



# Former Gasworks at Wharf Road Chelmsford

## Historic Building Investigation and Recording

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## *Historic Building Investigation and Recording*

### Contents

Summary .....	vii
<b>1 INTRODUCTION .....</b>	<b>1</b>
1.1 Project Background .....	1
1.2 Aims and Objectives .....	1
1.3 Methodology .....	1
<b>2 HISTORICAL BACKGROUND.....</b>	<b>3</b>
2.1 General Development of the Gas Industry in the 19 <sup>th</sup> and 20 <sup>th</sup> centuries .....	3
2.2 Elements of a gasworks.....	3
2.3 Historic development of Chelmsford .....	4
2.4 Chelmsford's Gasworks.....	5
<b>3 DESCRIPTION OF THE SITE.....</b>	<b>8</b>
3.1 Introduction.....	8
3.2 Gasholder Number 114.....	8
3.3 Gasholder Number 115.....	11
3.4 Base of former 1860s gasholder .....	13
<b>4 CONCLUSION.....</b>	<b>14</b>
<b>APPENDIX A BIBLIOGRAPHY .....</b>	<b>15</b>

## List of Figures

Figure 1: Site location

Figure 2: 1897 Ordnance Survey map

Figure 3: 1921 Ordnance Survey map

Figure 4: 1934 aerial photograph of site (ref: EPW046415)

Figure 5: Plan of Gasholder 114

Figure 6: Elevation of Gasholder 114

Figure 7: Site plan showing locations of photographs taken (based on 2001 drainage survey plan).

## List of Plates

Plate 1: Holder 114 from north on Wharf Road

Plate 2: Holder 114 from flyover to west

Plate 3: Frame of Holder 114

Plate 4: Holder 114 from south

Plate 5: General view of Holder 114 from south-east

Plate 6: General view of Holder 114 from north-west

Plate 7: Detail of structure of Holder 114

Plate 8: Holder 114 walkway detail

Plate 9: Holder 114 from south with modern boiler house

Plate 10: Bank to north-west side of Holder 114

Plate 11: Valve Pit to north side of 114

Plate 12: Valve Pit to north side of 114

Plate 13: Holder 114 general structure

Plate 14: Holder 114 general structure

Plate 15: Ladder to side of Holder 114

Plate 16: Tank of Holder 114

Plate 17: Ladder to east side of Holder 114

Plate 18: Trench around Holder 114

Plate 19: Detail of standard to side of Holder 114

Plate 20: Base of standard (Holder 114)

Plate 21: Standard (Holder 114)

Plate 22: Detail of standard fixed to tank (Holder 114)

Plate 23: Valve pit and building to north side of Holder 114

Plate 24: Steps into trench around Holder 114

Plate 25: Boiler house to south side of 114

Plate 26: Boundary wall to north-east of Holder 114

Plate 27: Crown structure to Holder 114

Plate 28: Crown structure to Holder 114

Plate 29: Interior of Holder 114

Plate 30: Crown structure to Holder 114

Plate 31: Structural detail of crown (Holder 114)

Plate 32: Interior of Holder 114

Plate 33: Detail of standard during demolition of Holder 114

Plate 34: Holder 114 during demolition, after removal of crown

Plate 35: Holder 114 during demolition, after removal of crown

Plate 36: Detail during demolition

Plate 37: Detail during demolition showing guide rollers

Plate 38: Detail during demolition showing guide rollers

- Plate 39: Riveted plates to floor of Holder 114
- Plate 40: Riveted plates to floor of Holder 114
- Plate 41: Internal face of inner lift during demolition
- Plate 42: Detail during demolition
- Plate 43: Detail during demolition
- Plate 44: Opening formed in side of Holder 114
- Plate 45: Side of Holder 114 during demolition
- Plate 46: General view of holders from flyover to west
- Plate 47: Holder 115 from west
- Plate 48: General view of Holder 115 from north
- Plate 49: General view of Holder 115 from south
- Plate 50: Side of Holder 115
- Plate 51: Detail of guide rollers on top of Holder 115
- Plate 52: General view of Holder 115 from north-west
- Plate 53: Depression around Holder 115, SW side
- Plate 54: Ladder on top of tank of Holder 115
- Plate 55: Ladder on top of tank of Holder 115
- Plate 56: Enclosure at base of staircase of Holder 115
- Plate 57: Enclosure around pipes and valve pit to south of 115
- Plate 58: Valve pit to south side of Holder 115
- Plate 59: Stairs to east side of Holder 115
- Plate 60: Stanchion supports for Holder 115 staircase
- Plate 61: Stairs to east side of Holder 115
- Plate 62: Detail of stairs to east side of Holder 115
- Plate 63: General view of Holder 115 from north-west
- Plate 64: Detail of support brackets to Holder 115
- Plate 65: General view of side of tank (Holder 115)
- Plate 66: Anti-flooding pipes to east of Holder 115
- Plate 67: Anti-flooding pipes to east of Holder 115
- Plate 68: Detail of lifts during demolition of Holder 115
- Plate 69: Detail during demolition of Holder 115
- Plate 70: Detail of side of 115 tank during demolition
- Plate 71: General view of Holder 115 during demolition
- Plate 72: Opening created in 115 during demolition
- Plate 73: Crown structure in 115 during demolition
- Plate 74: Crown structure in 115 during demolition
- Plate 75: Interior of Holder 115 during demolition
- Plate 76: Interior of Holder 115 during demolition
- Plate 77: Vertical pipe in Gasholder 115
- Plate 78: Central shaft within Holder 115
- Plate 79: Detail of head of pipe within Holder 115
- Plate 80: Plant in Pressure Reduction Station to NW of 115
- Plate 81: Boundary wall between holders
- Plate 82: Boundary wall between holders
- Plate 83: Valve pit to north of Holder 114
- Plate 84: Building to north of Holder 114
- Plate 85: Building to north of Holder 114
- Plate 86: Interior of building to north of Holder 114
- Plate 87: Interior of building to north of Holder 114
- Plate 88: Boiler house to south of Holder 114
- Plate 89: Plant in Pressure Reduction Station (still operational)

Plate 90: Drainage 'separator' between holders

Plate 91: Details of base of former gasholder to north of site

Plate 92: Details of base of former gasholder to north of site

Plate 93: Details of base of former gasholder to north of site

Plate 94: Details of base of former gasholder to north of site

Plate 95: Details of base of former gasholder to north of site

## Summary

Oxford Archaeology was commissioned by Montagu Evans LLP on behalf of National Grid to create an Historic Building Record of the former gasworks at Wharf Road, Chelmsford, Essex. The work focused on the two surviving gasholders: a frame guided holder constructed between 1913 and 1919 and a spiral-guided holder constructed in the 1940s. These holders were located on an area of 20<sup>th</sup>-century expansion to the gasworks which was originally established in 1819 and was one of the earliest inland gasworks in the country. The works was located close to one end of the Chelmer & Blackwater Navigation, a waterway which had been constructed in the 1790s and which allowed the supply of cheap coal shipped along the east coast from the north-east coalfield.

In common with other gasworks across the country the site steadily expanded during the later 19<sup>th</sup> and early 20<sup>th</sup> centuries with more facilities and ever larger gasholders but much of the works was made redundant in the later 20<sup>th</sup> century after the decision to phase out producing coal gas in favour of natural gas. Two holders survived into the 20<sup>th</sup> century but these also became redundant and are being demolished as part of the redevelopment of the site.

An archive record has been created prior to (and during) the dismantling of these holders as part of a national programme of recording these distinctive structures which have formed familiar landmarks in towns and cities throughout much of the 19<sup>th</sup> and 20<sup>th</sup> centuries. The work has provided for posterity an archive record of these distinctive structures and it will allow comparison with other sites.

The design of the older frame-guided holder (No.114) would have been a relatively conservative form for this period (c.1913-19), at a time when spiral guided holders had been introduced, although it was still a common type. Its standards were Type 32 (as defined by Malcolm Tucker) which were generally used between c.1880 and 1930 while the horizontal bracing was Type M (generally found between c.1890 and the 1930s).





## 1 INTRODUCTION

### 1.1 Project Background

1.1.1 Oxford Archaeology (OA) was commissioned by Montagu Evans LLP, on behalf of National Grid, to undertake historic building recording of the decommissioned gasworks at Wharf Road in Chelmsford, Essex. The former gasworks is situated to the east of Chelmsford City Centre, approximately 500m to the south-east of the cathedral (Fig 1). The work forms part of a wider national project agreed between Historic England and National Grid to record gasholders and gasworks prior to their dismantling, including those which are not listed or of only local interest.

### 1.2 Aims and Objectives

1.2.1 The principal aim of this project is to document the history and development of the site and to record and interpret the structures on this site prior to their demolition. The information is being presented in the form of a written, illustrated report and archive.

### 1.3 Methodology

1.3.1 This report has been produced in accordance with a brief produced by Montagu Evans LLP on behalf of National Grid and is based upon on-site investigation and documentary research. As specified in the brief, an 'enhanced Level 2 survey' was undertaken on one of the Gasholders (No.114) and a 'basic Level 2 survey' was undertaken for the other holder (No.115)

1.3.2 The level of recording undertaken in the wider project to record gasworks have previously been agreed with Historic England on a portfolio basis.

1.3.3 The 'enhanced' and 'Basic' Level 2 records are adapted from the Historic England guidelines in *Understanding Historic Buildings: A Guide to Good Recording Practice* which states that a Level 2 is: *'... a descriptive record, made in similar circumstances to Level 1 but when more information is needed. It may be made of a building which is judged not to require a more detailed record, or it may serve to gather data for a wider project. Both the exterior and interior of the building will be seen, described and photographed. The examination of the building will produce an analysis of its development and use and the record will include the conclusions reached, but it will not discuss in detail the evidence on which this analysis is based. A plan and sometimes other drawings may be made but the drawn record will normally not be comprehensive and may be tailored to the scope of a wider project.'*

1.3.4 An 'enhanced' Level 2 record requires a greater level of metric measured survey of the gasholder as well as additional research and photography.

1.3.5 The work comprises three principal elements: a photographic, a drawn and a written record.

1.3.6 The *photographic record* is intended to act as a general record of the structure prior to demolition and includes photographs of the exterior and interior, and architectural detail and fixtures. Digital photographs, in jpeg format, were taken using a camera with up to 24-megapixel capability.

1.3.7 The *drawn record* included two distinct elements: firstly the older gasholder (No.115) was laser scanned and AutoCAD drawings were produced from this (Figs 5 & 6). Secondly engineering site plans were made available to OA by the National Gas Archive and these drawings were used as a basis for the archaeological recording; locations of features being verified, the addition of further annotations for interpretation, and recording additional

information. There were fewer such plans of the Chelmsford works held at the National Gas Archive than other gasworks sites investigated by OA.

- 1.3.8 The *written record* consists of field notes and annotations that complement the photographic and drawn records and add further analytical and descriptive detail.
- 1.3.9 This site is not included in Historic England's Monument Protection Plan (MPP) Step 3 report for the gas industry.
- 1.3.10 The initial site visit to record the structures was carried out on 24 July 2018 and further visits were made on 3 September and 21 September 2018.
- 1.3.11 It is understood that the intention is to salvage a considerable quantity of the steelwork from the structure of the older gasholder at Chelmsford and to reuse it in some capacity in the new development. This would form an historical link with the site's past.

## 2 HISTORICAL BACKGROUND

### 2.1 General Development of the Gas Industry in the 19<sup>th</sup> and 20<sup>th</sup> centuries

#### 2.1.1 Introduction

2.1.2 The account below on the general development of the gas industry, as well as the discussion on different types of gas holders, is based largely on several articles available on line by Dr Russell Thomas, particularly *The History and Operation of Gasworks (Manufactured Gas Plants)* as well as the Monuments Protection Programme Step 1 report (1997) and the London Gasholders Survey by Malcolm Tucker (2000).

#### 2.1.3 General history

2.1.4 The origins of the use of gas for artificial lighting lie in the 1790s when William Murdoch first used coal gas to illuminate his house in Redruth, Cornwall. Murdoch produced the gas by burning coal in a small retort in his back yard. In the following years he continued to experiment with gas lighting by improving the technology and in the first decade of the 19<sup>th</sup> century his methods were used to illuminate various mills and industrial works.

2.1.5 Other important individuals were also helping to develop the industry in this period including Samuel Clegg an engineer who's work led to several technical advances and Frederick Winsor who established the Gas Light and Coke Company in 1812. Winsor's vision, which was for an industry where gas was supplied to many customers from a single large gasworks, differed from Murdoch's which was for individual smaller plants supplying single sites.

2.1.6 By 1850 there were 13 gas companies in London and many provincial towns were also lit by gas. In 1869 work began on the Gas Light and Coke Company's huge Beckton gasworks.

2.1.7 The industry developed in the later 19<sup>th</sup> century with various innovations such as the vertical retort plant, which allowed continuous operation and used gravity to create a process flow, the gas mantle light and the greater use of by products from the gas production process. Between 1875 and 1920 gas consumption trebled (MPP, 1997), partly due to the expansion of non-lighting uses and from competition with electricity.

2.1.8 The inter-war period saw a rationalisation of the previously fragmented industry with more regulation, consolidation of companies and standardisation. The Second World War had a major impact on the industry, particularly through bomb damage and loss of workers to the war effort and in an attempt to rebuild the industry after the war the Labour Government passed the Gas Act of 1948 which nationalised the industry with 12 gas boards.

2.1.9 In the later 1960s it was decided that the UK would phase out gas produced from coal and would instead move to an industry based on natural gas, some imported and some obtained from North Sea gas fields. This led to extensive works during the 1970s to clear redundant facilities from gasworks and adapt or convert other plant which was to be reused. By the mid 1970s there were very few surviving sites where town gas was still being produced; these were mainly in remote parts of Scotland and the last site closed in 1981. In 1986 the industry was re-privatised.

### 2.2 Elements of a gasworks

2.2.1 A typical gasworks where coal gas was produced comprised many different elements of plant, although some of these may only have been at the larger sites. Among the elements would be:

- The retort (a sealed container where coal would be heated externally to produce gas (and various other byproducts);
  - Condensers which cooled the gas;
  - Various washers/scrubbers/purifiers which would remove ammonia/tar/hydrogen sulphide/hydrogen cyanide;
  - Gasholders where the gas would be stored in order to cope with peaks and troughs in demand and to ensure that there was always a ready supply (discussed further below).
- 2.2.2 The flow of gas around the site would be maintained by plant called 'exhausters' which were found on all but the smallest gasworks.
- 2.2.3 ***Gasholders:***
- 2.2.4 From the early 19<sup>th</sup> century the gas produced in retorts was stored in large holders and in the early phase of the industry these tended to be housed within separate buildings due to fears of explosion. In truth however the dangers of leaking gas becoming trapped and then exploding was considerably greater when the gasholder was enclosed by a separate building and this gradually led to the external cylindrical gasholder which became the most familiar and easily recognisable type of structure at almost all gasworks. As indicated above their main function was to cope with peaks and troughs in demand but they also provided the mains pressure.
- 2.2.5 In 1824 the telescopic gasholder was invented whereby separate, circular, close fitting vessels would be located within one another so that each inner vessel would rise when the outer one reached its capacity, thus allowing increased storage on the same footprint. Until the second half of the century most of these holders had a single lift rather than multiple lifts and whereas the earlier ones operated with a chain lift mechanism the later ones used a form of guide framing. The first guide frames had a central column but these quickly gave way to a series of columns or girders around the circumference of the holder with bracing between to form a type of exoskeleton. Holder 114 at Chelmsford is of this basic type. The first three-lift holder was constructed in 1861 (Blackfriars) and the first four-lift was constructed in 1886 (East Greenwich). A 'cup and grip' seal between the lifts was formed through a U-shaped rim at the base of each lift filling with water and engaging with a similar inverted rim at the top of the adjacent lift.
- 2.2.6 This type of guided-frame gasholder was constructed at numerous sites at ever greater scales through much of the rest of the 19<sup>th</sup> century although in the late 1880s a distinctly different form of gasholder was invented. This was the spirally-guided holder comprising a series of vessels which would rotate and spiral up or down with each chamber guided by the one below. Each vessel would have diagonal guide rails fixed to its side which would engage with carriage rollers fixed to the top of the vessel beneath. One of the gasholders in the current study at Chelmsford is of this common design.
- 2.2.7 In almost all types of gas holder the cylinders were essentially floating on a large seal of water at the base and the gas would generally be stored here for 24 to 36 hours.

## 2.3 Historic development of Chelmsford

### 2.3.1 ***General development of Chelmsford***

- 2.3.2 The short summary below is based on easily accessible secondary sources and websites (see bibliography).
- 2.3.3 Chelmsford is located approximately midway between the two major Roman cities of London and Colchester, close to the main Roman road (now the A12) between these settlements. A

Roman fort was located here, where the road passed over the Rivers Can and Chelmer, and in the Roman period a settlement grew around it.

- 2.3.4 After the Romans left Britain the settlement at Chelmsford either declined or was abandoned but after the Norman Conquest a bridge was constructed here and at the very end of the 12<sup>th</sup> century a Royal charter was granted for a market here. The small town alongside the busy road grew and in the early 13<sup>th</sup> century it was recognised as the county town of Essex, forming the seat of local assizes. An important leather working industry developed and a number of fulling mills were established associated with the woollen industry. A Dominican Friary was established in the later 13<sup>th</sup> century.
- 2.3.5 During much of the post-medieval period Chelmsford was a modest sized market town but in the early 19<sup>th</sup> century it industrialised and grew, partly stimulated by the construction of the Chelmer & Blackwater Navigation from 1793-1797. This scheme, which formed part of the national 'canal mania' of the 1790s, was a 13 mile waterway which connected Chelmsford with the Blackwater Estuary, following a similar route to the smaller River Chelmer.
- 2.3.6 The aim of the navigation was to allow the importation of coal from the north-east, carried by collier ships along the east coast, and in 1819 one of the earliest inland gasworks in the country was established in Chelmsford to utilise this source of coal (detailed further below). Once the gasworks was established most of the coal carried on the navigation went to this site and as late as 1927 the gas company was still using the navigation for their coal.
- 2.3.7 The wider industrialisation of the town was also stimulated by being linked into the national rail network in 1843.
- 2.3.8 During the 19<sup>th</sup> and early 20<sup>th</sup> centuries the town developed important electrical and light engineering industries and then partly due to these industries it suffered considerable bomb damage during the Second World War, particularly in December 1944 when a V2 rocket hit a residential street.

## 2.4 Chelmsford's Gasworks

- 2.4.1 This account of Chelmsford's Gasworks is largely based on a very useful article '*A Century and a Half of Gas Manufacturing in Chelmsford*' by Peter Wynn (Essex Journal, 2009) as well as the main Ordnance Survey maps. The National Gas Archive holds less information on Chelmsford Gasworks than other comparable sites investigated by OA.
- 2.4.2 The origins of Chelmsford's gas industry lie in the formation of the Chelmsford Gas Light and Coke Company (CGL&CCo) in 1819 and the opening of its original gasworks on a site where the large multi-storey car park now stands, just to the north of the holders in the current study. The trustees of the company were a group of influential local men and they included individuals who were proprietors of the Chelmer & Blackwater Navigation Co.
- 2.4.3 The original gasworks was c.100m to the west of the main basin at the end of the navigation, lined with wharves and immediately north of a narrower feeder channel which linked to the basin. The site was on land acquired from the navigation company and Peter Wynn quotes the Chelmsford Chronicle reporting that the site had 15 retorts and a plan from 1819 shows that this was located at the south-eastern end of the site. The same plan shows a single gas holder at the north-western end of the site and Peter Wynn reports that it had a capacity of 10,000 cubic feet.
- 2.4.4 The Springfield Tithe map of 1842 shows no further development at the gasworks but it does show a housing development (Provident Row) constructed by the Chelmer & Blackwater Navigation Company on land immediately to the north-east of the works. This subsequently had some influence on how the gasworks developed when the demand for gas grew in the

- following decades as in 1856 the CGL&CCo purchased land from the navigation company beyond the housing development (to the NE) and they also acquired an agreement for a tramway between their two sites through the area containing Provident Row.
- 2.4.5 In the 1860s the gasworks expanded again, this time onto the meadows to the south-west of the feeder channel and in 1867 an agreement was reached with the navigation company for the construction of three bridges across this channel to connect the two parts of the gasworks.
- 2.4.6 The first edition Ordnance Survey (OS) map of 1874-6 (not reproduced here) shows the layout of the works at that date with the original site including two small gasholders, the 1850s north-eastern extension (beyond Provident Row) with a single larger gasholder and then the 1860s extension to the south with a single even larger gasholder. The gasholder shown in this area on the floodplain was located at the south-eastern corner of the gasworks site and the location of the two gasholders in the current study is just outside of this, to the south and east. The base of this holder did partly survive at the time of the current project and has been recorded.
- 2.4.7 In 1880 the gas company purchased the housing development of Provident Row and in 1885 an Act of Parliament for further development was approved. The plan accompanying this Act suggests that by this date the southwestern part of Provident Row had been demolished and that another gasholder had been constructed on the meadows (Floodgate Mead).
- 2.4.8 The second edition OS map of 1895 (published 1897, Fig 2) shows the two gasholders on Floodgate Mead but the two holders in the current project had not yet been constructed; this area was still undeveloped floodplain outside the boundary of the gasworks. The two small original gasholders had been demolished as well as the south-western part of Provident Row but the other two terraces from this development still survived.
- 2.4.9 In the early 20<sup>th</sup> century gas production at Chelmsford increased rapidly and several small plots of land were purchased to allow expansion. In 1913 a plot of land was acquired to the south of the feeder channel and this allowed the construction of a new larger gasholder immediately to the south-east of the previous holders<sup>1</sup>; this is holder No.114 which has been recorded in the current project. It is of course possible that this holder was not constructed for some years after 1913.
- 2.4.10 In 1914 negotiations started between the CGL&CCo and the Chelmsford Corporation for a proposed bill called The Chelmsford Act which would dissolve the old company and reincorporate it as a new one called The Chelmsford Gas Company. The Act would give the new company powers to supply gas to a wider area and to considerably expand their existing site. The Bill was passed and the new company established but there was a clause which prevented the company unreasonably opposing if a further Bill was proposed by the corporation for their acquisition of the private company. In 1915 the corporation did just this and in October 1916 the council confirmed the Memorandum of Agreement for the acquisition of the gas undertaking.
- 2.4.11 The OS map of 1919 (published in 1921, Fig 3) labels the Gas Works as being owned by *Chelmsford Corporation* and it shows the new gasholder constructed at some point after the plot was acquired in 1913. If the plot was only purchased in 1913 then the construction of the new holder may well have been delayed due to the First World War and/or the formation of the new company in 1914 and the transfer to the local corporation in 1915-6. The older parts

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<sup>1</sup> This date (and much of the rest of the information in this summary) is provided in Peter Wynn's article 'A Century and a Half of Gasmaking in Chelmsford' *Essex Journal* (2009).

of the gasworks to the north-east of the feeder channel have a similar layout on the 1919 map to that shown on the previous edition.

- 2.4.12 In the inter-war period the gasworks expanded greatly under municipal ownership, similarly to other sites across the country, and this included a new tar dehydration plant, a new retort house, iron oxide purifiers, extensions to the retort house, new boiler house etc. This expansion was concentrated on the meadows to the south-east of the c.1913 gasholder but it also included some smaller scale expansion to the north of the floodplain including the demolition of another section of Provident Row.
- 2.4.13 The *Britain from Above* website holds a number of useful aerial photographs showing the gasworks in some detail in the interwar period. These include one from 1923 (EPW009554) and several from a single flight in 1934 (including image EPW046415; Fig 4). These images of course show the gasholder constructed in or after 1913 but they are perhaps of greater interest because they also show the two older adjacent holders which have now been demolished. The holder which was constructed in the 1860s, from which part of the base has been recorded in the current project, was a relatively simple, single-lift, below-ground holder with eight vertical columns (apparently circular section) supporting a single horizontal tier of lattice girders at their head. The slightly later holder to the north, probably constructed in the early 1880s, was a 2-lift structure with tapering lattice standards and finials. This holder had two horizontal tiers of lattice girders (St Andrews Cross type).
- 2.4.14 The OS plan of 1940 (published 1947) shows the large expansion to the south-east of the previous site, almost doubling the size of the works, and then there is another map from 1948-9 which shows further expansion and a new gasholder on a part of the floodplain to the south-west of the c.1913 gasholder. This new gasholder is No.115 which has been recorded in the current project.
- 2.4.15 When the gas industry was nationalised in 1948-9 the Chelmsford works became part of the Chelmsford Group of the Ipswich division of the Eastern Gas Board.
- 2.4.16 Relatively few historic plans or other documents on the Chelmsford site are held at the National Gas Archive but there is a plan from 1964 which shows that at this date the gasholder which was probably constructed in the 1860s, and the base of which has been recorded in the current work, was still standing. An OS plan from 1964-8 also confirms this as well as another from 1968-74. However a plan from the Gas Archive from 1980s shows that by this date it had been demolished. It may have become redundant in the 1970s when the national gas industry switched from town gas to natural gas.



## 3 DESCRIPTION OF THE SITE

### 3.1 Introduction

- 3.1.1 As detailed above and as shown on the historic Ordnance Survey maps Chelmsford Gas Works expanded during the 20<sup>th</sup> century to become a huge complex largely located on the former meadowlands to the south-east of the town centre.
- 3.1.2 Following the end of gas manufacture in the 1970s much of the plant was removed and today most of this area is something of a post-industrial 'wasteland' awaiting redevelopment. Essex Record Office has been opened on part of the former works and a multi-storey car park, adjacent to a flyover has been constructed on the site of the original early 19<sup>th</sup>-century gasworks to the north-east of the Chelmer & Blackwater Navigation feeder channel. This feeder channel can still be seen adjacent to the car park.
- 3.1.3 A small, still operational compound (a Pressure Reduction Station) survives at the north end of the site but at the time of the current survey the most visible prominent elements of the once large complex were two gasholders adjacent to each other: No.114 to the north-east and No.115 to the south-west.

### 3.2 Gasholder Number 114

- 3.2.1 **General description:** Gasholder 114 (Pl. 1-45) was an above-ground, water-sealed, frame-guided holder which was constructed between 1913 and 1919 (discussed in historical background). This was a period when both spiral-guided and frame-guided holders were being constructed at sites across the country and the design of Holder 114 would have been relatively conservative, although still common.
- 3.2.2 The holder comprised a fixed above-ground tank (29.8 m diameter x 9 m tall), a bell within it formed by two separate cylindrical lifts and a structural frame which would have guided and supported the two steel lifts as they filled with gas and inflated. The condition of the holder was poor with the ironwork rusting severely and with very thick paint flaking away. The paint was light grey and there was no evidence of the holder ever having been a different colour. There was a concrete lined trench around the holder, 90 cm deep and 1.6 m wide and with a secondary kee-klamp type railing around this trench (Pl. 18, 20). In the south-western part of the holder there was a short set of steps allowing access into the trench (Pl. 24).
- 3.2.3 **Standards:** The structural frame which surrounded the tank comprised a single order of 12 full-height (c.26.9 m tall), riveted, I-section lattice-work standards which taper slightly towards their top and the bases of which were set within the trench around the holder (Pl. 20). These standards conform to Type 32<sup>2</sup>, as defined by Malcolm Tucker in his London Gasholders Survey, and with a double Warren arrangement of struts.
- 3.2.4 The standards had a relatively simple form with flat section outer flanges (26 cm wide) to which were riveted T-section steels and then with diagonal lattice members riveted to these. The diagonal members in each lattice were formed from channel-section steels, riveted back to back and with additional bracing in the form of short, regularly spaced horizontal spurs bolted to each end of the I-sections and fitting around (but not fixed to) the lattice members. The full width of each standard was 88 cm (ie the distance between the two outer flat section flanges).

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<sup>2</sup> Tucker provides an approximate date range of this detail from 1880 to 1930.

- 3.2.5 Each standard was essentially formed from three aligned sections: one from the base to the walkway at the top of the tank, one from the walkway to the first lattice girder and then from here up to the lattice ring at the top.
- 3.2.6 A full-height, channel-section, vertical steel was fixed to the inner face of each standard (although these could not be closely investigated from the ground) and these would have engaged with roller wheels fixed to the crown and lifts in order to guide the bell as it inflated with gas and the two lifts ascended in height. The rollers at the top of each lift could not be closely examined although they could be seen during the demolition phase (Pl 37-38).
- 3.2.7 **Bracing:** Above the tank the standards were braced by two tiers of horizontal, double-webbed, narrow box-section lattice girders (M-Type as defined by Tucker<sup>3</sup>) as well as by diagonal bracing rods in each panel connected by central cross-shaped tensioning 'sleeves' which are presumably threaded inside to allow them to be rotated and tightened (Pl. 7).
- 3.2.8 **Tank:** The tank was formed from six rows of riveted plate; the lower four rows were jointed by separate rectangular plates but in the upper two rows the plates merely overlapped and were riveted at this point with smaller rivets than below. It should also be noted that in the fourth row from the base the jointing plates were slightly smaller and with a different design to those below. Each standard was bolted to the side of the tank and at this junction, between the standard and tank, there was what appears to be an expansion joint of bitumen rubber (Pl. 22).
- 3.2.9 A walkway extended around the top of the tank with two circular section rails supported by regular uprights (three between each standard) formed from L-section steel (Pl. 8). Beneath the walkway deck each of these uprights kinked inwards and was fixed to the side of the tank, thereby providing support for the walkway. The walkway wrapped around each standard and beneath it there was a series of simple loops which presumably supported a small pipe.
- 3.2.10 On the south-eastern side of the holder there was a ladder with a simple safety enclosure to allow access up to the walkway around the tank (Pl. 15, 17) and adjacent to this there was also another similar enclosure from a ladder which would have allowed access up to the upper lifts when the holder was inflated. The ladder itself was not visible and must have been fixed to the side of the two holders.
- 3.2.11 **Internal structure:** After the gasholder was de-watered a large opening was created in the south-western part of the tank and through the two lifts within it (Pl. 44). This allowed the internal structure to be seen from the edge although full access into the holder was not possible when the recording was undertaken because a narrow depth of sludge was still being pumped out. Further recording was also undertaken at a later date when the sludge had been fully pumped out and it was possible to enter but at this point the roof structure had also been removed (see Plates 34-35, 39-41). At this point it could be seen that the base of the holder was constructed from sheets of riveted steel (Pl.39-40).
- 3.2.12 When it was in operation the gas would have been contained within the two lifts of the bell, which fitted inside the fixed tank, each of which were formed from riveted sheets of iron plate. At the newly created opening it could be seen that the sheets of steel which form the two lifts were of a thinner section than the tank (Pl. 37-38).
- 3.2.13 Fixed to the base of each lift there was a continuous U-shaped tray which extended around the full holder and these were part of the 'cup and grip' which would have engaged with a

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<sup>3</sup> The approximate date range for this detail is between 1890 and 1930s so the current structure is towards the centre of this range.

- similar U-shape at the top of the adjacent lift (or the tank) as the holder inflated with gas. The U-shaped tray would have scooped up water as it rose thus forming a seal at the junction between lifts. These features had been deformed by the creation of the opening in the holder but their basic form could be seen.
- 3.2.14 At the new opening it could also be seen that there were regular sets of small guide-roller wheels bolted to a radial rail on the outer side of the base of each lift (Pl. 37-38) which would have engaged with vertical channel-section steel joists fixed to the inner side of the adjacent lift (or tank). Thus as the holder inflated the roller wheels would have slowly risen vertically up the channel steel and guided the holder.
- 3.2.15 The inner face of the inner lift was braced by 24 vertical I-section steel posts (Pl. 34-35) and the top of each of these held the outer end of a steel truss supporting seven concentric rings of purlins (L-section steel) which themselves supported the steel-plated crown of the holder (Pl. 27-31). The inner end of each truss was fixed to a circular ring around the top of a tall cylindrical shaft at the centre of the holder. A vertical box-lattice was fixed at the centre of the holder, directly beneath the shaft so that when the holder was empty the shaft would have rested on it and been supported. Each truss was close to a cigar-shaped form with each end tapering and three L-section struts holding the upper and lower edges apart. The upper member (L-section steel) had a gentle curve but the lower element was formed from two straight members (flat section steel) with a kink between them.
- 3.2.16 The 24 trusses were arranged so that each alternate one (ie 12 in total) also had a long tie rod from the bracket at the outer edge of the holder (ie the bracket at the top of each RSJ) to the bottom of the central shaft. Some additional support to this tie rod was given by a simple hanger between the tie-rod and the main truss. Unusually there did not appear to be any diagonal, lateral bracing between the trusses.
- 3.2.17 There was a clear line of rust/corrosion whereby the lower halves of the trusses were an orange/brown colour whereby the upper halves were darker.
- 3.2.18 The main features within the holder were two large vertical pipes immediately adjacent to each other (inlet and outlet) towards the northern side supported by simple struts (Pl. 29).
- 3.2.19 ***Other plant or structures around Holder 114:***
- 3.2.20 On the west side of Holder 114, between it and Holder 115 was a concrete base (Pl. 90) with three circular man-hole inspection chamber covers (not shown on 1934 AP). This is labelled as a 'separator' on a 2001 Topographical Drainage Survey plan supplied by the Gas Archive. Adjacent to this feature was a small later 20<sup>th</sup>-century building constructed with pre-fabricated panels and with lagged pipes entering its side (Pl. 88). No access inside this was possible but the structure is shown to have been a boiler house on the same 2001 topographical drainage plan.
- 3.2.21 To the northern side of the holder there was a concrete lined, water-filled valve pit immediately adjacent to the holder and extending beneath the tank (Pl. 83). The section of this pit which is adjacent to the trench around the gasholder was open (with guard rails) but the pit extended away from the holder and this section was covered with railway sleepers. There are several rods into the water which were probably part of a valve mechanism.
- 3.2.22 Close to this pit was a small building constructed from stretcher bond brick with a flat roof and a plain timber plank door on the east side (Pl. 84-87). There are no other openings in the building. Inside the building the walls were of painted brick and the floor was covered in chequerboard lino tiles. There was no plant in-situ when the recording was undertaken although there are a number of large rolls of electrical cables and a telephone on the wall.

- 3.2.23 Neither the pit nor the building appear to be shown on the 1934 aerial photograph.
- 3.2.24 Another minor feature of note was a truncated stock-brick boundary wall to the west of Holder 114 and extending in a NW-SE orientation (Pl. 81-82). This wall survived from the early 20<sup>th</sup> century when this marked the edge of the gasworks and before it was extended in the 1940s with the construction of Holder 115. The simple wall, which was c. 60 cm tall by 22 cm wide, had a soldier course coping and it had been truncated.
- 3.2.25 To the east of Holder 114 the boundary facing Wharf Road was formed by a taller, but apparently later, brick wall (Pl. 26).

### 3.3 Gasholder Number 115

- 3.3.1 **General description:** Gasholder No. 115 (Pl. 46-79) was located to the south-west of No.114 and as referred to above it was constructed in the 1940s as an expansion to the capacity of the gasworks.
- 3.3.2 It was a telescopic, spiral-guided, cylindrical holder with three separate lifts which fit immediately inside one another. These three lifts were set within an outer drum or tank fixed in place at ground level with a clear depression around most of the holder's side (Pl. 53). The holder was c.36 m in diameter and it appears that the depression around it is usually filled with water; the lowest 50 cm of the tank within this depression was very rusty and there was a dried-up coating of algae or reeds on the gravel in this area. In some areas of the depression a shallow concrete curb was just visible at the base of the tank but this was largely obscured. The depression has been partially infilled on the east side.
- 3.3.3 **Tank:** The fixed outer tank was formed from seven horizontal rows of riveted steel plates, the lower ones of which were 1.3 m tall, without any tall structural standards as in Holder 114. The lower four rows were jointed with separate rectangular junction plates and large rivets but the upper three rows merely overlapped and were fixed with smaller rivets. The tank was painted a light grey colour similar to Holder 114. There were also horizontal lines of rivets at the points where each row overlapped the one above or below. These sheets were staggered as they climbed rather than each one stepping in and the rivets were each c.5 cm in diameter and with a domed profile rather than flattened. The number of the holder '115' had been crudely painted on its eastern side.
- 3.3.4 At the curb or top of the tank there was a projecting solid steel walk-way deck (Pl. 64) which was supported by tall rectangular shaped brackets, c.2.5 m tall and arranged in pairs. These brackets are simple structures with a main tapering flat-section 'fin' which was riveted to the side of the tank, and to the underside of the walkway, with a separate L-profile steel member. Each fin was the same height as the uppermost two rows of steel plate of the tank.
- 3.3.5 Between each of these pairs of main brackets there were also two further simple brackets formed from lengths of L-section steel which supported a handrail (circular section) around the projecting walkway. At their base these were riveted to the outer face of the tank and they had a kinked alignment with the outer edge of the walkway adjoining at the kink. Above this point the brackets were vertical and they supported two horizontal rails. There appeared to be three further walkways, one at the top of each of the inner lifts but these could not be seen closely from the ground. They were partially visible at a distance from the fly-over to the north of the site (Pl.51) and from here it was also possible to see the sets of roller carriages at the top of each lift and tank. These carriages would have engaged with diagonally set guide rails fixed to the side of the adjacent lift to allow the telescopic bell to rotate and rise.
- 3.3.6 Access to the walkway was provided by a primary staircase (Pl. 61-62) on the eastern side of the holder which was surrounded at its base by a vertical stake fence (Pl. 56). The staircase

comprised two aligned flights, both against the side of the tank, separated by a landing supported by simple stanchions set on concrete-block bases (Pl. 60). The landing at the top of the stairs was supported by simple brackets fixed to the side of the tank. The main handrail for the staircase had circular section posts quite different to the L-section members which the handrail around the top of the tank was constructed from. Indeed, the handrail of the staircase has the appearance of being older than that around the tank and it is possible that it has been reused from an older structure. It also appeared truncated at the bottom with the rails cut immediately beneath the lowest posts.

- 3.3.7 Within the small fenced enclosure at the base of the stairs there was a tall pair of anti-flooding inlet/outlet pipes which extended up to just above the top of the tank before looping around and returning to the ground (Pl. 66-67). There was a similar pipe (or pair of pipes) on the southern side of the holder, again set within a small fenced enclosure and within this there was a water-filled pit with large valve and wheel to operate it. There had been sleepers set over this pit but most have been dislodged (Pl. 57-58). The 2001 Topographical Drainage Survey plan referred to above shows that this pit was redundant at the time of this survey.
- 3.3.8 There were another three sets of steps projecting above the top of the holder, fixed to its edge so that as the telescopic bell rose it would have fitted immediately inside these steps (Pl. 54-55). One of these sets was fixed to the top of the tank, so it would not rise or fall itself but the other two are fixed to the tops of the outer two lifts so they would also have moved up and down as the bell inflated.
- 3.3.9 **Lifts:** A large opening was created through the side of the holder (Pl. 71) in preparation for the demolition of the structure, and this allowed both the inner face of the inner lift to be seen as well as a sectional view through the three cylindrical lifts and tank. A small amount of sludge (ankle deep) remained in the tank at the time of the recording and this prevented access into the holder but it was possible to see inside and learn more of the structure.
- 3.3.10 It could be seen that while the rigid steel plate which formed the outer tank was 2 cm thick the plates which form the inner lifts was much thinner (0.5 cm thick). The inner lifts are also constructed with much smaller rivets (Pl. 68-70).
- 3.3.11 The outer face of each lift had diagonally set I-section rails which would have engaged with carriage rollers fixed to the top of the adjacent lift and the top of the tank (as referred to above). These would have guided the lifts to rise and fall and to rotate telescopically as the holder filled with gas. The outline of these could be seen within the gasholder through diagonal lines of rivets (Pl. 76-77), and what appears to have been a separate plate, that secured the rails on the outer side of the innermost lift.
- 3.3.12 The base of each of the lifts comprised a U-shaped tray which would have been filled with water when the holder was in operation and it would have formed a seal with the top of the adjacent lift (cup and grip seal).
- 3.3.13 The internal face within the gasholder (ie the innermost lift) was braced by 24 full-height, I-section steel stanchions. The lower edge of the tank walls were lifted slightly to allow the flow of water into the space between the lifts (when the bell was lowered) by being set on short horizontal RSJ stubs.
- 3.3.14 The floor within the tank was constructed from riveted steel plates although this was largely obscured by the remaining water/sludge.
- 3.3.15 There were two large free-standing vertical pipes inside the gasholder (inlet and outlet pipes), on the eastern and southern sides, which extended from the floor to the crown and supported by simple sloped braces (Pl. 76-77, 79). Each of these is adjacent to the tall anti-flooding pipes outside the tank referred to above.

- 3.3.16 **Crown structure:** the roof or crown of the gasholder was a shallow dome formed from riveted steel plates supported by 10 concentric rings of purlins, set on 24 trusses which radiated like spokes from the centre of the dome (Pl. 73-74, 78). Unlike in some gasholders investigated by OA all 24 trusses appeared to be exactly the same and they were formed from L-section and flat section members.
- 3.3.17 The outer ends of each truss sat on one of 24 stanchions which lined the inner face of the holder and the inner ends were fixed to rings at the top and bottom of a shaft at the centre of the holder (Pl. 78). This shaft was held up, suspended by the trusses, and there was no vertical box girder fixed to the ground on which it rested when the gasholder was lowered.
- 3.3.18 Each truss comprised a bottom chord formed from flat section steel, a curved upper chord which followed the profile of the crown and a combination of flat section members (in tension) and L-section members (in compression). These members were each jointed with junction plates. The central shaft was longer than in some other gasholders investigated by OA and therefore the bottom chord of each truss sloped down slightly towards the centre of the holder.
- 3.3.19 The holder was stiffened by flat-section diagonal bracing ties above the trusses and below the 10 concentric rings of purlins.

### 3.4 Base of former 1860s gasholder

- 3.4.1 Approximately 6.5 m to the north-west of Gasholder 114 there was the surviving section of a curved concrete footing (Pl. 91-95) and it is very likely that this was the surviving base of the former gasholder which historic maps show was probably constructed in the 1860s and which is shown on aerial photographs from the inter-war period.
- 3.4.2 Only the south-eastern third (c.15 m long) of the holder base was visible, and even this area was partly covered by light vegetation; the larger north-western part was beneath the edge of a car park or beneath an earth bank which slopes up to the car park. The main concrete ring was c.48 cm wide by 12 cm tall and set on a brick base (3 courses visible). There was no visible reinforcing to the concrete and the nature of the concrete was crude (pebbly).
- 3.4.3 Every c.4.7 m there was a projection to the ring with a base for a former standard; the historic aerial photographs show that there were eight such standards. One of these visible bases is formed from a stone block, 95 cm<sup>2</sup> but one of the projections is formed from concrete so it's possible that one of these was replaced. From extrapolating the curve of the base this holder was probably c.20 m in diameter and the area within it was infilled with pebbles/hardcore.
- 3.4.4 There seems little reason to doubt that this this was the surviving base from the gasholder probably constructed in the 1860s and then shown on historic Ordnance Survey maps up to (and including) 1983. The holder is no longer shown on the OS map of 1990. It is in the right location, the base appears to correspond with the inter-war aerial photographs and the nature of the concrete would not suggest a later date.

## 4 CONCLUSION

- 4.1.1 The former gasworks at Wharf Road in Chelmsford is one of many similar sites across the country which have been decommissioned due to changes in the gas industry and the redundant gasholders are currently being dismantled. The two holders at Chelmsford have been prominent local landmarks for much of the 20<sup>th</sup> century and more recently they have remained as disused reminders of the industrialisation of this part of the city.
- 4.1.2 The site of the former gasworks is gradually being redeveloped and National Grid have commissioned Oxford Archaeology to document the holders through of programme of historic building recording. The recording, which has been undertaken both before and during the demolition, forms part of a wider thematic study to document other redundant gasworks and it will allow comparison between sites.
- 4.1.3 The two holders both date from the first half of the 20<sup>th</sup> century and they represent two distinct structural forms. The earliest holder (No.114) was probably constructed during or immediately after the First World War and is a frame-guided structure whereas the other gasholder (No.115) was constructed in the 1940s and is a spiral guided gasholder.
- 4.1.4 The design of the older frame-guided holder (No.114) would have been a relatively conservative form for this period, at a time when spiral guided holders had been introduced, although it was still a common type. Its standards were Type 32 (as defined by Malcolm Tucker) which were generally used between c.1880 and 1930 while the horizontal bracing was Type M (generally found between c.1890 and the 1930s).

## APPENDIX A      BIBLIOGRAPHY

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Ordnance Survey 25 inch map (1874)

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Ordnance Survey 25 inch map (1897)

Ordnance Survey 25 inch map (1921)

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Ordnance Survey 1:1250 map (1948-9)

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Ordnance Survey 1:1250 map (1968-74)

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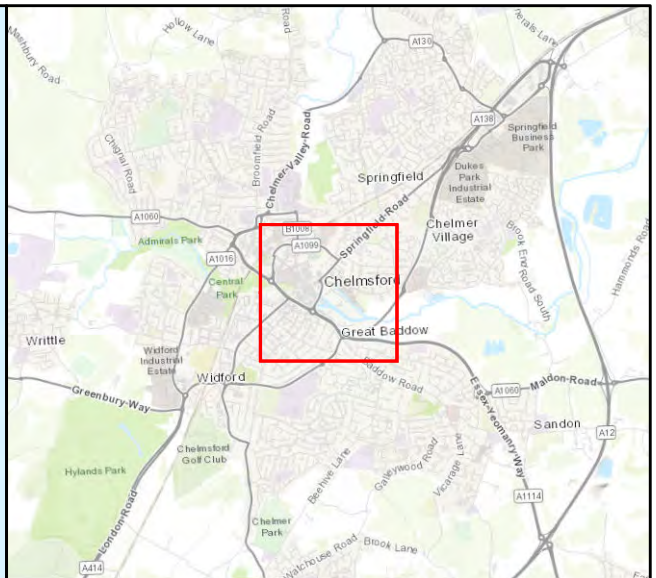
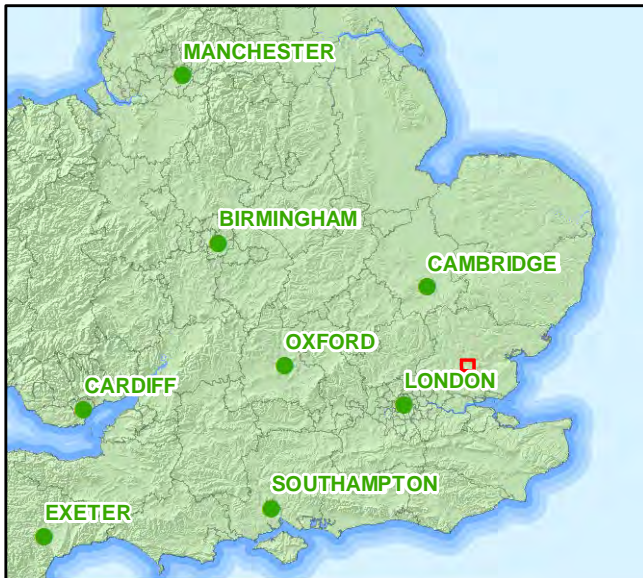


Figure 1: Site location



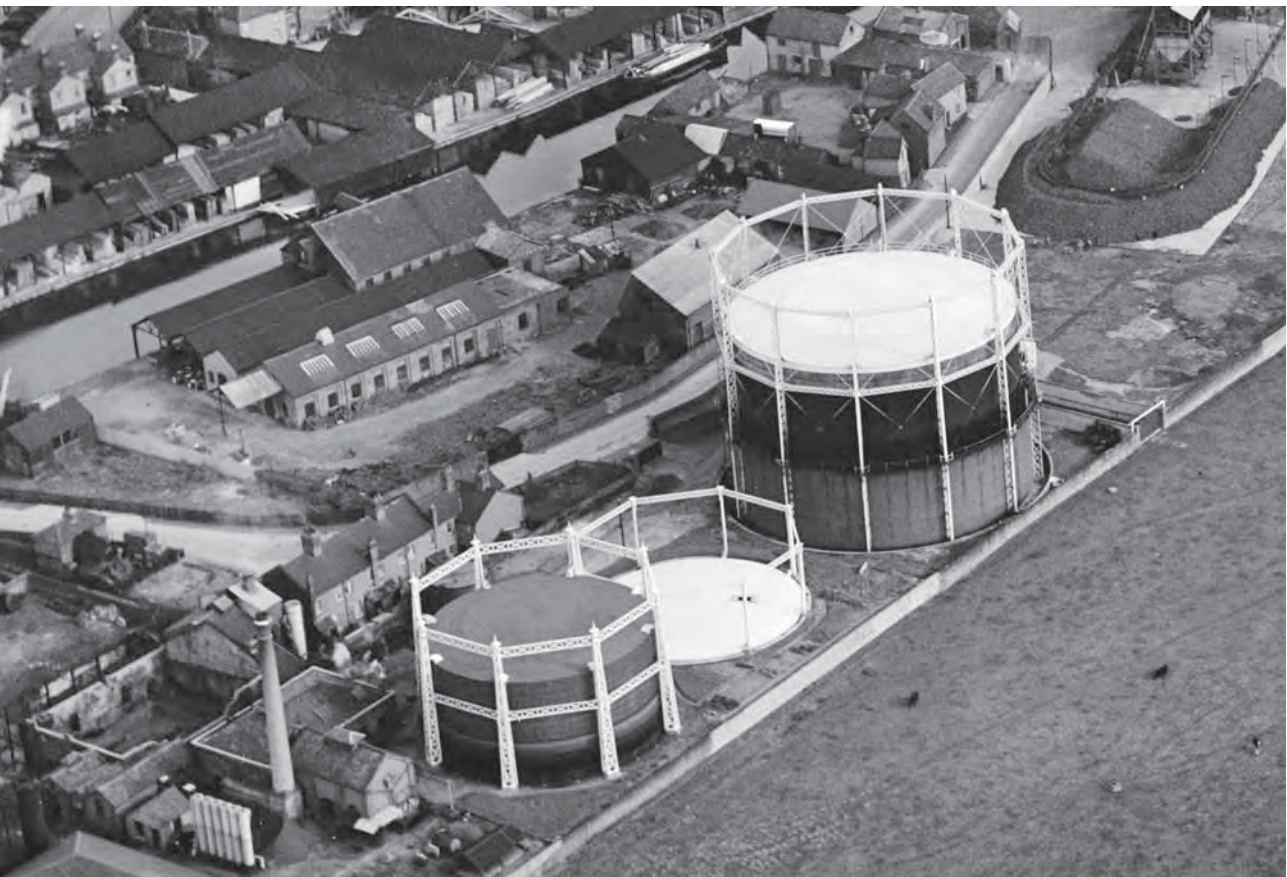


Figure 4: 1934 Aerial photograph of site (From Britain from Above, (ref: EPW046415)

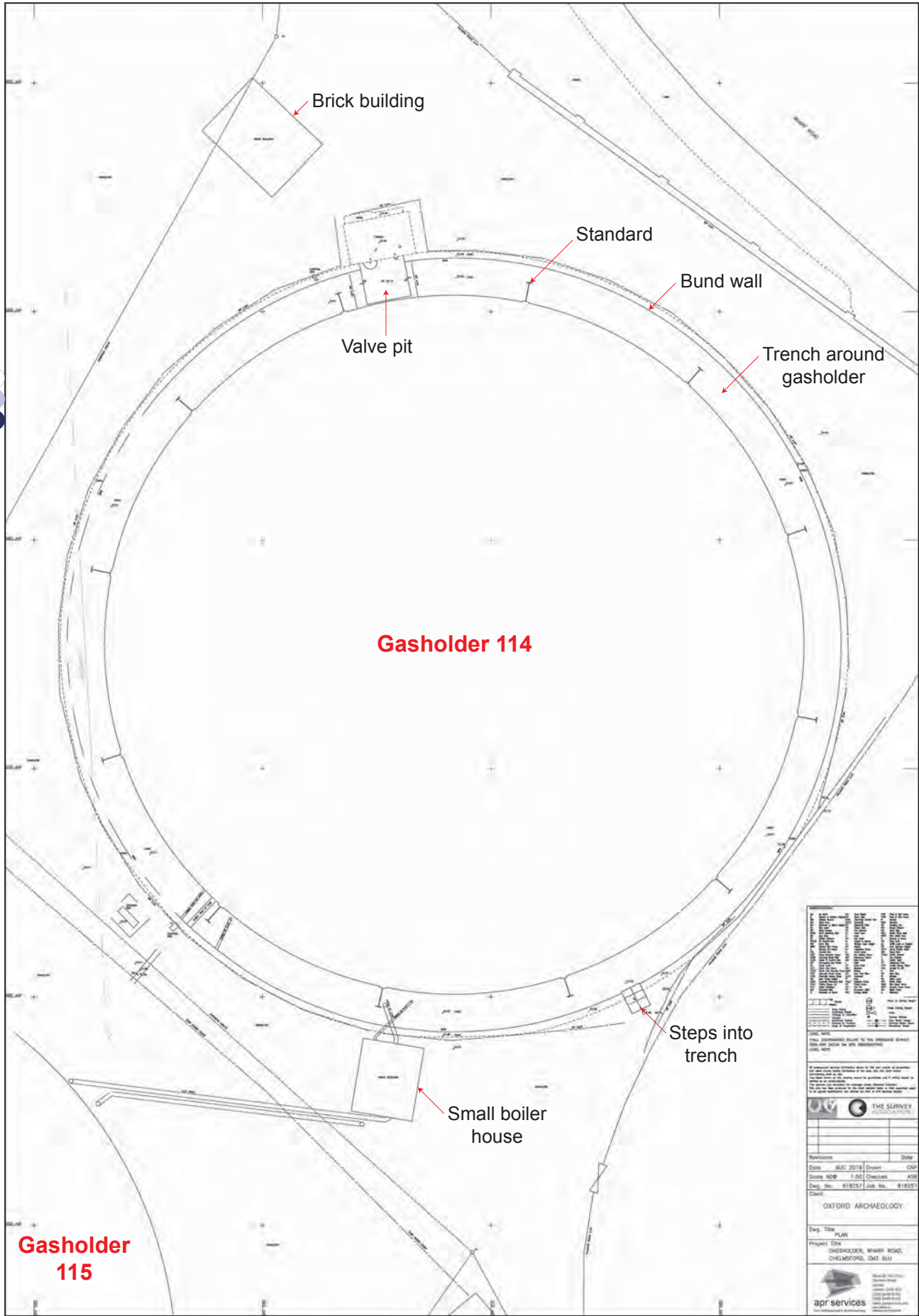
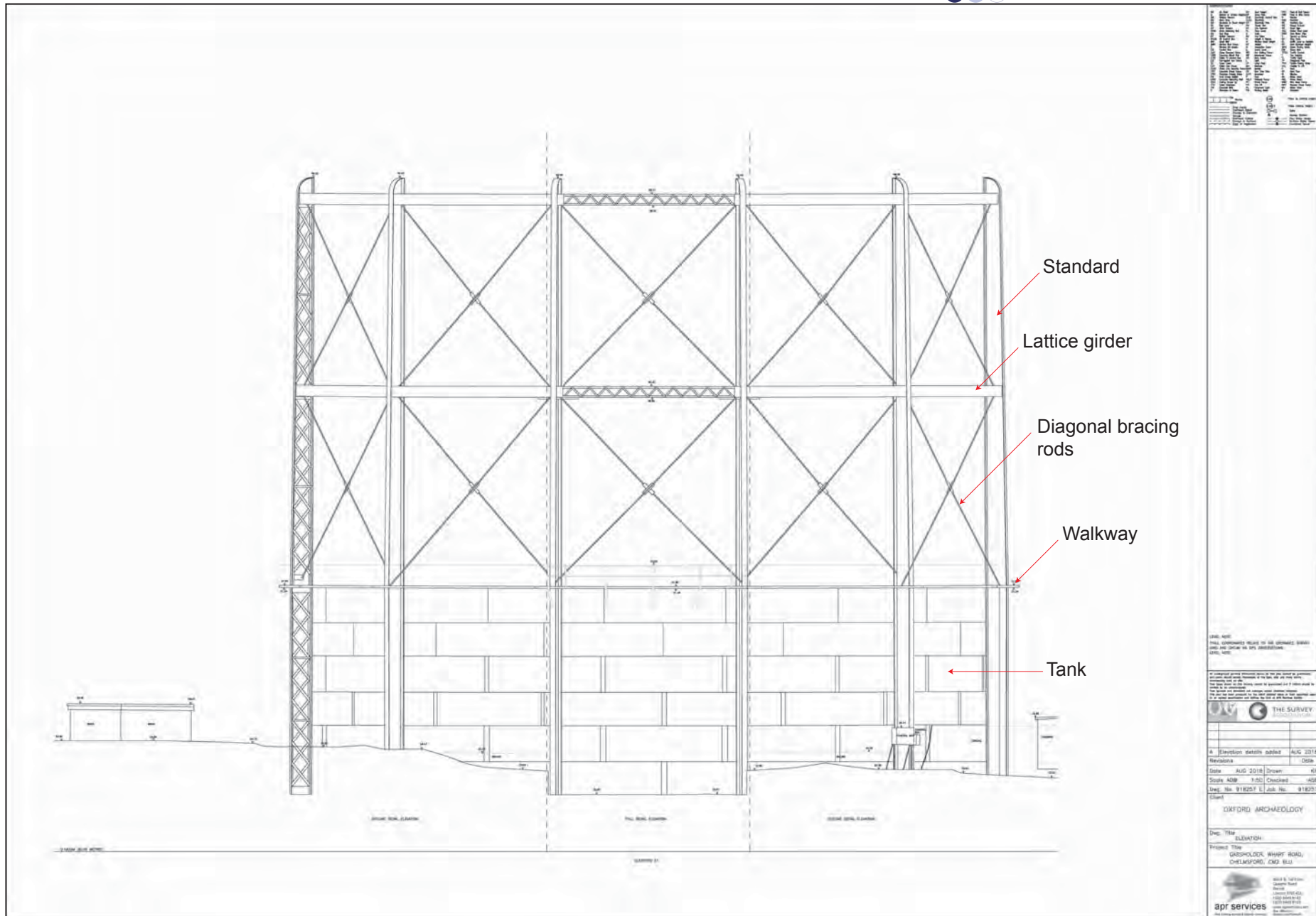


Figure 5: Plan of Gasholder 114



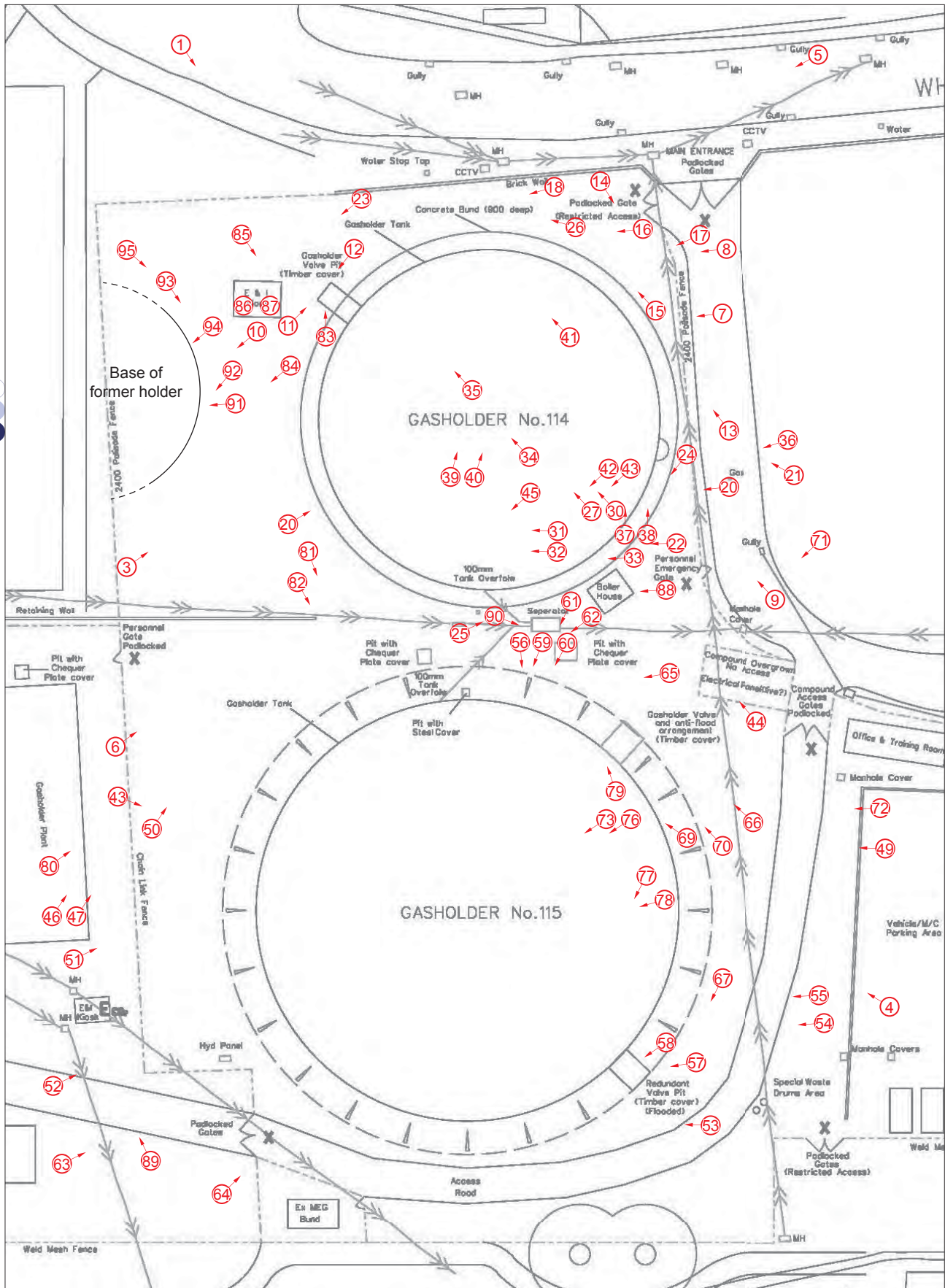


Figure 7: Site plan showing location of photos taken



Plate 1: Holder 114 from north on Wharf Road



Plate 2: Holder 114 from flyover to west



Plate 3: Frame of Holder 114



Plate 4: Holder 114 from south





Plate 5: General view of Holder 114 from south-east



Plate 6: General view of Holder 114 from north-west



Plate 7: Detail of structure of Holder 114



Plate 8: Holder 114 walkway detail



Plate 9: Holder 114 from south with modern boiler house



Plate 10: Bank to north-west side of Holder 114



Plate 11: Valve Pit to north side of 114



Plate 12: Valve Pit to north side of 114



Plate 13: Holder 114 general structure

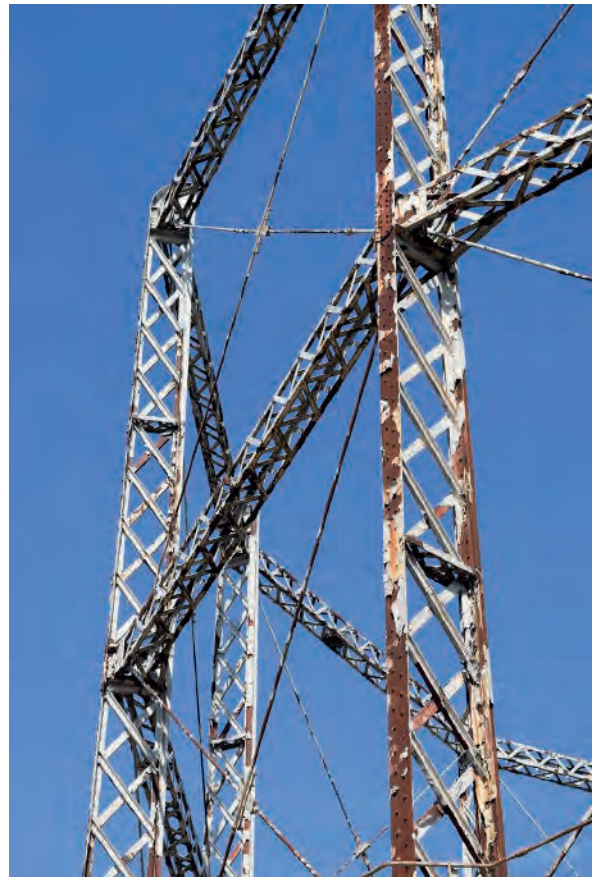


Plate 14: Holder 114 general structure



Plate 15: Ladder to side of Holder 114



Plate 16: Tank of Holder 114



Plate 17: Ladder to east side of Holder 114



Plate 18: Trench around Holder 114



Plate 19: Detail of standard to side of Holder 114



Plate 20: Base of standard (Holder 114)



Plate 21: Standard (Holder 114)



Plate 22: Detail of standard fixed to tank (Holder 114)



Plate 23: Valve pit and building to north side of Holder 114



Plate 24: Steps into trench around Holder 114



Plate 25: Boiler house to south side of 114





Plate 26: Boundary wall to north-east of Holder 114



Plate 27: Crown structure to Holder 114



Plate 28: Crown structure to Holder 114



Plate 29: Interior of Holder 114



Plate 30: Crown structure to Holder 114



Plate 31: Structural detail of crown (Holder 114)

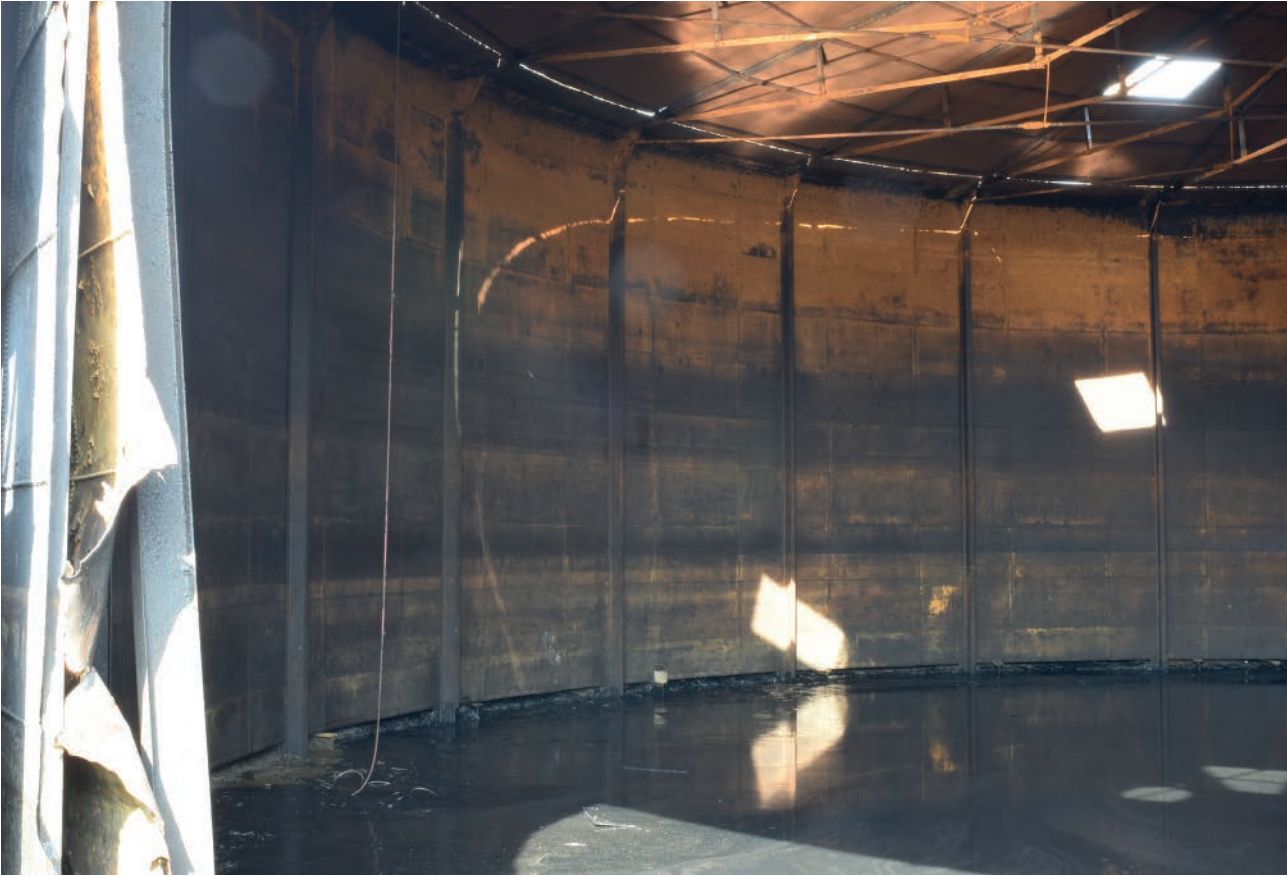


Plate 32: Interior of Holder 114



Plate 33: Detail of standard during demolition of Holder 114

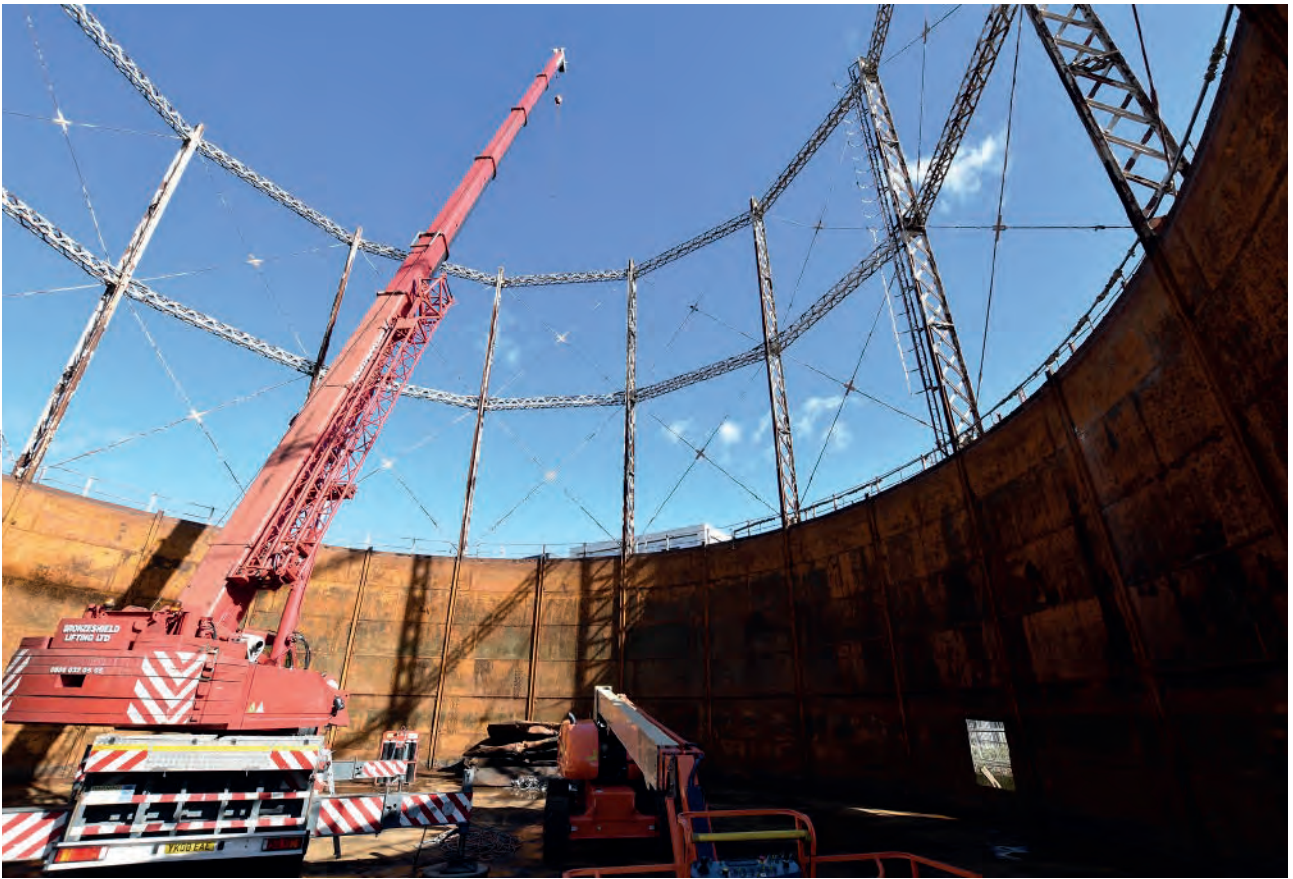


Plate 34: Holder 114 during demolition, after removal of crown



Plate 35: Holder 114 during demolition, after removal of crown



Plate 36: Detail during demolition



Plate 37: Detail during demolition showing guide rollers



Plate 38: Detail during demolition showing guide rollers



Plate 39: Riveted plates to floor of Holder 114



Plate 40: Riveted plates to floor of Holder 114



Plate 41: Internal face of inner lift during demolition





Plate 42: Detail during demolition

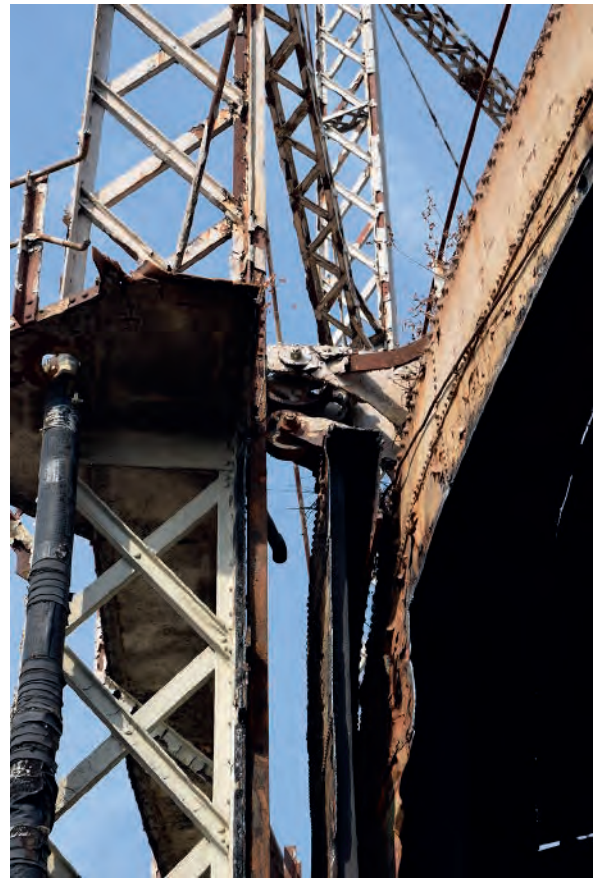


Plate 43: Detail during demolition



Plate 44: Opening formed in side of Holder 114

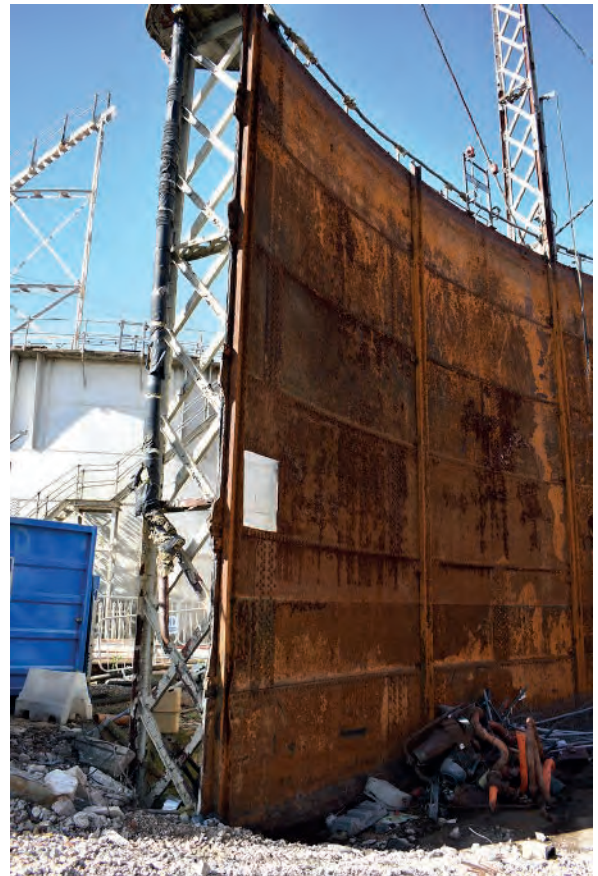


Plate 45: Side of Holder 114 during demolition



Plate 46: General view of holders from flyover to west



Plate 47: Holder 115 from west



Plate 48: General view of Holder 115 from north



Plate 49: General view of Holder 115 from south



Plate 50: Side of Holder 115



Plate 51: Detail of guide rollers on top of Holder 115



Plate 52: General view of Holder 115 from north-west



Plate 53: Depression around Holder 115, SW side



Plate 54: Ladder on top of tank of Holder 115



Plate 55: Ladder on top of tank of Holder 115



Plate 56: Enclosure at base of staircase of Holder 115



Plate 57: Enclosure around pipes and valve pit to south of 115



Plate 58: Valve pit to south side of Holder 115



Plate 59: Stairs to east side of Holder 115





Plate 60: Stanchion supports for Holder 115 staircase



Plate 61: Stairs to east side of Holder 115



Plate 62: Detail of stairs to east side of Holder 115



Plate 63: General view of Holder 115 from north-west



Plate 64: Detail of support brackets to Holder 115



Plate 65: General view of side of tank (Holder 115)



Plate 66: Anti-flooding pipes to east of Holder 115



Plate 67: Anti-flooding pipes to east of Holder 115



Plate 68: Detail of lifts during demolition of Holder 115



Plate 69: Detail during demolition of Holder 115

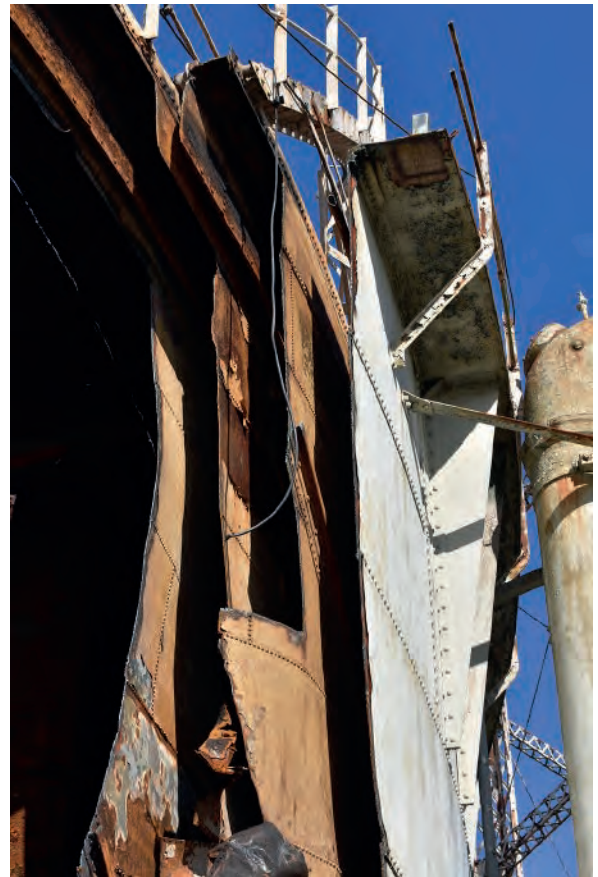


Plate 70: Detail of side of 115 tank during demolition



Plate 71: General view of Holder 115 during demolition



Plate 72: Opening created in 115 during demolition



Plate 73: Crown structure in 115 during demolition



Plate 74: Crown structure in 115 during demolition



Plate 75: Interior of Holder 115 during demolition



Plate 76: Interior of Holder 115 during demolition



Plate 77: Vertical pipe in Gasholder 115



Plate 78: Central shaft within Holder 115



Plate 79: Detail of head of pipe within Holder 115



Plate 80: Plant in Pressure Reduction Station to NW of 115





Plate 81: Boundary wall between holders



Plate 82: Boundary wall between holders



Plate 83: Valve pit to north of Holder 114



Plate 84: Building to north of Holder 114



Plate 85: Building to north of Holder 114



Plate 86: Interior of building to north of Holder 114



Plate 87: Interior of building to north of Holder 114



Plate 88: Boiler house to south of Holder 114



Plate 89: Plant in Pressure Reduction Station (still operational)



Plate 90: Drainage 'separator' between holders



Plate 91: Details of base of former gasholder to north of site



Plate 92: Details of base of former gasholder to north of site



Plate 93: Details of base of former gasholder to north of site



Plate 94: Details of base of former gasholder to north of site



Plate 95: Details of base of former gasholder to north of site







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