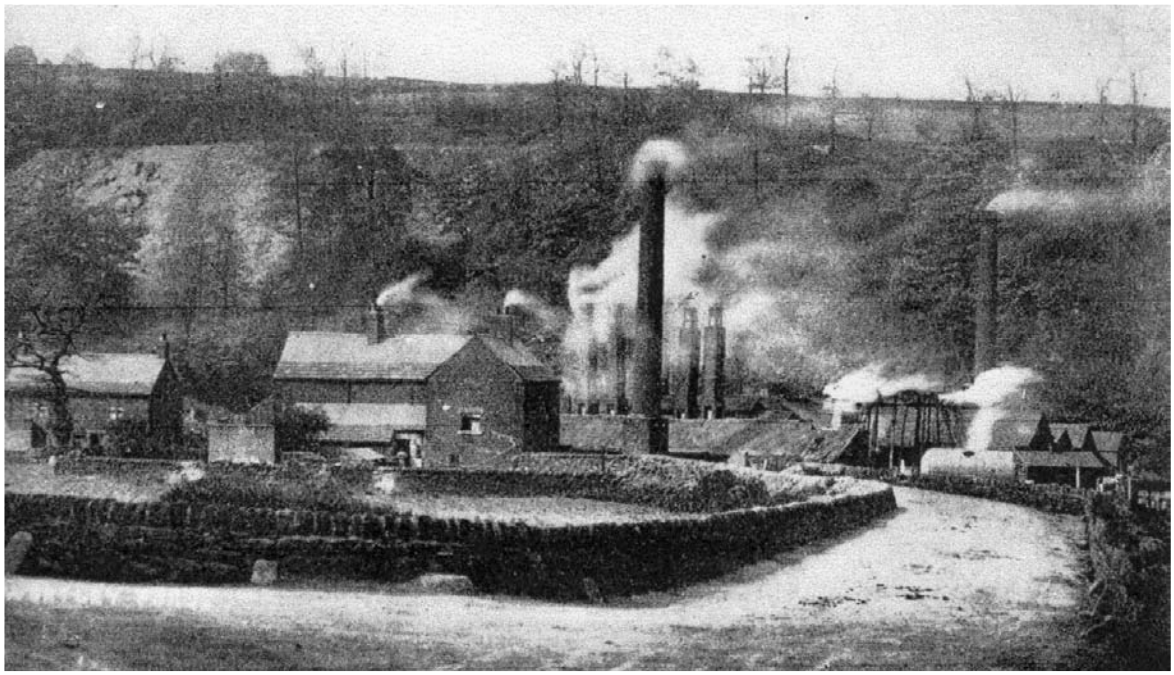


Figure 5 Wortley Low Forge

The buildings of Low Forge were demolished after WWII and the site is now marked by two rows of cottages and some remains; the standing and buried remains of the forge were included in the list of Scheduled Ancient Monuments in 2006. Continuing downstream, a Corn Mill belonging to the Lord of Wortley in times past stood close to where the river takes an abrupt turning to the right. The date of demolition is uncertain and no clear trace of it now remains. The final site is that of the Tin Mill. Mott (6) records that the site was originally that of a slitting mill in existence in 1695 and before this it was occupied by a bloomery known from lease records to have been operating in 1621 though how long it had existed before that date was not known to Mott. The slitting mill was converted in 1743 to a rolling mill for producing tin plate and black sheet iron for general use. Differing views have been expressed on whether coating of sheet iron with tin was ever actually carried out at the Tin Mill. Andrews (5, p.65) claimed that there was no existing

evidence that real 'tin plates' were manufactured there. However, Angerstein in a mid-18th century account (22, p.219) provides firsthand evidence while Morley (7) states that production of tin plate ceased before 1814. Thereafter, the Mill remained in operation as a sheet rolling mill though still, and to this day, being referred to as the Tin Mill. It was still operating in 1879 but had closed by 1883 when the lease was given up by the Wortley Forges (7). It is one of the few sites where remains of the 18th-century water-powered tin industry may still be seen. The former dam[4] of the Mill survives as a pond for fishing.

Returning to Top Forge as the main focus of attention, Figure 6 is a perspective sketch of the central complex of the Forge. It illustrates the collection of buildings as they would have appeared at the end of the era of operation as an ironworks. At the top of the sketch is the Forge office and the entrance courtyard. This part of the complex was sold separately prior to the Society's acquisition. It survives as a residence in private ownership and known as Top Forge Cottage. A complete description of the other buildings is given later together with details of the additions made during restoration and in the course of enhancing the attractions of the site. The area of water at the top right of Figure 6 is known as the Small Dam. It is not part of the Society's property. Originally it represented the sole water storage capacity for the Forge but (see later) this was subsequently enlarged by construction of a separate and larger dam off the sketch.

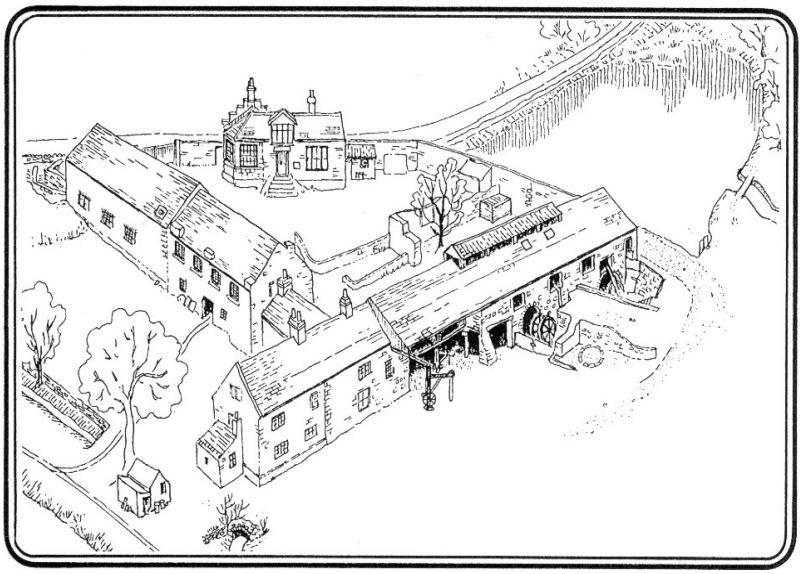


Figure 6 A perspective sketch of Top Forge

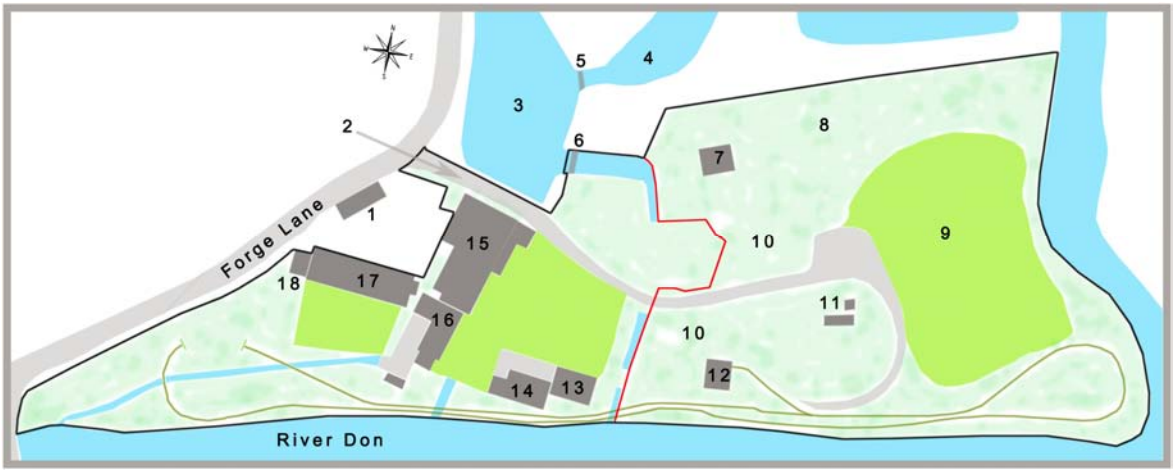
To complete the outline description of Top Forge as it once was, reference should be made to some associated buildings nearby. Skirting the Forge at the top of Figure 6 is the public road from Wortley to Thurgoland known as Forge Lane. Directly across this road, there was at one time a row of cottages for Forge workmen and sheds for the Forge wagons. These were demolished in the 1950s; they are shown in Figure 7 with the entrance to the Forge at the extreme right. Behind this row there was the Forge

Figure 7 Cottages for Forge workmen and the Forge wagon sheds, demolished in the 1950s.

[4] In the local parlance, a dam is the reservoir of water behind a wall or bank and not, as usual elsewhere, the retaining wall itself.

manager's house and farm known as Huthwaite Grange. Adjacent to the Grange was the house, Ravencrag, built by Thomas Andrews Junior, the last owner of the Forge. Both houses survive. Nearly opposite Ravencrag on the road to Greenmoor (see Figure 3) was a mission hall also built by Thomas Andrews Junior and it too survives. All of these former Forge properties are now privately owned as residences.

A site plan is shown in Figure 8 which includes numbers attached to the buildings and features. These numbers will serve as location references in the description that follows. Also marked is the boundary of the property for which the Trust is responsible. The property within this marked boundary will be referred to as the Top Forge 'site' in the remainder of this document. The area of the site is approximately 1.6 hectares.



LEGEND

- site boundary
- eastern boundary of scheduled area
- model railway
- water
- grass
- vegetation

1 Top Forge Cottage
2 entrance roadway
3 Small Dam
4 Back Dam
5 sluice connecting Back and Small Dams
6 overflow
7 Elizabeth engine house
8 storage area
9 car parking
10 outdoor exhibits
11 toilets
12 miniature railway facilities
13 South Yorkshire Ironworks building
14 smithy
15 main Forge building
16 cottages
17 blacksmiths & joiners shops & foundry
18 cementation furnace site

Figure 8 Plan of Top Forge site

2.2 Ownership of the Top Forge site

The freehold of the Top Forge site was acquired in two separate transactions in 1953 and 1959 by the Society. An account has been written

Figure 9 Derelict state of No.2 water wheel in the late 1950s. Note the wooden prop supporting the lintel and masonry of the Forge building. This was put in place as a short-term measure in 1955 by Oliver Inman who carried out emergency repair work. The prop could not be removed until 1975 after the structure had been consolidated.

(4) of the efforts by the Society, beginning in 1933, to acquire the site for preservation. It is now managed by the Trust on behalf of the Society for the purposes of restoration and maintenance and generally for stewardship of the site. Both the Society and Trust are charitable bodies; they have no employees and are legally separate. In compliance with charities legislation, the legal ownership of the site is vested in Trustees appointed by the Society (not to be confused with members of the Trust). Formal arrangements are in place for cross-membership of the respective Councils of the Society and Trust to ensure coordination and communication. Part of the site is used under licence by the Wortley Top Forge Model Engineers (an independent voluntary association) for running a miniature railway for leisure purposes. The abstraction system for providing and storing the water supply from the river Don used for operating the Forge water wheels is in separate ownership and control. There is at present no formal agreement between these owners and the Trust.

The freehold of the main Forge building (15 in Figure 8) was purchased in 1953 by the Society. It was in a near derelict state, as can be seen from Figure 9. The freehold of the other buildings existing at the time and the remainder of the site were acquired in 1959.

2.3 Details of Scheduling

Top Forge survives both as standing and below ground remains of iron making activities. The Top Forge is now generally described as a Scheduled Ancient Monument (National Monument No. SM29920). The first step in the scheduling history of the site was taken on 30 July 1952 when a notice was issued to the then owners by the Ministry of Works of intention to include the main Forge building with its machinery in the list of Scheduled Ancient Monuments (4). As a result of various additions in later years, the current scheduling status of the site varies between buildings, some of which are Listed Buildings. It is relevant to note in passing that proposals have been published, though not yet enacted, to change the heritage protection legislation, notably by combining listing and scheduling. However, the descriptions to follow are based on the current status of the property. Importantly, the scheduling does not cover the whole site. The eastern boundary of the scheduled area divides the site and is shown in Figure 8. A detailed description was given in the notice (9) issued in respect of the most recent addition to the scheduling. This was for the water supply system which in fact is not part of the site as defined. Nevertheless, the details are directly relevant and the following draws on that description. For completeness, the details to follow include the scheduling status of all the properties

not owned by the Society but which were at one time part of the Top Forge complex.

The main Forge building is included in the scheduling and is Listed Grade

Figure 10 Exterior view of main Forge building

Figure 11 Interior view of main Forge building

I. Views of the building (15 **in** Figure 8) are shown in Figures 10 and 11. The building retains a datestone of 1713 and includes the initials 'MW', a reference to the manager at that time, Matthew Wilson. The building shows evidence of different phases of construction. Structural alterations were probably carried out as technological changes dictated but the surviving functional layout is mainly mid-19th century in date. The building is of stone and the main structure is rectangular in plan. The functional layout is shown in Figure 12.

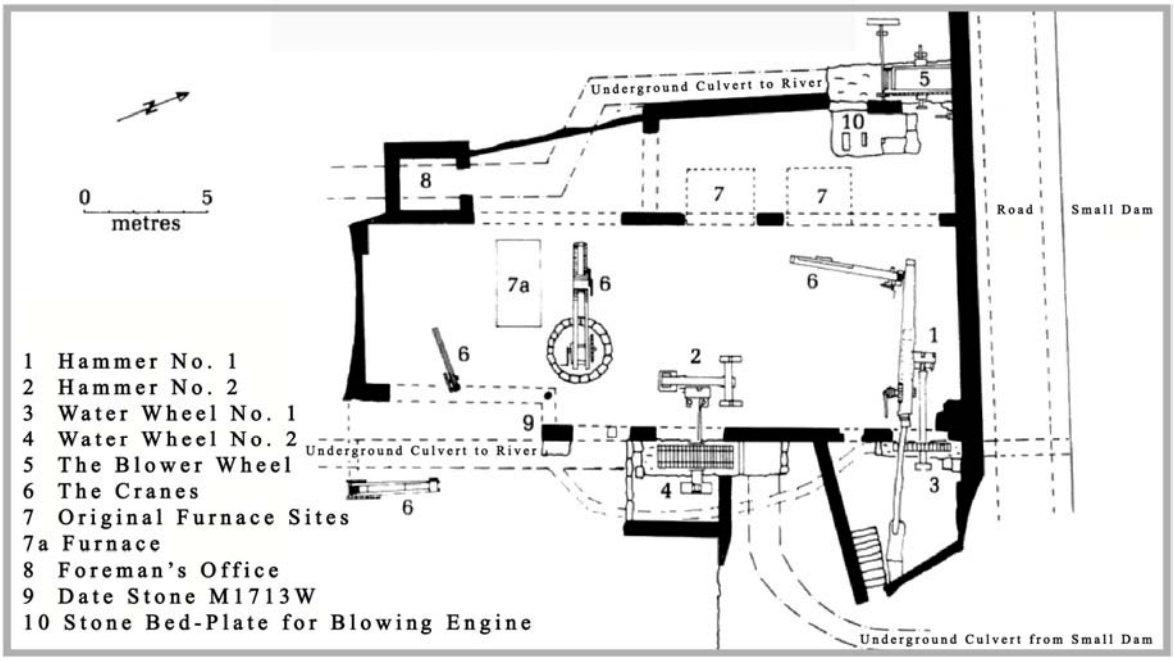


Figure 12 Functional layout of main Forge building

There is an outshut(an extension running along part of the length of the building under a lean-to roof) along the west sidewall of the building. Along the length of this wall are four segmental arches with brick voussoirs. The northernmost arch leads through to the location in the outshut of the stone bedplates of a two-cylinder horizontal blowing engine [5] which would have been driven by the surviving blower wheel immediately outside the outshut (11). An extension shaft from the blower wheel was used in the late 19th/early 20th century to provide lifting power for a drop test rig formerly located in the Forge yard, now the garden of Top Forge Cottage (1 in Figure 8). Adjacent to the outshut at its southern end is a small rectangular room which was used as a foreman's office. Bonded to the eastern wall of the building are two pits which house water wheels. The east wall has two large rounded, arched openings corresponding to these wheels. The wheels drive two belly helve hammers within the Forge building (see Figure 11 and the description below). The hammers are included in the scheduling though not the water wheels. Four hand-operated wooden-framed cranes keyed to the structure were used to assist in operations in the Forge. The cranes survive and are included in the scheduling. At the southern end of the east wall, and slightly set back, is a two-bay arcade with brick voussoirs supported on two round cast iron columns and forming the entrance to the building. The date stone is set in the northern pier of this opening. Originally the building was covered by a stone roof but during alterations around 1880, when part of the roof was raised to allow greater ventilation over the reheating furnaces, only the best stone was kept and slate was used to

[5] A reproduction of the blowing engine is currently under construction.

make up the difference. Now the upper roof is of Welsh slate and the lower roof of stone.

To the south of, but attached to, the main Forge building are two cottages (16 in Figure 8) which are Listed Grade II (see Sections 3.5 and 4.1 below). The cottages were once inhabited by workers of the Forge and are now used for display purposes and as an amenity for volunteer workers of the Trust. They are excluded from the scheduling, although the ground beneath is included.

Figure 13 Blacksmiths and joiners shops and foundry

To the south west of the main Forge building, and at right angles to it, is a building housing the blacksmiths shop and foundry (17 in Figure 8). This building includes the joiners shop on a mezzanine floor over the blacksmiths shop and is shown in Figure 13. It is now used partly as a workshop and for display and demonstration purposes by the Trust. The building is excluded from the scheduling together with the machinery and exhibits on display, although the ground beneath is included.

Figure 14 Possible location of an early cementation furnace

A small roofed structure (18 in Figure 8) is attached at the west end of the foundry and is widely believed to have been the housing for a cementation furnace. Researches by Dr Ken Barraclough (see later) led him to the view that steel was produced at Top Forge using the cementation process during the 18th century. The structure, shown in Figure 14, is included in the scheduling and is now used to house a compressor for operating the machinery on display.

The former main office of the Forge, now known as Top Forge Cottage (1 in Figure 8), is a Grade II Listed Building and lies to the north west of the foundry building. It is excluded from the scheduling, although again the ground beneath is included. The remains of the Forge yard, the main entrance to the ironworking complex, and the area once occupied by the drop test rig, all lie beneath the garden of Top Forge Cottage and are included in the scheduling. Both Top Forge Cottage and its garden are in private ownership.

The water supply to the Forge is provided by a complex water management system the whole of which was added to the scheduling in 1999. Its various elements are all in separate ownerships. It begins with a weir 90m west of the bridge, known as Sharp Ford Bridge, where Forge Lane becomes Cote Lane. Its location is indicated in Figure 3. The weir is a substantial stone-built construction across the River Don. The difference in level due to the fall of the river between the crest of the weir and the level at the discharge of the Forge water wheels provides the head of water needed to drive the wheels. The head goit[6] diverts from the river immediately south of the weir. Water supply to the goit was controlled by a sluice gate, surviving though now permanently open, at the head of the goit. It is shown in Figure 15. From here water flows on the level directly to the Small Dam (3 in Figure 8) and a second sluice gate further south along the goit is now used to control the flow. For most of its course, the head goit runs along the east side of Forge Lane. Although the Small Dam is separately owned, the dam wall is owned by the Society and is included in the scheduled area of the Forge. A metalled surface on the crest of the dam wall now serves as the main entrance (2 in Figure 8) to the Forge complex. The inadequate capacity of the Small Dam, with a maximum depth of 2m and an area of about 0.1 hectare, was recognised some time before 1746 and consequently a new and much larger Back Dam (4 in Figure 8) was built using the same head goit. It is possible that the water supply to the new dam was provided by means of a pipe, which ran from approximately half way along the length of the head goit into the west bank of the Back Dam. The pipe is still visible in both the east bank of the goit and the bank of the dam. In more recent times, a fishing lake was excavated in the area between the Back Dam and the head goit and this would have resulted in the removal of the middle section of the pipe. A sluice (5 in Figure 8) at the southern end of the Back Dam would originally have controlled the water supply between the Back and Small Dams but this control is now achieved by a sluice between the fishing lake and the head goit just upstream of the aforementioned existing sluice in the goit. The scheduling of the water management system covers all of the above features with the exception of the fishing lake.

Figure 15 The weir, sluice gate and beginning of head goit

An overflow weir (6 in Figure 8) on the east wall of the Small Dam serves to control the water level in the Small Dam and hence the maximum head of water available to the wheels of the Forge. The overflow from the weir is taken by a channel, partly underground, to the river some 40m upstream of the line of the eastern wall of the Forge. This channel forms part of the eastern boundary of the scheduled area (marked on Figure 8) of the site within which all the ground beneath is included in the scheduling in addition to the buildings already described.

[6] A goit is a channel which courses water from the river (head goit) or to the river (tail goit).

Figure 16 New constructions in the scheduled area

Immediately to the west of the overflow channel are two buildings constructed in the scheduled area during the Society's ownership and designed to be sympathetic to the surroundings. They are built on the remains of the foundations of former buildings but are not themselves scheduled. The first (13 in Figure 8 and to the right in Figure 16) is known as the smithy and houses miscellaneous forging machinery and other artefacts awaiting display. The second (14 in Figure 8 and to the left in Figure 16) is known as the South Yorkshire Ironworks building (12).

A narrow gauge railway track (indicated in Figure 8) runs along the southern edge of the site and is used for rides when the Forge is open to the public. It lies partly on the scheduled area and thus the ground beneath it in this part is included in the scheduling.

2.4 Machinery and Items Important to Effective Conservation of the Site

In addition to the surviving buildings, their setting and the overall sense of place of the site, the surviving machinery (mentioned in passing in Section 2.3) is very significant to the heritage merit of Top Forge. As explained earlier, the overall attraction of the site to visitors also benefits from the collections of items imported to the site during the period of restoration. These are in many cases related to the general engineering heritage of the area. Many of these items are displayed in the foundry and joiners shops or in the new buildings. Some larger items are on open display around the site or in temporary storage pending display. Since the enhancement of visitor attraction will be a key consideration in the viability of the Conservation Plan, a complete description of the original machinery and an outline of the imported machinery currently on the Top Forge site is appropriate.

A considerable amount of the original machinery remains in situ in the main Forge building. Referring to Figure 12, the northernmost water wheel, designated No. 1, of cast iron construction with modern wooden paddles, is 3.6m in diameter, breast shot and with a cast iron axle. This probably replaced an earlier wooden wheel. Wheel No. 2, which is also breast shot, is on the eastern side of the main Forge building and was installed in the mid-19th century. It is cast iron, 4.1m in diameter, with separate felloes and later wooden paddles. The blower wheel is again cast iron with wooden buckets and is 2.7m in diameter. It is fed from a cast iron pentrough (dated 1850) which is situated above the wheel. A shuttlemouth beneath the pentrough directs the water on to the top of the

wheel and gives the name of 'pitchback'. All three wheels are now in running order and are demonstrated during guided visits.

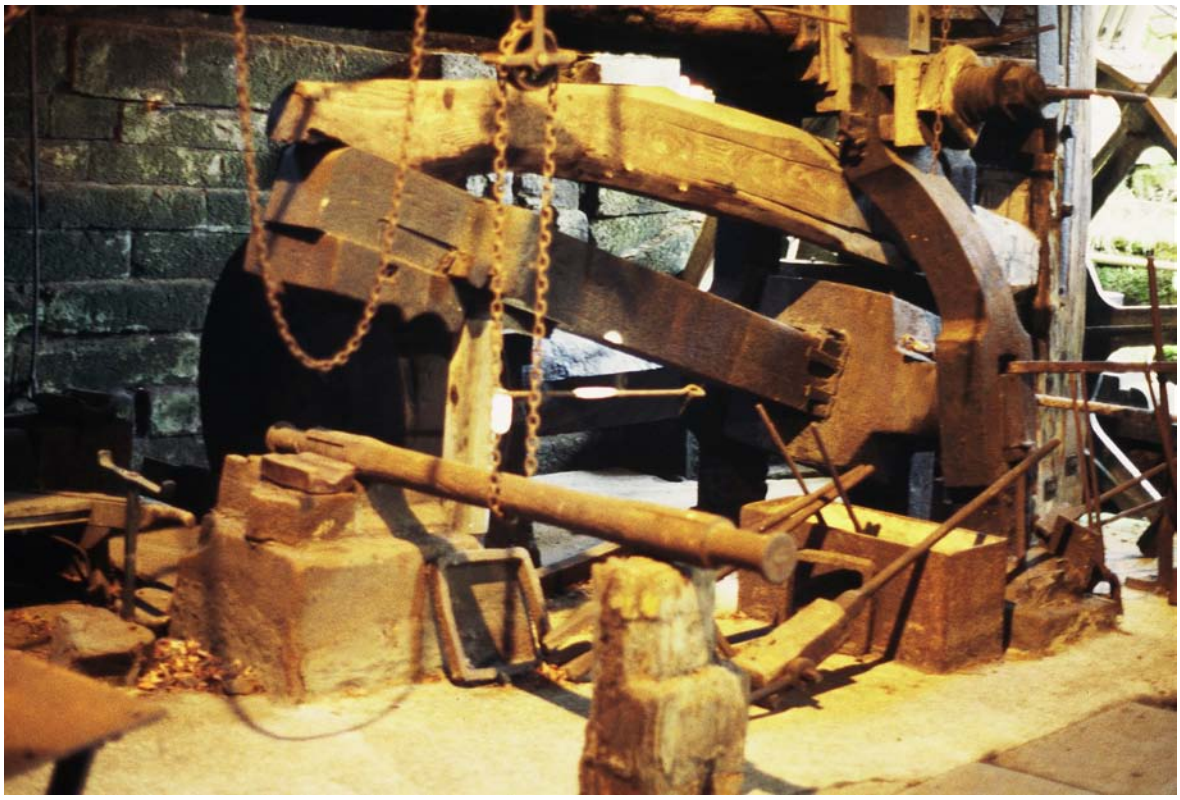


Figure 17 No.1 belly helve hammer

Nos. 1 and 2 wheels were used to drive two belly helve hammers[7] which have corresponding numbers. No. 1 hammer, seen face-on in Figure 11 **and in** more detail in Figure 17, is provided with a spring beam, a naturally-curved tree trunk which acts as a spring to give a heavier blow. This hammer, although altered by the addition of cast iron parts, still has a massive timber framework of uprights and beams, is of 18th century type and in essential layout dates from the finery period[8] of the Forge. No. 2 hammer, partly visible on the right in Figure 11, is a later free-fall hammer and is all-iron in a cast iron frame. Both of the hammers are fitted with heads and anvils suitably shaped for the forging of railway axles though hammer no. 2 is of a size and type more appropriate for heavy work. Two cranes close to the hammers were used to help place bundles of wrought iron bars into the furnace and then, after heating to white heat, to support them as they were being manipulated under the hammer. Two cranes at the entrance to the building were used to move the finished axles out of the Forge. One crane within the building loaded the axles on to a weighing machine and the other, in the yard and supported by a beam cantilevered out from the building, loaded the axles for delivery on flat-bedded wagons known as iron 'wains' or 'waynes'. One of these can be seen in the central shed in Figure 7. The hammers and cranes are not used for demonstration purposes.

[7] In this type of hammer, the hammer beam or helve is lifted intermittently by a cam striking the underside or belly of the helve between the pivot and the hammer head.
[8] See Section 3.2 for explanation of ironmaking terms.

Figure 18 Main Forge building showing chimney stacks

Towards the southern end of the main Forge building is a reverberatory coal-fired reheating furnace with two counter-balanced lifting doors. In this type of furnace, the firebrick-lined interior consists of two interconnected chambers. At the side is the firebox, fitted with cast iron fire grate bars upon which the coal fire burned. The furnace is not original having been moved to Top Forge from a Sheffield steelworks. It is representative of those used in forges during the period of axle production. A forced air blast would have been provided for the original furnace by the blowing engine, as described by Andrews (5). However, the air supply for this type of furnace could also be provided by a natural draught generated by means of a chimney stack and controlled by a damper on top of the chimney. Three such chimney stacks existed at one time but do not survive (13). They were prominent features in extant photographs of Top Forge in the early 20th century and can be seen above the roof in the view shown in Figure 18.

The blacksmiths shop is now used by the Trust for general engineering work connected with restoration and maintenance. Equipped with a variety of machine tools and a hearth, it is a typical 19th/early 20th century machine shop particularly in its use of overhead belt drive. All of this machinery has been brought to the site. The foundry and joiners shops house a collection of steam and internal combustion prime movers and ancillary equipment covering a range of scales and types. The collection includes an example of a steam engine built into the structure, as was early practice, and a venerable steam engine saved from the historic Sharrow snuff mill in Sheffield. It is believed to be the one supplied to the snuff mill by Davy Bros in 1843 and probably that firm's oldest surviving product. In other buildings on the site there is a comprehensive collection of machine tools and forging equipment from the hand tool and cutlery trades of Sheffield in various stages of restoration for display and demonstration. In the outside display area of the site is an engine house shown in Figure 19. This was constructed to house an overhead crank, grasshopper beam engine known as 'Elizabeth' acquired from a textile mill in Huddersfield with the aid of a grant from the Science Museum. A photograph of the engine in situ in the mill together

Figure 19 Elizabeth engine house

with a brief description can be found in (14). The engine is now demonstrated running on compressed air during Forge Open Days.

An interesting survival, believed to be from the Tin Mill, is a complete set of stone segments of the balance wheel or flywheel of a rolling mill. The Tin Mill latterly rolled wrought iron into sheets. Andrews (14) records that

> 'This rolling mill was driven by two water wheels of about 18hp each, running reverse ways, without toothed gearing of any kind, one driving the top roll, the other the bottom one. The water wheel is also weighted by a very heavy stone rim, bolted together in segments, so that the wheels act as fly wheels.'

One set of stone segments was fortunately rescued from a residential garden where they were used as a feature and the segments are now laid out on the ground for exhibition at Top Forge.

All of the above represents a selection of the machinery items that can be seen at Top Forge, complementing the visitor experience obtained from the Forge itself.

2.5 Developing the Case for Conservation

This Chapter has described the place both as it now exists and how it evolved to its present state, with a particular focus on the Top Forge site. This description provides the context for consideration in later chapters of future needs for conservation of the place, again with a particular focus on the Top Forge site. The remainder of the Statement will address the various aspects of those needs. We are fortunate in having available the extensive information from historical researches which have included scrutiny of the abundant documentary evidence in leases and accounts. The results of these researches into the past, allied with the evidence from observations of the substantial remains and the almost complete survivals as now exist, enable us to develop a comprehensive understanding of past activities and to elaborate on the many features of the site's significance and heritage merit. The judgements we then make on the adverse changes to which the future conservation effort could be vulnerable rely heavily on the knowledge and understanding of the site built up during the years of restoration and on appreciation of likely trends in the environment for conservation work by volunteer effort. Finally, having stated the case for conservation, the Statement sets out a policy on conservation and what would need to be done to ensure its fulfilment, though without specifying the means or timescale - these are matters for the later Conservation Plan in the light of available resources.

Chapter 3: Understanding the Top Forge Site

3.1 Overview

The Top Forge site was intimately connected with the production of wrought iron as a material and its use for finished products as well as its supply to other manufacturers as intermediate stock material for finishing into products. Throughout this document, the term 'wrought iron' specifically refers to a particular alloy of iron and carbon. It does not, as in common current usage, refer to everyday ornamental ironwork such as gates and fences (which anyway are nowadays universally made from steel). Wrought iron was the iron for blacksmiths, for nailmakers and armourers. Tough and ductile, it could be forged into bars, rolled into sheets or drawn out into wire. Very thin sheets, for example, were supplied to manufacturers of tags for shoe laces (7). Thicker sheets were used for the manufacture of spades and shovels. In this context, Andrews[9] (15) wrote of being told by a Forge workman who remembered that early in the 19th century

> '...as many as a dozen carts from all parts of Yorkshire within a radius of thirty miles waiting for shovels to be rolled and iron to be tilted for them at the tin-mill and forges. In times of dry weather, when the water was low in the river and dams, these teams and packhorses had frequently to wait several days before the orders could be executed.'

Andrews, writing in 1879, added that 'this waiting necessitated the erection of stables, which are still standing, but some of them have been recently converted for workmen.' It may be that he is referring here to the buildings shown in Figure 7.

Sheet wrought iron could be plated with tin by dipping in a bath of molten tin after it had been suitably prepared. Wire from bars of Wortley wrought iron was drawn in the nearby wire mills and had many subsidiary uses such as for needles and pins in the textile industry[10]. Large forgings could be made by faggoting or clamping together square bars of wrought iron in a bundle[11], heating the bundle white hot and then forge welding it under a hammer. Figure 20 shows the end of such a faggoted bundle cropped from a railway axle forging. The No. 1 preserved hammer at Top Forge, shown in Figure 17, is typical of 18th century construction. The Wortley Forges under James Cockshutt FRS were probably the first in Yorkshire to adopt the innovations of Henry Cort, inventor of the puddling process for making wrought iron and of hot rolling for producing bars and rods. For a long time, the Forges were an essential part of the industrial infrastructure of the Upper River Don valley as can be judged from the above quotation. But trade even reached across the Pennines and, again, Andrews (15) wrote that 'in the early 19th century a waggon regularly made two journeys a week across the moors to Manchester from Wortley Forges, taking tilted and bar iron there, and loading back with scraps.'

Figure 20 Cropped end of a faggoted bundle of wrought iron bars

[9] Thomas Andrews Junior was the father of C Reginald Andrews, author of (5).
[10] The village of Hathersage near Sheffield was once a centre of the needle making industry.
[11] The number of bars in a bundle was given as 16 in (5), p. 3.

Wrought iron eventually gave way to steel as an engineering material but in its time it played a dominant part in industrial history. The physical features of the surviving Top Forge, taken together with its setting and with knowledge and interpretation of its past, provide a unique resource for comprehending the various activities that made Wortley an important place in industrial life over nearly three centuries.

3.2 The Production of Wrought Iron

The evolution of the production process for wrought iron took place through several distinct periods. From Roman times, wrought iron was made in a bloomery hearth, which at the time was little more than a stone box less than a metre cubed. This was charged with charcoal and iron ore (consisting of iron oxide and clay). Combustion of the charcoal was assisted by bellows though the temperature achieved was not high enough to melt the iron oxide. Instead, the carbon in the charcoal combined chemically with the oxygen of the iron oxide, freeing the iron which formed a pasty mass with the slag from the clay in the ore. Hammering this pasty mass would squeeze out the fluid slag leaving wrought iron with a characteristic fibrous structure. A working demonstration of a bloomery hearth by staff of Sheffield University has recently featured in the programme for public open days at Top Forge.

The blast furnace changed the technology, especially following the transfer of technology from China into Europe around 1500. The higher combustion temperature allowed the iron oxide to be reduced to iron which at the same time combined chemically with some of the carbon to form a molten iron-carbon mixture. The addition of limestone to the charge of ore and charcoal resulted in a floating slag which could be tapped off separately from the molten mixture which was then poured or run into moulds. The result, known as cast iron or pig iron[12], had many uses due to the ease with which it could be cast into practicable shapes. It was cheap and could be mass produced. But it was brittle, without the malleability and tensile strength of wrought iron.

The next step was to convert the cast iron (with a relatively high carbon content) into wrought iron (with practically no carbon). This process of decarburisation was accomplished in the 16th and 17th centuries in finery hearths. A finery could be a relatively straightforward rebuild of a bloomery. Each process used three structures: in the bloomery, ore was smelted in the bloomhearth; the resulting bloom of iron was re-heated in the stringhearth and was then forged under a water-powered hammer. In the finery forge, the first hearth, the finery, was used to re-melt and decarburise cast iron from a blast furnace; the resulting bloom was heated in the chafery hearth and was then forged under a hammer. It was theoretically and actually possible to convert a bloomsmithy into a finery at relatively little cost compared with new construction, the two hearths requiring detailed modification, and the hammer being retained with little change. The provision of water power could be carried over. In areas where intensive fieldwork on the post-medieval iron industry has taken place, notably the Kent/Sussex Weald, continuity has been demonstrated, by the survival of deposits of bloomery and finery residues in stratified sequence.

[12] The name derives from the characteristic moulded shape of the iron as cast, resembling a sow and piglets.

3.3 Production of Wrought Iron and Forging of Products at Wortley

It was shown by Mott (6) that there was a water-powered bloomery at Wortley in 1621, indicated by a lease of 'iron smithies', the contemporary term for a bloomery. The lease allowed sufficient quantities of wood (for charcoal) and ironstone to make about 30 tons of wrought iron per year (16). The first clear reference to a finery forge is in a lease to John Spencer, the most prominent ironmaster in the region, in 1658. When the conversion took place is not precisely known; a general reference to 'smithies' rather than 'forges' on the Wharncliffe estates in 1638 indicates that the change was yet to be made, although the arrival in 1639 of William Fownes, who had worked finery forges in Shropshire, suggests that it would soon happen and had done so by 1658 when a lease to John Spencer refers to two forges at Wortley. It is probable that the northern part of the surviving range of Top Forge buildings relates either to the early part of the Spencer period or to the bloomery. Although the main Top Forge building bears a 1713 date-stone, the structure to the north of this stone is of earlier construction.

For the first half of the 18th century the Wortley Forges were part of the complex of ironworks operated by the Spencer partnerships. Finery-forges such as Wortley were supplied with pig iron from nearby blast furnaces such as Barnby, Chapeltown or Rockley, which continued to use charcoal as their fuel despite the innovative use of coke by West Midlands ironmasters after Darby's first use of mineral fuel in 1709. Andrews (5) states that the Rockley furnace was being fired with coke in 1799, though it was known to be still using charcoal in 1752 (16) so it must have been converted between those dates. The remains of the Rockley furnace (now a Scheduled Ancient Monument and owned by the Society) are shown in Figure 21. It probably ceased operation in the difficult years following the Napoleonic Wars (16). The M1 motorway was constructed over part of the Rockley site. A comprehensive archaeological investigation of the site was conducted prior to construction and the results have been reported in (17).

Figure 21 Remains of Rockley blast furnace

It was in 1754 that the Swedish author R. R. Angerstein, as part of his travels around Great Britain, visited the Wortley Forges, the Wire Mills and the Tin Mill (then all in common ownership). In his travel diary (18), he noted the Forges to be typical of their kind. In the century after 1750 the finery process for converting pig iron to wrought iron was gradually replaced by puddling. In the puddling furnace, the pig iron was melted and kept agitated by a rake so as to continuously expose fresh surfaces to the air and promote the decarburisation. The puddling process

was capable of converting larger quantities of iron and was more suited to dealing with coke-smelted pig iron. Some finery ironworks were developed as puddling works, some, such as Top Forge, became primarily manufacturers of wrought-iron goods, while many were re-developed for other industries. In general, the puddling of iron came to be concentrated in the urban coalfields, and continuity of use of rural water-powered sites such as Wortley by iron-related trades was rare. At Wortley, not only did the pre-1713 Top Forge building remain in use, with its water-powered hammer and water-wheel-blown reheating furnaces, but extension took place in the middle decades of the nineteenth century, still, and quite exceptionally, relying on water power.

No puddling furnaces were built at Top Forge, although they were installed at Low Forge. Beginning in the period 1774 to 1819 when the Cockshutt brothers (John II and James) in succession ran the Wortley Forges, a trade in heavy wrought iron products was developed and it was to forge such products that the hammers at Top Forge were equipped. It was noted in (5) that, under the Cockshutts, the Wortley Ironworks kept abreast with the technical progress of the times. In particular, James was noted as a man of considerable business enterprise as well as possessing considerable scientific attainments. The ranges of buildings to the west of the main Forge building were added and these, now restored, show the extent of the complex at its maximum size (see the sketch in Figure 6).

In the 19th century Wortley possessed a reputation for the production of axles for railway stock and for shafting for other purposes. Such specialisation is paralleled by the concentration on anvil production at Mousehole Forge, Sheffield, with which James Cockshutt was associated in the second half of the 18th century. Mousehole has parallels with Wortley Top Forge, in particular a wooden-framed hammer with detailed fittings similar to the No.1 hammer at Top Forge, but in far worse condition. The No. 2 belly-helve hammer in the Forge building was installed in the early 19th century (19). It is entirely built of cast iron parts, and it must be one of the last pieces of heavy water-powered plant to have been installed in the region. Top Forge was extended and re-equipped in the 1850s and continued to specialise in forging of wrought iron with water wheels as the sole source of power up to the end of production in 1908.

3.4 Wortley Forges' Role in Industrial Development

The output of the Forges fed the whole complex of small complementary works along a stretch of no more than 4km of the river Don. The complex represented an integrated industrial operation capable of producing a variety of wrought iron products from pig iron brought in as the primary material. Much of the wrought iron was sent to the slitting mill where it was processed into rods and bars used by blacksmiths for fabricating into the many objects necessary for furnishing the farms and households of the day (20). Thin wrought iron rods were used as raw material by local nailmakers (at Ecclesfield, Chapeltown, High Green and Hoylandswaine) in an age when the nail was the universal joining medium. A link with that industrial era is provided by the preserved nailmakers forge owned by the Society at Hoylandswaine, a village near to Top Forge.

By the middle of the 17th century, the times of Charles I and the Civil War, Wortley Forges were well established. Andrews (14) records that iron cannon balls were found 6 to 8 ft below ground level when digging foundations at Low Forge in 1868. They were subsequently stated to have been made during the Civil War period, probably the earliest specimens of Sheffield's armament productions (21).

Figure 22 An early rolling mill from Low Forge, now preserved at Top Forge

James Cockshutt was one of the first to appreciate the value of the invention of Henry Cort, patented in 1784, for puddling and rolling iron and, soon after 1787, the necessary furnaces were erected at Low Forge together with, at the Tilt Mill, the first bar mill with grooved rolls to be erected in Yorkshire (21). An old rolling mill of this type from Low Forge is now preserved at Top Forge (see Figure 22).

Another indication that the Top Forge in the late 18th century was no typical small forge but part of a complex near the forefront of contemporary metallurgy is provided by the researches of the late Dr Ken Barraclough. Based on excavations in 1977 of the small building (Figure 14) attached to the foundry, he recorded (22) his view that 'it does seem not unreasonable to suggest that here at Wortley we have the remains of one of the earliest South Yorkshire cementation furnaces.' In this type of furnace, wrought iron bars were layered with carbon in sandstone chests and heated to convert it to blister steel for subsequent forging into shear steel. John Cockshutt took up this manufacture at Wortley around the middle of the century though he also imported steel from Germany(23). The similarities between the remains of the structure revealed by the 1977 excavations and a furnace layout sketched by Jars in 1774, as quoted in (22), together with other evidence, led Barraclough to his view that the source of the blister steel needed for making shear steel was a cementation furnace at Top Forge. It should be noted that Andrews (5) stated that Wortley policy at the time was directed to production of high class charcoal iron and intriguingly he added 'It would be interesting to know if any of this iron was used in the Sheffield trades for conversion into steel.' But it is also of interest that John Cockshutt II (who ran the Forges after his father died in 1774) was noted (24) 'as a great innovator and it is quite likely that he made steel at Wortley; in any case, he worked steel to produce drawing plates for the making of wire from his iron at the Wire Mill further up the valley.' Whether the steel he used was of his own manufacture or imported from Germany must remain uncertain.

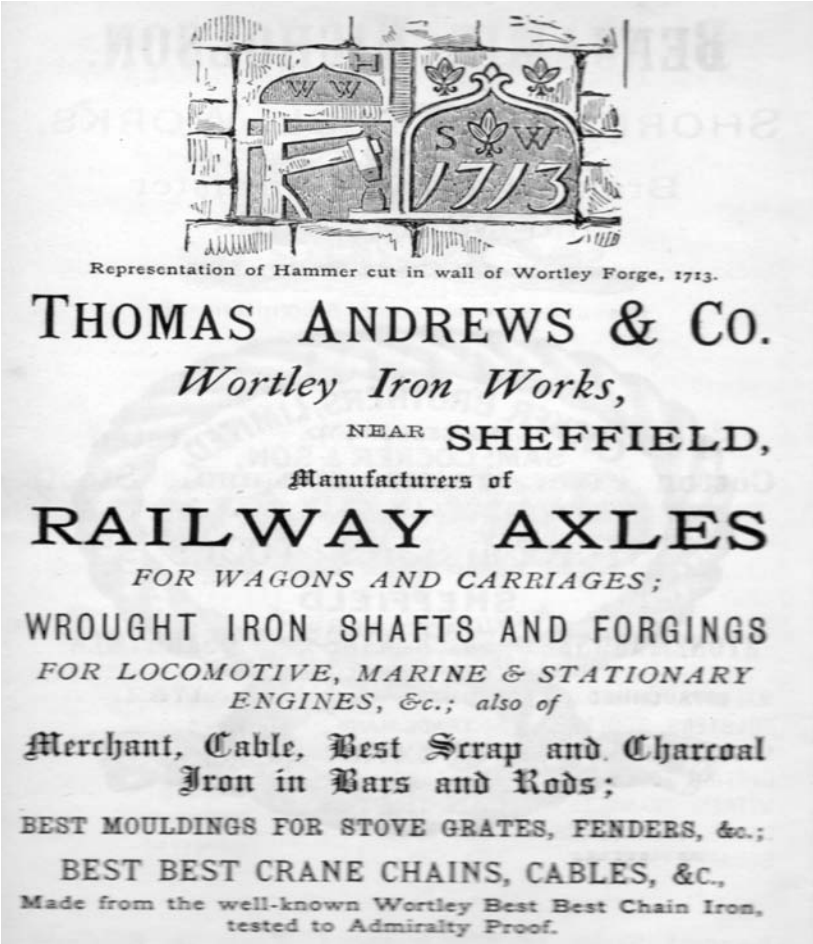


Figure 23 Advertisement for products of Top and Low Forges

The industrial revolution brought with it a demand for larger and larger iron castings – as opposed to forgings – initially for Newcomen engines (to drain coal mines) and later for stationary steam engines (to power workshops and mills). Whilst Wortley did not participate directly in supplying these needs, it did benefit from the development of railways needed for transporting coal, minerals and manufactured goods in a rapidly expanding industrialising nation (20). Wortley has a distinctive place in the development of railways. Whilst Low Forge concentrated on puddling pig iron to wrought iron and shaping into bars by hammering or rolling, Top Forge reforged piles of these bars into larger blooms as needed for all kinds of shafts, in particular for railway axles (see Figure 23)[13]. Railway axles needed to resist previously unheard of stresses. Increasing speeds and weights demanded new standards of reliability from the metallurgical industries. Wortley began forging axles in the late 1830s as the railways expanded. Andrews (15) recounted the expansion of production in the ensuing 40 years:

> 'It was considered a great achievement to make two or three axles per day under the old hammer and much charcoal iron was used. By way of contrast with this early period in the history of the iron trade, and in illustration of modern progress, it may be stated that these works now possess the necessary capabilities for turning out from 250 to 300 railway axles per week.'

The Wortley experience was a forerunner of the development of bulk steelmaking in the region, including the mass production of rails, axles and wheels at Ickles Works, Rotherham; axles, locomotive cylinder castings and buffer gear at River Don Works, Sheffield; and locomotive boiler and frame plates at Parkgate Works, Rotherham (20).

[13] The elaborate datestone in Figure 23 was at Low Forge.

Railway engineering at Wortley led recognisably modern elements to emerge from the "primitive" processes. A drop test rig was built by Thomas Andrews Junior in the Forge entrance yard (now the garden of Top Forge Cottage). Randomly selected axles were tested by letting a one ton metal ball fall on them repeatedly from a height of up to 20ft. The different railway companies laid down their own standards, in terms of the number of blows the axle had to withstand (15). Andrews carried out numerous experiments on the effects of freezing temperatures on the impact resistance of iron and steel axles, fully described in (25). A plan view of the drop test rig or tripod, taken from (25), is shown in Figure 24 and is the one that can be seen in the middle distance in Figure 1. Of course steel won in the end: it was more cost-effective and consistent as a material, and had other superior qualities. Wrought iron was hard to work but it still had desirable properties: it was less prone to brittle fracture and could withstand shock loading, making it especially valuable for chain-link railway couplings and mine-cage support gear.

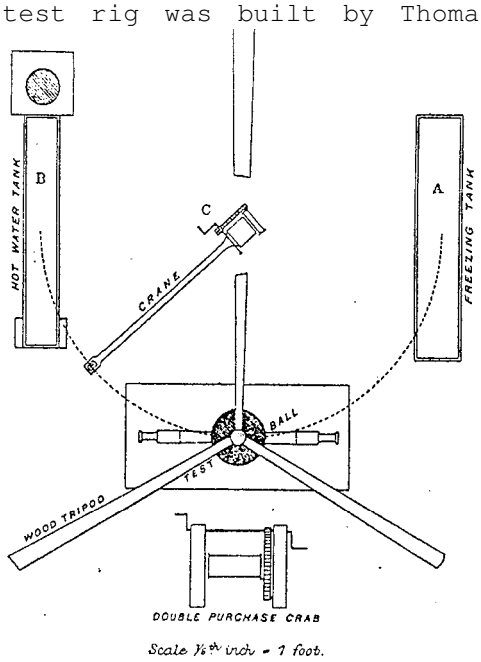


Figure 24 Plan view of drop test rig for axles

The Wortley Forges mark the transition from old to new, from craft to technology. It is scarcely a coincidence that two of Wortley's owner/managers - James Cockshutt (1742-1819) and Thomas Andrews Junior (1847-1907) - were elected as Fellows of the Royal Society of London; Andrews additionally was elected a Fellow of the Royal Society of Edinburgh. The certificate for Cockshutt's election in 1804 stated that he was '...a gentleman well-versed in many theoretical as well as practical branches of natural knowledge, having been under the instruction and frequently in the employment of the late Mr John Smeaton.' Smeaton had been the foremost civil engineer of the day and one of the supporters of Cockshutt's nomination was Sir Henry Cavendish. The proposer for Andrews' election in 1888 was Henry Clifton Sorby, the founder of the science of metallography or microscopic examination of the structure of metals. This was a subject in which Andrews achieved renown. His obituary notice published by the Royal Society (26) noted that 'Mr Andrews...contributed many papers upon this subject, paying particular attention to the crystalline structure of iron and steel, and the manner in which sulphide of manganese was distributed in steel forgings.' The notice further stated that 'Mr Andrews acquired the reputation of an expert upon metallurgical questions; he was consulted by His Majesty the late King of the Netherlands, the Board of Trade, the Admiralty, and many leading railway and naval companies, upon matters relating to iron and steel, and in the course of his work examined

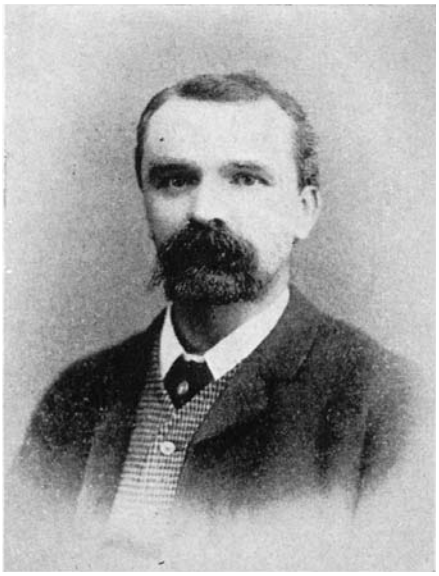


Figure 25 Thomas Andrews FRS FRSE CE FCS

and reported upon many serious accidents caused through the breakage of steel.' A comprehensive account of Andrews' life is given in (27).

Recognition of the significance of Top Forge to the industrial heritage and of the efforts to preserve it was marked in 1994 by the achievement of the Engineering Heritage Hallmark Award of The Institution of Mechanical Engineers. The citation for the Award, as recorded on a plaque at Top Forge, states 'It was a pioneering example of integrated engineering, combining research, design, manufacture and testing.' Professor Francis Evans, in a commemorative programme (28) produced on the occasion of the Award, noted that it is 'a monument enshrining key stages in the evolution of engineering in Britain.'

3.5 The Cottages

As mentioned earlier, two cottages survive on the Top Forge site and are shown in Figure 26 (also refer to 16 in Figure 8). They comprise a two-storeyed 'L' plan range of buildings, originally consisting of a two-floor four-room house. The main range (on the right in Figure 26) is of stone construction, originally with wooden mullion windows, of which one survives, and dates from the 17th century. This was presumably occupied by the manager/overseer of the forge. The house was extended by one bay late in the 17th century. The other range, set at right angles, is a one-up/one-down brick wing added early in the 18th century. A sketch of 1749 by William Fairbank I shows the house and the main Forge building as separate buildings. Subsequently the main Forge building was extended southwards towards the house, probably when the brick wing was added, with a stair to an original office or counting-house. The drawing also shows a lean-to, substantially the surviving structure, although it is shown with a gabled rather than a monopitch roof.

Figure 26 The range of cottages. The original detached forge manager's house is the main part of the right leg.

The Top Forge Cottage, already mentioned, was originally an integral part of the Forge site. It served as the Forge office during the 19th century. It consists of 2 bays of stone build whose date of construction is not known but is of early 19th-century style. The present garden to this cottage was once the Forge yard, with the entrance to the Forge site through the gates which now serve the Cottage.

3.6 The End of Forging at Wortley

Following the death of Thomas Andrews in 1907, the Wortley Forges were sold to the Wortley Iron Company. Production of wagon and locomotive axles at Top Forge ceased shortly after in 1908 though Low Forge continued to produce bar iron for railway couplings and textile machinery. Top Forge was used for storage and administration to up to its final closure in 1912. Low Forge managed to stave off closure until 1929

leaving their part of the valley quiet. Francis Evans (28) has summarised in suitably evocative terms the place of the Wortley Forges in history, thus:

> 'The preceding three centuries of hammering had seen the greatest change in human life since the adoption of agriculture twelve thousand years ago - and Wortley had been one of the centres of this Industrial Revolution. The Forge we have preserved has seen that time through, from the preconditions of the 17th century, through the 18th century 'take-off', the consolidation and transport revolution of the 19th century, till the age of scientific metallurgy. Britain will always be 'the First Industrial Nation', from which the new ways spread; so that Wortley has its place in world history, an important part of the international heritage. Perhaps the modern engineer might like to cast his mind even further back and wonder about the earlier beginnings - how the Cistercian monks brought ironmaking to the area in the 12th century.'

Describing his vision for the study of industrial history and archaeology, Neil Cossons (29) has similarly cast his net wider than attention only to the detail:

> 'What I would like to see is an emerging consensus within which we can agree some of the key characteristics of Britain's transition into the first industrial nation - and, indeed, agreement that it was just that - as well as its subsequent industrial history; and one which can help us transmit, through the tangible evidence of its remains, something to future generations.'

Top Forge and its surroundings provide us with an ample supply of such tangible evidence. The founders of the Society in 1933 recognised the heritage merit of Top Forge, though interest was initially focused on its still surviving forging hammers. The preservation of the hammers was henceforth a priority objective of the Society (4) though later this was broadened to cover the whole Forge. Many obstacles had to be overcome and it was not until 1953 that the future of the Forge was finally secured.

3.7 The Rebirth of Top Forge as a Historic Site

Following its acquisition by the Society and the carrying out of some essential repairs, the main Forge building was reopened at a ceremony on 9 July 1955. The ceremony was performed by Dr Mary Andrews, daughter of Thomas Andrews Junior, the last forgemaster and owner at the time of his death in 1907. She recorded the scene in an Epilogue to the history of the Forges by her brother C. R. Andrews (5) as follows:

> 'There was a dream-like atmosphere about the occasion with the brilliant July sun falling through the once grimy arches of the dear old Top Forge. The two ancient hammers stood within as grim guardians of the long deserted place. The aged cranes standing like gaunt sentinels of the past looked down on the happy scene, whilst the rusty old water wheels without murmured a faint and peaceful echo of their once noisy chatter. The silver trumpets of the Stocksbridge Works Band sounded Reveille. Not only did that glorious fanfare wake the Forge, but it pierced the dim mist of past history - a fitting tribute to all who had toiled by the hammers through long centuries; and it filled those of us with deep emotion, who had known and loved the old Top Forge for a lifetime, as one loves a very dear friend....It is hoped some day that the sound of the hammers will be heard again in the silent valley on special occasions.'

The sound of the hammers has still to be heard and such an event must now be regarded as an unlikely happening, even though the Society at one time optimistically looked forward (21) to 'the restoration, in due course, of the working efficiency of this famous 18th century Forge, with its two old water-driven Tilt Hammers...' However, the water wheels do turn again; the restored No. 2 wheel is shown in Figure 27. The atmosphere so well described by Dr Andrews can readily be captured by present day visitors to the Forge who, with little exercise of the imagination, can transport their minds back to the days when it was a place of industrious activity. The restoration of the Forge has only been possible through the generosity, with gifts, money or time, from many individuals and organisations.

Figure 27 The restored No. 2 water wheel. The prop formerly supporting the lintel (see Figure 9) has been removed

Chapter 4: Assessment of Significance and Heritage Merit

4.1 Significance

The significance of the Top Forge site can be briefly represented by:

1. The continuity between water-powered bloomery, finery forge and wrought ironworks which can be expected to be disclosed by archaeological investigation of so-far undisturbed ground on the site. This potential has no parallel in terms of survival anywhere else in Britain.
2. The survival of buildings and a forge hammer from the finery-forge period, unique in Britain.
3. The survival of the buildings and a forge hammer of a 19th-century ironworks, also unique in Britain.
4. The survival of domestic buildings within the curtilage of the ironworks.

Each of these aspects of significance is examined in turn in the sub-sections that follow.

4.1.1 Continuity: Archaeological interventions at the Top Forge site have not yet disclosed a stratified sequence of residues from the two processes of bloomery and finery forging. However, past work has been limited to small areas around the forge hammers, and major residue-deposits have not been located and tested. Given the documented sequence of events in the 17th century, such a sequence of residues is to be expected.

Any evidence which might be recovered of early working at Top Forge would have national significance, in that over Britain as a whole there are few examples of excavated sites of bloomeries and fineries. Medieval powered forges have been investigated at Bordesley (Worcs), Chingley (Kent) and Rockley (Yorks), together with the recording of deposits in the Weald, as referred to above. None of these has provided a comprehensive picture: at Bordesley the evidence for iron-smelting, as opposed to the forging of artefacts, was not convincing; at Chingley there were bloomery residues and structural remains of the water-wheel and its frame, but there were no remains of hearths, while at Rockley, the example local to Wortley, there were excellent surviving hearths but what appeared to be an atypical manually-powered hammer, which could not be related to a water-wheel (17).

There is a comparable lack of archaeological information for finery forges. The only comprehensive investigation has been at Chingley (Kent), where the three elements, finery, chafery and hammer, were recorded. At Ardingly (Sussex), a later fulling mill had reduced surviving detail of the finery, and at Blackwater Green (Sussex) a brief excavation disclosed elements similar to Chingley but with poor survival. No excavations have taken place on fineries outside the Weald.

At Top Forge there is excellent potential, as the No. 1 hammer relates to the finery period. The location of the hearths is less certain, but can be narrowed down to an area within the pre-1713 part of the building. Outside the Forge, there is potential for a sampling survey, aimed at location of dumps of residues in the surrounding ground, much of which does not appear to have been disturbed. The layout of the Small Dam and No. 1 hammer and the probable hearth location corresponds well with Chingley, with continental illustrations of 18th-century practice (30) and with sites in France, where forges such as Forge D'Aube in Normandy have survived better than in Britain. In 1754 Angerstein visited the Wortley forges (19, pp. 217-218) and found the forges to be typical of

their kind. Hammer No. 1 at Top Forge is a particularly fine survivor - as good as any in Europe, despite the 19th-century replacements of some parts in cast iron. There is a local parallel, at Mousehole Forge, Sheffield, which is less well preserved. There are no other examples of the timber-framed tilt-hammer in Britain.

Top Forge was extended and re-equipped during the 1850s. The No. 2 hammer installed at this time is entirely built of cast iron parts and it must be one of the last pieces of heavy water-powered plant to have been installed in the region. It is not known where the hammer was made: there is no evidence for its manufacture at Wortley.

4.1.2 Survivals of Forge building, machinery and water supply: The Top Forge site is of particular significance for a 19th-century ironworks in the survival of the water wheels and the supply system of channels and ponds and dams fed by the River Don. This is complete and capable of operation, and is a rare example of a system developed at this time for a relatively heavy and power-hungry industrial use. The flow on the Don was sufficient, not only to power the Forge, but to do so through breast and undershot wheels, less efficient than overshot or pitch-back but requiring less head of water. The adequacy of water supply explains the minor use of steam power, despite the proximity of the colliery opened near Wortley village in the middle of the 19th century. As a water-powered ironworks, in use until the immediate pre-First-War period, the Top Forge is unique in Britain. The surviving Forge range containing the two hammers and four cranes is complete apart from the original re-heating furnaces. The location and character of the latter can be established from the excellent photographic record which survives from 1911, and furnaces which have been obtained from Sheffield are a satisfactory approximation to those seen on these photographs. Despite the loss of the Low Forge, whose operations complemented those at Top Forge, the latter is a survival of national significance.

4.1.3 Survival of domestic buildings: The two cottages (see Figure 26) adjoining the main 17th century Forge building are typical of workers cottages that were once an integral part of industrial sites such as Top Forge. It is of significance that the main part of the range that now exists was originally a detached house of rather higher status, as described in Section 3.5 above. The cottages provide the opportunity to the visitor to imagine the domestic world of the forgeman and his family and to appreciate what life was like living with stone floors, no bathroom or indoor sanitation. One of the rooms contains models which are used by guides to explain to visitors some of the technical processes involved in forging as well as tracing the making of iron from its raw material to the finished product. There is also a variety of exhibits associated with the history of the site. However, the space available is very limited and commentary by guides is the main means of interpretation.

4.2 Heritage Merit

In addition to the significance of the Top Forge site as a surviving example of industrial development and adaptation over a period of three centuries, the site has substantial additional claims to heritage merit arising from various exogenous features. Forging of wrought iron was the *sine qua non*. But the Top Forge did not exist in isolation and the influences that stemmed from the activities at the Forge were widespread. Furthermore, the site has substantial merit in the facility it affords for providing explanation and display of why and how these activities were carried on at this particular place. Such intrinsic merit would be absent in attempting to provide explanation remotely at a museum. The

site is also rich in natural features and has abundant wildlife in an environment that has been largely untouched by modern developments.

Thus the overall heritage merit stems from integration of

1. the existing intrinsic merit derived from in situ preservation of the largely intact remains of past industry backed by the extensive knowledge of the many facets of the industry's infrastructure and operations as already described, with
2. the educational merit derived from understanding, interpretation and visible appreciation of the influence of the Forge and its people on technological, social and economic development during its active period, and
3. the potential for enhancement of (1) and (2) by providing opportunities for further learning and research 'on the ground' on diverse aspects of a preserved industrial site ranging from archaeology to ecology to demonstrable evidence of achievement of the role of voluntary effort in conservation of the industrial heritage.

The following sub-sections amplify on aspects 2 and 3 of the above.

4.2.1 Contribution and adaptation to technological development: Many innovations in the working of metal were introduced by John II and James Cockshutt FRS when they were successively managers of the Wortley Forges in the late 18th century. As already described, these included the two techniques developed by Cort - grooved rolling mill rolls for making nail rod and the process of puddling wrought iron in a reverberatory furnace - as well as the evidence for an early cementation furnace for production of blister steel.

In the latter half of the 19th century, Wortley products were renowned for their quality as a result of the attention given to what would now be called quality assurance or fitness for purpose. There is the evidence of extensive testing of Wortley products and resulting metallurgical research carried out at Top Forge by Thomas Andrews Junior FRS (27). In the former Forge yard, now the garden of Top Forge Cottage, are the remains of the test rig used by him to research the ability of axles to withstand impact loading. He researched extensively on the structure of wrought iron and on the corrosive effects of exposure to salt water. He was active in investigating the causes of failure in service and was a consultant in that regard to many railway companies in the UK and to naval departments in the UK and abroad. He published his results widely and received many awards, including the Telford Medal of the Institution of Civil Engineers, the Bessemer Gold Medal of the Society of Engineers and the Medal of the Franklin Institute of America. He gave several courses of lectures in the Engineering Department of Cambridge University on the then-new science of metallography. He was a Fellow of the Royal Societies of London and Edinburgh. Locally, he was a member of the Council of the Sheffield Technical School and later of the Sheffield University Council.

The newer techniques of the later 18th century, for example when charcoal was gradually replaced by pit coal [14], presented little operational difficulty to the industrial sites along the River Don in the area of Wortley. Their survival by adaptation to technological change provides an interesting historical perspective. It was easier to transport coal than go to the trouble of coppicing the woods and preparing the charcoal. Mining of coal for the furnaces was taking place in the vicinity at

[14] Andrews (5, p.52) notes that charcoal iron continued to be produced as a speciality at Wortley into the 19th century.

Silkstone, Elsecar and Chapeltown in the 18th century. However, water power continued to be used even though in nearby Sheffield there was a move to steam power - as indeed was partly the case in the Low Forge. The production of pig iron was, at the same time, undergoing change and the older group of charcoal-fired furnaces went out of operation between 1750 and 1800, being replaced by larger coke-fired furnaces, the most notable ones being at Chapeltown and Elsecar. Better transport came with the opening of railways and provided access to many sources of scrap iron or pig iron. In 1845 a station was opened at Wortley on the mainline of the Manchester, Sheffield and Lincolnshire Railway, later the London & North Eastern Railway. The trackbed of this railway is but a short distance from the Top Forge site and has been developed as part of the Trans Pennine Trail.

4.2.2 Importance in social and economic development: The rise of the Wortley Forges and the associated works along the River Don owed much to the advantages afforded by the natural resources of the area. Forges such as those at Wortley were built by or on behalf of a landowner who wished to raise money from exploiting these natural resources (24). So sometime between 1602 and 1625 Sir Francis Wortley chose a rural site on the banks of the Don with easy access to sources of material. It was near to a place where he had successfully worked a bloomery. He therefore had confidence that the water would be available to turn his wheels except in the driest summers. In addition to a reliable source of power, the forge owner needed to be sure of supplies of three materials. In the first place, the furnace stone probably came from the quarries of Greenmoor stone in the locality, the remains of which are evident features of the landscape. The iron ore was obtained from local Tankersley ironstone seams and the capped shaft of a former ironstone mine with associated Newcomen engine house can be seen on the Rockley blast furnace site owned by the Society. Initially, the ore was processed into wrought iron as already described. Later, pig iron was available from the Barnby furnace in nearby Silkstone and the Bank furnaces near Emley, both owned by a business associate, and possibly also from a furnace at Rockley predating the furnace whose remains survive. The charcoal required as fuel was available from the dense woodlands on his land and the wooded hillsides are still a characteristic feature of the valley, as seen in Figure 1. Local availability was of paramount importance: the shorter the distance between the charcoal burners' fires and the hearths of the forge, the less loss there was from the inevitable damage through breakage when all the charcoal had to be carried in baskets or sacks by horses over rough tracks until the improvement of the transport infrastructure. All told, the diverse industries centred on Wortley would have provided support to a widespread community formerly dependant on agriculture.

Figure 28 Cricket match with Top Forge in the background; date and teams unknown

There is much evidence (5) that the Wortley Forges themselves were the nexus of a closely-knit community. A roll call of Wortley workers around 1900 showed a total of nearly 100 men (but no women) - a large number for a rural area though some were retired from the workforce. They would have lived locally as did the Forges' owner. Andrews (5) recorded

that there was 'a kind of family feeling under conditions which I fear have passed away.' He went on to say: 'We worked hard and we played hard, especially on the cricket field; we had our Forge Brass Band, while the Back Dam was the scene of many jolly times winter and summer, especially when the black ice bore a heavy load of skaters and sliders. And above all, we all pulled together and took a real pride in upholding the reputation of the old works for honest-to-goodness quality and craftsmanship.' Although these were views from the perspective of a paternalistic owner, there is direct evidence that they were shared by the workforce. Morley (7) reproduces the recollections of working at Low Forge written in 1972 by a former forgeman, John Shore, in which he recorded 'I never heard the men grumble about anything, they were what you would term a very happy family and a most loveable set of men...No foreman or manager worried us...During a working day you could hear whistling, or singing, by the men which speaks for itself - happy memories!' and other reminiscences in similar vein. It was common practice in those days to lay off the workforce temporarily during periods of economic downturn while retaining their loyalty. For example, in the issue for 30th January 1880, 'The Engineer' reported that 'At Wortley Ironworks last Saturday, Messrs Andrews and Dyson[15] invited their old workmen with their wives to tea, in celebration of the reopening of their establishment...Five months ago they were closed because iron had got below profit point. Now they are in full swing...' (20)

Attached to the Forge manager's residence, Huthwaite Grange, was a farm including a stag paddock. The farm had long been part of the Wortley concern and grew hay and oats for the horse transport besides supplying milk and butter, some of which was sold at a low price to the workmen's families. Being a man of strong religious faith, Thomas Andrews Junior built a Mission Hall near the Forges where he conducted two services on Sundays (5).

Economic development is tied to improvements in efficiency and the practices of the Wortley Forges provide several illustrations. The reuse of scrap wrought iron was an early example of the sustainable use of resources, exemplifying the modern concept of recovery of the embedded energy in processed materials. On this same theme of sustainability, it is noteworthy that the steam for the 150hp engine at Low Forge was raised using the waste heat from the furnaces (5). Furthermore, the Wortley practice was to use iron that had been reforged in three successive steps resulting in the forge products having the label 'best best fagotted scrap'. This reforging greatly reduced the susceptibility to crack propagation, an important characteristic where a component was subjected to cyclic stresses giving rise to what is now known as metal fatigue, a topic on which Thomas Andrews Junior conducted early investigations, for example (29). The reduced susceptibility led to a longer working life and thus reduced costs.

All of the above features of the site's development provide rich material for understanding the change from a social and economic life based largely on agriculture and the individual's reliance on selling his own labour, to an organised world of work in a scientific/industrial complex under a benevolent ownership.

4.2.3 Top Forge as a site of ecological and environmental interest: One of the attractions of the Top Forge site is its 'greenfield' setting and its biodiversity. Being situated on the River Don, the site forms part of a green corridor that allows animals to move between the fragmented

[15] John Dyson and Thomas Andrews Junior were partners in the Wortley Forges between 1874 and 1881. After this period, Andrews became the sole owner until he died in 1907.

habitats of the city and the surrounding countryside. The variety of environments and habitats to be found within the site and adjacent to public footpaths in the vicinity was given early publicity by the Society in the 1960s. Recently, the Trust commissioned a comprehensive ecological survey, funded by the Heritage Lottery Fund's Awards for All grant scheme, for the purpose of providing information for the Trust on ecological management of the site (32). The survey report noted that the site is a haven for wildlife and represents a diverse assemblage of habitats as can be seen in the habitat map in Figure 30. Part of the work included a survey of small mammals, a vital food source for owls, kestrels, weasels and foxes. The survey found wood mouse, bank vole, common and pigmy shrew. Knowing which species are present allowed the ecologists to recommend management regimes to protect, preserve and perhaps improve the rich biodiversity of the site.

Figure 29 The Small Dam offers a haven for wildlife

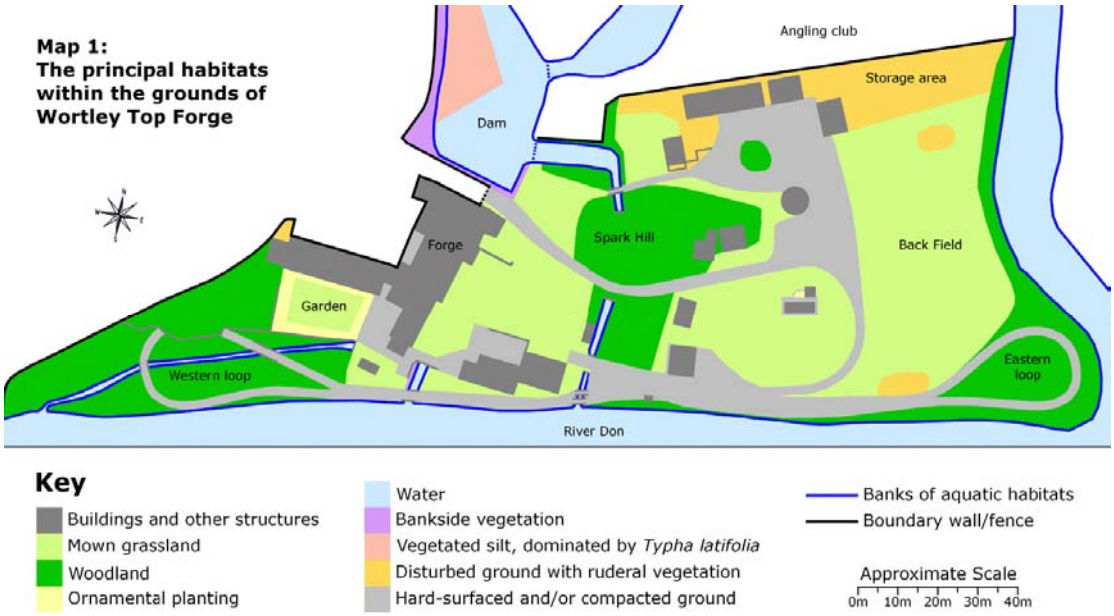


Figure 30 Habitat map for the Top Forge site from ecological survey

The Trust is using the recommendations of the survey in preparing the management plan for the site. An initial step has been the designation of a sign-posted nature trail one third of a mile long around the site. An illustrated brochure for site visitors has been produced (33) describing features along the trail. The survey report and brochure provide a wealth

of information on the natural environment of the Forge which will be valuable for educational purposes such as school projects.

4.2.4 Learning and research: The Top Forge site offers an outstanding opportunity to people of all ages and backgrounds to learn about and value a heritage reflecting nearly three centuries of activity. Earlier parts of this Statement have described the processes involved in producing wrought iron as a material of great practical use, the role of the Forges in the industrial revolution, the way of life and the achievements of the working community at Wortley, the historic relevance of the Forge location to its development and the utilisation of nature's power source in the river flow. These multiple facets of the site, many of them with high visibility from the extant physical evidence, provide the potential for a richly rewarding experience for visitors. Significant effort has been and is devoted to assisting and encouraging learning through guided visits, displays, demonstrations and publications. However, the potential for enhancing the educational merit of the site through investment in visitor facilities is substantial and especially so if resources were available to integrate the Top Forge visitor experience with that of other industrial heritage sites in the area, including the remains of the blast furnace and Newcomen engine house at Rockley, Hoylandswaine nailmaker's forge and the remains of the Bower Spring cementation furnace in Sheffield (all of them in the Society's ownership) together with the industrial museums at Elsecar, Kelham Island and Abbeydale. Indeed, the Conservation Plan for Top Forge is envisaged as providing for a far-reaching management and funding strategy which will take account of the need for coordination and cooperation with these other sites in the South Yorkshire area.

Special educational visits for schools featured at one time in the access arrangements though currently they are somewhat in abeyance due to the lack of an education adviser amongst the volunteer guides. Nonetheless, help is given to local schools to carry out projects at Top Forge, with the schools providing the educational content. There is obvious scope for enhancing the educational potential of the site for schoolchildren but to pursue this, the Trust needs a volunteer with recent teaching experience to advise on links to the National Curriculum. Such enhancement would additionally benefit from the development of interactive learning activities now favoured and particularly suited to understanding of the variety of processes undertaken at the Wortley Forges and of the relationship of the processes to the properties of the Forges' products.

In addition to educating schoolchildren and visitors interested in the heritage, the site offers outstanding opportunities for archaeological research as described earlier. Furthermore, social research would fill gaps in understanding of the place of the Wortley Forges in the local community. With such a possibility in mind, discussions have been held with a local interest group in Greenmoor just above the Top Forge and with the Thurgoland Local History Society.

Finally, and importantly, the way in which the site has been preserved by voluntary effort is itself of social and educational interest. A common presumption is that substantial and long term conservation projects can only be undertaken by organisations with employees and a management structure. The results achieved by the community of volunteer workers at the Top Forge site over a period of above 50 years confound that presumption. The quotation about 'a family feeling' from C R Andrews given earlier translates readily from the Forge in its working days to the Forge when being preserved and restored. The successes, setbacks and sheer hard work enjoyed or endured by the volunteers have yet to be properly documented though some reminiscences have been published, for

Figure 31 Duncan Smith and Ken Hawley enjoy a break from restoration

example (34). Of course, things might be done more quickly if a well-endowed organisation was in charge. But there is a choice to be made between organisational control and voluntary effort towards a shared objective and, so far, the decision has been in favour of the latter - though alternatives have at times been explored. Nonetheless, it is achievement that counts in the end and the Top Forge site stands today in testimony of the advantages of voluntary effort. The history of preservation at the Top Forge site would thus be a valuable educational exercise with wider application.

Figure 32 Aerial view of Top Forge as restored, to be compared with Figure 1

Chapter 5: Vulnerabilities of the Significance

5.1 Effects on Significance of Past Changes

Despite the fact that the Top Forge ceased production just over one hundred years ago and thereafter decayed to a near-derelict state over a period of nearly fifty years, the site is now in a remarkable good state of preservation. This is fortuitously due to the absence of serious depredation, for example from the threat at one time of disposal of the machinery for scrap, and to the subsequent restoration and maintenance efforts of volunteers, with relatively small inputs of external funding for contracted work. In particular, the main buildings, the two hammers, the three water wheels and the cranes built into the structure of the Forge are now as they were when the Forge ceased production.

Some features of significance were lost at various times before the acquisition by the Society in 1953. Principal among these was the loss of Low Forge though fortunately the remains have recently been scheduled.

In relation to Top Forge, the losses due to past changes are set out below.

5.1.1 Blowing engine: The removal at time unknown of a two-cylinder horizontal blowing engine installed to provide the air supply for the reheating furnaces during the period of ownership by the Cockshutt brothers (1746-1819). The engine was driven by a pitchback water wheel which survives. The former location of the engine in the Forge is reliably known from the surviving bedstone. The design of the engine can be reliably inferred from the designs of the period published by Joseph Smeaton FRS and held in the archives of the Royal Society of London. Construction of a replica of the engine has been in progress for some years and is a continuing project of the Trust.

5.1.2 Chimney stacks: A painting of the Top Forge in the 19th century shows a single tall chimney though this was later replaced or added to, giving a set of three chimneys fitted to the furnaces used for reheating items during forging operations. They replaced, at time unknown, the blowing engine referred to in 5.1.1. They were demolished in the early part of the last century but their location and general dimensions can be inferred from the excellent contemporary photographic records held by the Society and extant evidence on the west wall of the Forge building. Construction of replicas, though it might be practicable, is not currently contemplated in view of the vulnerability to damage of the venerable hammers if they were ever to be used again for forging of hot metal.

5.1.3 Water supply system: The ownership of the extraction system for supplying water from the River Don was separated from the ownership of the Forge when the Forge was acquired by the Society. The vendor retained the water supply arrangements including sluice, head goit and dams (though not the dam wall protecting the Forge) and these are now used to enable the provision of commercial facilities for leisure fishing. The water supply for the Forge is controlled by the owners of the facilities and takes priority over the needs of the Forge. Furthermore, the ownership of the rights to water extraction from the river, on which the Forge depends via the control exercised by the dam owner, are not known to the Society and require clarification.

5.1.4 Forge office and yard: As described earlier, the former Forge office is now occupied as Top Forge Cottage in private ownership. The entrance yard of the Forge is now the garden of the cottage. It should be

said that the Society and Trust have excellent relations with the present owner of the cottage. Indeed, the parents of the present owner acted as caretakers of the Forge prior to, and for some years following, the Society's acquisition and they also gifted the area occupied by the blower wheel, as well as the wheel itself, to the Society. However, the current satisfactory situation might not persist on a future change of ownership and it would be highly desirable to pre-empt any adverse effect on the Forge by purchasing the cottage should it be offered for sale.

5.1.5 Andrews' test rig: The drop rig used by Andrews for testing railway axles in the later years of the Forge's operations has largely disappeared. However, quite complete descriptions are available from Andrews' published papers in the scientific literature (30). The location of the foundations of the rig and the tracking of the shaft from the blower wheel for driving the hoist are still evident. However, these remains are largely situated within the boundary of Forge Cottage. For that reason, a planning application in 1991 to extend the cottage was refused after a Public Inquiry. Although it would be a practicable and attractive proposition to construct a complete replica of the rig incorporating the extant features in its original position, the feasibility of doing so is entirely dependent on the possible purchase of Top Forge Cottage.

5.1.6 Reheating furnaces: Although the reheating furnaces in the main Forge building have been lost, redundant furnaces of similar design were obtained by the Society from a Sheffield forge some forty years ago. They have been installed close to the original location and are considered to be a satisfactory representation.

5.1.7 Recorded information on the Forge: In addition to the losses of physical features as described above, there has been an irrecoverable loss of information about the working history of the Forge through the disappearance or destruction of documents and photographs and from the unrecorded memories of people who worked at or whose lives were linked to the Forge.

5.2 Vulnerabilities of the Significance to Present or Potential Future Issues

The following is a list of issues that affect the vulnerability of the significance of the Top Forge site to loss or gradual deterioration. Some apply to the site as it now is and some have the potential to apply in the medium to longer term.

5.2.1 Diminishing knowledgebase: As time passes, there will be a potential loss of knowledge about the site. Much is known and recorded, some is known though not recorded and still more awaits researching. The effort available to build the knowledgebase is intermittent and random, lacking the continuity of effort needed for effective learning and recording of the intricacies of this complex site. Direct knowledge on some aspects - for example, the social and environmental impacts of the Forge's working - have virtually disappeared due to fading memories of contemporary experiences as related by the previous generation. Of particular importance is the lack of a coherent record of the fund of knowledge possessed by the volunteers concerning the main phases of restoration together with associated documents and photographs. Some efforts have been made towards this end but a great deal remains to be done. We still have continuity of memories back to the 1960s - but time is running out.

5.2.2 Loss of volunteer effort: The corps of volunteers - embracing all sources of expertise - may decline in numbers over the next few years due to the age profile, continuing frustration in securing adequate resources for the work of restoration and maintenance, and the absence of a shared vision and strategy for the site. In recent years, Forge Open Days have had to be reduced in frequency because they overstretch available volunteer effort. The number of active volunteers is on average between 15 and 20. As well as the loss of income, there is disappointment for volunteers, a limitation on the word-of-mouth publicity which brings in many visitors and a diminution of one of the sources of volunteers. Any further decline in volunteer numbers would leave too small a number to form a viable team to administer and operate the site.

Figure 33 Forge Open Day August 1991

5.2.3 Loss of the site's character: The special character of the site could be vulnerable through trying to cater for much larger numbers of visitors. This might take several forms: most obviously the inability to attend to the visitors themselves and find space for their cars, but also the provision of unsuitable extra buildings and facilities. Adding unrelated attractions in the hope of attracting more visitors could also be financially risky as well as harmful to the character of the site.

5.2.4 Loss of skill base: The work at Top Forge requires specialist millwrighting and engineering skills that are in reducing supply in the external workforce. This skill base is inevitably diminishing due to the natural march of time and changes in engineering skills and technology. Over the next few years the specialist skills which have sustained the work at Wortley up to now will be lost forever unless transfer of the skills to new volunteers can be accomplished. There is also a gradual loss of people with understanding of, as distinct from practising, the manufacturing processes used at Top Forge such as the forging of wrought iron railway axles using hammers driven by water wheels.

5.2.5 Security of water supply: The security of the water supply required to drive the water wheels could be in jeopardy due to the separate ownership of the dams and the extraction system. The owners are not involved in the affairs of the Trust or Society and in the past have been divorced from the work of preservation at the site, having to pursue their own business interest in ensuring the water supply for their leisure fishing facilities. Furthermore, the continued running of the water wheels is vulnerable to silting of the Small Dam. The cost of securing the water supply is likely to be high in terms of time, effort and money.

5.2.6 Setting of the site; Unsympathetic development in the neighbourhood could threaten the setting of the site. This could involve the building of houses, the development of industrial premises, the opening of quarry sites, changes to the road system outside the site and modifications to Top Forge Cottage, any or all of which could have a deleterious effect on the site. The pressure for development across the economy as a whole in

recent years due to increasing affluence could be reflected in the environment of the site. For example, a proposal for housing development in the old quarry across the river from to the Forge was only narrowly rejected.

5.2.7 Integrity of Structures: A full structural survey of the site's buildings does not exist with the result that repairs are piecemeal rather than in accordance with a planned schedule based on periodic monitoring.

5.2.8 Archaeological remains: Lack of complete archaeological records from site investigation could result in well meaning but ill-considered actions destroying or damaging parts of the site particularly in areas that have not been fully surveyed and potentially contain important aspects that are currently unknown.

5.2.9 Authentic restoration: Authentic restoration of the fabric of the buildings incurs high material costs. Authentic restoration also requires a team of skilled volunteers who may not always be available or to recourse, at considerable cost, to external contractors.

5.2.10 Financial security: Deterioration of past investments in restoration will result from continuation of a situation where the income stream of the Trust, especially from visitor receipts, leaves little or no margin above what is needed to meet realistic and unavoidable day-to-day expenditure. The present hand-to-mouth existence means that any longer-term planning on capital projects is wasted effort since the Trust does not have significant financial reserves to call upon. For example, increased financial vulnerability might well result if new facilities or policies (for example, to increase expenditure on publicity or marketing or to employ paid staff) cost more to run than the extra revenue that they produce. On the other hand, any attempt to counteract this by increasing visitor numbers is constrained by insufficient volunteer effort, inadequate car and coach parking space within the site as well as restricted access for vehicular traffic.

5.2.11 Financial efficiency: The lack of funding inhibits investment in labour-saving equipment and durable materials and consequently affects the efficiency of maintenance and restoration operations. It also has a serious effect on the motivation of the volunteer workers compelled to expend time and effort which could otherwise be more usefully employed.

5.2.12 Inadequate site security: The difficulties and cost involved in maintaining adequate security at the site could lead to artefacts being stolen or costly damage occurring to the site. A serious fire, whether accidental or resulting from an arson attack, is a risk about which more should be done, especially in the light of occurrences elsewhere. Comprehensive fire insurance has been investigated but the cost is quite beyond the resources of the Trust.

5.2.13 Compliance with legislation: Undue emphasis on rigour in complying with legislation such as the Health and Safety at Work Act and the Disability Discrimination Act could result in unreasonable effort and expenditure. There is an obligation to fulfil statutory requirements so far as is reasonably practicable and doing so in a way that minimises possible conflict with conservation requirements whilst respecting the perceptions and priorities of the times.

5.2.14 Extreme weather: The riverside location of the Forge has in the past made occasional flooding a fact of life and vulnerability to this risk has not been an issue. However, it is now the accepted view, based

on forecasts of more frequent occurrence of extreme weather events, that there is an increased probability of flooding more severe than experienced on the site in the past and of storm damage to structures.

5.2.15 Indifference and apathy: The work of the Trust is exposed to a general and overriding vulnerability arising from political indifference, both local and national, and of society's apathy to conservation of the industrial heritage. Although these adverse factors appear currently to be changing for the better, the effect on future funding provision for conservation activities is not yet clear. These factors are outside the Trust’s immediate control though it might be hoped that the work of the Trust can help to overcome them. Nonetheless, an absence of improvement in the general outlook for conservation would have repercussions on the Trust’s continuing ability by its own efforts to preserve the heritage of the site.

5.2.16 Governance: The governance of the Society and of the Trust is acutely vulnerable to the availability of a small number of people willing to undertake a multiplicity of duties including charity administration, accountancy, fundraising, liaison with relevant authorities, educational work, historical and archaeological research, publicity and marketing, and planning.

Chapter 6: Conservation Policy

6.1 Background

A conservation policy, though not referred to as such, has been in existence since the time of the original acquisition of the site by the Society. Further back in time, when the Society was founded in 1933 as the Society for the Preservation of Old Sheffield Tools and Machinery, it had an objective, *inter alia*, 'to preserve tools and machinery formerly employed in the district of Sheffield which are now obsolete'. The artefacts mentioned as being in scope for preservation included 'old tilting and forging hammers worked by waterwheels' and the examples at the Wortley Forges were explicitly included in the scope. Over the course of time, the Society's ambition changed from acquisition of machinery for removal and preservation elsewhere to acquisition of the Top Forge with the machinery preserved in situ (4). The decision to purchase the Forge was taken in 1944 but it was not until 1953 that the purchase was concluded. A development plan was accepted by the Society in 1957 in consultation with the Ministry of Works. The Ministry initially had wished to take over the property as owners and matters were taken to the point where a draft contract had been submitted to the Treasury Solicitor. However, the proposal did not come to fruition. The development plan envisaged that 'the main forge building should be restored to an agreed scheme' and the plan might indeed be seen as the forerunner of what is now called a conservation plan.

Later, in 1959, the Society took the opportunity to purchase the two cottages and adjacent land together with the former joiners shop, blacksmiths shop and foundry. The combined acquisitions of land, buildings and machinery now comprise the Top Forge site (on which some later constructions have been added both inside and outside the scheduled area). Thus a conservation policy to preserve Top Forge as an integrated and restored heritage site has been the basis for all of the endeavours undertaken at Top Forge. The policy has necessarily been framed around the essential aim of preserving, and where necessary and practicable restoring, the historic buildings and machinery of the Forge, somewhat narrower than is now the aim of a conservation policy. Initially, the implementation of the policy was pursued by the Society but in 1969 it was delegated to the Trust specially set up for the purpose and given effect in 1976 by a lease of the Forge to the Trust. The Trust's Memorandum of Association gives as its objects

> 'To protect, conserve and manage industrial buildings, monuments, machinery and other artefacts of historical or architectural importance for the benefit of the public in general and the inhabitants of South Yorkshire in particular'.

In 1979, the Council of the Society formed a Policy sub-Committee which produced a draft Policy Statement. In its essence and in the detail of what it said, that Statement was a forerunner of this section of the Conservation Statement. The particular issues it identified as meriting attention are incorporated in the policy objectives to be described below. In view of its relevance, the 1979 Policy Statement is reproduced in its entirety in Annex I.

However, the main focus of the Trust's efforts has been on restoration and preservation. This emphasis has served the interests of the Society very well, in the light of the improvements in the condition of the Forge achieved since its acquisition. However, as explained at the outset of this Statement, a conservation policy based only on physical preservation and restoration is now seen as serving a narrower spectrum of stakeholder

interests than is currently envisaged for conservation policies for sites of heritage merit such as Top Forge.

It should be recorded that an attempt was made in the late 1990s to implement the policy objectives by seeking to interest the National Trust in taking over responsibility for the Forge. After protracted negotiations, the National Trust withdrew its interest for financial reasons. However, their representatives were very impressed by the heritage value of the site and by the way it had been cared for and restored with very limited resources.

6.2 The Consultation Process

Following the National Trust's withdrawal, the Trust proceeded on its own accord. The emerging national picture on the needs of conservation planning emphasised the importance of the public's perception of the distinctiveness of places of heritage merit. The Trust henceforth adopted a consultation process to bring these perceptions to the fore so that the Conservation Plan for the Forge could be properly informed. The consultation process undertaken by the Trust is fully in keeping with the relevant headline Conservation Principles established by EH (1), namely

> Principle 1: The historic environment is a shared resource, and
> Principle 2: Everyone should be able to participate in sustaining the historic environment.

Since the process of consultation is an explicit part of the Trust's Conservation Policy as described in this chapter, it is appropriate to set it out in some detail.

The first step was to organise a one-day meeting in May 2002 to engage with an expanded range of stakeholders. The broad purpose of the meeting was to consider what needed to be done

> 'to sustain Wortley Top Forge in order to hand on what we value to future generations'.

In addition to members of the Society and Trust, the meeting was attended by representatives of English Heritage, National Trust, Barnsley MBC, Wortley Parish Council, Hunshelf Parish Council, Sheffield Industrial Museums Trust, local residents and the owners of the forge dams and of Top Forge Cottage. A detailed presentation on the concept of conservation planning and the requirements of a plan was given by English Heritage. The meeting discussed in detail the relevant considerations pertaining to Top Forge under the following headings:

- Why Wortley Top Forge?
- The changing Forge - main milestones
- Stakeholders in the Forge
- Elements of the Forge
- Values attached to the Forge
- Possible threats to the Forge
- Actions required of the Society and Trust
- Desirable improvements and the benefits that would accrue
- Associated risks
- Next steps

The views expressed and the identification of issues on which more information was needed proved extremely valuable and together served to inform the preparation of a draft of this Statement in the format suggested by HLF (3). In particular, the points made in discussion,

together with the policy imperatives laid down by the Society and Trust over the years, provided the material for the preparation of a draft of the Conservation Policy for incorporation in the Statement.

The draft Statement was submitted to a second consultation meeting convened by the Trust in July 2007 and involving the same range of stakeholders. The purpose of the meeting was to consider the accuracy and comprehensiveness of the draft Statement, especially on the significance and heritage merit of the site and on the vulnerabilities identified. The meeting went on to obtain views on the values that matter to the stakeholders so that these could be reflected in policy principles and to exchange ideas on how to shape the future of the Forge. In anticipation of the needs of the Conservation Plan, the opportunity was taken to record views on priorities for action. The meeting served largely to confirm the factual content of the draft Statement, provided valuable amplifications and corrections on some of the matters of judgement and identified gaps needing further work. The present document is a revised and expanded version of the draft considered during consultation.

6.3 The Vision for the Site

The vision for the site is

> *To preserve and provide interpretation of the Top Forge site to the highest standards and to afford opportunities for people, now and in the future, to have access to, learn about and enjoy a place of local and national significance in the industrial heritage.*

This vision is consistent with achievement of the objects of the Trust as described above but with the addition of an inclusive regard for the values of the interested public seeking to fulfil their desires for the future of the Forge.

6.4 Overall Aim of the Policy

The aim is

> *to achieve the vision by ensuring the preservation and maintenance of the heritage merit of the site and by enhancing the merit as resources permit in ways that reflect the values held by all those interested in what the site represents.*

6.5 Conservation Philosophy

The Society and Trust are committed to a conservation philosophy that pays full regard to the public interest in the preservation of the site for the education and enjoyment of current and future generations. This philosophy overlays and guides their stewardship responsibilities and the voluntary activities undertaken at the site by their members. The delivery of the policy will in part be dependent upon the degree of support available from public funds. The Trust is committed to undertaking the necessary work to procure public funds for those aspects of the policy that are pursued in furtherance of the interest and enjoyment of the public.

6.6 The Policy Principles

The conservation policy in essence is to seek to preserve features of significance, both tangible and intangible, and, where practicable, to restore features lost as well as to enhance the attractions of the site by provision of facilities for public access, education and enjoyment.

Delivery of the policy will in due course be formalised through a management plan. The conservation policy and the management plan will be linked through a concise set of policy principles to be observed in addressing, first, the specific risks of diminution or loss of significance and, second, in taking opportunities for the enhancement of the existing merit. The principles are intended to be enduring, reflecting the views and values of the Society and Trust and as expressed in the course of consultation. They are therefore properly part of this Conservation Statement and they will determine the content of the management plan to achieve the policy aim.

The set of policy principles that have been drawn up by the Trust is given in Table 1. They are grouped into conservation-related themes and, where appropriate, are cross-referenced to the related vulnerabilities from Chapter 5. The specific principles will have obvious relevance to particular management actions though some of these actions may be mutually dependent, for example actions relating to expenditure will be conditional upon pursuit of funding-related ones. The actions will vary in their priority and the timescales over which they will be pursued to a successful outcome. Some will be within the control of the Trust in the sense that the Trust can initiate and pursue actions though ultimate success may depend on the actions of others. Finally, some will inevitably be expressions of hope and aspiration consistent with the vision rather than being controllable actions leading to a defined outcome. All of these considerations will be appropriately covered in a Management Plan which itself will be an integral component of the Conservation Plan.

Table 1 Principles associated with the conservation policy

Conservation Theme	Ref. No.	Policy Principle	Associated Vulnerabilities
Preservation and Restoration	6.6.1	All work done must comply with statutory requirements on preservation of the site and equipment.	
	6.6.2	The historic buildings and equipment on the site will be kept in a good state of repair and will be protected against deterioration or damage.	5.2.7
	6.6.3	Materials and methods used in preservation and maintenance will, so far as is reasonably practicable, be consistent with those in the original fabric and design.	5.2.9
	6.6.4	Archaeological investigations will be encouraged and facilitated in order to extend the archaeological recording of the site and to promote publication of research results.	5.2.8
Enhancements and Acquisitions	6.6.5	The site's features will be presented and interpretation provided so as to facilitate education and research on the engineering heritage and on the Forge's part in the history of the country and the local area.	5.2.1; 5.2.15
	6.6.6	Acceptance of offers of artefacts and proposals for storage of items owned independently will be determined by an acquisitions policy which takes account of their relevance and contribution to the site's attractions.	
	6.6.7	Acquisition of contiguous properties that were formerly part of the site, in particular the Small Dam and Top Forge Cottage, will be a priority if and when circumstances permit.	5.1.4; 5.1.5
	6.6.8	Site facilities will be enhanced through acquisition, if and when opportunities occur, of suitable adjacent property, in particular but not exclusively the former quarry across the River Don from the site.	
	6.6.9	Society-owned machinery associated with the forging of metal and with the engineering industry of Sheffield and South Yorkshire will be displayed as an integrated collection.	

Table 1 (continued) Principles associated with the conservation policy

Conservation Theme	Ref. No.	Policy Principle	Associated Vulnerabilities
Public Interest	6.6.10	Effective communications will be maintained with all stakeholders on proposals and activities affecting the site's external impacts.	
	6.6.11	The site will be open to visitors, as far as resources permit, and means of access to it and information on its heritage merit will be publicised using all available media.	5.2.15
	6.6.12	A rich habitat will be sustained for flora and fauna associated with the riverside location of the site.	
Operations	6.6.13	All conservation work will be done consistently with statutory requirements for health and safety, disabled access and building control.	5.2.13
	6.6.14	A prioritised scheme of work will be organised for maintenance and enhancement of the existing assets including where practicable the replacement of features of significance that have been lost.	5.2.2
	6.6.15	Risks to site security will be kept as low as reasonably practicable and will be periodically reviewed.	5.2.12
	6.6.16	The system of governance for operation of the site will be such as to encourage participation of a body of volunteers large enough, and with a wide enough range of skills, to meet the needs of the work.	5.2.16
Resources	6.6.17	The costs of all work must be covered by available resources.	5.2.10; 5.2.11
	6.6.18	Income from visitor receipts and other funding sources must be sufficient for financial viability without compromising continuity of voluntary effort and the significance and special character of the site.	5.2.3; 5.2.10
	6.6.19	Capital investment for improvement of visitor facilities will be given due priority.	5.2.10

Chapter 7: Next Steps

7.1 Preparation of the Conservation Plan

The descriptive text of the present document will be used by the Trust as the definitive reference source in drawing up the Conservation Plan, including the Management Plan, to achieve the aim of conservation of Top Forge.

7.2 Implementation and Review

The continuing actions and discrete projects in the Management Plan will be detailed as to the resource needs, the foreseeable constraints and timetables, and the arrangements for monitoring progress. The actions will be prioritised so as to take a balanced account of the limited resources available, both human resources for administration and execution and financial resources for necessary expenditure.

Progress on the overall implementation of the Plan will be overseen by the Council of the Trust. The Plan will be reviewed after five years and a revised and updated Plan will then be prepared by the Trust.

8. ENDNOTES AND REFERENCES

1. Conservation Principles: Policies and Guidance for the sustainable management of the Historic Environment, English Heritage, April 2008.
2. Thinking about...Conservation, Heritage Lottery Fund, April 2008.
3. Conservation Plans for Historic Places, Heritage Lottery Fund, March 1998. Further useful reading is Kate Clark, 'The best cause', British Archaeology, 10-13, Jan/Feb 2006.
4. Jim McQuaid, 'Evolution of the ambitions for Top Forge', South Yorkshire Industrial History Society Journal No. 4 (in the press).
5. C. Reginald Andrews, The Story of Wortley Ironworks, 3RD edition, 1975. R. Milward Printers Ltd, Nottingham NG7 2LY.
6. R. A. Mott, 'The early history of Wortley Forges', Bulletin of the Historical Metallurgy Group, **5**, No. 2, 63-70, 1971.
7. Chris Morley, Forging thro' time: The story of the Wortley Iron Works, unpublished manuscript (c.2002) in the Society archives. This comprehensive and detailed history with extensive use of original sources covers all of the various sites, including Top Forge, extending in time from their antecedents, through their establishment and their working lives up to their closure, as well as details of the personalities who ran them.
8. The planning policies of Barnsley MBC relevant to developments affecting the setting of Top Forge featured in the objection by English Heritage (dated 14 Feb 2000) to a Planning Application (Ref. No. B/00/1169/W0) for change of use to residential of Riverside Garage, Chemistry Lane, Wortley. The Garage is located directly opposite Top Forge across the River Don. The planning application was refused on the grounds of its intrusive impact on the setting of Top Forge.
9. Information contained in the 'Description of Monument' of the Entry in the Schedule of Monuments compiled under Section 1 of the Ancient Monuments and Archaeological Areas Act 1979 as amended, dated 2 Feb 1999, Monument No. 29920. The entry relates to an amendment to the original entry dated 30 July 1952 and extends the scheduled area to include the two dams, the weir and the head goit.
10. The name is given as Huthwaite House in the biographical entry for James Cockshutt FRS (1742-1819) in the Library and Archive catalogue of the

Royal Society. However, the name most widely used is Huthwaite Hall.

11. It is believed that there was at one time another blower wheel and evidence suggests (Duncan Smith, personal communication) that it was located slightly to the east of the surviving wheel but it no longer survives. Some support for this is provided by an inventory of the Upper (i.e. Top) Forge in an auctioneer's advertisement in the Sheffield Mercury 20 March 1824, reproduced in (7, p.92), which mentions two wheels each of 9ft (2.7m) diameter and working a pair of bellows. The existing blower wheel is 2.7m diameter.

12. This title derives from the inscribed stone entrance arch obtained from the old South Yorkshire Ironworks in Attercliffe, Sheffield and now incorporated into the gable wall of the building. The Ironworks had a historical connection with the Wortley Forges as the site was used to establish a crucible steel melting works in 1868 as an associate of the Wortley Forges (7, p. 102). The building displays a fine collection of forging machinery from Sheffield industry, including a file cutting machine.

13. The structural details and date of installation of the three chimney stacks are not currently known. Whether they operated in conjunction with or substituted for the blowing engine is not currently known. Andrews (5) recalls (p.76) that the blowing engine 'was much too large for the job of supplying wind for the two blacksmiths hearths it served in my day' and he further noted that 'only one of the cylinders was then in use.' Since he died in the early 1950s, it can be surmised that 'his day' would have been c.1880 at the earliest. There was also a single brick chimney visible in a mid-19th century painting of the Top Forge (shown in Andrews (5), plate XIII) but it is not known when this was demolished.

14. George Watkins, The Textile Mill Engine, Vol. 1, p.44 and plate 27, David and Charles, Newton Abbot, 1970.

15. Thomas Andrews, 'The Strength of Wrought Iron Railway Axles', Trans Soc. Engrs, London, pp. 143-178, 1879.

16. R A Mott, An Appeal for funds for the preservation of Rockley Furnace and Wortley Upper Forge, brochure, Sheffield Trades Historical Society, c.1962.

17. David Crossley, 'The blast furnace at Rockley, South Yorkshire', Archaeological Journal, **152**, 381-421, 1995.
18. It is not known whether the surviving No. 2 wheel now coupled to the hammer was also installed at the same time. The No. 2 wheel is 3.6m diameter and it is relevant that the advertisement mentioned in (10) includes reference to a wheel 12ft 2ins (3.7m) diameter 'applied to working a pair of bellows'.
19. Torsten Berg and Peter Berg (Translators), Illustrated Travel Diary 1753-1755: Industry in England and Wales from a Swedish Perspective by R R Angerstein, Science Museum, 2001, London.
20. Trevor Lodge, 'Surviving link with the past', Steelworks News Rotherham and Wolverhampton, British Steel Corporation, 13 August 1981.
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27. Jim McQuaid, 'Thomas Andrews: Last Forgemaster of Wortley', 4th Kenneth Barraclough Memorial Lecture, Cutting Edge, No. 12, pp.3-26, 1996. South Yorkshire Industrial History Society, Sheffield.
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29. Neil Cossons, 'Industrial Archaeology: The Challenge of the Evidence', The Antiquaries Journal, **87**, 1-52, 2007.
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31. Thomas Andrews, 'Deterioration by Fatigue in Steel Rails', Engineering, 13 July 1897.

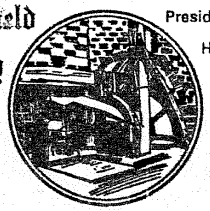
32. Roger Butterfield, Ecological Survey of Wortley Top Forge, Report to South Yorkshire Trades Historical Trust, November 2007.
33. Wortley Top Forge Nature Trail, brochure, South Yorkshire Trades Historical Trust, 2008.
34. Ken Hawley, 'Reminiscences of Top Forge', Cutting Edge, No. 5, pp.20-22, 1989. Sheffield Trades Historical Society, Sheffield.

Annex I

Sheffield Trades Historical Society

Draft Policy Statement for Wortley Top Forge, 1979

The Sheffield Trades Historical Society



President: K. C. BARRACLOUGH
Hon. Secretary: M. J. TILLEY
Hon. Treasurer: D. J. BRADBURY

WORTLEY TOP FORGE
Policy Statement

The Policy sub-Committee, consisting of Messrs. R.T. Doncaster, F.T. Evans, J.A. Cooper and M.J. Tilley, met four times during the year and the Draft below has been produced for comments and discussion by Council.

POLICY STATEMENT - Draft only

1. It is paramount that the character of Wortley Top Forge is not altered but that the site be made as attractive as possible without affecting this character. The Society is to retain full control of the Forge although co-operation with other bodies, both public and private, is to be encouraged together with any assistance in cash and/or kind as may be acceptable without compromising our aims.

2. Whilst our primary concern is Top Forge, its history and restoration of its buildings and working machinery, a Museum of Forging (and forging products) is to be established: this being relevant to the Sheffield area in general and to Wortley in particular, so far as the Society, as owners of Top Forge, is concerned. However, this Museum of Forging is not to be formed to the exclusion of other worthwhile branches of industrial, social and domestic preservation. Special consideration ought to be given to past local industries such as nail and chain manufacture although it is felt that trades such as cutlery and holloware etc. will be adequately covered by Sheffield City Museums. There is, however, a case for incorporating items relating to the tool trades at Wortley.

3. The Engine Collection is potentially excellent, and in some cases, unique. The subject has such a broad appeal that the major items should be retained and will eventually provide an important secondary contribution to the site.

Further contribution can be made by the use of the cottages to develop the social and domestic aspects of the area thus accepting the need to provide interest for lady visitors.

5. Relating to paras. 2, 3 and 4, items acquired for preservation by whatever means, are only to be accepted if they are relevant to the Society's aims.

6. The Forge should be open to the public at times other than Sunday, although, with Society membership as it now stands, this could only be achieved with generous assistance from the local authority with its attendant problems of bureaucracy. Similar problems also affect the scale of the development of any new building.

7. Archive facilities are essential for the recording and documentation of Society propperty and information which at present is widely scattered throughout homes of various members. To this end, central facilities should be provided, preferably at Wortley, for an Archivist to work and for storage of records. Ideally, suitable storage facilities should also be provided for all the items of plant and machinery in the Society's possession although it is accepted that some degree of compromise must be exercised in this instance.

8. This Policy Statement should not be regarded as a rigid definition but it is recommended that the Policy be reviewed, say, at intervals of 5 years.