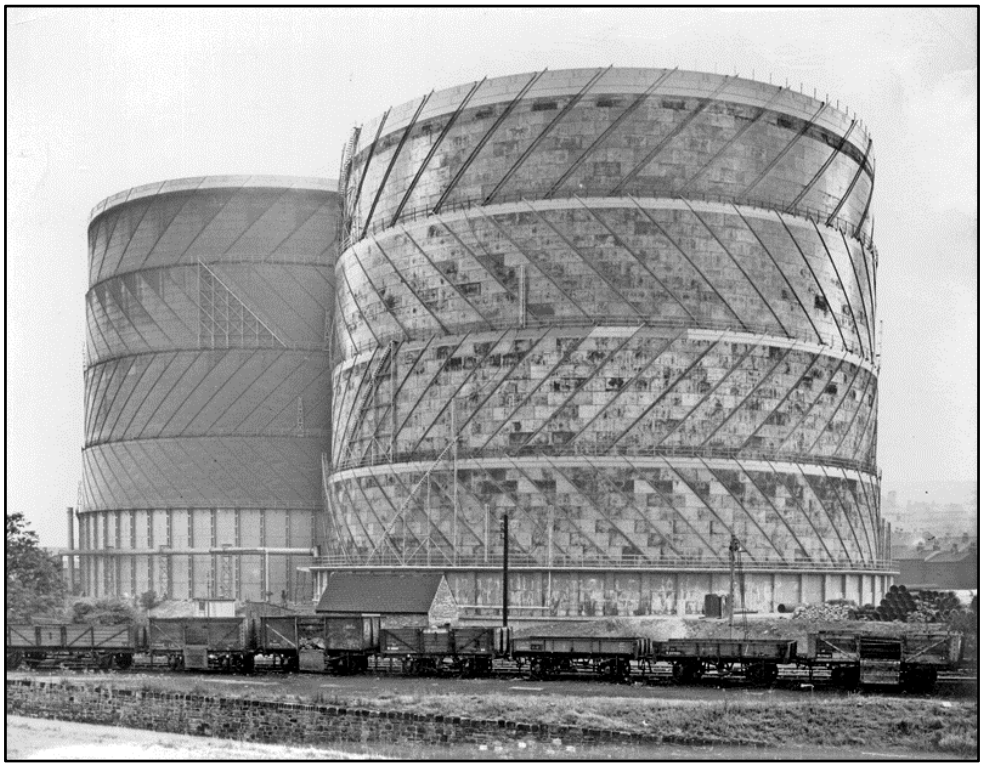

Historic Building Recording of Gasholders at the former Wincobank Gasworks Barrow Road, Sheffield October 2015 – March 2016

Report No. 16/52

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Quality control and sign off**:**

Issue No.	Date approved:	Checked by:	Verified by:	Approved by:	Reason for Issue:
1	29.03.16	P Chapman	A Chapman		Draft for client

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STAFF

Project manager:	Amir Bassir BSc
Text, fieldwork and illustrations:	Amir Bassir

OASIS REPORT FORM

PROJECT DETAILS	*OASIS* molanort1-246658
Project title	Historic Building Recording of Gasholders at the former Wincobank Gasworks, Barrow Road, Sheffield, October 2015 – March 2016
Short description	MOLA carried out a programme of historic building recording of two gasholders at the former Wincobank Gasworks, Sheffield. The gasworks began operating in 1938, initially comprising Gasholder 1, a 73m tall spiral-guided gasholder with a static steel base-tank, and a much smaller tank, gasholder 2, which was dismantled by the mid-1970s. Gasholder 1 was un-trussed and dismantling revealed a tall, multi-tier crown-rest. Gasholder 3 was constructed in the late 1940s-early 1950s. It had a fairly unique design comprising a partly above-ground concrete tank, with the dumpling being sunk several meters into the ground. The gasholders have been dismantled to allow redevelopment of the site.
Project type	Historic Building Survey
Previous work	Unknown
Future work	Unknown
Monument type and period	Early – mid 20th-century spiral-guided gasholders and associated infrastructure
PROJECT LOCATION	
County	South Yorkshire
Site address	Barrow Road, Sheffield
NGR	SK 38908 91901
Area	*c*1.3 hectares
PROJECT CREATORS	
Organisation	MOLA Northampton
Project brief originator	Montagu Evans on behalf of National Grid
Project Design originator	MOLA Northampton
Director/Supervisor	Amir Bassir
Project Manager	Amir Bassir
Sponsor or funding body	Montagu Evans on behalf of National Grid
PROJECT DATE	
Start date	October 2015
End date	March 2016
BIBLIOGRAPHY	
Title	Historic Building Recording of Gasholders at the former Wincobank Gasworks, Barrow Road, Sheffield, October 2015 – March 2016
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Author(s)	Amir Bassir
Page numbers	49
Date	March 2016

Contents

Figures

Historic building recording of Gasholders at the former Wincobank Gasworks Barrow Road, Sheffield October 2015 – March 2016

Abstract

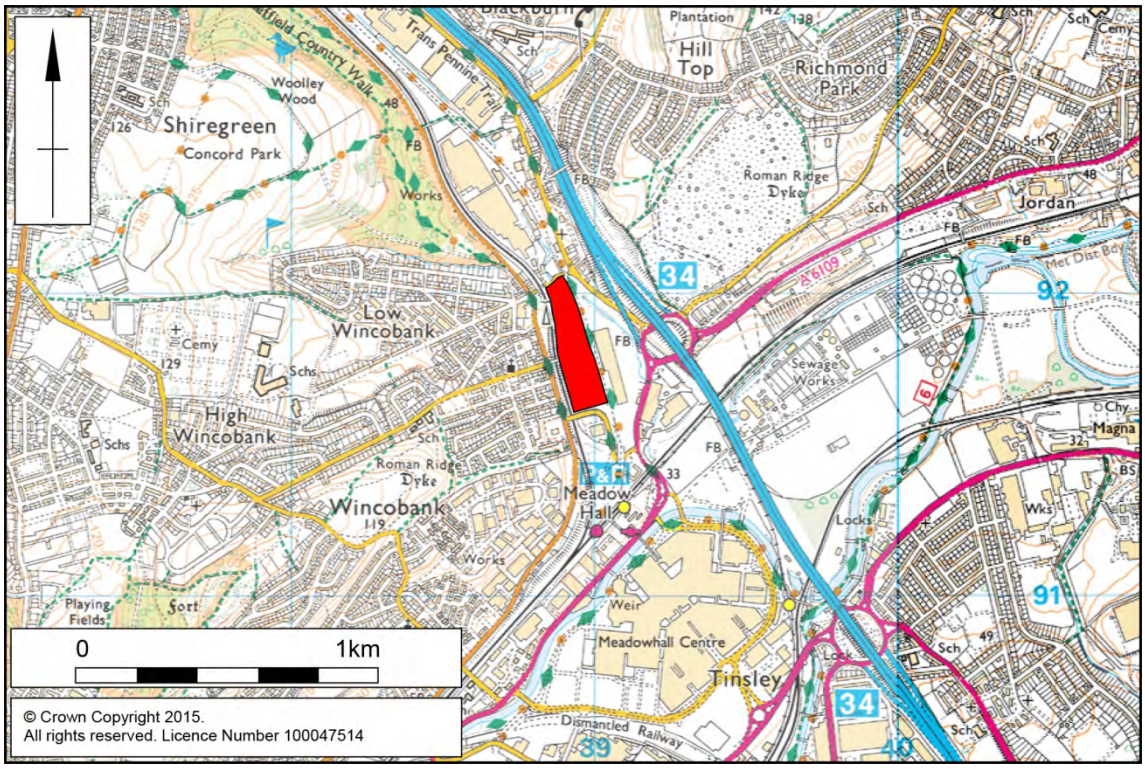
MOLA carried out a programme of historic building recording of two gasholders at the former Wincobank Gasworks, Sheffield. The gasworks began operating in 1938, initially comprising Gasholder 1, a 73m tall spiral-guided gasholder with a static steel base-tank, and a much smaller tank, gasholder 2, which was dismantled by the mid-1970s. Gasholder 1 was un-trussed and dismantling revealed a tall, multi-tier crown-rest. Gasholder 3 was constructed in the late 1940s-early 1950s. It had a fairly unique design comprising a partly above-ground concrete tank, with the dumpling being sunk several meters into the ground. The gasholders have been dismantled to allow redevelopment of the site.

1 INTRODUCTION

MOLA Northampton was commissioned in February 2015 by Montagu Evans, acting on behalf of National Grid, to undertake a programme of historic building recording at the former Wincobank Gasworks, Barrow Road, Sheffield (NGR SK 38908 91901, Figs 1 and 2).

The survey is a voluntary exercise commissioned by National Grid as part of their commitment to the heritage of their broader estate. This report is in response to a Historic Building Recording brief by Montagu Evans (pers-comm Montagu Evans 2015) and in accordance with current best archaeological practice as defined in the Chartered Institute for Archaeologists' *Standard and Guidance for the Archaeological Investigation and Recording of Standing Buildings or Structures* (CIfA 2014) and the Historic England procedural document *Management of Research Projects in the Historic Environment* (HE 2015).

The former Wincobank Gasworks is located at the north-eastern extent of Sheffield, partway between Sheffield and nearby Rotherham. The site occupies a long, linear, north-south footprint, bound to the west by a rail line and the B6082 Barrow Road and to the east by rail line and a large engine shed. The M1 motorway runs north-south a short distance to the east of the site with roundabouts for Junction 34 of the M1 to the east and south-east of the site. Beyond the motorway are a landfill site and the Blackburn Meadows Sewage Treatment Plant. A short distance to the south of the gasworks is the Meadowhall Interchange Railway and Bus Station with lines of the North Midland Railway crossing south-west to north-east. The River Don separates the stations and railway lines from the Meadow Hall Shopping Centre, a large retail development dating to 1990. To the west, the land use is primarily residential with a mixture of 20th-century housing. The gasworks is bound to the north by the Outo Kumpu Steelworks and to the east by the premises of the Chesterfield Special Cylinders Ltd. The Foundry pub, the sole remnant of a former row of houses that ran along the eastern side of Barrow Road between its intersections with Newman Road and Fife Street, marks the current site entrance over the railway bridge.



Site location Fig 1

The recording area (image © Google Earth) Fig 2

2 OBJECTIVES AND METHODOLOGY

The objectives of this survey as set out in the brief were to:

- Produce an illustrated, written document detailing the fabric, appearance and form of the gasholders and associated structures and pipework. Due to the safety constraints associated with gasholders, recording was limited to the exterior of the structures;
- Provide historical survey drawings (or sketches) for comparable investigation relating to building form and function, identification of fixtures and fittings where visible or accessible;
- Provide an account of historic fixtures, fittings and architectural features where visible or accessible;
- Provide a photographic record of the structures in context.

The level of recording was specified as enhanced Level 2 – a descriptive record (Historic England 2015).This is defined by consisting of:

- A systematic account of the building's origins, development and use;
- A drawn and photographic record to illustrate the building's appearance and structure as well as measured drawings of specific elements of historic or architectural interest.

Recording was carried out in two phases. Phase I encompassed pre-demolition recording of the extant elements of the site whilst Phase II comprised recording of any areas not visible or accessible during Phase I. The demolitions contractor, Erith Group, carried out day to day Phase II photography which included the interior of the tanks and the crowns. Phase I recording was carried out in February 2015. The site was photographically recorded to include general views of the site and structures and detailed views of any structural, historic and architectural details that would be lost during demolition. A roller carriage of Gasholder 3 was subject to photogrammetry using Agisoft Photoscan software, to create a 3d model of this element (electronic appendix 1).

Photography was carried out using a Nikon D200 DSLR equipped with Sigma 35-17mm and Nikon 18-70mm lenses. Black and white 35mm film photography was carried out using a Nikon F80 SLR equipped with a Sigma 10-20mm lens. The photographs are reproduced on archive quality photographic paper, submitted alongside this report. Additional photography was carried out using a Fujifilm Bridge camera.

There is some uncertainty with regards the nomenclature of the geographic area in which the gasworks is located. Historically the gasworks was referred to as the Wincobank or Low Wincobank Works and is referred to as such by Ralph Halkett, General Manager and Secretary of the Sheffield Gas Company. The area to the west of the site is marked as Wincobank on modern mapping and the site is considered by staff at the Sheffield Local Studies Library to fall under the Wincobank area. However, modern signage at the site refers to the site as Meadowhall and many of the businesses present at the time of the site's development were named after Meadowhall, such as the Meadowhall Ironworks which was replaced by the gasworks. This report will refer to the site by its historic designation of Wincobank Gasworks or The Gasworks.

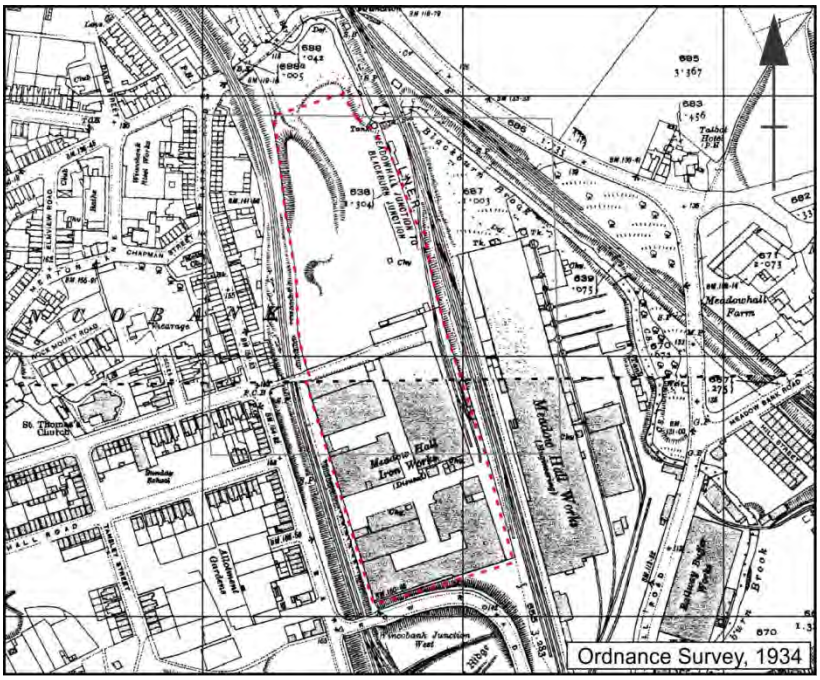
3 HISTORICAL BACKGROUND

3.1 Local history and development of the Wincobank area

In the mid-19th century, the Meadow Hall or Wincobank area comprised an isolated farm labelled as Meadow Hall or Meadow Hall Farm. This was located alongside a supposed Roman road a short distance to the north of the River Don. The surrounding area was mainly enclosed fields and woodland, crossed by the Sheffield and Rotherham Railway tracks, with the South Yorkshire Railway branching off to run west of the farm.

By 1892 substantial industrial development had taken place centred around the expanding rail interchange. These included the *Meadowhall Works (Engineering), Meadowhall Iron Works, Sheffield Tube Works, Sheffield Sewage Works* and *Meadowhall Colliery*. Alongside the industrial works, there was also a development of residential properties and amenities including churches to serve the workers. The residential area was located on fields formerly associated with *Nether Wincobank*, to the east of Meadowhall and were centred on the east-west Newman Road.

Throughout the early 20th century the rail infrastructure continued to expand with the construction of new rail sidings and branches and the industrial businesses and associated residential areas also expanded and increased at the same time. By 1905 there had also been substantial development to the south-west of Meadowhall in the Brightside area which was served by the *Grimesthorpe Gas Works*. By the 1930s, the area was roughly central to a continuous chain of industrial activity which had developed along the railways from Rotherham to the north-east to Sheffield to the south-west. Clearance for the Wincobank Gasworks seems to have begun by 1934 with the demolition of a few small buildings which formerly occupied the site (Fig 3). The area chosen for the gasworks was located to the immediate north of the Meadow Hall Ironworks and was bound to the east and west by railway sidings and to the north by football and cricket grounds. The gasworks began operations in 1938, comprising a single gasholder, No.1. A small tank with a capacity of 150,000 cu.ft was added shortly afterwards, followed by a third, much larger gasholder, No.3, which became operational by 1954. The discovery and exploitation of North Sea Gas in the late 1960s sparked a national decline in town-gas and the decommissioning of many former sites. Some sites were converted with new plant for the enrichment of natural gas which was stored in and distributed by existing gasholders. Ordnance Survey mapping of 1971-75 shows that several of the former gasworks buildings at Wincobank had been demolished by this time. The majority of the remaining buildings were cleared in the subsequent years, leaving the two gasholders and remnants of infrastructure on the site. Live national grid pipework remains *in-situ* along the eastern site boundary.



Ordnance Survey map of 1934, showing the site of the future gasworks Fig 3

3.2 The Sheffield Gas Company

Much of the following history of the Sheffield Gas Company is condensed from *The Sheffield Gas Undertaking*, *1818-1949* by D E Roberts, a highly detailed account of the history of the company and the economic and practical factors which affected both the company and the town of Sheffield, as well as the personalities who drove the industry at that time. Unfortunately the Wincobanks site receives only a fairly brief mention within the context of the gas company as a whole. Additional information was obtained from newspaper clippings of *Daily Independent* articles at the time of the inauguration of the gasholder by the Duke of Kent in 1938. To mark this event, a small booklet and a fold-out pamphlet were produced which provide a brief history of the site and basic specifications for the gasholder.

> *Among the East Midlands towns in which gas companies were formed, Sheffield was second only to Nottingham in taking the necessary steps to establish a gas company, and then only by a matter of months. Following the lead of London, Exeter, Glasgow, Manchester and Nottingham, a group of notable townsmen…called a public meeting which was held at the Cutlers Hall on 6 March 1818. Here it was resolved to seek an Act of Parliament to form a company by adding gas lighting to an Improvement Bill which was pending in the House of Commons. The Sheffield Gas-Light Company was in due course incorporated by an Act passed on 23 May 1818* (Roberts 1979).

The newly incorporated gas company had its offices in Haymarket Lane and situated its gasworks at Shude Hill, near Sheaf Bridge, a location chosen for its close proximity to the River Sheaf and canal wharves which greatly facilitated the transportation of the raw materials and equipment needed for the works. The company encountered numerous problems from the outset, many caused by the lack of experienced gas engineers and the rudimentary state of the gas industry at this time. *Bad workmanship in stonework, serious delays in the delivery of ashlar stone, imperfect casting , etc., proved frustrating. It is also evident that the second gasholder was defective and had to be replaced in 1820* (Roberts 1979).

The Sheffield New Gas company, previously known as the Consumers' Gas Company, was formed under the Sheffield Gas Act of 1835 as a rival to the Sheffield Gas-Light Company. The emergence of this rival company was in part a response to a perceived insufficient expansion in the gas supply and high gas prices.

> *By 1835 Sheffield had expanded considerably in every direction. The population had risen from about 60,000 in 1818 to around 105,000… Sheffield Gas-Light Company was selling insufficient gas of poor quality at a high price…by 1835 Sheffield required nearly double the quantity of gas used in 1828 to provide an equal amount of light* (Roberts 1979).

The Sheffield New Gas Company was supported by a number of industrialists and manufacturers and the proposed new gas company was entered as a Bill into Parliament in 1835. The Bill was opposed by the Sheffield Gas-Light Company. During a House of Commons committee meeting it was highlighted that

> *the* [Sheffield Gas-Light Company] *was failing to remove completely the ammoniacal liquour and sulphuretted hydrogen from the gas before distribution… the Company had never… inspected any work done by pipefitters, and a great deal of shoddy work was being undertaken* (Roberts 1979).

> *The Sheffield New Gas Company gained the support of Parliament…Under the Sheffield Gas Act of 1835, the New Company was authorised to raise £80,000 in capital with which to establish works at Effingham Street to supply gas in competition with the Old Gas Company* (Roberts 1979).

Shortly thereafter the Sheffield Gas Act of 1844 the Sheffield New Gas Company and the Sheffield Gas-Light Company were amalgamated as the Sheffield United Gas-Light Company.

> *The merger led to improved profits for the proprietors and a reduced price of gas for consumers…Considerable saving resulted from having only one management, the removal and replacement of old and decayed pipes, the connection of services to one set of new mains, and he collection of accounts on a quarterly basis* (Roberts 1979).

The Shude Hill works were improved and added to and additional land was purchased on which to erect a new gasholder to meet the increased demand. This gasholder was operational by 1850. A rival to the Sheffield United Gas-Light company emerged in 1850 when the Highways Board and Town Council, along with certain members of the public formed the Gas Consumers' Company. The company obtained a Board of Trade licence to operate and a new gas works was opened in August 1932 at Neepsend. Due to a lack of Parliamentary sanction, the Gas Consumers' Company acted somewhat illegally and were opposed by the United Company who took it upon themselves to act outside of the law and place obstructions in the way of the Consumer's Company's workmen such as filling in pipe trenches during the night which had been dug by the United Company's labour force during the day.

The Sheffield United presented a Bill to Parliament in 1855, presenting a deed for amalgamation. This amalgamation became law under the Sheffield Gas Act of 1855.

> *One of the first actions of the newly established Board was to authorise re-arrangement of the mains based on the extension of the Effingham Street site, including the erection of two large gasholders, and the running down of the*

> *Neepsend station. The disused gasholder at Neepsend was sold to the contractor of the Effingham Street development* (Roberts 1979).

The onset of war in 1914 presented a considerable challenge to the Sheffield United Gas Company and indeed gas companies throughout Britain. Among the problems faced by the company were a reduction in the quality of gas caused by the extraction of toluol and benzol (chemicals required for high explosives), an increase in demand from the steel industry and a shortage of labour.

> *In the face of inflationary rises in wages and the price of coal and other raw materials, gas companies suffered losses in the markets for residuals. The main markets were overseas, the German chemical industry being a major buyer…*
>
> *In terms of revenues from gas and coke sales, however the Sheffield Gas Undertaking was in a more favourable position than most other gas companies…The Sheffield steel industry was at the heart of the munitions drive, so that the Sheffield Gas undertaking, which provided a growing quantity of fuel power necessary for the output of armaments, became a crucially important cog in the war machine.* (Roberts 1979).

Friction between the steel industry and the gas company over the provision of good quality gas at high pressure was compounded by labour shortage. The men offered to the company by the Supply Department of the Ministry of Munitions were unsuitable for the heavy labour required and of the 600 men initially seconded to the gas company only 61 remained by 1917. The Company had begun employing women to meet the labour shortage but these were unable to carry out the heavy work required. Strike threats and complaints from the munitions producers led to an intervention by Winston Churchill, then Minister of Munitions, as a result of which, the company director, Wilson Mappin, resigned from his post.

In 1919 Ralph Halkett succeeded the Managing Director Hanbury Thomas as General Manager, then as General Manager and Secretary from 1925 to 1940, then as Director and General Manager until 1945. From 1917, a long term decision was made to *change over from being primarily a gas maker to being predominantly a collector and re-distributor of gas* (Roberts 1979). This goal required the *collection, purification and re-distribution of coke oven gas, and… the gradual merger of small gas undertakings within an extended area (Roberts 1979).* The Sheffield Gas Grid as it became known was the means by which the large quantities of gas were collected from the various coking plants within the Gas Company's collection zone. This plant was located as various sites throughout South Yorkshire and the gas was pumped at high pressure to Sheffield for purification and re-distribution.

> *By 1929 the contribution of coke oven produced gas to the total supply had been increased to 68 per cent, so about a third only of the gas supplied to customers was manufactured town gas* (Roberts 1979).

As stated by Ralph Halkett:

> *Prior to 1931, the greater part of the gas produced in the manufacture of coke was literally blown into the air – sheer waste. Nowadays that Gas is purchased, purified and distributed by the Sheffield Gash Company to the benefit of all consumers, industrial and domestic within an area of 314 square miles… More than that, valuable residuals and by-products are extracted from the Gas and put to profitable use* (G11_SHE_5514).

As part of its plan to merge smaller gas undertakings, the company acquired the Woodhouse and Dronfield undertakings in 1924, followed by works at Holyand, Elescar, Baslow, Matlock, Bakewell, Eckington and Killamarsh between 1932 and 1940.

> *The area of supply which had in 1920 been 167 square miles…had by 1938 been enlarged to 314 square miles. In view of the expansion the name of the undertaking was altered to the Sheffield and District Gas Company…Thus, when war broke out in 1939, the Sheffield Grid System was almost complete and served a large region* (Roberts 1979).

> *It was because of the tremendous growth in the operations of the Sheffield Gas Undertaking …that the significant part played by the Gas Company in the Second World War was probably greater than that in the Great War…the production of crankshafts for Spitfires and Hurricanes was carried out by one of the leading Sheffield firms, and output of the forges depended upon gas* (Roberts 1979).

The Gas Company's works were fortunate to escape the brunt of the damage from air raids during the Blitz. This was in part due to the Company's control system which had been developed during the inter-war period and consisted of a fully equipped underground control room from which the Company could control the Grid System throughout the area of its authority. Direct lines allowed the various gasworks to be rapidly notified of any impending attacks. On 12 December 1940, the Neepsend and Grimesthorpe works were hit by bombs.

> *No direct hits were reported at Wincobank, but a high explosive bomb completely destroyed the central laboratory at Grimesthorpe and wrecked No.2 holder, the 1.5 million cu.ft. of gas burning out in a matter of seconds in a gigantic mountain of fire* (Roberts 1979).

Ralph Halkett resigned as director and was succeeded by his son Ralph Halkett Junior who was appointed General manager and Chief Engineer. The Gas Company passed into public ownership in 1949, following the Gas Act of 1948 which nationalised the UK gas industry.

3.3 The Wincobanks Gasworks

The decision, taken in 1917 and led by Halkett, for the Gas Company to change from being primarily a gas producer to a collector and redistributor of gas by the collection of waste coke oven gas led to a greatly increased output by the 1930s. The Wincobanks Works was developed in response to a need for increased storage capacity. Ralph Halkett, General Manager and Secretary of the Sheffield Gas Company, stated that "*in 1918 the highest daily output of gas was 22 million cubic feet, in 1938 it has grown to the enormous figure of 40 million cubic feet"* (G11_SHE_5514).

> *By 1937 output had reached 10,000million cu.ft., compared with4,600 million cu.ft., in 1918, and 75% of the gas was used for industrial purposes. To accommodate the extra coke oven gas received, new storage had to be provided. The following year the world's largest spiral guided gasholder was inaugurated by the Duke of Kent. Built by Newton Chambers & Co. Ltd., for use at Wincobank, and costing £106,428, the holder stood as high as St Paul's Cathedral and could hold eight million cu.ft., of gas* (Roberts 1979).

Sheffield's *Daily Independent*, in an article of 28 June 1938, carried an interview with Major W. T. Kitching, General Manager of Newton Chambers, regarding the erection of the holder.

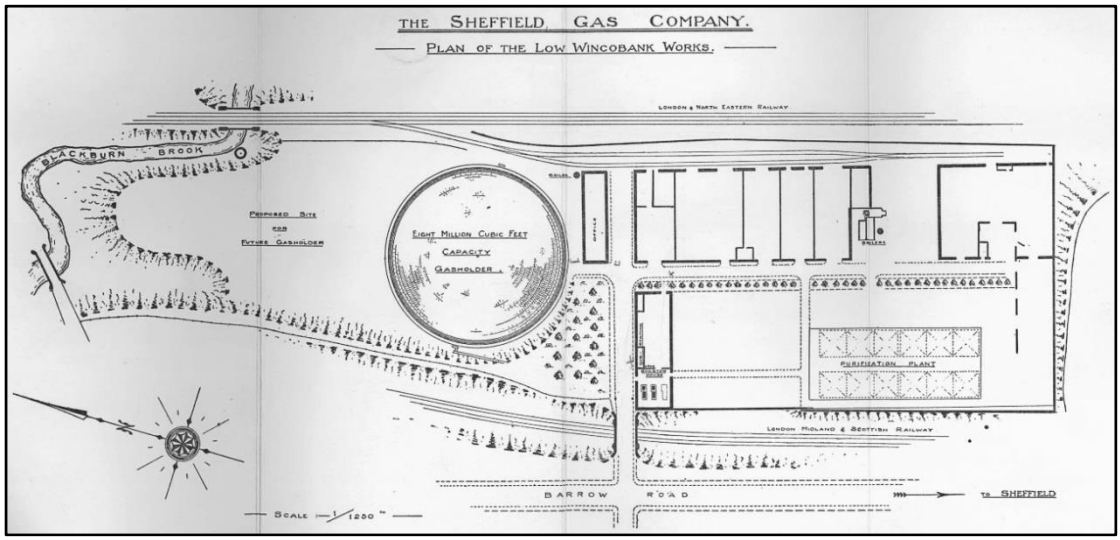
> *…describing the difficulties of erecting this giant gasholder…between 3000 and 4,000 tonnes of rock were removed from the site. Then they found split rock pointing to the presence of mine workings, and…work was begun on the site only after the utmost precautions had been taken to see if everything was satisfactory. "The gasholder is as yet unpainted as the steel has to weather…We intend to camouflage it as well as we can. The main point about camouflage is the shadow. That would mean planting a lot of trees nearby, and we don't feel that this is necessary at the moment". Major Kitching gave some figures showing that the weight of foundation concrete as 6,830 tons, the steel is foundation was 137 tons, the steel in tank 2,111 tons, steel in holder 1,384 tons, and the water in tank was 61,633 tons. The diameter of the tank was 230 feet* (*Daily Independent*, 28 June 1938).

> *The contract for this eight million cubic feet capacity holder was placed with Messrs. Newton Chambers & Co., Ltd., of Thorncliffe Ironworks, Sheffield. The first sod was cut on June 30th, 1936, and the foundations completed by November 30th of the same year. The erection of the tank and holder was completed by November 6th, 1937, when it was inflated with air, tested and finally purged ready for use on January 21st, 1938* (G11_SHE_5514).

The construction of the gasholder was not without difficulty. As related to the *Daily Independent* by Sir Samuel Roberts, Chairman of Newton Chambers & Co:

> *"In spite of the fact that the holder was on solid whinmoor rock, the miners sank a shaft 28 feet through the rock to determine that geographical conditions were safe". During the erection they experienced one of the most severe winters of modern times and men were at work through severe snowstorms. They were able to do this owing to welfare provisions of the ironworks general manager, Major W. T. Kitching. To crown their difficulties, they experienced the worst gales the country had known during the inflation tests* (Daily Independent Thursday 30 June 1938).

The Wincobanks site was officially inaugurated by the Duke of Kent on 29 June 1938. Regarding the gasholder, the Duke stated that "*its construction marks another important step in the life of the Sheffield Gas Company, and I feel also that it will prove to be a far-reaching development in the use of gas for industrial purposes in Sheffield*" (*Daily Independent*, Thursday 30 June, 1938).

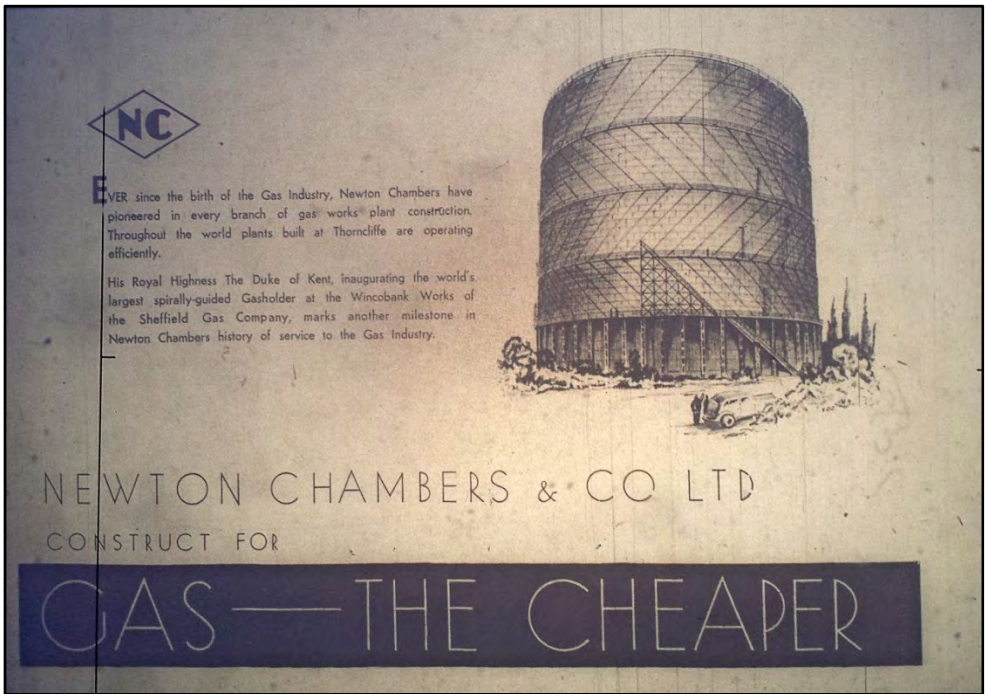


Plan of the Wincobank Works at the time of its inauguration in 1938 Fig 4

At the time of its opening, the Wincobanks site comprised the gasholder, site office, purification plant, booster house and sub-stations. The gasholder was located in the northern half of the site adjacent to the site office which was housed in a long narrow building, aligned east to west beside the road. To the north of the gasholder is a label *proposed site for future gasholder*, where Gasholder 3 would later be constructed. Opposite to the site office, on the south side of the central access road was the largest building on the site at that time. Unfortunately this building is not labelled and the function omitted though it has at its southern end some boiler plant. Adjacent to this building is another, square structure, again with no label or function. The purification plant is located at the south-west of the site, on a north-south alignment. The gasholder was located over an old quarry which can be seen on the Ordnance Survey map of 1892. The quarry is not marked on the map of 1903, instead a building is depicted which likely relates to the Meadow Hall Ironworks that occupied the southern extent of the site at this time.

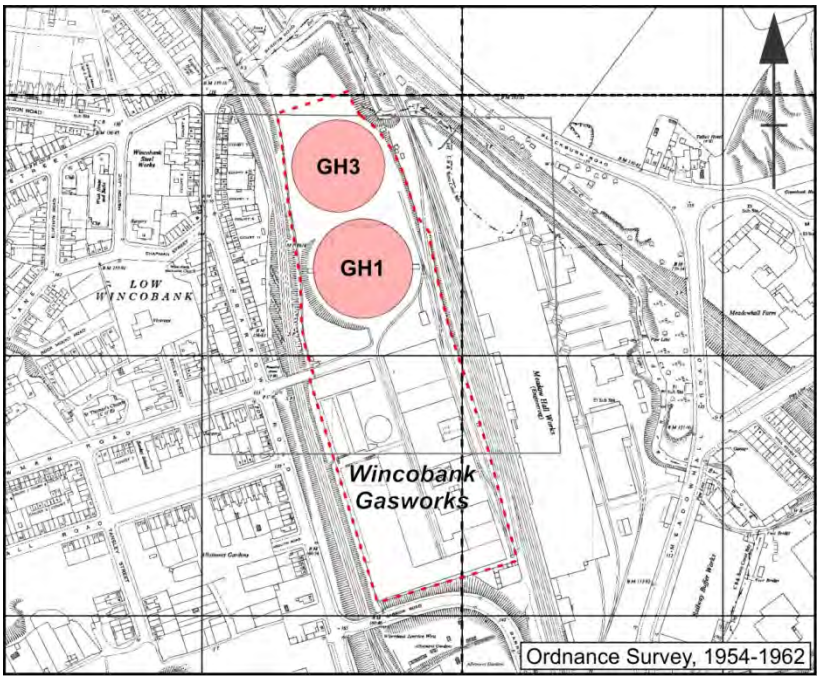
Gasholder No.2 was a much smaller structure with a 150,000 cu. ft capacity, constructed between 1938 and 1940. It is noted as remaining undamaged following a Blitz raid that took place on 15 December 1940 (Hird 1944). A small round tank can be seen within the southern area of the gasworks from the Ordnance Survey maps of 1948 – 1971 but it is labelled as *tank*. In the absence of any other structure on the site which might qualify as gasholder No.2 it must be assumed that this tank was gasholder No.2

Based on Ordnance Survey mapping gasholder No.3 was likely constructed between 1948 and 1954. The plan of 1938 labels the site of Gasholder 3 as *Proposed Site for Future Gasholder* (Fig 4). It is not mentioned in the list of damages during the blitz of 1940 and likely post-dates the war. A photograph of the gasholder under construction is available at the Picture Sheffield archives, but unfortunately this image is undated (Fig 6, u04893). The gasholder first appears on Ordnance Survey mapping of 1954-1962 (Fig 7).

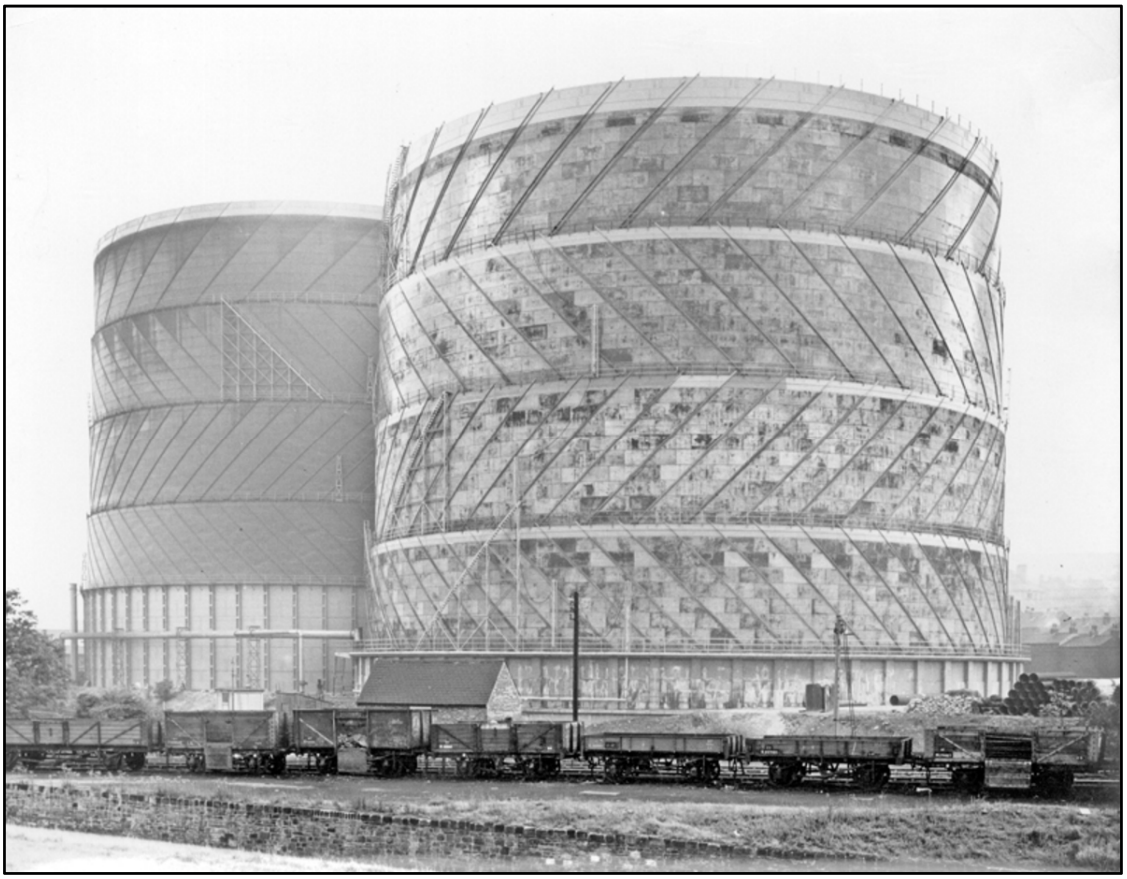


Newton Chambers & Co., advertisement, with image of Gasholder 1 (*Daily Independent*, 30 June 1938 Fig 5

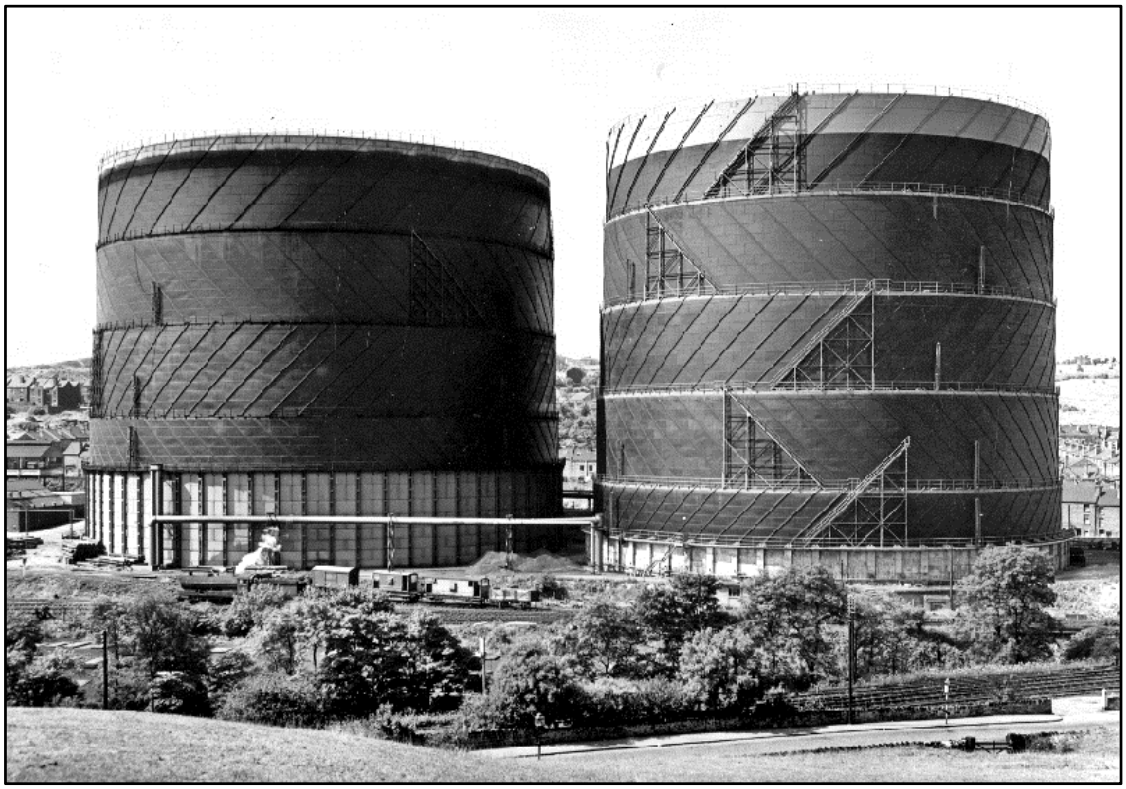
Undated view of Gasholder 3 under construction (u04893) Fig 6



Ordnance Survey map of 1954-62, showing the gasworks and gasholders 1 and 2 Fig 7



Undated photograph of the gasholders, looking south-west (u04894) Fig 8



Undated photograph of the gasholders, looking west-south-west (xg00916) Fig 9

View of the gasholders from the west, showing the scale of the structures in the local skyline (s19682) Fig 10

3.4 Archival and documentary evidence

As part of background and historic research for this report, searches were conducted of the National Grid Archive, the Sheffield Local Studies and Archives, Sheffield City Council's online photographic archive and the Britain from Above online photographic archive.

Reference	Description	Date
G11_SHE_5513	Official inauguration leaflet	June 1938
G11_SHE_5514	Official inauguration, commemorative booklet	June 1938
Xg00916	Photograph of the gasholders	Undated

Archive documents used in this report. Held at National Grid Archive

Description	Date
The Daily Independent	28th June 1938
The Daily Independent	30th June 1938

Archive documents used in this report. Held at National Grid Archive

Reference	Description	Date
S19682	View of the gasholders from the west	Undated
U04894	View of the gasholders from the north-east	Undated

Archive documents used in this report. Held at the Sheffield City Council's online photographic archive

4 DESCRIPTION OF THE GASHOLDERS

4.1 Gasholder 1 (Figs 11-51)

Gasholder 1, at the south of the site is approximately 70m in diameter, comprising a static base-tank *c*13.7m in height, with three lift-tanks rising to a total height of *c73*m or 233.75 feet. The gasholder capacity is given as 8,000,000 cubic feet. The gasholder is a spiral-guided type with an outer ring of sixty-four roller carriages. The base-tank and lift-tanks are constructed of staggered, welded steel sheets riveted along the edges. The sides of the base-tank were given increased strength by the installation of riveted steel panels over the vertical edges of the sheets. Diamond-shaped panels on the lower five courses connect through the tank to rectangular panels, with further rectangular panels on the inner face of the remaining courses to the top of the tank. Vertical stiffeners comprising steel I-beams are fixed to the inner faces of the lift-tanks between the top and bottom curbs. The stiffeners are bolted at the base and top of the tank with further fixings where each crosses a guide rail.

The outer face of the static base-tank is encircled by sixty-four full-height columns which support the outer roller carriages at the top of the tank. At the bottom, each column rests atop a square concrete pad and brackets secure the columns to the tank along its full height. The columns are formed of opposing steel C-beams with nine flat horizontal braces facing outwards. The manufacturer's mark *Appleby-Frodingham England* is stamped on many of the girders. Triangular braces project from the top of the columns to provide support for a steel walkway which encircles the tank. The walkway is formed by overlapping sheets of steel with embossed grip, with rivets along the inner and outer edges. Safety barriers encircle the outer edge of every tank. Each barrier is formed of three rings of equally spaced yellow-painted steel bars with connecting nuts between the bars. The rails run between vertical steel posts bracketed to the lift-tanks.

Steel steps comprising three flights with short landings at each junction are located at the south side of the tank. The steps are held away from the main body of the tank and are carried over free standing, steel supports. A square, steel, commemorative plaque is fixed to the outer face of the first stair support. It bears the following notation: *The Sheffield Gas Company, Ralph Halkett, General Manager & Secretary. Gasholder 8 Million Cu Ft Cap. Manufactured & Erected by Newton Chambers & Co Ltd, Newton Chambers & Co Ltd, Thorncliffe Ironworks, Sheffield, 1937*. A second commemorative plaque is fixed to the base of a column adjacent to the steps: *This Gasholder was Inaugurated by H.R.R the Duke of Kent on June 28th 1938 and The Sheffield & District Gas Company General Manager and Secretary Ralph Halkett Esq. Contractors Newton Chambers & Co Ltd, Thorncliffe Ironworks*. An additional square plaque bearing a raised number *1*, denoting the first column and roller carriage is fixed to the same column. Yellow-painted safety rails are installed along both sides of the steps and a steel door can be locked to prevent access to the upper level of the gasholder. The steps to the lift-tanks are free-standing steel structures, each of which is fixed to a different tank, allowing them to rise and lower with the tanks. The central tower is square in plan, tapering toward the top, and is formed of right-angle mild steel posts at the corners connected by C-profile beams at six tiers. Flat steel barns span between the tiers at each face of the tower. The tower is raised from the floor surface by square concrete blocks at each of its corners. At the top of crown rest are curving ribs or purlins which span between the central tower and the outer curb of the base-tank, over the top of the vertical posts. Concentric rings of rafters comprising right-angle steel bars are bolted to the top of the purlins and supported the crown when at rest.

The roller carriages are rectangular in plan, 1.2 x 0.5m. They are of a standard form comprising adjacent rollers which engage to either side of the guide rail. Each roller turns on an axle which is housed within a semi-circular housing mounted atop the rectangular base plate. The outer roller carriage mechanisms are each positioned directly above the columns to which they are firmly bolted. The inner circles of rollers are an identical design and are affixed at to projecting anchor plates at the top-curb of each tank on its inner face. Each roller carriage carries a small square plastic plate bearing a designating number.

The crown is fabricated of white painted, welded steel sheets arranged in concentric rings, each ring being staggered to form a break-joint layout for increased strength. The crown's surface displays little warping and deformation, which can be a common problem of gasholders often caused by weakness in the crown-rest. Several venting pipes project from the crown, to allow for dispersal of the gas to atmosphere. The sheets at the top-curb are riveted to underlying braces and thickened with additional panels. Dismantling of the gasholder revealed an impressive multi-tier crown-rest with a central, square stanchion that rises from the centre of the dumpling. The dumpling has a surface of riveted steel sheets which covered the underlying concrete base. The sheets are rectangular in plan, shaped to the curve of the gasholder at the edges and are staggered in the style of brick stretcher bond. Square concrete pads supporting steel posts are arranged in concentric rings from the outer edge of the tank towards the central stanchion of steel beams rises to the apex of the crown. The vertical posts are formed of lengths of steel I-beams, bolted to one another and rising to the crown's rest height. Further I-beams span between the posts at set heights, effectively forming two platforms, one at mid-height of the base-tank and another at its top. In addition to the beams, the structure is strengthened by diagonal crosses of tensioning rods with adjusters at one end or centre of each span. Unlike gasholder 3, Gasholder 1 is un-trussed.

A lagged pipe formerly encircled the static base-tank at a height of 1.5m, carrying anti-freeze solution. Vertical pipes branch off from the main pipe and rise to the top of the tank. Above the base-tank, flexible pipes running between steel cages carry the solution to the upper lift-tanks as they rise.

Inlet and outlet pipes are located at the eastern side of the gasholder. The pipes are each 36" in diameter and rise from a sunken, brick-lined sump pit to the top of the base-tank. A pipe rises from the sump pit, and supported over steel gantries, continues overhead to the north-east. Another pipe with *Donkin* flow valves connects to the sump pit, descending back underground a little to the south. The body of the pipe is supported over concrete blocks over a flat concrete pad. A small plastic telemetry kiosk on a concrete pad stands nearby. A sump pit is also located at the western side of the gasholder. The pit is concrete-lined with brick dwarf walls around and is covered with steel grates. A steel pipe with bolted cap partly protrudes from the pit. An electrical box labelled *Holder No1 Sump Pump Controls* is positioned adjacent to the pit.

To the south of the gasholder was a single storey brick building on a roughly east-west alignment. This was a fairly modern structure and likely formerly held telemetry and electronics for a tall transmitter mast alongside the building. The mast and building first appear on Ordnance Survey mapping of 1967-1975, following the partial removal of embankment to the south-west of the gasholder.

Detailed statistics and dimensions for the gasholder are provided in the inauguration leaflet:

Total weight of concrete in foundation: 6850 tons
Steel in foundation: 157 tons
Steel in tank: 2111 tons
Steel in holder: 1384 tons
Water in tank: 61633 tons

Diameter of tank: 250 feet
Inner lift: 237.75 feet
Second lift: 241.00 feet
Third lift: 244.25 feet
Outer lift: 247.50 feet

Depth of tank: 45.75 feet
Inner lift: 45 feet
Second lift: 45 feet
Third lift: 45 feet
Outer lift: 45 feet

4.2 **Gasholder 3** (Figs 52-92)

Gasholder 3 is of an unusual design, having a partially above-ground tank of concrete. Concrete tanks were usually fully below ground with a curb projecting from the ground level and supporting roller carriage footings. rather than steel or iron. Above-ground tanks, such as Gasholder 1, primarily comprised steel base-tanks, with the concrete base being flush to the ground. The above-ground base-tank of gasholder 3 is formed of reinforced concrete slabs, each being 1m by 2.6m and raised four slabs in height, with a concrete cap forming a walkway above. The tank is stepped back slightly at mid-height, between the second and third slabs. The slabs are interspersed between sixty-four square pilasters or buttresses which project outward from the tank. Demolition of the concrete revealed the internal mesh of circular profile reinforcing bars, *c*25mm in diameter. A photograph of the tank under construction shows steel scaffolding and walkways against the reverse face of the tank, with the slabs being pre-fabricated and manoeuvred into their final positions. The external face of the above ground concrete tank shows numerous areas of corrosion and deterioration. A leading cause of damage is likely the reinforcing steel bars within the concrete, which rust and expand, pushing out and cracking the surround concrete, which is then subject to greater weathering. Pitting of the concrete's surface is a consequence of repeated freeze-thaw action. Mineral deposits of varying type and colour can be seen, particularly at the northern side of the tank which is most exposed to the elements. Some attempt has been made at patching and repairs, the largest of which can be seen at the north and eastern sides of the tank.

Within the gasholder, the bottom of the tank is several meters below ground level. A ring of concrete, 1.5m in height, fully encircles the outer edge of the dumpling, separating it from the steel lifts. The concrete dumpling has a shallow profile, with a wide, flat centre descending at a shallow angle to the concrete ring. The shallow angle of repose is suggestive of loose or wet strata (Thomas 2010). Angles between 37-16 degrees are required for strata ranging from dry sand to peat, damp sand and wet clay. The dumpling slopes downward considerably to the north indicating considerable subsidence. The inner ring of concrete at the edge of the dumpling also descends down to the north. The outer concrete tank, however, does not display any warping and stress fractures which might be expected if its footings were to subside. The Blackburn Brook passes a short distance to the north of the site and the plan of 1938 shows that the ground slopes downward toward the brook.

The lift-tanks are fabricated in the usual fashion for spiral-guided tanks, comprising welded rectangular sheets with vertical stiffeners on the inner face and riveted and bolted diagonal guide rails on the external face. The lift-tank steps come to rest along the eastern side of the gasholder. These are of a standard design comprising a steel structure which curves to match the tanks' edge, with safety rails along the outer edge. The treads are of steel with embossed grip patterns.

The crown has a diameter of approximately 65m and is formed of welded, tapered steel sheets. A number of circular access points or manholes are located at the outer edge of the crown. At the apex of the crown is a valve to allow venting of the gasholder. "Walkways" providing increased grip for worker access lead from the edge of the crown at the east and west of the gasholder, to the valve at the apex. The outer edge or top-curb is more robust than the main body of the crown and has riveting at the edges of the sheets, with additional steel panels at the overlaps. At the underside of the top-curb, steel brackets bolted to the vertical stiffeners provide a strong anchor where the underlying trusses connect to the edge of the tank. The gasholder is trussed and the crown-frame comprises a central post or pipe from which radiates an umbrella-like skeleton of steel trusses. The main trusses connect to a ring at the top of the pipe and increase in number with intermediate trusses being added from the middle of the crown and towards the edge, providing from support towards the top-curb. Additional straps or braces extend from a ring at the bottom of the pipe to the outer edge of the crown. Concentric rings of steel bars on top of the trusses carry the crown sheeting. When the gasholder is deflated the crown comes to rest on a concrete post at the centre of the dumpling.

Steps to the upper level are located at the south-eastern side of the gasholder. The steps are steel fabricated with steel safety rails along both sides. They are formed of two flights with a gated barrier / cage at a landing midway. A steel platform mounted on a concrete pad supports the steps from below the landing. At the top, the steps connect to a concrete platform which projects outward from the main walkway. A much weathered sign with the notation *No.3 Holder* is fixed to the hand rails over the stair. The walkway fully encircles the tank and is formed of concrete slabs which project outward from the tank surface. Yellow-painted steel handrails run around the outer edge of the walkway, with additional handrails at the edge of each lift-tank. There are sixty-four outer roller carriages, regularly-spaced, each anchored atop the projecting pilasters. The main roller mechanism and housing is similar to those of Gasholder 1, comprising side by side rounded tubes containing the roller axles. The roller carriages project a short distance from the tank by raised footings which comprise a wide, tapered base plate to which the roller carriages are bolted. The inner roller carriages are of an identical design, though without the base plates.

Anti-freeze piping formerly encircled the outer edge of the tank at waist height, supported over brackets fixed to the tank. Branches lead upward at the north, south and west sides of the gasholder. At these points, flexible pipes running between steel supports allowed the anti-freeze solution to be fed to the lift-tanks when they were raised.

To the south-east of the gasholder are inlet / outlet pipes which rise adjacent to the tank from sunken pipe pits, and internally within the tank to above the waterline. Manually operated *Donkin* flow valves are installed to regulate the flow of gas within the pipes. A light-weight kiosk adjacent to the pipes houses electronic controls and telemetry.

5 DISCUSSION

The Wincobank Gasworks was well sited, taking advantage of established rail links in an area dominated by heavy industry and residential areas housing the workers. The works incorporated a standard range of infrastructure and plant necessary for the production of gas. In the early 20th century, General Manager Ralph Halkett oversaw a transformation of the gasworks from being primarily a gas producer to a collector and redistributor of gas, a foresight which greatly increased the works' profitability and output. The Wincobank works and the other gasworks of the Sheffield Gas Company, Grimesthorpe, Effingham Street and Neepsend, played a crucial part in the war effort, allowing Sheffield's steel and iron works to continue manufacturing during this period.

Spiral-guided gasholders originate in the late 19th century, with the first being built in Northwich, Cheshire in 1890 by Clayton, Son & Co Ltd of Leeds. This form increased in popularity in the early 20th century due to a lower cost and increased reliability, replacing column-guided gasholders as the preferred type. Newton Chambers, the manufacturer of Gasholder 1, was prevalent in the construction of gasholders and fabrication of their components. The firm was founded in 1795 and had its ironworks at Thorncliffe, near Sheffield.

The site is included in the MPP Gazetteer of Assessed Sites (Trueman 2002a) as *Notable spiral gasholder of 1938 unusually with above-ground concrete tank-apparently largest in world when built*. It should be pointed out that this description contains some factual inaccuracy as it is in fact Gasholder 1 which dates to 1938 and was deemed to be the largest in the world at that time, while gasholder 3 has an above-ground concrete tank. The MPP Gasholders Step 3 Report (Trueman 2002b), states that, *The one seeming exception to the typical pattern of tank provision for spirals is at Wincobank where the above-ground tank of the 1938 holder appears to be of concrete with external buttressing. It is a prominent landmark alongside a larger holder with a metal tank and is visible from the motorway.*

As noted by Trueman, a somewhat disparate construction method was employed for Gasholder 3. It is unclear why a partly above-ground concrete tank was utilised here, as below-ground concrete tanks and above-ground steel tanks were the preferred designs at this time and were economically viable and technically successful. Unfortunately, no documentary evidence relating to this gasholder could be found during research for this report. Newspaper clippings at the time of the inauguration of Gasholder 1 note that the underlying geology comprised solid whinmoor rock which miners determined to be safe, though split rock pointed to the presence of mine workings. However, the slope of the dumpling and its subsidence would suggest that the underlying strata were perhaps unsuitable and may have influenced the design. Whilst subsidence has affected the dumpling, the outer concrete tank appears structurally sound.

With regards to materials and types of construction for tanks, Tucker notes that

Mass concrete was used increasingly for in-ground tanks from the 1870's usually incorporating reinforcing bands of wrought iron. Reinforced concrete followed to a limited extent in the twentieth century, but cast iron had by then been supplanted by stronger mild steel, which made above-ground tanks generally the cheapest solution once more. (Tucker 2000).

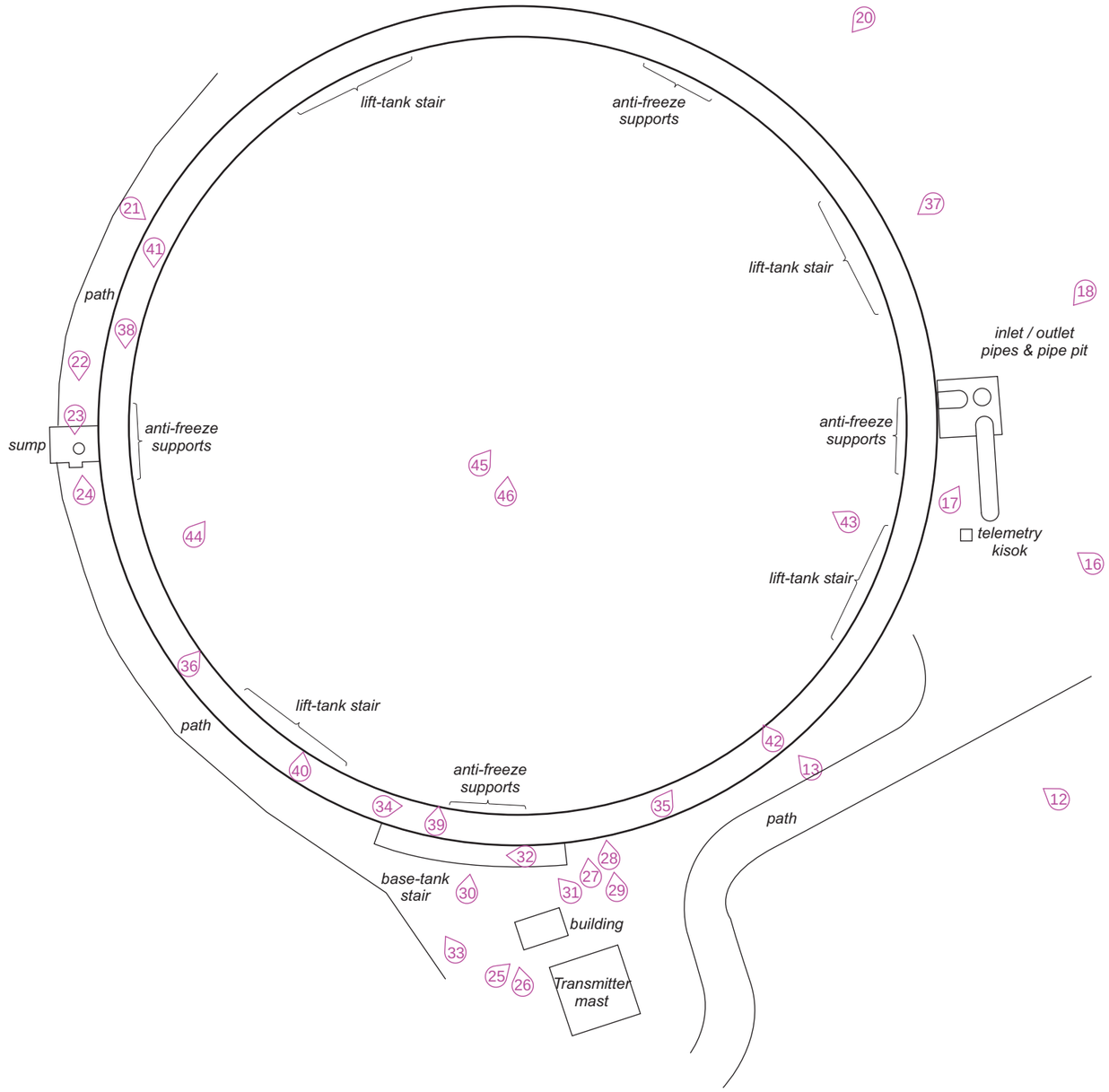
Further, *The efficiency and low cost of above-ground steel tanks may have diminished the role for reinforced concrete in gasholders, since the material was otherwise widely used in gasworks structures…The slow and limited introduction of concrete to gasholder tanks might be seen to indicate the conservative tendency of*

gas engineers, but it may be argued this was rooted in a sound understanding of what was economical and robust in a particular set of circumstances.

The poor condition of the concrete tank and the number of repairs are perhaps indicative of why this design was not utilised elsewhere. Reinforced concrete was used in gasworks structures and below-ground tanks, Gasholder 3, however, appears to be the sole example where it was utilised in above-ground tanks (of the 162 sites assessed for the MPP report). Steel tanks were more economical and not subject to the same degradation as concrete if properly coated and maintained and steel sheets could be patched or replaced with no resulting structural weakness to the tank.

With the exception of the unusual concrete tank, Gasholder 3 incorporates industry standard safety, electrical, anti-freeze and monitoring equipment as well as associated pumps and piping. The roller carriages are likely manufactured by Newton Chambers and whilst the roller carriages themselves are of a common design, the baseplate to which they are anchored could be a custom design, fabricated for this particular gasholder.

Gasholder 1 was formally inaugurated by the Duke of Kent on 30th June 1938 as part of a tour of the Wincobank works and the Vickers Works of the English Steel Corporation. Regarding the gasholder the Duke stated that, *its construction marks another important step in the life of the Sheffield Gas Company, and I feel also that it will prove to be a far-reaching development in the use of gas for industrial purposes in Sheffield* (*Daily Independent*, 38th June 1938). The structure was purported to be the largest in the world at the time, standing as high as St. Pauls Cathedral. The gasholder's form is not revolutionary or unusual in its design, though the crown-rest is quite a complex structure. The fabrication of the base and lift-tanks is of a standard form comprising steel sheets as seen on numerous gasholders throughout the UK. The roller carriages are of a common Newton Chambers design and the gasholder incorporates standard safety, electrical, and anti-freeze equipment.



0 2m

Scale 1:500

Plan of Gasholder 1, showing photograph locations Fig 11

Gasholder 1, looking north-west Fig 12

Detail of the outer tank fabrication Fig 13

Detail of manufacturer's stamp *Appleby-Frodingham, England* Fig 14

Detail of column base Fig 15

Inlet / outlet pipes and kiosk Fig 16

Detail of flow valves Fig 17

Pipe pit with inlet / outlet pipes Fig 18

The top of the inlet / outlet pipes Fig 19

Gasholder 1, looking south-west Fig 20

Remnant anti-freeze pipe Fig 21

Sump with sump pump controls, looking south Fig 22

Sealed pipe from the sump Fig 23

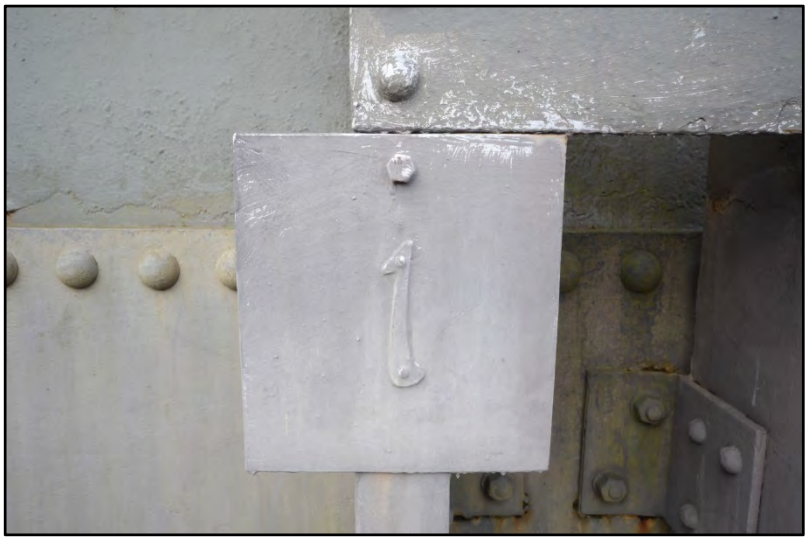
Sump, looking north Fig 24

Defunct brick structure adjacent to former transmitter mast Fig 25

The base-tank stair, looking north Fig 26

Signage and plaques at the base of the stair Fig 27

Damaged commemorative plaque Fig 28



Number plaque, column 1 Fig 29

Commemorative plaque on stair support Fig 30

The bottom of the steps Fig 31

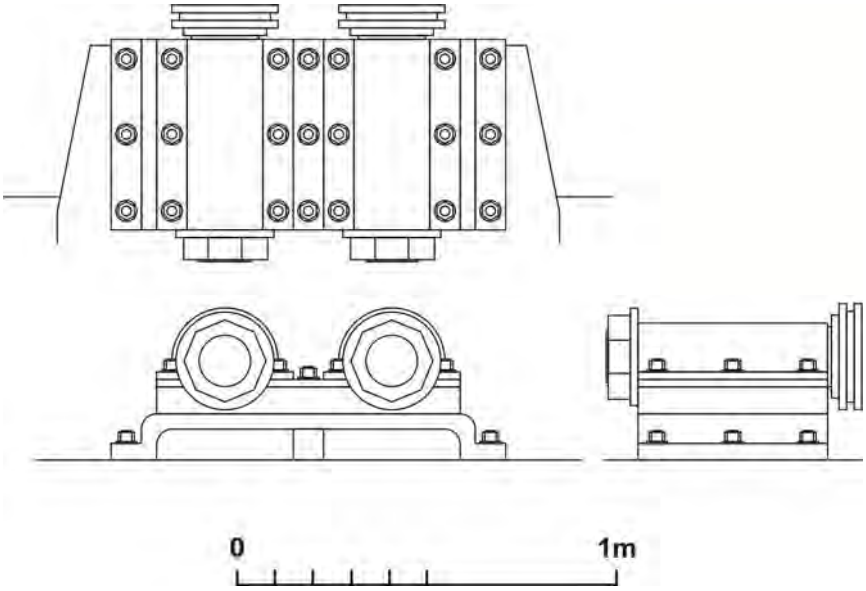
Signage on stair gate Fig 32

The upper part of the base-tank stair, also showing lift-tank stair Fig 33

The walkways, hand rails, and anti-freeze pipe supports, looking east Fig 34

The roller carriages Fig 35

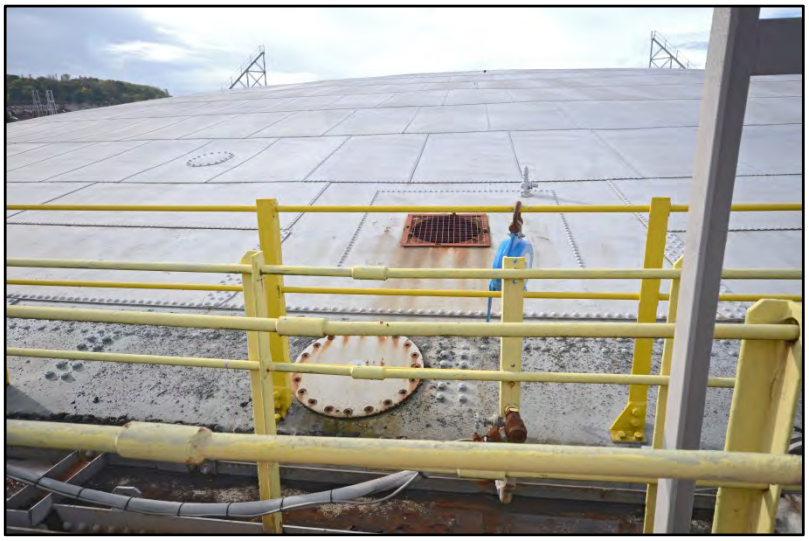
The roller carriages Fig 36



Detail of roller carriage (dimensions approximate) Fig 37

Detail of lift-tank access stair Fig 38

General view of the gasholder, looking south Fig 39



The crown, showing manhole access points Fig 40

Inspection equipment Fig 41

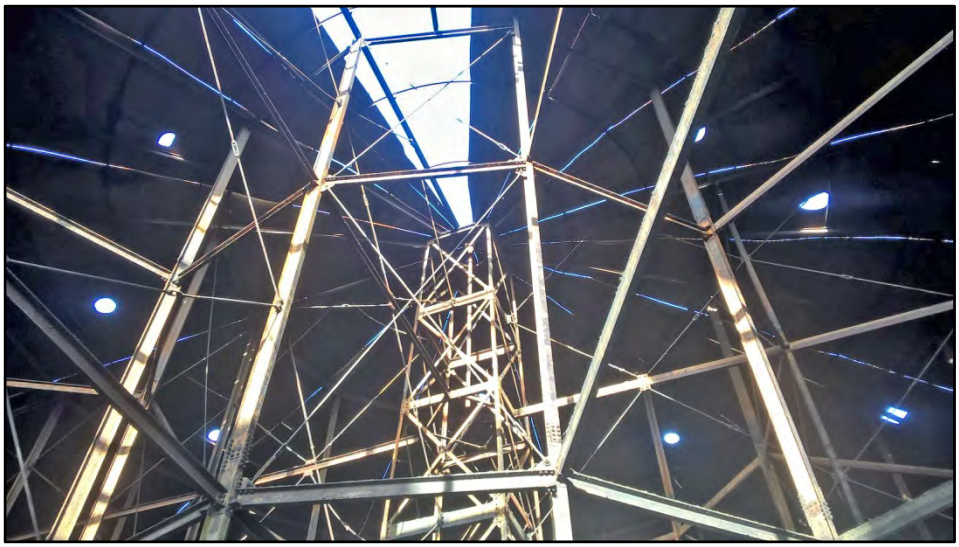
Operational equipment Fig 42

The removal of crown sheets to expose the underlying crown-rest Fig 43

Interior of Gasholder 1, showing the crown-rest supports Fig 44

The crown-rest supports Fig 45

The central stanchion base Fig 46



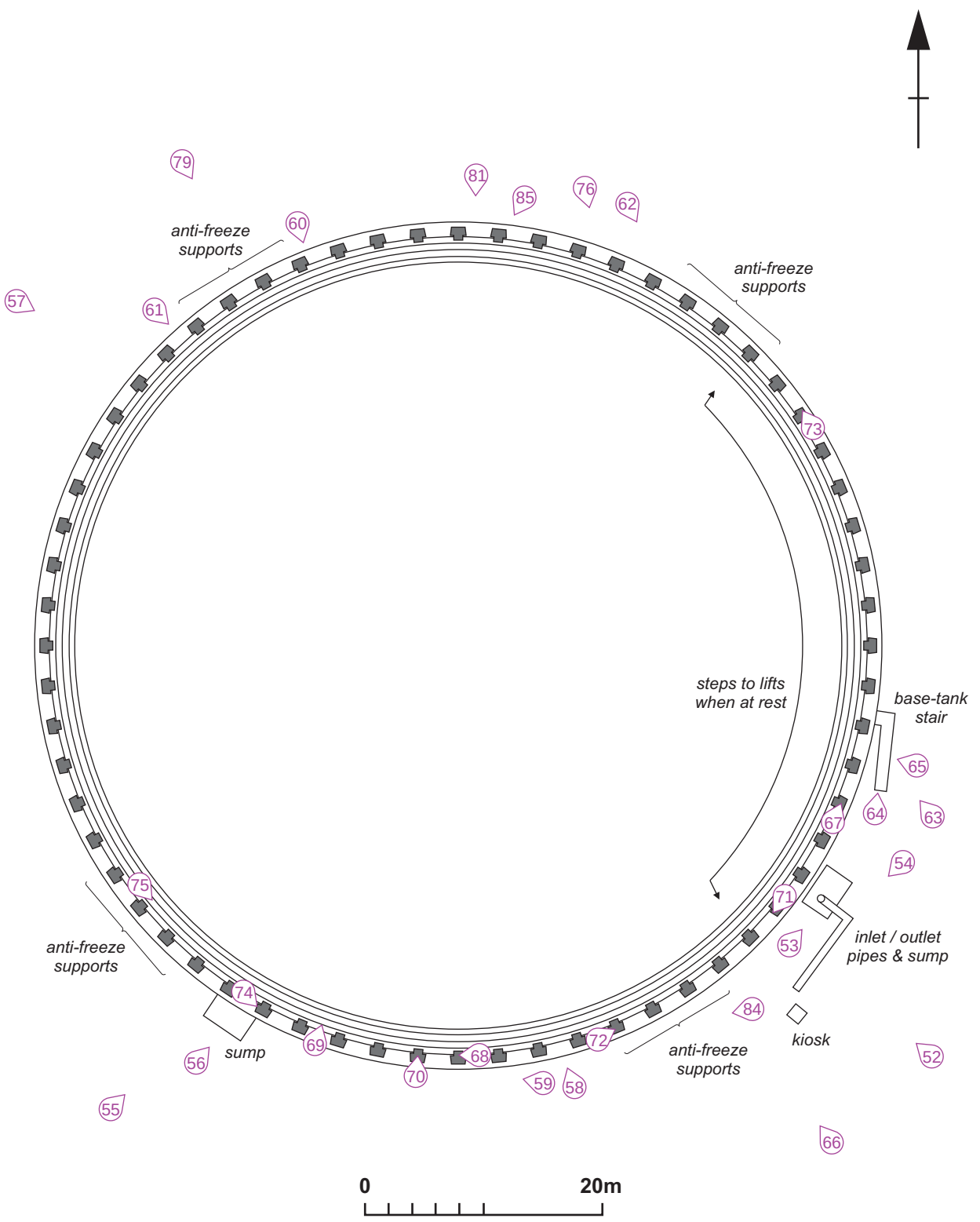
The crown-rest Fig 47

Dismantling of the crown-rest and crown Fig 48

The inner face of the lift-tanks, showing vertical stiffeners Fig 49

Dismantling of the base-tank Fig 50

The inner face of the base-tank Fig 51



Scale 1:500 Plan of Gasholder 3, showing photograph locations Fig 52

Gasholder 3, looking north-west Fig 53

Inlet / outlet pipes and flow valves, looking north-east Fig 54

The inlet / outlet pipes and pipe pit, looking south-west Fig 55

Gasholder 3, looking north-east Fig 56

Sump at the south-east side of the gasholder Fig 57

Gasholder 3, looking south-east Fig 58

Detail of the base-tank construction Fig 59

Brackets for former pipes Fig 60

Detail of surface damage and repairs Fig 61

Detail of large repair on north side of the tank Fig 62

The east side of the tank, also showing anti-freeze supports Fig 63

The base-tank steps Fig 64

Signage on the base-tank stair Fig 65

Gasholder designation sign on handrail adjacent to base-tank stair Fig 66

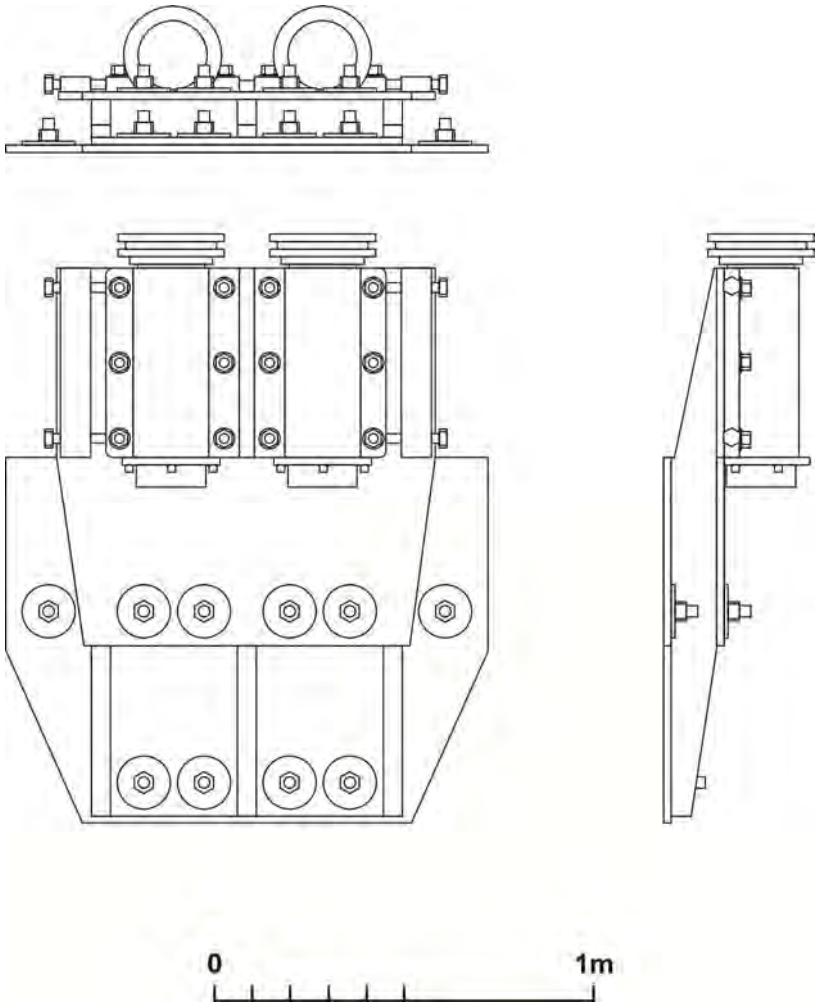
View of the gasholder crown, looking north Fig 67

The gasholder walkway and handrails, looking north Fig 68

The roller carriages Fig 69

Detail of inner roller carriages Fig 70

Detail of outer roller carriage Fig 71



Detail of roller carriage (dimensions approximate) Fig 72

Operational equipment Fig 73

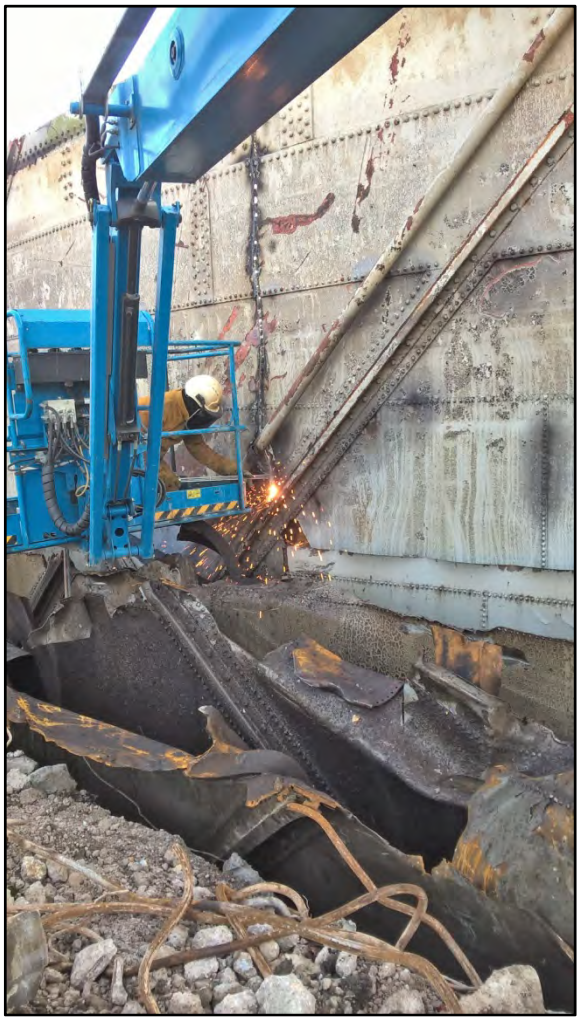
Anti-freeze pipes and supports Fig 74

The anti-freeze supports Fig 75

Operational equipment Fig 76

Remnant equipment Fig 77

Demolition of the concrete tank, showing reinforcing bars Fig 78



Dismantling of the lift-tanks Fig 79

Dismantling of the lift-tanks and revealing the crown-frame Fig 80

General view of the dismantled gasholder, looking south Fig 81

The top-curb and outer extent of the crown-rest Fig 82

The crown-frame following disconnection from the inner lift Fig 83

The apex of the crown-frame Fig 84

The lower portion of the crown-frame post, with radial straps Fig 85

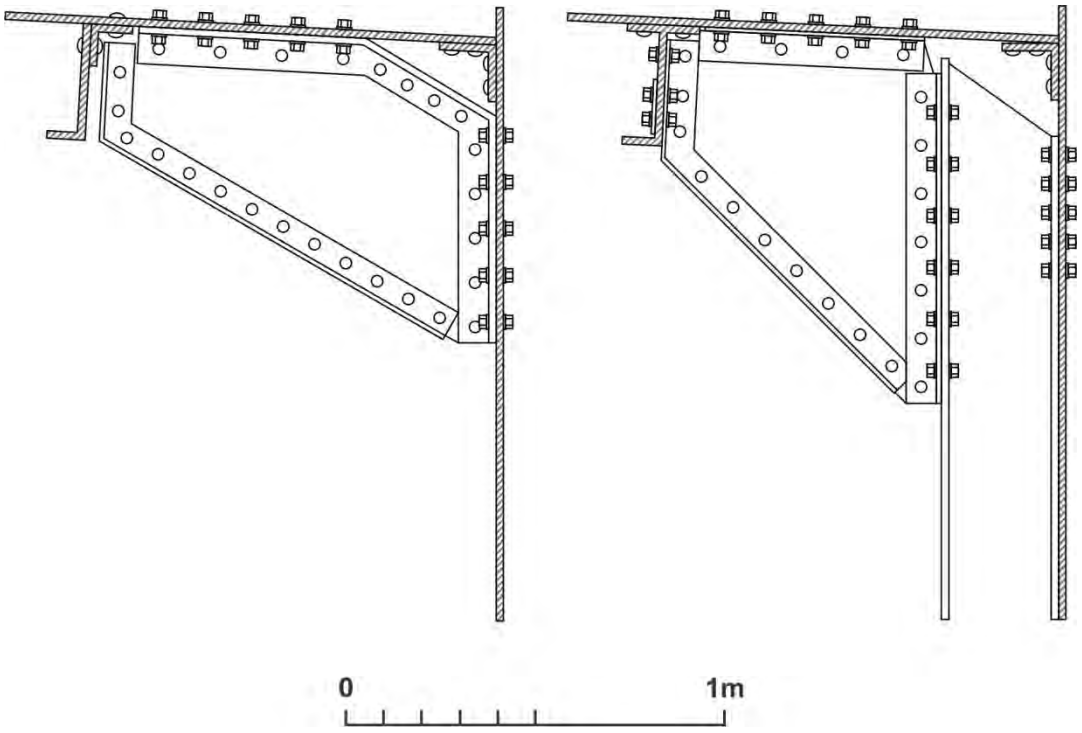
The dumpling edge and pipe leading to the former western sump Fig 86

The inner concrete ring and subsidence of the dumpling Fig 87

Detail of the top-curb fabrication Fig 88

Detail of bracket at the top-curb Fig 89

Secondary bracing of the top-curb Fig 90



Detail of the top-curb brackets and supports Fig 91

Detail of the lift-tank guide rails Fig 92

BIBLIOGRAPHY

CIfA 2015 *Standard and guidance for the archaeological investigation and recording of standing buildings and structures*, Chartered Institute for Archaeologists

Evans, D, 2012 *Gasworks Buildings; Their types and measures of significance in the built environment,* Montagu Evans

HE 2015 *Understanding Historic Buildings: A guide to good recording practise,* Historic England

Hird T W 1944 *"Ex Fumo Dare Lucem," The Blitz Story of The Sheffield and District Gas Company*, Local Pamphlets, Vol 160., 042S

Roberts D E 1979 *The Sheffield Gas Undertaking 1818-1949,* British Gas PLC (East Midlands)

Tucker, M, 2000 *London Gasholders Survey, The Development of the Gasholder in London in the Later Nineteenth Century, Part A General*, English Heritage

Thomas, R, 2010 *Gasworks Profile B: Gasholders and Their Tanks,* Parsons Brinckeroff

Trueman, M, 2002a *Gas Industry Step 3 Report for Monuments Protection Programme,* English Heritage

Trueman, M, 2002b *Gasholders Step 3 Report for Monuments Protection Programme,* English Heritage

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