Former Gasworks
Walton Avenue, Felixstowe
Phases 1 and 2
Historic Building Investigation and Recording

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Former Gasworks, Walton Avenue, Felixstowe: Phases 1 and 2

Historic Building Investigation and Recording

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Summary

Oxford Archaeology was commissioned by Montagu Evans LLP on behalf of National Grid to create an Historic Building Record of Gasholder 124 and its ancillary buildings at the former gasworks on Walton Road to the south-west of Felixstowe town centre.

Production of gas was switched to Ipswich and the gasworks closed in 1931, although the gasholders were retained for storage. Gasholder 124, an above-ground spiral-guided gasholder with three lifts and a welded tank, was constructed in 1966 on the footprint of a 19th-century gasholder and by the mid to late 1970s was the only gasholder remaining on the site.

Improvements in distribution plant in recent years has caused the gasholder to become redundant and it was isolated from the mains and decommissioned some time prior to this survey.

The historic building recording focussed upon researching the history of the site and photographing the gasholder and its context before and during the dismantling. Phase 1 of the project comprised the recording of the gasholder and associated structures in their context prior to work on site and Phase 2 comprised the recording of the gasholder during its demolition.

The wider programme of recording work of the remaining gasholders across the country will allow a comparison of the structures between sites.

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 Gasholder 124 at the former gasworks in Felixstowe in two phases: Phase 1 of recording, prior to its demolition, and Phase 2 during the demolition work and incorporating the interior of the gasholder. The ancillary buildings on the site were also recorded during the project.

1.1.2 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.

1.1.3 The former gasworks, hereafter referred to as 'the site', is situated to the south-west of Felixstowe town centre, approximately 1.3km or three quarters of a mile south-west of Felixstowe Town Hall (Figure 1).

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 before and during their demolition. The information will be 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 the 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, a 'Basic Level 2 survey' was undertaken which was largely photographic and descriptive in nature. The level of recording undertaken in the wider project to record gasworks have previously been agreed with Historic England on a portfolio basis.

1.3.2 The 'Basic Level 2' record is 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.*'

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

The *photographic record* is intended to act as a general record of the structures before and during their demolition and includes photographs of the exterior and interior, and details and fixtures. Digital photographs, in jpeg format, were taken using a camera with up to 24-megapixel capability.

For the *drawn record*, the surviving engineering site plans were made available to OA by the National Gas Archive. 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.

The *written record* consists of field notes and annotations that complement the photographic and drawn records and add further analytical and descriptive detail. The written record also incorporates research carried out using other primary and secondary sources. The written record also incorporates research carried out using other secondary sources.

1.3.4 Visits to the Science Museum archive and the Historic England archive prior to the Phase 1 survey did not find any documents relating to the gasholder. The local studies library was consulted following the Phase 1 site visit but no information regarding the gasworks was held there. The Ipswich branch of the Suffolk Archives was closed, initially due to the COVID-19 lockdown followed by their moving to a new archive building; a search of their electronic catalogue and correspondence with the archive staff found that no relevant records have been deposited at this facility.

1.3.5 Images of the site are also available on Google Streetview and Google Earth dating to sporadic intervals between 2000 and 2020; these images have been used to determine changes within recent years.

1.3.6 This site is not included in Historic England's Monument Protection Plan (MPP) Step 3 report for the gas industry.

1.3.7 The site visit to record the structures prior to their demolition was carried out on the afternoon of 27th June 2018. The weather was clear with glaring sunshine and the enclosed nature of the site necessitated the use of a wide-angle lens for some of the photographic recording. No access to the walkway at the top of the tank was permitted. The visit to record the gasholder during its demolition was carried out on the 1st July 2020 during dry but overcast weather.

1.3.8 The site is aligned approximately NNE to SSW. For ease of description, the site shall be referred to in the text as being aligned north to south.

2 HISTORICAL BACKGROUND

2.1 Introduction

2.1.1 The history of the town of Felixstowe has been widely published and so this historic description will concentrate solely upon the immediate area of the site.

2.1.2 There are no records held by the Suffolk Historic Environment Record for this site which have been made available via the Heritage Gateway website, other than a mention of the gasworks itself. Two pillboxes and two air raid shelters dating to the Second World War were located in the vicinity, although are no longer extant. Within 500m of the site, several further Second World War features have been recorded. An early 19th-century Martello Tower is 430m to the SSE and another is just over a kilometre to the north-east. No archival records are held at the county archive, as discussed in 1.3.4.

2.1.3 Two listed cottages are approximately 800m to the north-west of the sites, however, these are not intervisible with the gasholder due to the lie of land and surrounding buildings and trees. The Martello Tower to the SSE of the site is both a listed building and a scheduled monument but is not intervisible with the site due to the intervening buildings. The shingle spit to the south of the site, beginning 1km to the south and stretching to the end of the spit approximately 2.4km south of the site is a scheduled monument which includes Landguard Fort, a late 19th-century fort with 16th-century origins, this is not intervisible with the site due to the container port.

2.1.4 The site is not within a Conservation Area and is neither associated with or intervisible with the Felixstowe South Conservation Area approximately 620m to the north-east, nor with Felixstowe (Central) Conservation Area farther to the north-east.

2.1.5 The gasholder was visible from the main road, from the mixed industrial and residential area to the east of the railway and from the industrial area to the west of the site.

2.1.6 The railway to the immediate east of the site is the Felixstowe branch line which connects the port to the Great Eastern Mainline and was opened in 1877.

2.1.7 The site lies upon the sedimentary bedrock clay, silt and sand of the Thames Group, with the undifferentiated clay, silt and sand of the Thanet Formation and Lambeth Group with superficial deposits of the clay and silt of the Tidal Flat Deposits.

2.2 Felixstowe's Gasworks

2.2.1 The Ordnance Survey (OS) First Edition map of 1881 shows the site defined as marshes. The Felixstowe Gas Light Company was formed in 1883 and the gasworks opened on Walton Avenue in 1884. The OS edition of 1903 shows a gasholder at the south-east corner of the site, the retorts to the north of the site at the edge of Walton Avenue, two small structures to the east edge of the site and two houses in the south-west corner of the site. A smaller tank is to the north of the gasholder. An undated and untitled technical drawing of a gasholder is in the National Gas Archive collection for Felixstowe which has been incorrectly titled at a later date as being Gasholder 124.

This depicts a 250,000 cubic feet capacity spiral-guided gasholder with two lifts which may account for this smaller circular feature.

2.2.2 By the time of the edition of 1926, the gasworks has expanded to the south and a further gasholder constructed to the south-west of the original. The retorts at northern end of the site have been extended, and several new structures have been constructed across the gasworks including three rectangular buildings along the northern edge of the west boundary of the site.

2.2.3 In 1929, Ipswich Gas Light Company purchased the Felixstowe Gas Light Company. A notice was published in The London Gazette on 26th April 1929 stating that the manufacture of gas at Felixstowe would continue until the supply was available from Ipswich. The gasworks closed in 1931 and the gasholders retained as a gasholder station.

2.2.4 The next edition of the OS map is published around 1952 and no other site plans are available for the intervening period. The gasholder station has undergone some alteration to the site layout since the closure of the gasworks. The smaller possible gasholder has been replaced by a rectangular structure and most of the small structures have been removed, although the small tank to the west of the site – probably for tar storage during the gasworks phase – remains. This edition includes labels: the houses are labelled 'Gasworks Cottages' and are shown as numbers 1 and 2, the remaining part of the building along the north end of the west boundary is labelled 'Engine House' (although it is actually the Governor House) and the retorts at the north boundary are now labelled 'Ruin'. A chimney to the south side of the retorts is also labelled.

2.2.5 On the 31st January 1953, a flood caused destruction along the east coast of England. Felixstowe suffered much damage and the gasholder station and the surrounding buildings were also flooded. Photographs taken the following day have been made available by the Environment Agency show the flooding. Plate 1 shows the tank of the original gasholder with the already-ruined retorts in the distance and the Governor House to the north-west. The column-guided gasholder tank has steel plates riveted together with one row of rivets top and bottom and two rows of rivets between sheets, the joints being staggered. Thin columns are at regular intervals around the tank, supporting the walkway which is accessed via a ladder and in turn the columns which supported the lifts.

2.2.6 Plate 2 shows in the foreground the damaged roofs to the rear of the Gasworks Cottages. To the north of the gasholder is a single storey building which is evidently in use, with the derelict gasworks buildings visible to the northern end of the site. A former resident, Violet Sparrow, was interviewed by the BBC on the 50th anniversary of the flooding. Her husband worked for the Gas Board, so evidently the houses were still available to Gas Board employees, and she describes how her and her neighbours, Mr and Mrs Haigh, demolished the plasterboard first floor party wall and made a hole in the ceiling to access the roof space to escape the water which had flooded the first floor and removed roof slates to be able to monitor the flooding. Airmen had to row to the houses to rescue the families. The houses were condemned and the residents rehoused (BBC Local Suffolk, 2003).

2.2.7 An aerial photograph (Plate 3) of the flooded area shows the two gasholders: the later spiral-guided gasholder to the west and the original column-guided gasholder to the east and in the location of the current gasholder. The other buildings cannot be seen clearly on the image and the houses and the single storey building to the north of the gasholders are hidden from view behind the gasholders, however, the floating prefabs to the east of the railway line, where most of the fatalities occurred, indicate that the photograph is definitely of the 1953 flood.

2.2.8 On the 6th January 1956, an explosion destroyed the Governor House and two men were killed. Eric Sparrow, whose family were caught in the flood which destroyed the Gasworks Cottages, was also hospitalised. A photograph (Plate 4) in the National Gas Archive's collection shows the remains of the building at the northern end of the western boundary, with the houses, still to be demolished, and the spiral-guided gasholder in the background. Another photo available on the Ipswich Star's website, but not of sufficient quality for reproduction in this report, shows both of the gasholders in the background which appear to have escaped damage and no damage to the gasholders was reported in the newspaper (Ipswich Star, 2018).

2.2.9 The Historic Building Recording Brief states that the current gasholder was constructed by Clayton and Sons in 1966, however, no manufacturer's plate or information is located on the gasholder and no archival documents have been found by OA which relate to this. A company called Clayton, Son and Co. Ltd. manufactured gasholders, gasworks plant and other engineering plant in Leeds between 1862 and approximately 2002 and may have supplied this gasholder. Their early 20th-century advertisements state that they were the manufacturers of the first spiral-guided gasholder in 1889 (Grace's Guide to British Industrial History, 2018).

2.2.10 The current gasholder was constructed on the footprint of the late 19th-century gasholder. By the 1967 edition of the OS map, only the two gasholders, the office building towards the northern end of the western boundary (in the location of the Governor House) and two small structures around the site remain. By the edition of 1978, only Gasholder 124, the office building and three small structures remain; an undated aerial photograph in the National Gas Archive's collection shows the site at around this time (Plate 5). An open-sided covered area is depicted to the north of the gasholder and indicates the addition of the Gas Distribution Station which was divided from the gasholder site sometime between the Google Streetview surveys of September 2016 and July 2017.

2.2.11 An Eastern Gas Property Plan, originally dated 1958 but with later undated alterations, shows a strip of land to the north of Walton Road labelled as 'Sold 1960' (Figure 2). No indication of the use of the land is noted on the site plan or maps, in fact that site boundary is only shown on the OS edition of circa 1952.

2.2.12 The change from town gas to the cleaner natural gas in the 1970s caused Ipswich Gasworks, like the gasworks across the country, to be decommissioned. Gasholder 124 and the gasholder station site was retained for storage but in 2010 was decommissioned and isolated from the network.

3 DESCRIPTION OF THE SITE

3.1 Introduction

3.1.1 The site is located to the south of Walton Avenue (Plate 6) and is bounded to the east by the railway and to the west by a service road called Outfall Road in reports of the 1953 flood, but not named on available maps and plans of the area (Plate 7). To the north between the site and Walton Avenue is a distribution site controlled by the gas distribution company, Cadent, and was formerly part of the gasworks site. To the south is wasteland, also formerly part of the gasworks. The site boundary is marked by chain link fencing and concrete posts.

3.1.2 The site contained the gasholder, one brick building and a derelict concrete block building. The distribution site to the north of the gasholder station contains the distribution plant (Plate 8), specifically labelled as the Pressure Reduction Station on National Grid's Preliminary Dismantling Assessment site plan, and the brick building labelled 'Reporting Centre' on the Eastern Gas Property Plan and 'Office' on the National Grid site drainage plan (Figure 3).

3.1.3 Figure 4 indicates the location and direction of the images used as plates.

3.2 Gasholder Number 124

3.2.1 The gasholder was an above-ground spiral-guided gasholder in a steel tank with three lifts and had a diameter of 33.91m (Amec Foster Wheeler, 2018) and a capacity of 500,000 cubic feet (Montagu Evans, 2018) (Plate 9). The tank was set slightly below ground level, resulting in a dry bund surrounding the gasholder. The base and sloping sides of the bund were lined with concrete slabs and was guarded with metal railings (Plate 10). The tank was formed from steel plates welded together with staggered joints alternating between rows. One round hatch was to the north side of the tank, with two handles and bolts at regular intervals around the edge (Plate 11). There was one pair of inlet and outlet pipes to the SSW of the tank (Plates 12 & 13).

3.2.2 At the south-east of the gasholder, to the immediate east of the concrete block outbuilding, was the interceptor, formed of three below-ground settling tanks which removed contaminants from any overflow water from the gasholder.

3.2.3 Only the tank was visible as the lifts were all retracted in the tank. The steps to the top of the lifts were visible at the north-east and north-west of the gasholder (Plates 14 & 15). A steel staircase provided access at the north-west of the tank, although access was not permitted during the Phase 1 survey. The walkway at the top of the tank was supported on small triangular brackets set at regular intervals and welded to the tank.

3.2.4 The crown, although not accessible at the time of survey, is shown in the asbestos report and the monthly inspection report (ASKAMS, 2017a; BNP Paribas, 2018), although the images are not of sufficient quality to reproduce here. It can be seen that the crown was a concave structure covered with concentric circles of trapezoidal steel sheets welded together.

3.2.5 There were no manufacturer's details on the tank. The tank was painted green, although peeling paint showed brown paint beneath. The number 124 was painted in white at the west of the tank.

Interior:

3.2.6 The gasholder was dewatered, the tank and lifts cut to form a large opening for the plant at the north-west, and a second, smaller, opening at the north-east. The interior of the gasholder was accessible following the desludging of the interior and prior to the removal of the crown structure (Plate 16).

3.2.7 The lifts, stays, tank, base and the guide rails were all welded while access points were bolted, (as also seen externally in Plate 11) (Plates 17 & 18). The tank was formed of approximately 15mm thick steel sheets to the bottom ring and approximately 11mm above that, although no others could be measured. The tanks were formed of approximately 4mm thick steel sheets (Plates 19 & 20). The roller carriages were supported on a pair of steel angles braced with small bars welded to the inner face of the lifts (Plate 21).

3.2.8 The inlet/outlet pipe extended from the approximate south of the tank (the exterior is shown in Plates 12 & 13), supported on simple steel stands, and extended upwards through the central support (Plates 22 - 25).

3.2.9 The welded plates of the domed crown were supported on a frame of concentric steel rings supported in turn on trusses spanning between the central post and the inner lift (Plates 26 & 27). An additional brace was located at the north-west of the crown, although it was not evident if this was a later repair or part of the original design. The trusses were formed from a bar and rod spanning between the post and inner lift with further bars spanning between the inner lift and the centre of the crown cover. The braces were formed from angles and all joints were bolted.

3.2.10 The central post was formed of a steel cylinder to which the trusses were bolted and supported the crown structure as it rose and fell. This in turn was supported on a steel frame in the centre of the tank when the gasholder was empty (Plate 28). The frame was square in plan and braced diagonally in alternate directions on opposite sides; all members were steel angles bolted together (Plates 29 & 30).

3.3 Brick Building 'Electric Room'

3.3.1 A small structure, aligned north-east to south-west, was to the west of the gasholder and was a flat-roofed, single-storey red brick building in stretcher bond which stood on a concrete base (Plates 31 - 34). A part-glazed wooden door in a wooden frame was to the south-east elevation. Vents were in the south-west wall. The fascia boards were painted timber and the roof covering appeared to be bituminous felt. The roof sloped slightly to the south-west which had black plastic rainwater goods.

Interior:

3.3.2 The interior of the structure was not accessible. The view through the glazed door established that the space consisted of a single room containing electrical plant and the main electrical switch (Plate 35). No other information could be ascertained.

3.3.3 The asbestos report (ASKAMS, 2017b), which also referred to the building as the 'Electric Room', states that there was a plasterboard ceiling and concrete floor; the internal skin of the wall was of concrete blocks.

3.4 Concrete Block Building 'Boiler Room'

3.4.1 To the south of the gasholder was a dilapidated, flat-roofed, concrete block building (Plates 36 - 38). Timber plank double doors were to the east and west walls and vents were in the north and south walls. The roof covering was missing but was evidently a corrugated sheet as the fillet survived to the west wall; the joists survived. The roof sloped slightly to the east to the grey plastic gutter, although the downpipe had gone by the time of survey.

Interior:

3.4.2 There were no partitions within the building. The building contained a pump connected to the two pipes which extended up to the top of the tank (Plate 39). The asbestos report (ASKAMS, 2017a) refers to the building as the ' Boiler Room'. No access was available to the top of the tank to establish the connection to the gasholder but it is probable this structure was associated with the anti-freeze system.

3.5 Office Building

3.5.1 This building was constructed on the site of the Governor House which exploded in 1956. It is unclear if it contained plant, although it is more likely that it was constructed for offices as it is labelled as a Reporting Centre with a separate Governor Site on the available Eastern Gas Property Plan which was originally produced in 1958 but has later, undated, alterations to the drawing.

3.5.2 The red brick building was aligned north-east to south-west with a pitched roof covered with corrugated asbestos cement sheets with asbestos cement ridge, circular finial and barge boards (Plates 40 - 43). The brickwork was in English bond. There were three windows in the north-west elevation which overlooked the service road, two in the end elevations and two in the south-east elevation, either side of the central entrance glazed timber double doors.

3.5.3 The metal-framed windows had 20 panes with the six central panes forming an opening light which appeared to pivot horizontally, but this could not be established with any certainty. The manufacturer could not be established from the external view, although by this date, Crittall had produced for several decades this particular type of window for industrial buildings which were called ‘Fenestra Sashes’. The window at the westernmost end of the north-east elevation had been replaced with a timber-framed window with obscure glass. Several windows, including all to the service road elevation, had metal bars fitted externally. The door and windows were all under painted concrete lintels and the window sills were also concrete.

Interior:

3.5.4 The interior of the structure was not accessible at the time of the Phase 1 survey. The glazed entrance door in the south-east elevation provided one view into the building which showed that the building was divided into several rooms, accessed via glazed wooden doors (Plate 44). A hatch was between the entrance area and the room to the

left of the door. The asbestos report (ASKAMS, 2017b) shows the ground floor divided into three offices, a kitchen, toilet and cupboard with vinyl-tiled floors throughout, although the accuracy of this layout is unclear when compared with the single available view through the door. The roof space had no partitions.

4 CONCLUSION

4.1.1 Gasholder 124 at the former gasworks in Walton Road, Felixstowe was constructed in 1966 on the footprint of an earlier gasholder on a former gasworks which had been reduced in size and used as a gasholder station. The gasworks were commissioned in 1884 and had expanded by the early years of the 20th century, however, the gasworks was reduced to a gasholder station in 1931 when the gas supply was switched to Ipswich. The switch to natural gas between 1968 and 1976 lead to the closure of gasworks throughout the country, although Gasholder 124 was retained for storage. Improvements to distribution plant in recent decades has caused the gasholder to become redundant and the gasholder was isolated from the mains and decommissioned in 2010.

4.1.2 This Historic Building Recording project has researched the history of the site and created a photographic record of the structures and their context before and during their demolition. An archive has been collated to provide a permanent record of the gasholder and ancillary structures which will be accessible at both the county and national research centres.

4.1.3 The wider programme of recording work of the remaining gasholders across the country will allow a greater comparison of the structures between sites.

4.1.4 There are no similar gasholders in the range recorded by OA to date. Welded gasholders were evidently a later innovation, although there is over two decades of overlap between riveted and welded gasholders in the examples surveyed by OA.

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APPENDIX B A SUMMARY OF GASWORKS' PLANT AND PROCESSES

INTRODUCTION

This account of the general development of the gas industry and the functions of gasworks plant and gas holders is based largely on several articles and presentations available online by Professor Russell Thomas, particularly *The History and Operation of Gasworks (Manufactured Gas Plants),* as well as the Monuments Protection Programme Step 1 report and the London Gasholders Survey by Malcolm Tucker.

Gasworks followed a general form, however, the types of each building, plant and equipment and the layout of each site varied widely according to the location, type of coal available, the likely size of the supply required and the manufacturer of the plant. The advancement of technology and the continuous obsolescence and replacement of plant resulted in a regular rebuilding of many gasworks operations.

This appendix describes the general operation of a gasworks and the principle functions of its plant, however, it does not seek to describe every combination of plant available and research should be carried out when investigating each site.

DEVELOPMENT OF THE GAS INDUSTRY IN BRITAIN

General history

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 19th century his methods were used to illuminate various mills and industrial works.

Other important individuals were also helping to develop the industry in this period including Samuel Clegg, an engineer whose 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.

Initially, gas was used for streetlighting and to light industrial works and the homes of the wealthier population, although municipal operations became widespread and by 1820 the principal English and Scottish towns were lit by gas; by 1830, over 200 and by 1859 there were over 1000 public gasworks built across Britain. The industry developed in the later 19th 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.

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 1064 local gas undertakings into 12 area gas boards. The boards would subsequently merge in 1972 to form British Gas, which was privatised in 1986.

In the later 1960s it was decided that the United Kingdom 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; this change also resulted in the physical conversion of every gas appliance in the country. 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.

Some gasworks were partially demolished to create a gasholder station to store the natural gas, removing the gas production buildings and equipment but retaining the gasholders, transmission plant and distribution network. By the early 2000s, gas distribution technology had improved which rendered even the gasholder stations redundant and a programme to dismantle the gasholders was commenced.

ELEMENTS OF A GASWORKS

Introduction

A typical gasworks where coal gas was produced comprised many different elements of plant and processes, and followed the same basic principle, although some of these may only have been included at the larger sites.

Not all coal was suitable for gas manufacture and some coal fields were more suited to different types of retorts and so the gasworks design would be adapted to the coal available. The transport of the coal was also important: the proximity of canals, and later the railways, or sometimes docks in coastal areas, was essential. Many gasworks had their own railway sidings.

The retort

The retort is fundamentally a sealed container where coal would be heated to drive off moisture, gases and various other by-products. The retort house held 'benches' of retorts and the retort construction advanced from cast iron to fireclay to silica giving improved performance and the ability to withstand higher temperatures.

Retorts went through several stages of design; early retorts were horizontal and heated by radiant heat from the furnace below at relatively low temperatures. The coal shrank as it was heated and the resulting coke was raked out of the retort and more coal put in; mechanical stoking equipment was introduced with through-retorts. Inclined retorts were angled at 32° to horizontal, in theory creating less wear and tear and easier to load and unload, but they could be difficult to operate and were only suitable for certain types of coal and so were short-lived.

Vertical retorts were attempted throughout the 19th century but became successful by the turn of the 20th century. There were several types, but the basic principle was that tapered continuous vertical retorts, filled by hoppers above the retort, were heated by burning gas from separate producers. These could carbonise the coal continuously as it descended and the coke was extracted at regular intervals from the bottom of the retort, the residual heat sometimes being used for other purposes. The coke and breeze (the finer ash) which was not needed for reuse on the site was sold as fuel to industrial and domestic customers.

The gas extracted from the coal rose through an offtake pipe at the top of the retort.

Condensers

There were numerous designs for condensers, some using air, some using water, but all of which were used to reduce the temperature of the gas and also begin the process to remove the tarry impurities.

Exhausters

Exhausters drew gas off the retorts and pushed it through the purification system. This was essential to prevent the building up of pressure in the retort.

Cleaning and purification

The gas produced by heating the coal had many impurities which had to be removed before it could be transferred to the gasholder, including, but not limited to, ammonia, tar, hydrogen, sulphide, benzole and hydrocyanic acid.

Numerous machines and systems were patented for this purpose. The method employed was used according to the impurity, and included passing the gas through water or oil in the form of bubbles (washing) or passing the gas over a large area covered in the solvent liquid (scrubbing); in the later part of the 19th century, the distinction between the two was lost and tended to be referred to simply as 'washing'.

Dry purification involved passing the gas through trays of granular lime or iron oxide.

The impurities extracted were often valuable as by-products, such as coal tar, sulphate of ammonia, sulphuric acid, benzole, hydrocyanic acid and the spent lime from the purification, and these were also sold to other industries.

Metering, storage and distribution

The amount of gas produced would then be measured by the station meter before being stored in the gasholder.

The gas was stored in a gasholders to cope with peaks and troughs in demand and to ensure that there was always a ready supply; their form and function will be discussed in the following section.

The station governor maintained the pressure of the gas leaving the holder when distributing it into the gas mains. Using a similar principle to the gasholder, the pressure was controlled using weights set onto a floating bell, although as with most other gasworks equipment, designs varied. Booster pumps were later developed to increase the pressure of the gas flowing into the gas main and were particularly used when the area supplied was far from the gasworks or where a gasholder station was used for the storage of gas between the gasworks and the remote location.

GASHOLDERS

Introduction

The introduction of gasholders removed the need for continuous gas production, the storage also acted as a buffer for periods of high demand and during halts in production and contained enough gas supply for 24 to 36 hours.

The basic principle of a gasholder is that it consists of two parts: a tank containing water and a cylindrical vessel called a 'lift'. The water provided a seal to prevent the gas from escaping and acted as a resisting surface to the incoming and exiting gas; the lift held the gas, rising and lowering according to the volume. The weight of the lift determined the pressure of the gas in the mains - and the back pressure on the gas making plant if no exhauster was used. Weights could be added to the lift or lifts if additional pressure was required, such as at times of high demand.

History

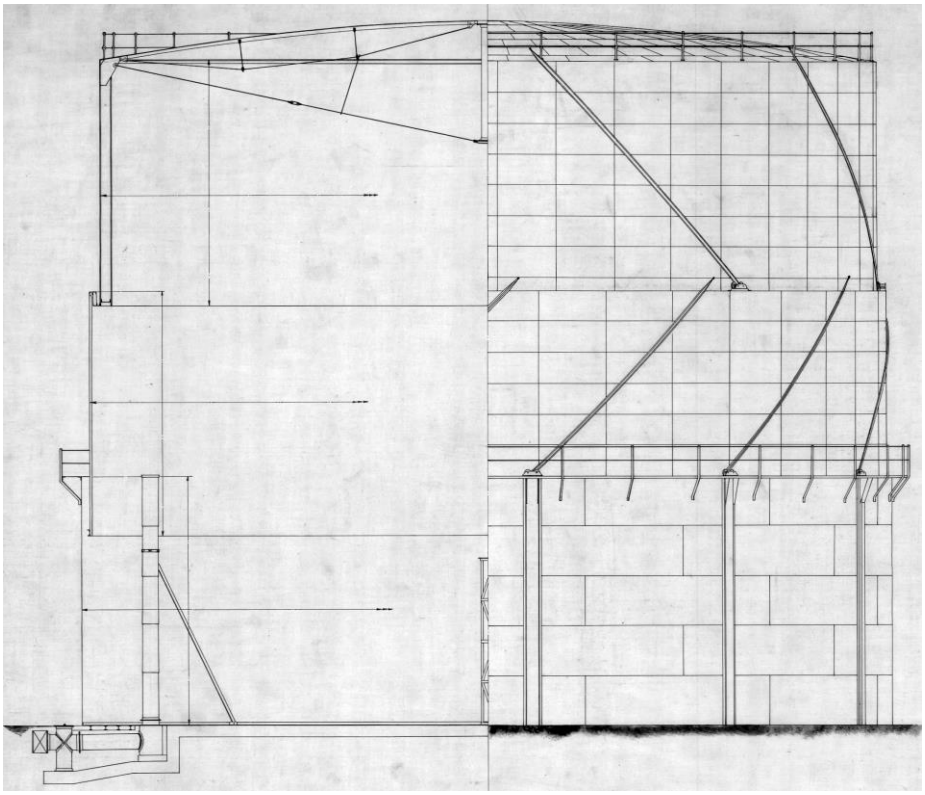
The earliest gasholders were small and built of iron or wood with the moving vessel guided by counter weights on chains. The wooden tanks particularly, sometimes repurposed from the brewing industry, were unreliable and prone to leaking.

From the early 19th 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 recognisable feature of any gasworks (Appendix Figure 1).

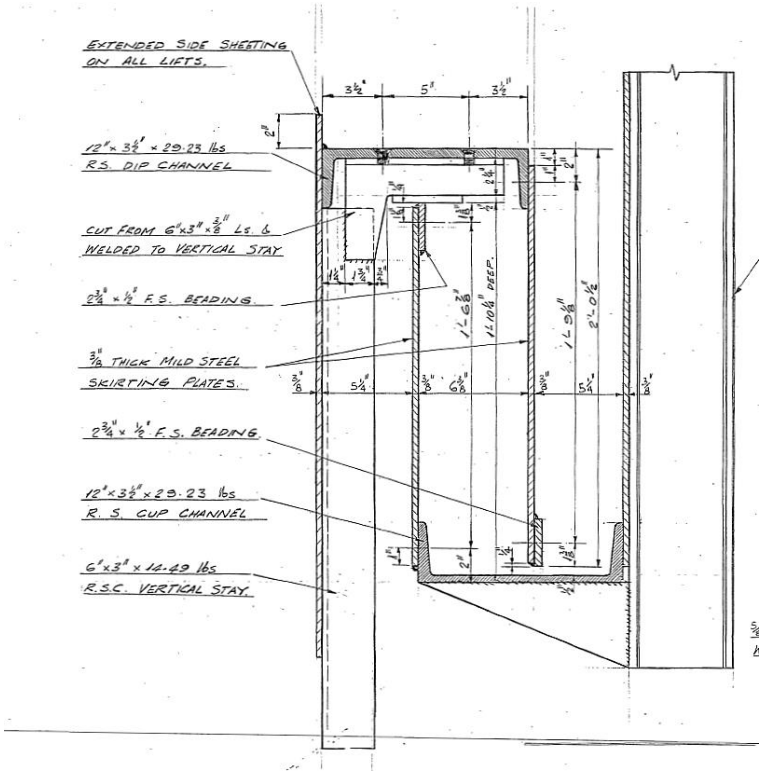
By the time the industry became established, above ground tanks were usually made from steel on a circular concrete slab. The steel floor plate was laid on top of the slab and the steel plates forming the sides of the tank were attached to the floor plate using a steel curb. The sides of the tank were constructed from rows of steel sheets, the bottom row thicker than those above it which often decreased in thickness with the height of the tank. The plates were usually rivetted, although some later tanks were welded.

Below-ground tanks were also used, built of brick, stone or concrete and sometimes cut into bedrock if it was suitable; each method must be made watertight, usually using puddle clay or render. The centre of the tank need not be excavated, leaving a dumpling in the centre of the tank.

The gas was prevented from escaping by a water seal in the tank and around each lift. The top of the tank and each lift returned towards the centre of the gasholder, called a 'dip' and the base of the next lift returned towards the outer edge of the gasholder, called a 'cup' (Appendix Figure 2). When the lifts rose, the cup and dip, which contained water, would interlock and form a seal against the gas within the gasholder.



Appendix Figure 1: A section and elevation of an above-ground two-lift spiral guided gasholder (Extract of drawing EA/SA/FEG/E/T/1 National Gas Archive)



Appendix Figure 2: A cross-section of the cup and dip seal of the lifts of a gasholder which would be filled with water when the gasholder was in use (Extract of drawing NW/MA/DNE/E/E/6 National Gas Archive)

Originally, gasholders used a single lift, but later the telescopic gasholder was invented whereby separate close fitting vessels would be located within one another so that each inner lift would rise when the outer one reached its capacity. This allowed increased storage on the same footprint.

Initially the upper lifts of the early types of telescopic holders were guided by columns or frames; guide rails on the inner face of the columns guided wheels on arms attached to the top of the lifts, keeping the lift in place as it rose and fell. A short-lived cable-guided gasholder was developed whereby the lift was guided by a system of wire ropes and pulleys, although their use was not widespread.

In the late 1880s the spirally-guided gasholder was invented comprising a series of lifts which would rotate and spiral up or down with each chamber guided by the one below. Each lift would have diagonal guide rails fixed to its side which would engage with roller carriages fixed to the top of the vessel beneath. These guide rails could rotate the lifts in alternating directions or in the same direction, according to the design.

Waterless or Dry Gasholders were developed in the early 20th century which used an internal piston which moved with the aid of guide rollers within a static tank and fixed roof; three main types were developed: the MAN gasholder used a tar or oil seal, the Klonne used a grease seal and the Wiggins used a rubber seal.

There were many styles of gasholders, but with the exception of the waterless gasholders, the chief distinction between the types was regarding the method of guiding and support of the lift or lifts.

The crown

The nature of the support for the domed crown is among the most interesting aspects of any gasholder and it is also an area where a variety of approaches evolved in the 19th century.

The interest is partly as a result of the structure being required to function under two quite different conditions. When a holder is inflated the crown is naturally supported by gas pressure so in this situation there is no need for a large superstructure but when the holder is empty the crown needs to be supported.

Early holders tended to have a trussed crown with radial structures where the dome was self-supporting, albeit with a fixed prop which could support the centre of the crown when the holder was lowered. These trussed crowns were often technologically sophisticated and in the middle decades of the 19th century the spans of the larger holders often rivalled or exceeded the largest spans of industrial sheds or railway stations. This is of course a misleading comparison because the structure was supported by pressure when the holder was inflated and when it was deflated there was a fixed stanchion at the centre to help support the crown.

However, in *c*1850 another approach, that of the 'untrussed crown' was introduced (Tucker, 2000) in which the crown was either supported by gas pressure (when the holder was inflated) or by a fixed 'rest frame' when the holder was empty. The frame, of either timber of

ironwork would not rise with the crown when the holder inflated, and this type of holder was widely used in the 1860s and 1870s.

Another slightly different approach to the trussed crown was introduced in the 1870s with 'radial girders'. These were ribs with plates or lattice webs beneath and the central fixed prop as with trussed crowns. All three types of crown continued to be used into the 20th century (Tucker, 2000).

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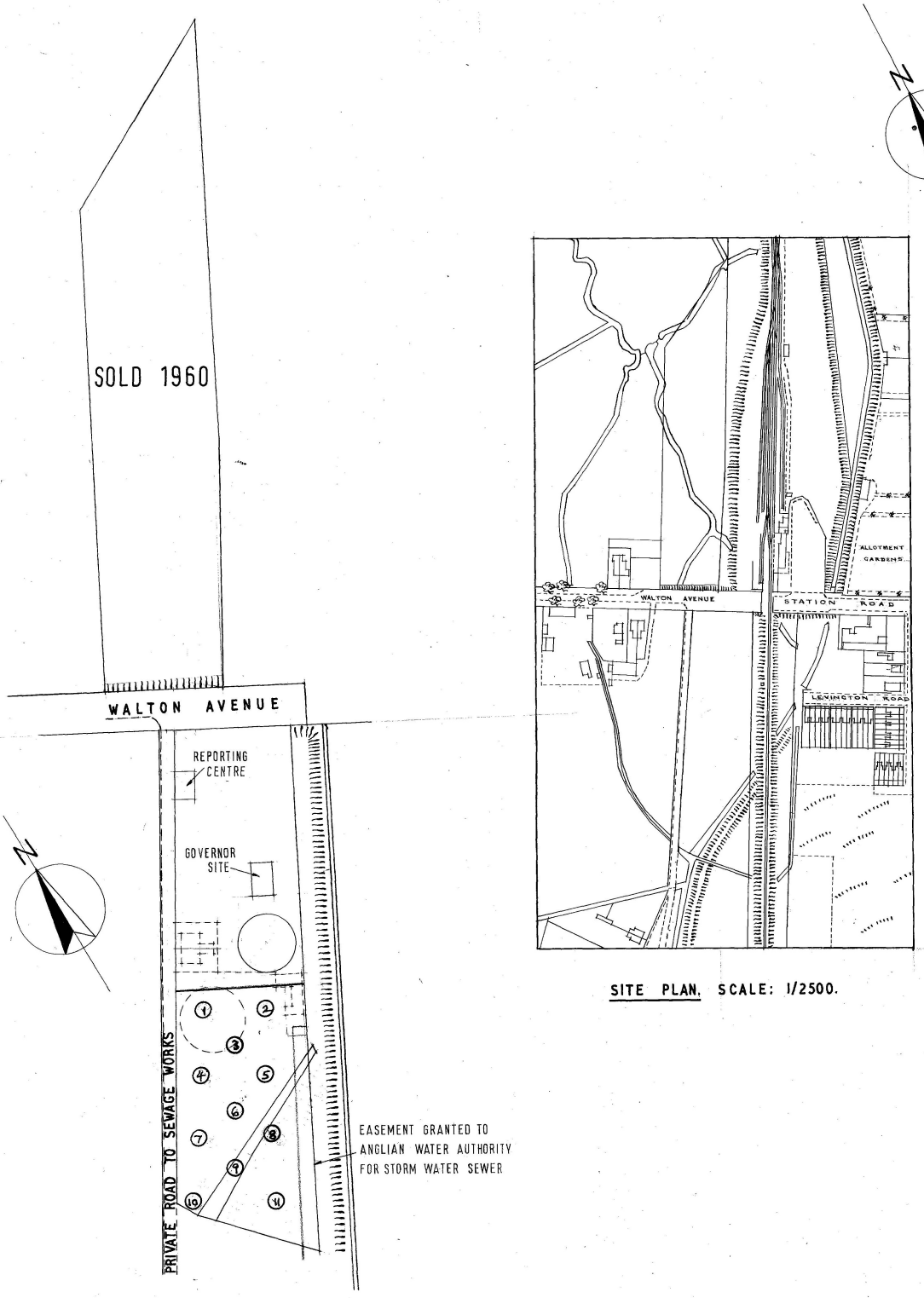
APPENDIX C OASIS FORM

PROJECT DETAILS		
Project name	Building Recording of gasholder at Walton Avenue Former Gasworks, Felixstowe.	
Short description	Oxford Archaeology was commissioned by Montagu Evans LLP on behalf of National Grid to create an Historic Building Record of Gasholder 124 and its ancillary structures at the Former Gasworks, Walton Avenue, Felixstowe. Gasholder 124, an above-ground spiral-guided gasholder with three lifts and a welded tank, was constructed in 1966 on the footprint of a 19th-century gasholder; the site by this time was a gasholder station on the site of the former gasworks which had closed in 1931. This forms part of a national programme of recording these distinctive structures which have formed familiar landmarks in towns and cities throughout much of the 19th and 20th centuries. The archive record that is being produced will allow comparison between different sites. The project has also included research on the history of the site.	
Project dates	Site work undertaken on 27 June 2018 and 1 July 2020	
Project type	Building recording	
Previous work	None	
Future work	Potential for further historic investigation	
Monument type	Non-listed structure	
Significant finds	N/A	
PROJECT LOCATION		
Site location	Former Gasworks, Walton Avenue, Felixstowe	
Study area	The area containing the gasholder is approximately 39m x 45m	
Site co-ordinates	TM 29127 33479	
PROJECT CREATORS		
Name of organisation	Oxford Archaeology	
Project brief originator	Montagu Evans	
Project design (WSI) originator		
Project Manager	Jonathan Gill	
Project author	Angela Warner	
PROJECT ARCHIVE		
		Content
Physical	Suffolk Historic Environment Record	Site records, report, notes, digital photos
Paper		
Digital		

Figure 1: Site location



EASTERN GAS		PROPERTY PLAN.	
AREA. SOUTH ANGLIA	PROPERTY. FELIXSTOWE HOLDER STATION AND LAND		REF. NO.
TOWN. FELIXSTOWE	SCALE. 1/1250.	DATE. 1958.	S 486.

Figure 2: Eastern Gas Property Plan. Dated 1958 with later, undated, alterations.
National Gas Archive Document Reference: EA/SA/FEG/E/E/1

This Drawing is for Reference Purposes Only. It is Recommended that prior to this Drawing being used, its suitability and accuracy is confirmed.

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DO NOT SCALE. IF IN DOUBT ASK. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED.

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SITE UNDER OFFER
FREEHOLD

CONTAINER AND
TRAILER PARK

GASHOLDER No.124

Office

Vent

Interceptor

IC

Gully

Surface Drain

100 Dia Drain

100mm Pipe
Through
Bund Wall

75 mm
Tank
Overflow

100 Dia

150 Dia

Piped Ditch

To IC
Downstream

1.6m

RAILWAY
STATION

Level
Crossing

SB

SP

3.4m

BEACH STATION ROAD

Ambulance
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LEVINGTON ROAD

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Site: FELIXSTOWE GASHOLDER STATION M37

Title: SITE DRAINAGE LAYOUT

SP Ref: NETWORK STRATEGY WAS M37-BS 13

Drg No: EE/M37XXX/N/001

Revision 2

Not to scale

Figure 3: National Grid Site Drainage Layout showing the extant structures

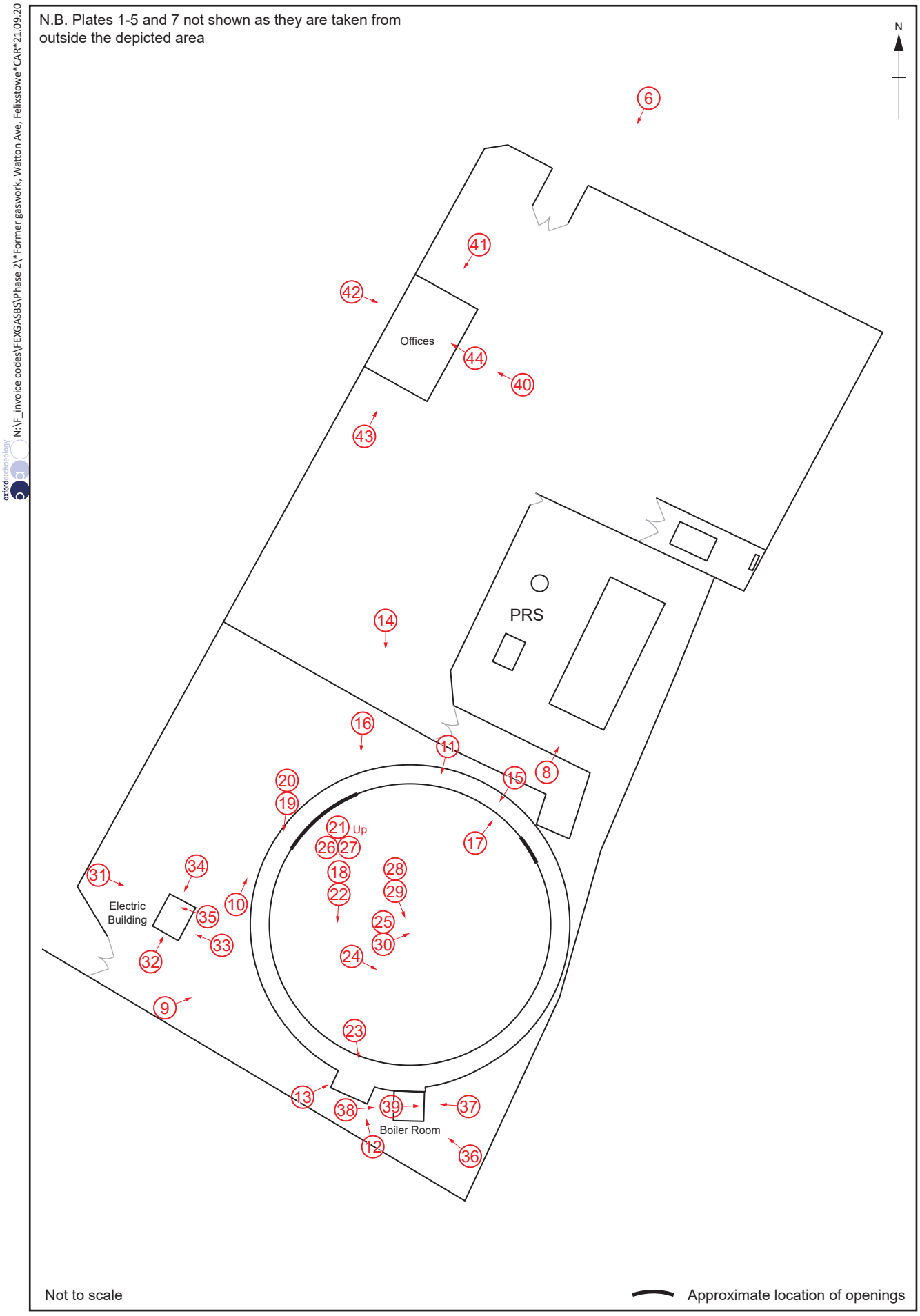

Figure 4: Photograph locations of plates

Plate 1: Looking north across site the morning after the flood. 1st February 1953. ©Environment Agency

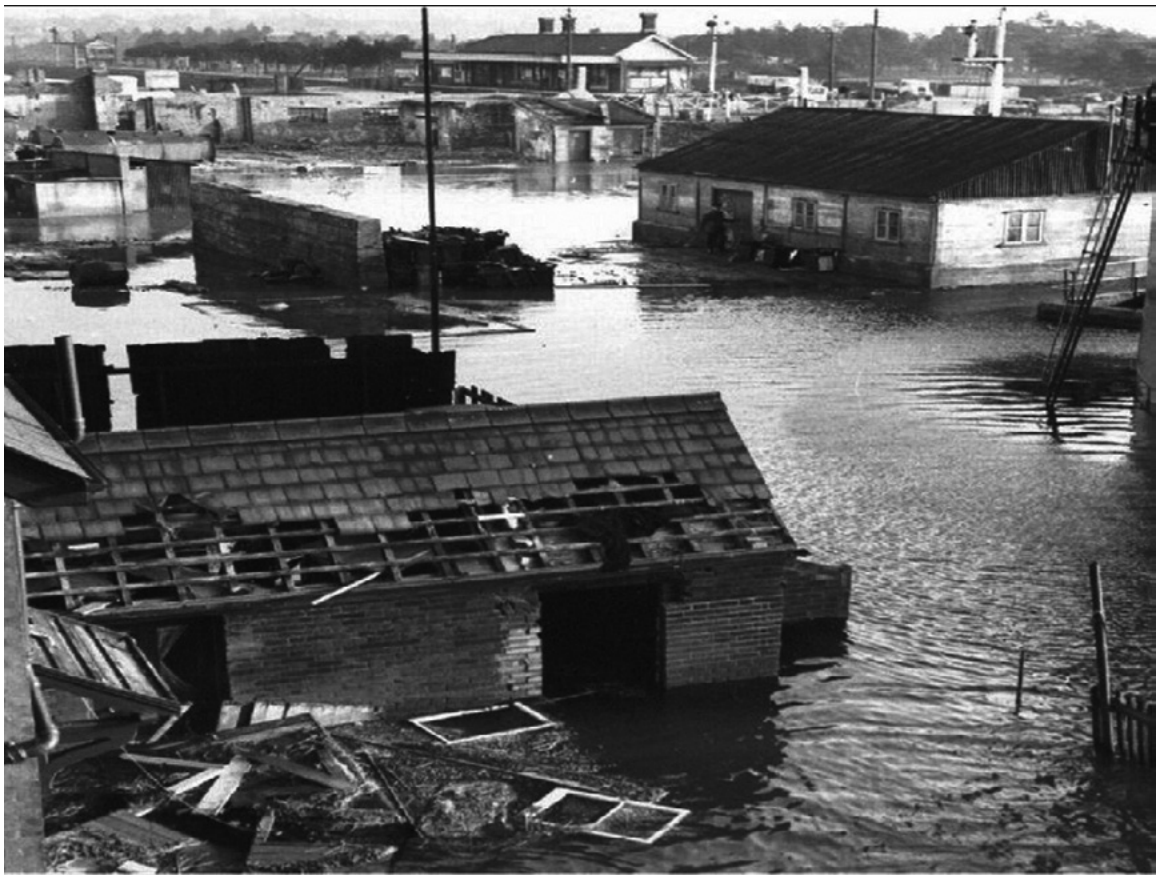

Plate 2: Looking north across site the morning after the flood. 1st February 1953. ©Environment Agency

Plate 3: Looking north across site the morning after the flood. 1st February 1953. ©Environment Agency

Plate 4: The Governor House following the explosion of 6th January 1956, looking south. National Gas Archive Document Reference: EA/FEG/E/F/1/xg02662

Plate 5: Undated aerial view of the site, looking approximately south. c1970s or 1980s. National Gas Archive Document Reference: EA/DX/E/F/3/xg02643

Plate 6: The view of the site from Walton Avenue, looking south

Plate 7: The view of the site from the service road, looking north-east

Plate 8: The PRS, looking north

Plate 9: The gasholder, looking north-east

Plate 10: The bund surrounding the gasholder

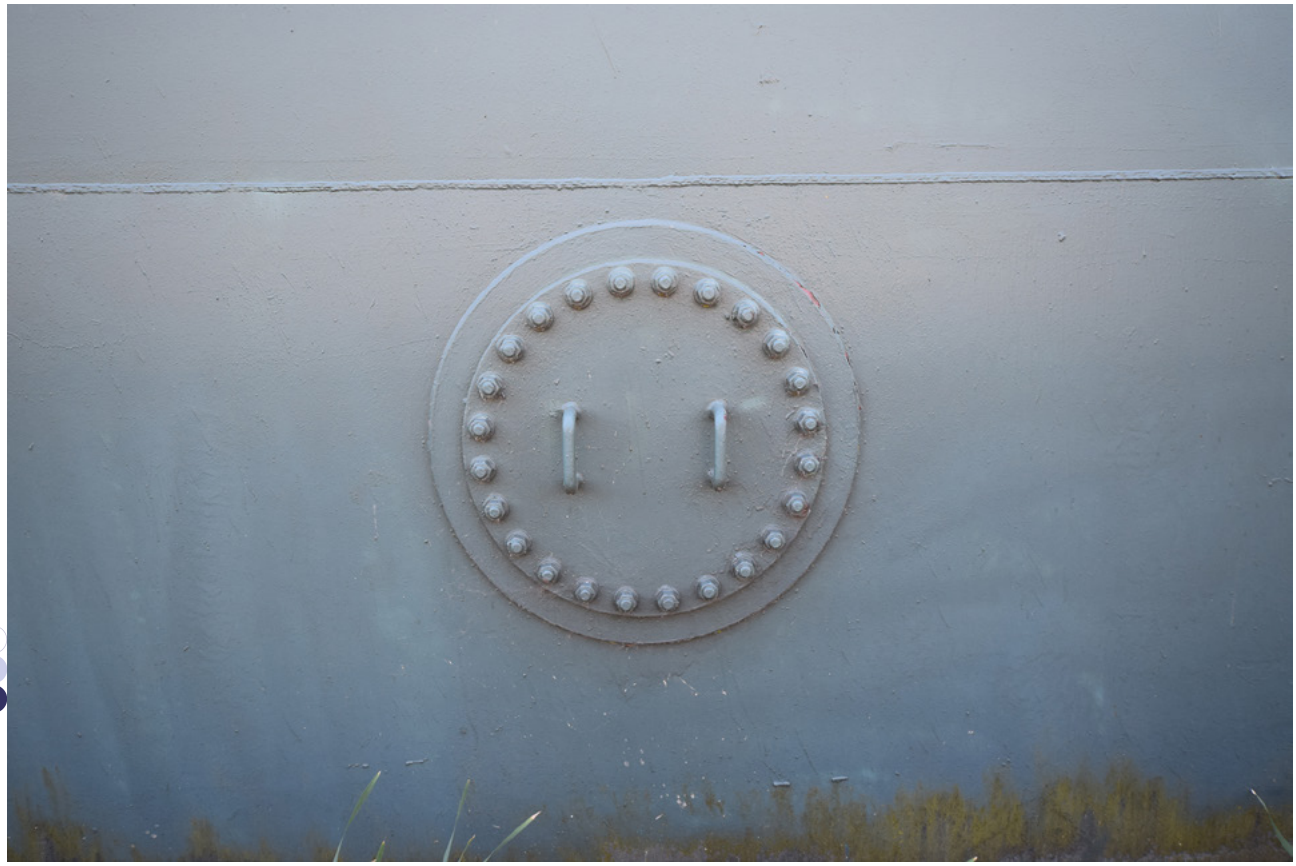

Plate 11: The access hatch at the north of the gasholder

Plate 12: The inlet and outlet pipes

Plate 13: The inlet and outlet pipes, detail

Plate 14: The steps to the top of the tank and lifts

Plate 15: The steps to the lifts

Plate 16: The tank after opening-up and desludging, looking south-east

Plate 17: An example of the inner lift and fixtures

Plate 18: The base of the tank

Plate 19: A cross section through the tank and lifts

Plate 20: A cross section through the tank and lifts including the cups

Plate 21: An example of a roller carriage bracket

Plate 22: The interior of the gasholder, looking south

Plate 23: The inlet/outlet pipe in the interior of the gasholder

Plate 24: The inlet/outlet pipe support

Plate 25: The inlet/outlet pipe inside the support post

Plate 26: The crown structure

Plate 27: The trusses

Plate 28: The support structure

Plate 29: The base of the support structure

Plate 30: An example of the bolted joints

Plate 31: The brick building in relation to the gasholder, looking east

Plate 32: The south elevation of the brick building

Plate 33: The east elevation of the brick building

Plate 34: The north elevation of the brick building

Plate 35: The view through the glazed door of the interior of the brick building

Plate 36: The concrete block building in relation to the gasholder, looking north

Plate 37: The east elevation of the concrete block building

Plate 38: The west elevation of the concrete block building

Plate 39: The interior of the concrete block building, looking east

Plate 40: The east elevation of the office building

Plate 41: The north elevation of the office building

Plate 42: The west elevation of the office building

Plate 43: The south elevation of the office building

Plate 44: The view through the glazed door of the interior of the office building

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