

**BETHNAL GREEN GASHOLDERS,
LONDON**

**HISTORIC BUILDINGS RECORD
(Historic England Level 2)**

NGR 534613 183410



**Project No. 160002
Report No. 2016114**

April 2016



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(HISTORIC ENGLAND LEVEL 2)**

NGR: 534613 183410

**Commissioned by
Montagu Evans
on behalf of National Grid**

**Project No. 160002
Report No. 2016114
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SUMMARY

In March 2016 Archaeology South-East (a division of the Centre for Applied Archaeology, UCL) carried out a programme of historic building recording of the gasholder station in Bethnal Green, London (NGR: 534613 183410). The work was commissioned by Montagu Evans LLP on behalf of National Grid, in advance of the redevelopment of the site.

The site occupies an area of land measuring c. 1.86ha. The site is located east of Marian Place in Bethnal Green, London, E2 9AX. The site is bound to the north-east by Regent's Canal, to the north-west by residential developments along Darwen Place, and by commercial properties to the east, south and west. The gasholder compound comprises four large gasholders: No. 2 to the north (built in 1866), with No. 5 to its east (built in 1889), No. 1 to the south-east (rebuilt in 1925), and No. 4 to the south-west (rebuilt in 1931). Two ancillary buildings (the Valve House and Gas Pumping Plant Building) are situated to the west of the site, near the Marian Place entrance. The remains of a fuel tank and the Foreman's House are situated within the same area. Modern gas plant are situated between the former Valve House and Gas Pumping Plant Building.

Gasholder No. 2 reflects one of the earliest surviving examples of a double-order two-tier gasholder, designed by Joseph Clark. Despite alterations to the columns the holder retains much of its character and grandeur – albeit lessened by its proximity to the might of Gasholder No. 5.

Gasholder No. 5 is the most dominant feature on the site, and present in the skyline from the canal, railway line, and nearby streets. The holder was the largest constructed at the time by the Gas Light and Coke Company. The holder is one in a series designed by George Trewby, the first example in fact of such a construction technique being used to such a scale (the first four being diminutive builds at St. Pancras).

Gasholders No. 1 and No. 4 represent fairly typical examples of 20th-century water-sealed spiral-guided design, based on a developed design by Gadd & Mason of Manchester (1887).

The gasholders and associated buildings are illustrative of the general evolution of both gasholder and plant design during the 19th and 20th centuries which was inextricably linked to broader trends in the gas, electric and by-product industries.

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1.0 INTRODUCTION

- 1.1 In March 2016 Archaeology South-East (a division of the Centre for Applied Archaeology, UCL) carried out a programme of historic building recording of the gasholder station in Bethnal Green, London (NGR: 534613 183410; Figure 1). The work was commissioned by Montagu Evans LLP on behalf of National Grid, in advance of the redevelopment of the site.
- 1.2 The site's redevelopment, including the possible demolition of the gasholders and the associated non-operational plant, is to be carried out by National Grid under permitted development rights set out in part 17, Class F of the General Permitted Development Order for Statutory Undertakers.
- 1.3 A brief for the works was produced in January 2016 by Montagu Evans LLP (Montagu Evans LLP 2016). A description and history of the site has been previously produced by Malcolm Tucker (English Heritage 2000), emphasising the significance of two of the gasholders (Gasholders No. 2 and No. 5) for their age, aesthetic and design value.
- 1.4 The gasholder station is a non-designated site. There are a number of designated heritage assets (e.g. scheduled monuments or listed buildings) located within 500m of the site and the north-east part of the site is located within the Regent's Canal Conservation Area. The boundary of the conservation area incorporates Gasholders No. 2 and No. 5.

2.0 SCOPE & METHODOLOGY

- 2.1 The scope of work and methodology for the building recording is detailed in a brief produced for the work by Montagu Evans LLP, dated November 2016. The work was also carried out in accordance with the relevant ClfA standards and guidance.
- 2.2 Gasholders No. 1 and No. 4 and the ancillary structures were recorded to Historic England Level 2 as defined by Historic England (English Heritage 2006a), while Gasholders No. 2 and No. 5 were subjected to an enhanced Historic England Level 2 record in accordance with the above document and the brief issued by Montagu Evans LLP (November 2016). A Level 2 record is essentially a descriptive record.
- 2.3 The descriptive section of this report uses the gasholder terminology provided in the *London Gasholders Survey* (English Heritage 2000, 7-8). Definitions for the main structural components have been summarised in a separate appendix at the back of this report (see Appendix 1).
- 2.4 The site was visited by Seth Price and Hannah Green on the 14th and 15th March 2016 in order to carry out the recording work. This entailed the compilation of written notes and the production of a photographic record. Selected structural components of Gasholders No. 1 and No. 5 were also drawn for illustrative purposes.
- 2.5 The drawn record was produced using measurements obtainable from ground level, supplemented by details obtained from photography; the dimensions of upper level frame components are therefore approximate where actual measurements could not be obtained.

- 2.5 The photographic record comprised high-quality digital photography. Selected photographs include a scale, to provide appropriate reference to detailed shots. Within the report selected images have been reproduced as plates, together with a full index of the digital photography and location plots (Figures 20-24). A full catalogue of all photographs is included in the archive.
- 2.6 A professional fine-art architectural photographer has also been commissioned by National Grid, in order to fully record the gasholders at the site prior to any alterations and to capture the setting of the structures. The resulting photographs will be incorporated as an appendix to this report once they become available.
- 2.7 In drawing up this report, a variety of cartographic and documentary sources were consulted. Relevant sources were obtained/sought from the National Gas Archive (NGA, Warrington), Historic England Archive (Swindon), the National Archives (NA, Kew) and the Tower Hamlets Local History Library and Archives. Additional sources held within the Archaeology South-East library were utilised, and appropriate on-line databases interrogated. A search was made of the aerial photographs held by the Historic England Archive, as well as the Britain from Above website (2015) and Google Earth website. Material from other sources has been referenced separately within the text where necessary. A full list of the cartographic sources used can be seen at the end of this report (Section 7.0); where possible, the pictorial sources referred to within the text are reproduced as figures.

3.0 SITE LOCATION

- 3.1 The site occupies an area of land measuring c. 1.86ha (Plate 1) and is located east of Marian Place in Bethnal Green, London, E2 9AX (Figure 2). The site is bound to the north-east by Regent's Canal, to the north-west by residential developments along Darwen Place, and by commercial properties to the east, south and west. The site can be accessed from both Marian Place to the west and Emma Street to the south. Internal circulation is defined by paving running east then south from Marian Place, with a gravel surface servicing the rest of the site. The surrounding area comprises a mixed 19th- and 20th-century mixed use landscape. Site boundaries are defined by metal palisade fencing to the canal, and a mixed brick wall to east, west, and north-west. The rear curtilage of a mid-20th-century office building defines the southern boundary of the site.
- 3.2 The gasholder compound comprises four large gasholders: No. 2 to the north, with No. 5 to its east, No. 1 to the south-east, and No. 4 to the south-west. Two ancillary buildings (the Valve House and Gas Pumping Plant Building) are situated to the west of the site, near the Marian Place entrance. The remains of a fuel tank and the Foreman's House are situated within the same area. Modern gas plant are situated between the former Valve House and Gas Pumping Plant Building.
- 3.3 All four gasholders have been isolated from the main grid, via cuts in the connecting pipework, and have been purged of gas. Associated piping and plant (defunct siphon pits, volumetric governors and piping) are situated adjacent to each gasholder.
- 3.4 The interiors of the ancillary buildings were not accessible at the time of the site visit, with the exception of one part of the Gas Pumping Plant Building (the Booster Room).

4.0 HISTORIC BACKGROUND

- 4.1 Much of the following site history has been drawn from the *London Gasholders Survey* produced by Malcolm Tucker (English Heritage 2000). The use of gas for street lighting originated during the late 18th century in London and was established by Frederic Windsor. By 1823 London had three gasworks, supporting 40,000 street lamps in 213 streets, demonstrating gas as a viable industry and an effective form of lighting. By 1830 gas street lighting had spread with the erection of 200 gas companies operating throughout England.
- 4.2 The Imperial Gas Light and Coke Company (IGLCCo) was incorporated by Act of Parliament in 1821, opening its first gasworks beside Regent's Canal in 1823 at Shoreditch. The Bethnal Green gasholders were created as a holder site for the Shoreditch works, approximately 0.5km to the west, in the 1853. By 1876 the IGLCCo supplied a territory ranging across north London from Paddington and Hampstead to Clapton and Bethnal Green. The same year the company was merged with the Chartered Gas Light and Coke Company, which had been expanding rapidly with the acquisition of several other coke companies in the London area. The combined Gas Light and Coke Company (GLCCo) was the world's largest gas undertaking until nationalisation in 1949 (English Heritage 2000). Under the GLCCo the gasholders on the site acquired their present numbering, based on ascending order of capacity (No. 1 being the smallest).
- 4.3 The land for the Bethnal Green holder station was purchased from the Regent's Canal Company for £5,750. Prior to its purchasing the site contained an irregular fish pond. The site is referred to as 'Bunker's Pond' in later company minute books. The site was hemmed in by developments from the time of its incorporation as a holder station. A canal layby in the north-east of the site was used to accommodate boats servicing a limekiln and the gasworks further along the river (English Heritage 2000). The 1829 map of the Environs of London (Figure 3) shows the location of the site prior to the construction of the gasholders. The 1862 Stanford's Library Map of London and Its Suburbs (Figure 4) clearly shows the IGLCCo gasworks with two gasholders, and the layby in the canal to its north. The map's accuracy in depicting the locations of the gasholders is slightly off however, as it shows Gasholder No.1 slightly further south than in reality. Both the layby and limekiln, as well as Gasholders No. 1, No. 4 and No. 2 are clearly shown on the 1873-1877 Ordnance Survey (OS) mapping (Figure 5).
- 4.4 Gasholder No. 1 was the first to be constructed, in 1853. It was of two lifts, 38.9m in diameter, and had a capacity of 630,000 cubic feet. The original holder comprised a below ground brick tank with a single order of sixteen classical columns. The ironwork of the original holder was produced by Westwood and Wright's of Dudley, and the engineer was Joseph Clark. In 1925 the Gasholder was adapted to a four-lift spiral-guided gasholder manufactured by S Cutler & Sons Ltd, retaining its original below-ground tank. Westwood & Wright's Ltd (founded 1830, Brierley Hill, Dudley, Staffordshire) are listed in the 1937 British Industries Fair advert as 'Gas and Constructional Engineers' Contractors', and in 1961 as 'general constructional engineers, manufacturing gas plants' (Grace's Guide 2014).
- 4.5 Gasholder No. 4 was constructed in 1856 following an Act of 1854 which authorised an increase in the company's share capital. The holder's tank, constructed of brick bands in cement mortar, measured 62.2m across and 12.65m deep. The holder cost £12,986 to construct and comprised a two-lift holder supported by two orders of classical columns with a nominal capacity of 2,450,000 cubic feet. As with the

previous holder, the works engineer was Joseph Clark, and the metalwork was by Westwood and Wrights (subcontracting a Mr Richard Barrow of the Staveley Iron Co, Derbyshire). In 1931 this gasholder too was also converted to a spiral-guided gasholder of three-lifts, 12.19m in height.

- 4.6 Gasholder No. 2 was the third holder to be constructed on the site (originally known as No. 11). The plan for constructing the gasholder was resolved upon in December 1864. Its construction would require the diversion of a public sewer as well as access to a tenant's wharf and limekiln to the north-east. An injunction by the tenant resulted in the holder being redesigned at a smaller size, in order to avoid a delay. The holder was designed with a capacity of 920,000 cubic feet, rather than the intended 1 million. The holder is smaller than the original Gasholder No. 4 to its south-west, but was designed to be architecturally very similar to Gasholder No. 4, with two orders of classical columns, Doric superseded by Corinthian, bound by two tiers of traceried girders. The tank and dry well (sump) were constructed by Thomas Docwra and Sons, at a cost of £7,250, while the ironwork was once again designed by Joseph Clark and constructed by Westwood and Wright's for £10,675. The holder was completed in 1866. Gasholder 2 remains much as constructed, with minor alterations and deductions from its architectural detailing.
- 4.7 The 1873-77 OS mapping (Figures 5) show the site at the time, with the three gasholders, and the layby and limekiln to the north-east. At the time the site was encompassed by residential developments, with primary access granted to the west via Marian Place. The oval is shown to the east of the site, and a park square recorded as Marian Square is shown to the north-west. The only buildings of the site, with the exception of those pertaining to the limekiln, appear to be two small storage structures, and superintendent's cottage near the entrance from Marian Place. Emma Street is shown running along the south margin of the site.
- 4.8 Gasholder 5 was the last gasholder to be produced at the site (No. 3 being located at the Shoreditch works to the west). The holder was the fifth in a series designed by George Careless Trewby, and the first example of his box-lattice design being used to a large scale – the first four being much smaller affairs at St. Pancras (English Heritage 2000, 110). The holder was completed in 1889, with a capacity of 4.2 million cubic feet; the largest constructed by the GLCCo to that date. In order to construct the holder the tenant's canal layby was bought-out and infilled. The holder's tank is of concrete construction, measuring 61m in diameter, and 15.4m in depth, constructed by Messrs Lucas, Aird and Ellis for £16,786. The work necessitated the underpinning of the adjacent gasholders (No. 1 and No. 2). The construction of the ironwork was awarded to Samuel Cutler and Sons at the cost of £25,671. The gasholder was designed by the engineer George Trewby.
- 4.9 Both the 1896 and 1916 OS mapping (Figures 6 and 7) show no details of the site proper, although both maps indicate the infilling of the canal layby. By 1916 the square to the west of the site had been replaced by a stone yard. A series of aerial photographs taken in 1936 show the working gasworks encompassed by development and situated alongside the ribbon of the Regent's Canal (Figure 8). Gasholders No. 1 and No. 4 are clearly spiral-guided by this time. To the east runs the railway, paralleled by the line of Cambridge Heath Road. The images show Gasholder No. 5 dominating the site, with its striking framework dwarfing the adjacent structures.
- 4.10 A site plan dated to 1938 (NG Archive: NT_GAL_E_E_1) shows the four gasholders, labelled with their nominal capacities (Figure 9). No. 1 and No. 4 are labelled as

spiral guided gasholders. The former superintendent's cottage is not shown, and a new foreman's house had been built. The new house was constructed in 1937 by Messrs. A. E. Symes Ltd. for a cost of £903.10 (NG Archive: NT/GAL/E/E/1). The valve house had been constructed by 1938 between No. 2 and No. 4, with a circular structure labelled as a vertical boiler being shown to its east. An inventory of plant and buildings at Bethnal Green (NG Archive: NT/GAL/E/E/1) records that the valve house was constructed in 1937 for £2,400. The valve house would have played a role in regulating flow to and from the main grid, the gasworks, and the individual gasholders. It is possible the building contained plant to increase and decrease pressure flow. The vertical boiler, a steel structure with a 22'6" high chimney stack, is recorded as having been constructed in 1900 and demolished in 1938 (NG Archive: NT/GAL/E/E/1). The map also shows the entrance to Marian Place, with a weigh bridge just within the site, and secondary access to a right of way alongside the bank to the north-east. The weigh bridge was constructed in 1911, with an associated timber structure. The weigh bridge itself was second hand from Haggerston Gasworks. Neither the weigh bridge nor related structure survive.

- 4.11 The 1948 OS mapping (Figure 10) shows the ongoing development and evolution of the surrounding area, though no changes of note are seen within the site. The 1957 and 1967 site plans (NG Archive: NT_NW_BGR_E_E_1 and NT_NW_BGR_E_E_2) show much the same (Figures 11 and 12). A small building to the east of the site entrance is labelled as being leased to the L.E.B. (London Electricity Board). By 1961-71 (Figure 13) mapping shows that the last remnants of the formerly residential area surrounding the site had been removed or redeveloped. Emma Street is no longer shown bounding the south-west of the site, being replaced by large commercial buildings. Two tanks (for fuel) are shown within the site proper, and the L.E.B building by the site entrance is labelled as an electrical substation.
- 4.12 The 1972 site plan (Figure 14) (NG Archive: NT_GAL_E_E_1) shows an additional fuel tank alongside a Gas Pumping Plant Building within the west of the site. The Gas Pumping Plant Building contains a Booster Room (for pressurising gas for distribution to the main grid), Machine Room, and Telemetry Room. The boiler for the tank antifreeze system is still shown to the centre of the site. The 1978-1983 and 1989-1990 OS mapping (Figures 15 and 16) inaccurately portray the site, as they fail to show the Gas Pumping Plant Building. An aerial photograph dated to 1984 (Figure 17) (NG Archive: NT/NTG/E/F/2/14) shows the site much as existing – though with insufficient clarity to facilitate further description.

5.0 DESCRIPTION OF THE STRUCTURES

Operation

- 5.0.1 During operation, each gasholder was filled overnight using a volumetric governor and its stock utilised during the day to meet peak periods of demand. When a gasholder was filled, the inner lift rose vertically and automatically engaged the annulus ring of the second lift. This process is known as 'cupping'. As the gasholder contents further increased, the second lift engaged the third lift, and the process repeated until the gasholder was full. When gas was extracted, the process worked in reverse with the outermost lift descending until it automatically disengaged or 'uncupped' from the next inner lift (National Grid 1999, 7-8).

5.1 Gasholder No. 1

The General Design

- 5.1.1 Gasholder No. 1 is situated to the south-east of the site. The gasholder represents a relatively typical example of a water-sealed gasholder. The original gasholder was constructed in 1853 – the first gasholder to be constructed at the site – being modified to a four-lift spiral-guided gasholder in 1925. The spiral-guided holder was built to a developed design first patented in 1887 by Gadd & Mason of Manchester (English Heritage 2000, 41; Appendix 2). The spiral-guided design features a series of rails arranged in a helical pattern set at 45 degrees around the entire circumference of the bell. This design produced a self-supporting structure eliminating the need for an external guide frame and resulted in a significant reduction in construction materials required. The economic design and easily maintainable construction increased its popularity, such that by the 1930s the design was commonly used for the construction of new gasholders (English Heritage 2000, 42). Gasholder No. 1 retains its original 1853 below-ground brick tank. The in-ground tank design utilises the surrounding ground to oppose the outward compressive force generated by the structure (English Heritage 2000, 59). The holder's lifts are constructed of riveted steel sheets.

The Principal Elements

- 5.1.2 Gasholder No.1 (Plate 2) is of a four lift spiral-guided design with in-ground brick tank. The tank has a diameter of 38.90m and depth of 8.00m. A concrete rim (200mm in width) was added to the tank during the conversion of the gasholder in 1925 (Plate 3). The holder has a diameter of 38.30m and a maximum extended height of 31.00m. The nominal working capacity of the gasholder is 1,134,000 cubic feet. Its bell has a convex crown constructed of eight rings of riveted steel plates (Plate 4). The first ring is of horizontally lain sheets strengthened with additional riveting, with the inner seven rings being formed of vertically orientated sheets. The interior of the holder can be accessed via circular hatches in the crown.
- 5.1.3 The top of the lift walls (lift grips) measure 330mm in width. Each lift is separated by a water sealed channel (lute). The outermost lute measures 335mm in width, while the inner lutes measure 170mm (Plate 5).
- 5.1.4 The gasholder is equipped with monitoring equipment to provide warning for low water levels and pressure monitoring alarm systems. Hose cables for filling under-filled lutes (with water and anti-freeze) are also present, fed by a ring main which runs parallel with the edge of the tank. Cables and hoses associated with the

aforementioned systems are guided by four sets of steel cable guide V-section channels as the holder extends (Plate 6) – ensuring cables are not over-strained, caught, or tangled. Each cable guide features a Boss 10 bar pressure gauge (Plate 7). A series of four panels situated on the west side of the holder are part of a graduated pressure warning and venting system to prevent over pressurisation of the tank (Plate 8). The panels are mounted on steel stanchions surmounted by 45° angle irons. The panels themselves are simple square shaped steel panels with attached switches facing towards the centre of the gasholder. The panels are labelled ‘LO’ (low-pressure alarm), ‘LOLO’ (low-pressure alarm and shutdown), ‘HI’ (high-pressure alarm) and ‘HIHI’ (high-pressure alarm and shutdown) in turn. Associated plant at ground level includes a switch box with Honeywell emergency switches and transmitters to vent or process gas from or to the gasholder and a cup level monitoring system junction box (Plate 9).

- 5.1.5 A series of guide carriages of paired-wheel type are located at regular intervals around the perimeter of each lift excepting the first (Plates 10 and 11): 12 on the second lift, 12 on the third lift, 16 on the fourth lift, and 24 on the tank edge. The guide carriages serving the inner and middle lifts are mounted to the top of the corresponding lift wall (lift grip). The guide carriages serving the outer lift are fixed to the edge of the tank, set 170mm over the outer lute. All guide carriages are secured with a bolted footplate. The guide carriages are of a uniform size (880mm x 280mm) excepting the outermost guides which are more substantial and measure 990mm x 500mm. The differing size and construction of the outer guide carriages is due to their function in supporting the greatest weight. The carriages were produced by Steel-All, with the outer carriages being constructed to Steel-All patent 19984.
- 5.1.6 Each guide carriage houses its respective I-section guide rail which is inclined at 45°, and gripped between the paired carriage wheels (see Appendix 2). The first spiral-guided designs originally housed the guide rails internally but they were later housed externally for ease of maintenance, giving significant operational advantages over column-guided holders (English Heritage 2000, 42). The lifts alternate in their operational rotation, starting in an anti-clockwise direction from the inner lift outwards.
- 5.1.7 The outer edge of each lift is served by a handrail, comprising typical angle-iron uprights and tubular rails with a height of 1.14m replete with a 150mm high footplate (Plate 12).
- 5.1.8 Each lift was served by a narrow steel staircase (Plate 13). The staircases have been truncated since the decommissioning of the gasholder. The staircases are formed of textured steel treads with open risers between parallel angle-iron steels supported by a now truncated angle-iron framework. The stairs feature I-section guide-rails along their inner edges, which accommodate the guide rails of the upper lifts as they rise. The direction and form of the stairs curves to match the form and rotation of the gasholder. A concrete slab and pair of steel footings adjacent to the west side of the holder likely correspond to a removed outer stair.
- 5.1.10 Associated pipework, in the form of a siphon pit and volumetric governor lie immediately to the north-west of the holder (Plates 14 and 15). The pipework has been isolated from the main grid by the removal of interconnecting pipework. The pipework was produced by Donkin (part of AVK UK). The siphon pit to the north-west of the holder features a yellow stock-brick lined dry-well fitted with Westwood & Wright’s Ltd. pipework and a rather fetching Lee, Howl & Co. Ltd. Oasis hand-cranked wheel sump pump with serpentine spokes. Lee, Howl & Co. Ltd. was established in Tipton in 1880, specialising in pump production.

5.2 Gasholder No. 4

The General Design

- 5.2.1 Gasholder No. 4 is situated to the south-west of the site. As with Gasholder No. 1 the gasholder represents a relatively typical example of a water-sealed gasholder. The original gasholder was constructed in 1857, being modified to a three-lift spiral-guided gasholder in 1931. Gasholder No. 4 retains its original below-ground brick tank. The holder's lifts are constructed of riveted steel sheets.

The Principal Elements

- 5.2.2 Gasholder No. 4 (Plate 16) is of a three-lift spiral-guided design with in-ground brick tank. The tank has a diameter of 62.17m and depth of 12.19m. A concrete rim (200mm in width) was added to the tank during the conversion of the gasholder in 1931 (Plate 17). The holder has a diameter of 61.26m and a maximum extended height of 35.36m. The nominal working capacity of the gasholder is 3,275,000 cubic feet. Its bell has a convex crown constructed of 13 rings of riveted steel plates (Plate 18). The outer four rings are of horizontally lain sheets strengthened with additional riveting, with the inner nine rings being formed of vertically orientated sheets. The interior of the holder can be accessed via circular hatches in the crown.
- 5.2.3 The top of the lift walls (lift grips) measure 340mm in width. Each lift is separated by a water sealed channel (lute). The outermost lute measures 465mm in width, while the inner lutes measure 150mm (Plate 19).
- 5.2.4 The gasholder is equipped akin to Gasholder No. 1 with monitoring equipment to provide warning for low water levels and pressure monitoring alarm systems. Hose cables for filling under-filled lutes (with water and anti-freeze) are present, fed by a ring main which runs parallel with the edge of the tank supported at waist-height by angled steel stanchions. Cables and hoses associated with the aforementioned systems are guided by three sets of steel cable guide V-section channels as the holder extends (Plate 20) – ensuring cables are not over-strained, caught or tangled. Each cable guide features a Boss 10 bar pressure gauge. As with Gasholder No.1, a series of four pressure alarms are situated on the east side of the gasholder. Associated plant at ground level includes a switch box to vent or process gas from or to the gasholder and top-up pump, and a cup level monitoring system junction box (Plate 21).
- 5.2.5 A series of guide carriages of paired-wheel type are located at regular intervals around the perimeter of each lift excepting the first (Plates 22 and 23). There are 36 carriages to the outer lift. The outer carriages feature two differing sizes of concrete base (1.99m x 1.83m x 0.24m and 1.20m x 1.34m x 0.33m), arrayed in a regular pattern of one large base followed by two small. The bases do not seem to correspond to the location of the 24 columns of the former 1858 column-guided gasholder. Each of the outer carriages is fixed to its corresponding base by four large (100mm diameter) holding-down bolts. The guide carriages serving the inner and middle lifts are mounted to the top of the corresponding lift wall (lift grip). The guide carriages serving the outer lift are fixed to the edge of the tank, set 240mm over the outer lute (Plate 24). All guide carriages are secured with a bolted footplate. The guide carriages are of a uniform size (420mm x 380mm).

- 5.2.6 Each guide carriage houses its respective I-section guide rail which is inclined at 45°, and gripped between the paired carriage wheels (see Appendix 2). The lifts are consistent in their rotation, differing to Gasholder No. 1, rotating clockwise.
- 5.2.7 The outer edge of each lift is served by a handrail, comprising typical angle-iron uprights and tubular rails with a height of 1.10m replete with a 120mm high footplate.
- 5.2.8 Each lift was served by a narrow steel staircase (Plate 25). The staircases have been truncated since the decommissioning of the gasholder. The staircases are formed of textured steel treads with open risers between parallel flat-iron steels supported by a now truncated angle-iron framework. The stairs feature I-section guide-rails along their inner edges, which run through inverse guide carriages of the upper lifts as they rise. The direction and form of the stairs curves to match the form and rotation of the gasholder. A concrete slab and pair of steel footings adjacent to the north side of the holder correspond to the removed outer stair (Plate 26).
- 5.2.10 Associated pipework, in the form of a siphon pit and volumetric governor lie immediately to the north-east of the holder (Plate 27). The pipework has been isolated from the main grid by the removal of interconnecting pipework. The pipework was produced by Donkin (part of AVK UK). The siphon pit to the north-east of the holder is similar to that seen alongside Gasholder No. 1, albeit with two hand-cranked sump pumps rather than one.

5.3 Gasholder No. 2

The General Design

- 5.3.1 Gasholder No. 2 is situated to the north of the site (Plate 28). Built in 1866, the gasholder was the oldest surveyed as a part of the *London Gasholders Survey* (English Heritage 2000). The gasholder is of two lifts supported by 16 guide columns, and was designed to enable a storage capacity of 900,000 cubic feet (Plate 28). The actual working capacity of the holder is recorded as 806,000 cubic feet (NG Archive: NT/GAL/E/E/1). The guide frame corresponds to a 'Type 14', in the typology devised by English Heritage (English Heritage 2002, 35) and measures 40.60m in diameter, with a height of 22m. The majority of the frame is constructed using riveted wrought iron and cast iron components.

The Principal Elements

- 5.3.2 The in-ground tank is constructed of London stock brick with a diameter of 40.60m with a depth of 11m (English Heritage 2002, 93) (Plate 29). The tank is presumed to have been made watertight using hydraulic lime mortar with bands of several courses of bricks laid in Portland cement mortar with embedded hoop-iron reinforcement (English Heritage 2000; 84). Behind the initial brick rim to the gasholder (220mm in width) is a concrete surface extending 370mm to a timber surface. The timber may extend below ground, forming an initial lining to the tank's pit.
- 5.3.3 The holder has a diameter of 39.62m and a maximum extended height of 21.34m. Its bell has a convex crown constructed of 14 rings of riveted steel plates, likely supported internally by a truss structure (Plate 30). The outer ring is of horizontally lain sheets strengthened with additional riveting, with the inner rings being formed of vertically orientated sheets. Additional reinforcement is provided by lines of six vertical sheets extending to the crown of the bell from opposite each column. The interior of the holder can be accessed via circular hatches in the crown. A rack for

concrete counterbalance blocks is situated on the north side of the crown. A short bridge to the south-east side provides access to the crown while the holder is retracted (Plate 31). The bridge is bolted to the crown via two I-girder baseplates. The walls of the bell are formed of small close-riveted plates (measuring 0.60m x 1.29m) erected in a straight-joint pattern (English Heritage 2000, 85). Both lifts feature vertical stiffeners, mounted opposite each guide column (external for the second lift, and internal for the first).

- 5.3.4 The top of the lift (lift grip) measures 340mm in width. Each lift is separated by a water sealed channel (lute). The outermost lute measures 430mm in width, while the inner lute measures 130mm (Plate 32). The lift grips and corresponding cups are formed of flat iron plates and angle-iron members, rectangular in section, predating the ready availability of curved rolled channels (English Heritage 2000, 85)
- 5.3.5 The guide frame structure of Gasholder No. 2 consists of two stacked orders of 16 cast-iron columns 8.20m apart (6.67m at column base), with two tiers of composite I-section (English Heritage Type F) girders (Figure 18; Plate 33). The columns sit atop substantial square-sectioned pedestals (1.36m x 1.64m x 2.08m including mouldings) with a cyma moulded cornice and matching inverted mouldings below, atop a rectangular plinth (English Heritage 2000, 84). The pedestals are decorated with a panelled dado, with the date '1866' embossed at the centre of the outward face. The lower order sits atop a double torus above a square plinth surmounting the pedestals. The lower order of columns have Doric capitals, with reeded mouldings below the echinus and above the abacus while the upper order are capped by Corinthian capitals, devoid of their original foliage (English Heritage 2000, 83). The Corinthian capitals have trumpet-flared heads where the acanthus leaves have been removed. The spandrel between the two orders, to which the lower girders attach, is decorated in typical Doric manner, with triglyphs superimposed by metopes. The flared ribs above the spandrel were formerly hidden behind cyma mouldings (*ibid.*). The upper spandrel is decorated alike with the Corinthian capital below, with acanthus inspired mouldings to its cornice, formerly rising to a prominent cornice block which has since been removed (*ibid.*). Both orders feature entasis, and have a simple neck ring below their capital. The exposed interior of one of the pedestals demonstrates the hollow nature of the moulded columns, with internally bolted joints, and internally concealed holding-down bolts (Plate 34).
- 5.3.6 The composite I-section girders are of cast- and wrought-iron construction, and measure c.8.20m in length (Figure 18; Plate 33). The girders are formed of cast-iron filigree friezes strengthened by rolled angle-iron flanges which are bolted to both faces along each edge. The angle-iron pieces are then bolted in turn to the spandrels between the orders. The designs within the girders varies from the upper tier to the lower, with overlapping roundels above, and an eclectic interweaving pattern of fluted shapes below. The use of intermediate girders between each standard increased horizontal stiffness to protect the outer leg of the standard from lateral buckling (English Heritage 2002, 96). Its first ever use on a gasholder was by Joseph Clark for the original guide frame of Gasholder No. 4 (English Heritage 2000, 47).
- 5.3.7 The guide columns each feature an inset to their rear, which houses a cast iron T-section guide rail (155mm in width) (Plate 35). The guide rails are attached to the columns by a series of twelve bolted-on flared cast-iron brackets. Cast-iron guide carriages are situated in-line with each column, with a large carriage bolted to the crown atop the first lift, and a lesser carriage atop the lift grip of the second lift (Plate 36). The guide carriages are of a typical goose-neck cantilever design of diminishing size so that they stack, Russian doll-esque, one atop the other. The larger top

carriages have large baseplates, bolted to the bell of the holder, measuring 790mm x 560mm, and large flanged guide wheels measuring 300mm in width, with substantial flanges. The smaller carriages measure 515mm x 465mm with a wheel width of 220mm. Smaller flangeless guide-wheels mounted on trunnions attach to external stiffeners on the exterior of the second lift, extending below the water level of the outer lute (English Heritage 2000, 84). The trunnion mounted guide wheels were not visible at the time of the survey.

- 5.3.8 The gasholder is equipped akin to the other gasholders, with monitoring equipment to provide warning for low water levels and pressure monitoring alarm systems. Hose cables for filling under-filled lutes (with water and anti-freeze) are present, fed by a ring main which runs parallel with the edge of the tank supported by the pedestals. Hose cables are guided to the top of the second lift by simple crooked stanchions atop the lift grip (Plate 37). Each cable guide features a Boss 10 bar pressure gauge. A series of typical four pressure alarms are situated on the east side of the gasholder. Associated plant at ground level includes a switch box to vent or process gas from or to the gasholder and top-up pump, and a cup level monitoring system junction box.
- 5.3.9 The outer edge of each lift is served by a handrail, comprising typical angle-iron uprights and tubular rails with a height of 1.13m. The handrails are not an original feature, having been added in 1942 at the cost of £481 (NG ARCHIVE: NT/GAL/E/E/1).
- 5.3.10 The gasholder is served by two levels of caged ladders, one for each tier of the guide frame (Plates 35 and 38). The ladders are mounted on the south-east of the gasholder. The ladders are open on the gasholder side so that the bell can be accessed at any level of extension. The ladders are formed of tubular iron rungs supported between flat-iron rails and protected by a cage of curving cast-iron ribs. A small landing, formed of a flat iron sheet protected by angle-iron uprights and tubular rails, provides access between the two ladders.
- 5.3.11 Associated pipework, in the form of a siphon pit and volumetric governor lie immediately to the south-east of the holder (Plate 39). The pipework has been isolated from the main grid by the removal of interconnecting pipework. The pipework was produced by Donkin (part of AVK UK). The siphon pit is similar to the two described above, albeit with a differing design of pump, lacking the serpentine spokes and makers mark. The siphon pit measures 4.18m in diameter.

5.4 Gasholder No. 5

The General Design

- 5.4.1 Gasholder No. 5 is situated to the north-east of the site (Plates 40 and 41). The gasholder is of three lifts supported by 22 standards, and was designed to enable a storage capacity of 4,200,000 cubic feet (Plate 40). The actual working capacity of the holder is recorded as 4,035,000 cubic feet (NG Archive: NT/GAL/E/E/1). The guide frame corresponds to a 'Type 35', in the typology devised by English Heritage (English Heritage 2002, 35) and measures 61.00m in diameter, with a height of 45.10m. The majority of the frame is constructed using riveted wrought iron components.

The Principal Elements

- 5.4.2 The in-ground tank is constructed of cast-in-place concrete with a diameter of 60.10m with a depth of 15.40m. The tank has a concrete rim 230mm wide (Plate 42). At the centre of each bay is a vertical reinforcing stiffener, projecting slightly above the rim of the tank.
- 5.4.3 The holder has a diameter of 60.00m and a maximum extended height of 45.10m. Its bell has a convex crown constructed of nine rings of riveted steel plates (Plate 43). The outer three rings are of horizontally lain sheets strengthened with additional riveting and measuring 4.16m x 0.84m. The outermost sheeting is notably thicker and more significantly reinforced than the other sheets – likely due to its role in supporting the large primary guide carriages. The inner rings are formed of vertically orientated sheets in a staggered pattern. The interior of the holder can be accessed via circular hatches in the crown. As with Gasholder No.1, a short bridge on the south-east side provides access to the crown while the holder is retracted (Plate 44). A second bridge bolted to the second lift underlies the crown bridge. The walls of the bell have apparently been re-sheeted, as the plates are staggered and notably thick in places (English Heritage 2000, 86). The first two lifts rest on legs internally, thus providing greater clearance from the tank base (*ibid.*).
- 5.4.4 The top of the second and third lifts (lift grips) measure 285mm in width. Each lift is separated by a water sealed channel (lute). The outermost lute measures 475mm in width, the second lute measures 185mm, and the inner lute measures 155mm (Plate 42). The lift grips and corresponding cups are rectangular in section, formed of flat iron plates and angle-iron members.
- 5.4.5 The lattice guide frame structure of the gasholder consists of 22 wrought iron standards spaced 7.82m apart (8.7m from centre to centre) with four tiers of (English Heritage Type L) girders. The stanchions are tapered, constructed in a box girder form of St. Andrew's Cross panels. The base of the stanchions sit atop heavy concrete-filled base-boxes (1.90m x 1.40m) with ovolo moulded iron bases (2.18m x 1.68m) with four substantial integrated holding-down bolts (Plate 45). As the standards taper upwards and narrow, the number of frame panels per storey increases by one – from six at the bottom to nine at the top level (Plate 46). The top of each standard stands proud of the top girder, adding height and elegance to the form.
- 5.4.6 The lower three tiers of girders are of I-section lattice form, comprising repeating St. Andrew's Crosses between angle-irons affixed to larger flat-iron sections, presented narrow side out (Plate 46). The top girder is a box-section lattice form, of repeating St. Andrew's Crosses between angle-irons. The girders attach to the standards via tapered spandrels approximately 11.30m apart. The top-most spandrel differs in design to the lower ones, in fitting with the variation in girder form.
- 5.4.7 The rear of each stanchion climbs vertically, supporting large rolled H-section guide rails (210mm x 155mm) (Plate 47). The guide rails are affixed by bolted on 'L' shaped ties between each panel. Guide carriages are situated in-line with each standard, with a large carriage bolted to the crown atop the first lift, and a lesser carriage atop the lift grip of the second lift, and a diminished carriage to the third lift (Plate 48). The guide carriages are of a typical goose-neck cantilever design of diminishing size so that they stack one atop the other. The larger carriage differs, however, in having tangential rollers in addition to its primary radial guide roller, providing greater stability (Plate 49).

- 5.4.8 The gasholder is equipped as the other gasholders, with monitoring equipment to provide warning for low water levels and pressure monitoring alarm systems. Hose cables for filling under-filled lutes (with water and anti-freeze) are present, fed by a ring main which runs parallel with the edge of the tank suspended from tubular metal ties. Hose cables are guided to the top of the second and third lifts by simple crooked stanchions atop the lift grips, alike with Gasholder No. 2 (Plate 50). In places the ring main features offshoots, rising vertically to the first girder level, from where hoses to the inner loot, rigged to the second lift, descend (thus reducing the distance the hoses must rise) (Plate 51). In addition, at intervals along the ring main are the ubiquitous Boss 10 bar pressure gauges. A series of typical four pressure alarms are situated on the south side of the gasholder. Associated plant at ground level includes a switch box to vent or process gas from or to the gasholder and top-up pump and a cup level monitoring system junction box.
- 5.4.9 The outer edge of each lift is served by a handrail, comprising typical angle-iron uprights and tubular rails with a height of 1.10m replete with a 0.15m high footplate.
- 5.4.10 The gasholder is served by four levels of caged ladders, one for each tier of the guide frame (Plate 52). The ladders are mounted on the south of the gasholder. The ladders are open on the gasholder side so that the bell can be accessed at any level of extension. The ladders are formed of tubular iron rungs supported between flat-iron rails and protected by a cage of curving cast-iron ribs. Small landings, formed of flat iron sheets protected by angle-iron uprights and tubular rails atop the girders, provide access between the ladders.
- 5.4.11 Associated pipework, in the form of a siphon pit and volumetric governor lie immediately to the south of the holder. The pipework has been isolated from the main grid by the removal of interconnecting pipework. The pipework was produced by Donkin (part of AVK UK). The gasholder differs to the other three gasholders, in not having a brick drywell. The siphon pit is equipped with one of the Lee, Howl & Co. Ltd. Oasis hand-cranked wheel sump pump with serpentine spokes (Plate 53).

5.5 Associated Buildings

- 5.5.1 Located to the west of the gasholders are a number of ancillary buildings: the Valve House, the Gas Pumping Plant Building, the electrical substation-come-toilet, and the remains of the foreman's house and a fuel store. With the exception of the booster room within the Gas Pumping Plant Building none of the interiors of the buildings were accessible at the time of the survey. Between the Valve House and the Gas Pumping Plant Building is an area containing modern live gas pipes (Plate 54).

The Valve House

- 5.5.2 The Valve House (Plates 55 and 56) is a single storey flat asphalt-roofed stock-brick building constructed in Flemish bond. The building measures 14.64m x 7.32m x 5.40m with a 2.44m deep basement. The building is fenestrated to south, east and west by large metal-framed windows with brick sills and lintels. Access is provided to the south via a single timber door with an overlight, and north via a single louvred timber door and a large two-leafed timber door. The building features a soldier-coursed brick frieze below an ogee moulded cornice at roof level. To east and west are concrete pits containing isolated pipework, previously connecting to the gasholders (Plates 57 and 58). The pit to the east measures 14.64m x 2.74m x 2.44m, while the one to the west is smaller, being only 7.25m in length. The site

inventory of 1955 (NG Archive: NT/GAL/E/E/1) informs that the building contained a porch, lobby and lavatory as well as a two ton overhead travelling crane. It is presumed that the Valve House contains boiler and antifreeze apparatus, as the line to the ring mains runs from the south side of the building.

The Gas Pumping Plant Building

- 5.5.3 The Gas Pumping Plant Building is an unremarkable late 20th-century fare, constructed of stock-brick in English bond, with a flat roof and irregular footing (Plates 59 and 60). The building contains three rooms: the booster room, the machine room, and the telemetry room. Only the booster room was accessible at the time of the survey. Donkin piping services the booster room through its south and east walls, running above ground from the east of the Valve House where the piping drops below ground level to run to the governors adjacent to the gasholders (Plate 61). Cabling for the alarm and monitoring systems on site run along a panel on the piping to the telemetry and machine rooms.
- 5.5.4 The booster room is accessed via a single timber door in its north elevation and a fire exit to its south. The room contains Donkin pipework and booster plant for re-pressurising stored gas back to grid levels. The room has a concrete floor, rendered walls, and a panelled ceiling (Plate 62).

Electrical Substation and Toilet

- 5.5.5 The electrical substation is a low 19th-century flat-roofed brick building in Flemish bond, constructed against the west wall of the site by the Marian Place entrance (Plate 63). The toilet is situated as a small block on the south wall of the building (Plate 64).

Foreman's House and Fuel Store

- 5.5.6 The remains of the Foreman's House, situated north of the Gas Pumping Plant Building, comprise an 'L' shaped footing of brick and concrete, with an area of remnant brick tiling (Plate 65).
- 5.5.7 The Fuel Store is situated just south of the Gas Pumping Plant Building, and comprises a reinforced concrete box type structure containing two concrete plinths (Plate 66).

5.6 Boundary Wall

- 5.6.1 The boundary wall of the compound varies in form, and reflects the evolution of the Bethnal Green site and development of the surrounding properties. To the west, south of the main entrance, the wall is constructed of 19th-century stock-brick in Flemish bond relieved by regular buttresses and a chamfered engineering brick plinth (Plate 67), running for c. 80m before being keyed into a later wall. To the east of the entrance a mishmash of 19th-century or early 20th-century walls run north-east to the canal, emerging into a similar style of wall to that to the south of the entrance (Plate 68). Alongside the canal runs a modern metal palisade fence (Plate 69). The 19th-century buttressed wall runs along the east side of the site from the canal, before merging into the rear elevation of properties along the oval (Plate 70). At the north end of this section, by the canal, a blocked entrance was apparent (Plate 71) – leading to the canal-side right of way marked on the historic site plans. A small section of the same wall occurs on the south side of the site also, though the majority

of the boundary is defined by the rear of a mid-20th-century commercial building constructed in red stock brick in header bond. A row of late 20th-century street lights run around the site boundary. The two site entrances are modern palisade fence affairs of no particular note.

6.0 DISCUSSION

- 6.1 Gasholder No. 2 was constructed in 1866. The holder reflects one of the earliest surviving examples of a double-order two-tier gasholder, designed by Joseph Clark – who first pioneered the two-tier design for the original guide frame to Gasholder No. 4 at Bethnal Green in order to handle the combined height of the two orders of columns. Despite alterations to the columns (namely the removal of aesthetic architectural components) the holder retains much of its character and grandeur – albeit lessened by its proximity to the might of Gasholder No. 5.
- 6.2 Gasholder No. 5 was constructed in 1889. It is the most dominant feature on the site, and present in the skyline from the canal, railway line, and nearby streets. The holder was the largest constructed at the time by the Gas Light and Coke Company. The holder is one in a series designed by George Trewby, the first example in fact of such a construction technique being used to such a scale (the first four being diminutive builds at St. Pancras).
- 6.3 Constructed in 1925 and 1931 respectively, Gasholders No. 1 and No. 4 represent fairly typical examples of 20th-century water-sealed spiral-guided design, based on a developed design by Gadd & Mason of Manchester (1887). Both gasholders' tanks were previously the basis for early column-guided gasholders, the most notable being Joseph Clark's original Gasholder No. 4.
- 6.4 The structures are illustrative of the general evolution of both gasholder and plant design during the 19th and 20th centuries which was inextricably linked to broader trends in the gas, electric and by-product industries.
- 6.5 The remaining ancillary structures and associated plant serve to give context to the gasholders, while the nearby canal, road and rail connections serve as a reminder of the influence that improved technology and transport links had in advancing the gas industry within Britain.

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Primary Resources

National Gas Archive			
RefNo	Title	Description	Figure
BG44/PD/NT/BOX 8/A	PROPERTY DIVISION	Bethnal Green, development of the Oval adj. holder station ED B410/6; Bethnal Green, holder station ED B410/11; Bethnal Green, holder station demolition ED B410/13; Bethnal Green, Taxation ED B410/15; Billericay, High St s/rooms 1968-81 ED B45; Bow; lease of Roman Rd ED B50/1; Bow Common, Holder station ED B560/5A; Bow Common, demolition ED B56/6	N/A
NT/BOX 6	NORTH THAMES GAS BOARD AND SUCCESSORS	Post 1949 site plans - Cookham, Harrow, Canvey, Lea Bridge, Bromley, Bow Common, Bethnal Green, Southall, Windsor, Poplar, Slough, Brentford, Richmond, Fulham, Staines, Woodford, Missenden, Goswell Road, Stratford, Chertsey, Amersham, Kensal Green, Cannon Lane, East Ham, Romford, Stanford-le-Hope, Hornsey, Battersea, Grays, Holtspur, Little Missenden, Pound Lane, Stanmore, Stepney, Great Missenden, Maidenhead, Marlow, Montgomery Wharf, Shoeburyness, Greenford, Denham, Haggerston, Hawood Terrace, Ilford, Harwood, Heston, Brentwood, High Wycombe, Uxbridge, St Pancras, Mill Hill, Staines, Beckton, Nine Elms, Slough, Amersham, Ascot, Basildon, Billericay, Cannon Lane, Holehaven Creek, Bracknell, Sunbury, Vincent St, Dawley, Colybrook, Beaconsfield, Ingatestone, Monck St, Pinner, Shoreditch.	N/A
NT/GAL/E/E/1	Bethnal Green.	Inventory of Plant & Buildings at Bethnal Green and Site Plan (1938)	9
NT/NTG/E/F/2/14	AERIAL PHOTOGRAPH - BETHNALL GREEN (SCANNED)	BLACK AND WHITE, SHOWS HOLDERS, BUILDINGS AND SURROUNDING AREA	16
NT/NTG/E/F/2/15	AERIAL PHOTOGRAPH - BETHNALL GREEN (SCANNED)	BLACK AND WHITE, SHOWS HOLDERS, BUILDINGS AND SURROUNDING AREA	N/A
NT/NW/BGR/E/E/1	Bethnal Green-Plan of Holders		11
NT/NW/BGR/E/E/2	Bethnal Green-Plan of Holders		12

NT/NW/BGR/E/E/3A	Bethnal Green-Plan of Holders		N/A
NT/NW/BGR/E/E/3B	Bethnal Green-Plan of Holders		N/A
NT/NW/BGR/E/E/3C	Bethnal Green-Plan of Holders		14
Britain From Above			
EPW050849		Gas holders and the residential area at Bethnal Green, Bethnal Green, 1936.	8
EPW050852		St Jude's Church, gas holders and the residential area at Bethnal Green, Bethnal Green, 1936	8
EPW050853		Gas holders and the residential area at Bethnal Green, Bethnal Green, 1936	8
EPW050656		Gas holders and the residential area at Bethnal Green, Bethnal Green, 1936	8
Historic Mapping			
N/A	Environs of London to a Distance of 32 Miles from St. Paul's Cathedral, 1829		3
N/A	Stanford's Library Map of London and its Suburbs, 1862		4
N/A	Ordnance Survey Map, 1873-1877		5
N/A	Ordnance Survey Map, 1896		6
N/A	Ordnance Survey Map, 1916		7
N/A	Ordnance Survey Map, 1948		10
N/A	Ordnance Survey Map, 1961-1971		13
N/A	Ordnance Survey Map, 1978-1983		15
N/A	Ordnance Survey Map, 1989-1990		16

8.0 DEPOSITION OF THE ARCHIVE

A full archive intended for deposition with a suitable local museum has been prepared. The archive has been assigned the site code MRA16. In addition a digital copy (pdf) of the report will be supplied to Montagu Evans; the Historic England Archive, Swindon; the National Gas Archive, Warrington and GLAAS. The full site archive will be prepared in accordance with the principles of *Management of Research Projects in the Historic Environment (MoRPHE)* (English Heritage 2006b) and the requirements of the recipient body. The full archive will comprise a hard copy of the full report, a pdf version of the report on CD, the full photographic record with registers, field notes and drawings.

9.0 ACKNOWLEDGEMENTS

Archaeology South-East would like to thank Montagu Evans LLP, for commissioning this Historic Building Record, on behalf of National Grid. The author would like to thank all those who helped with archival enquiries, but particularly Alison Percival (National Gas Archive, Warrington) and Charis Abraham (Historic England Archive, Swindon).

PLATES



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Plate 2: Gasholder No. 1 (MRA16-0031)



Plate 3: Concrete rim to the brick tank of Gasholder No. 1 (MRA16-0012)

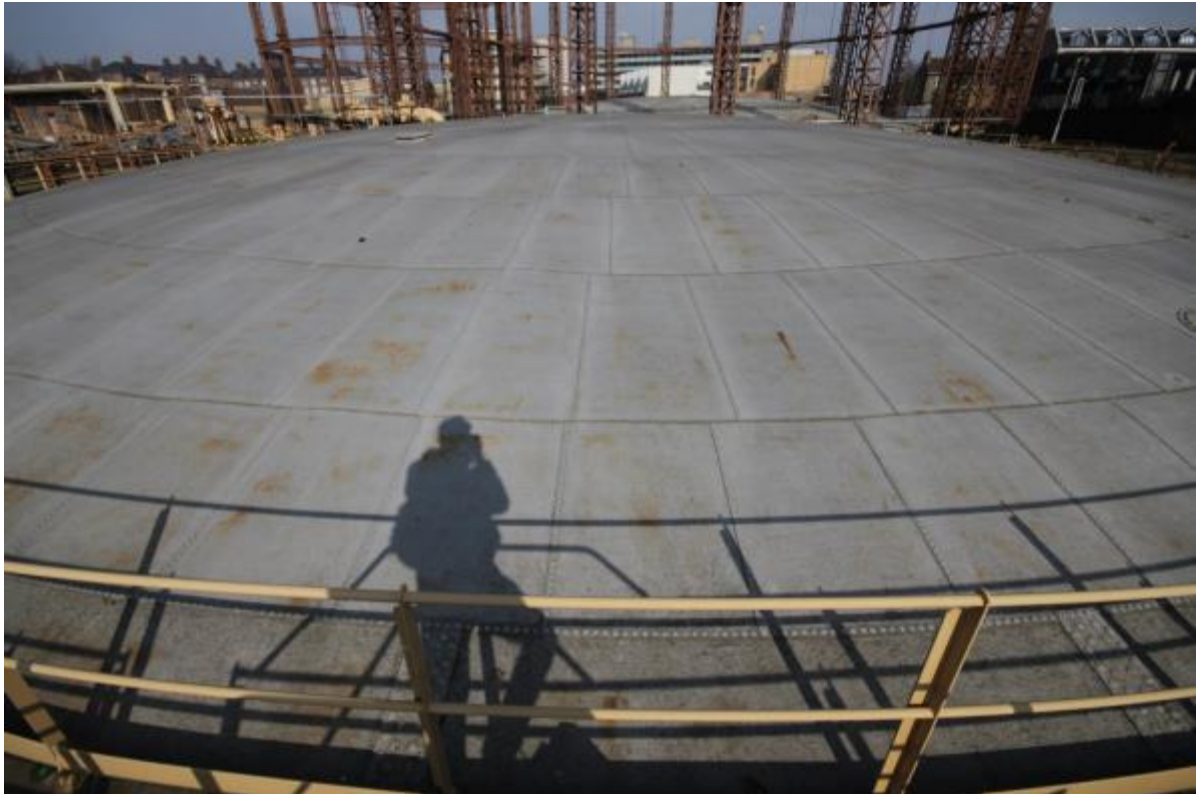


Plate 4: Crown of Gasholder No. 1 (MRA16-0018)



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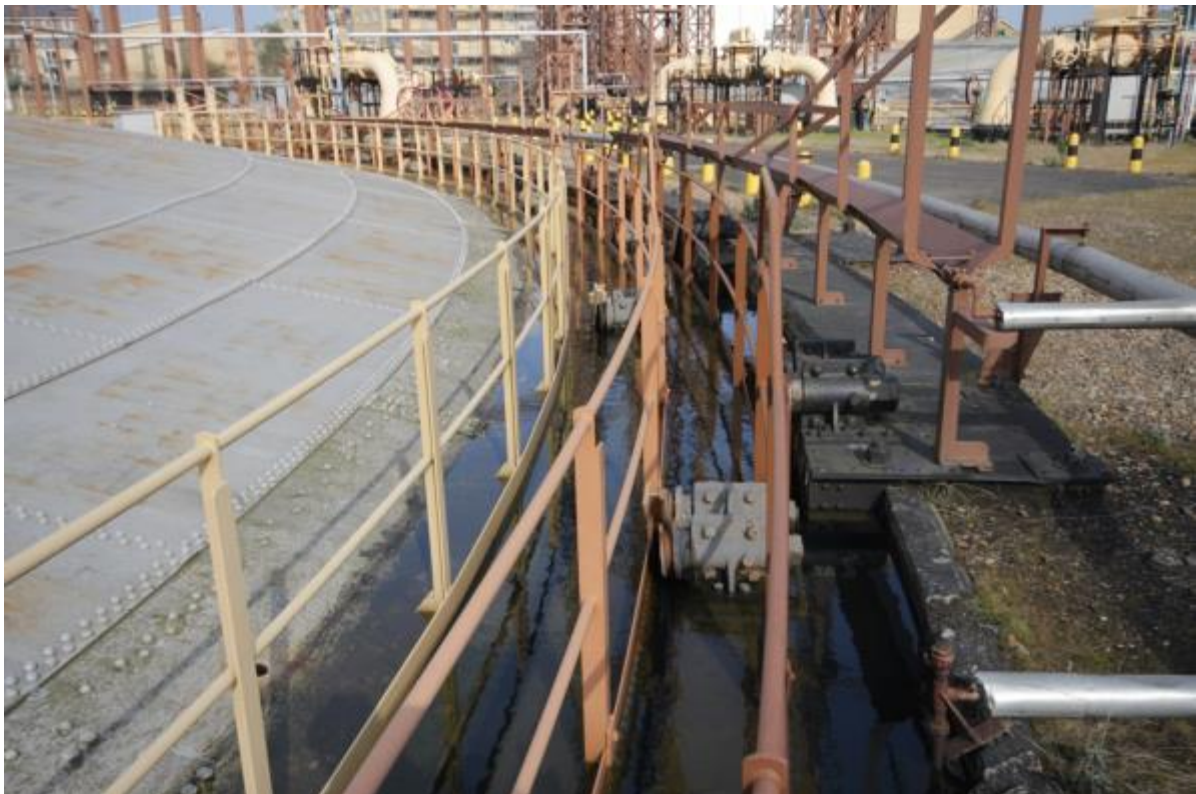


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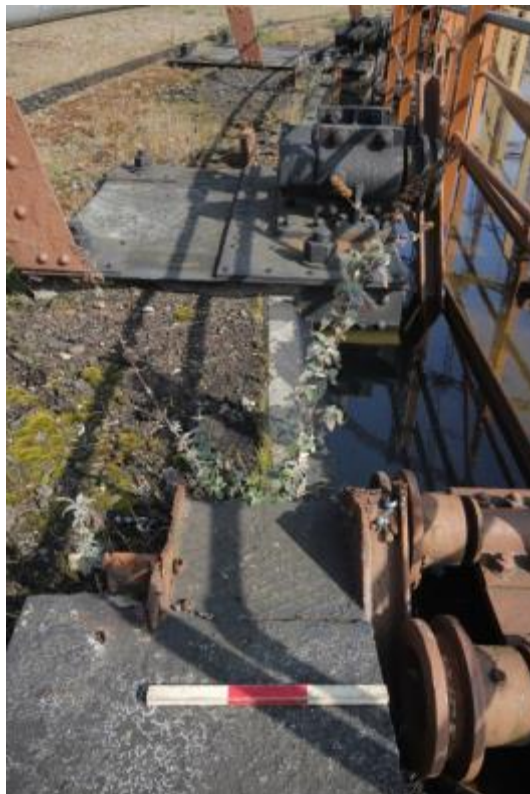


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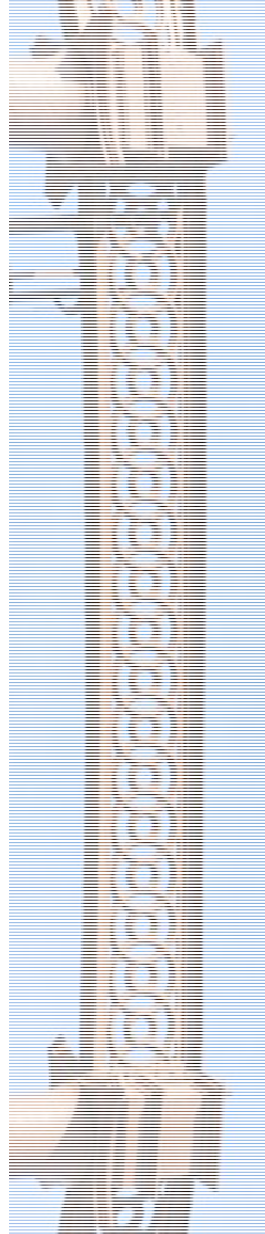
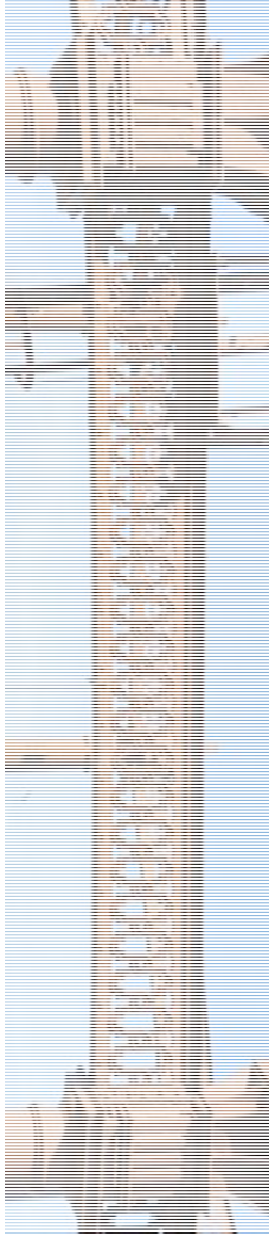


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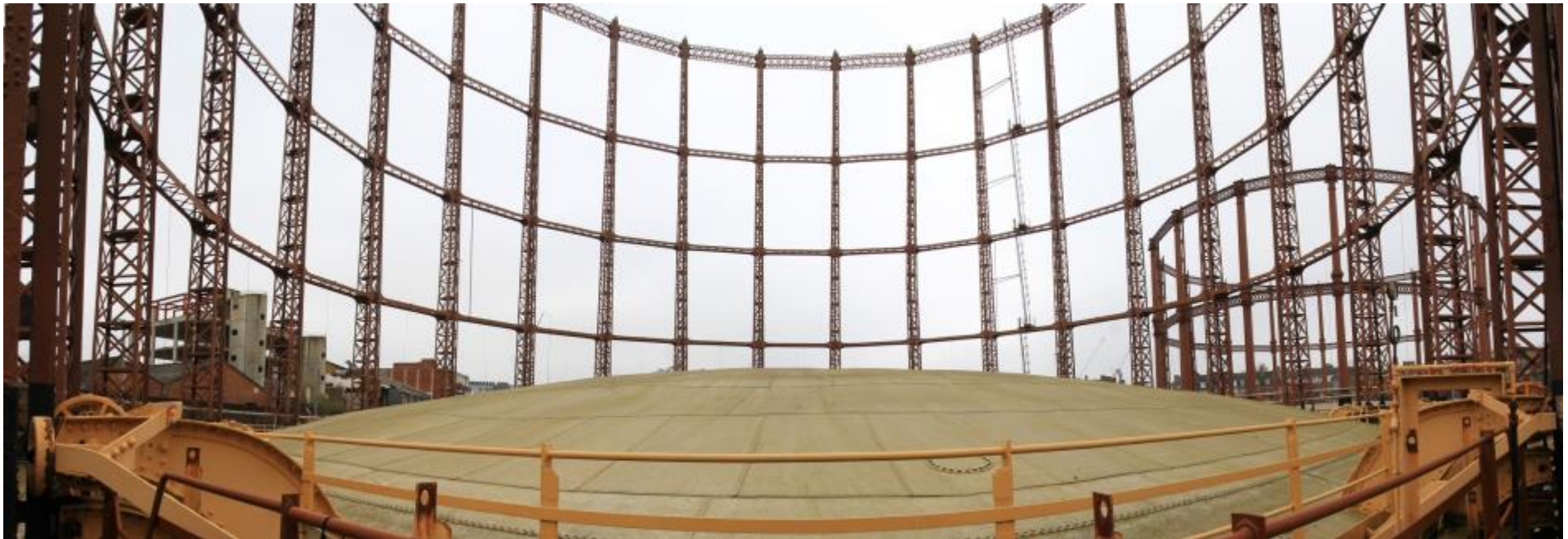


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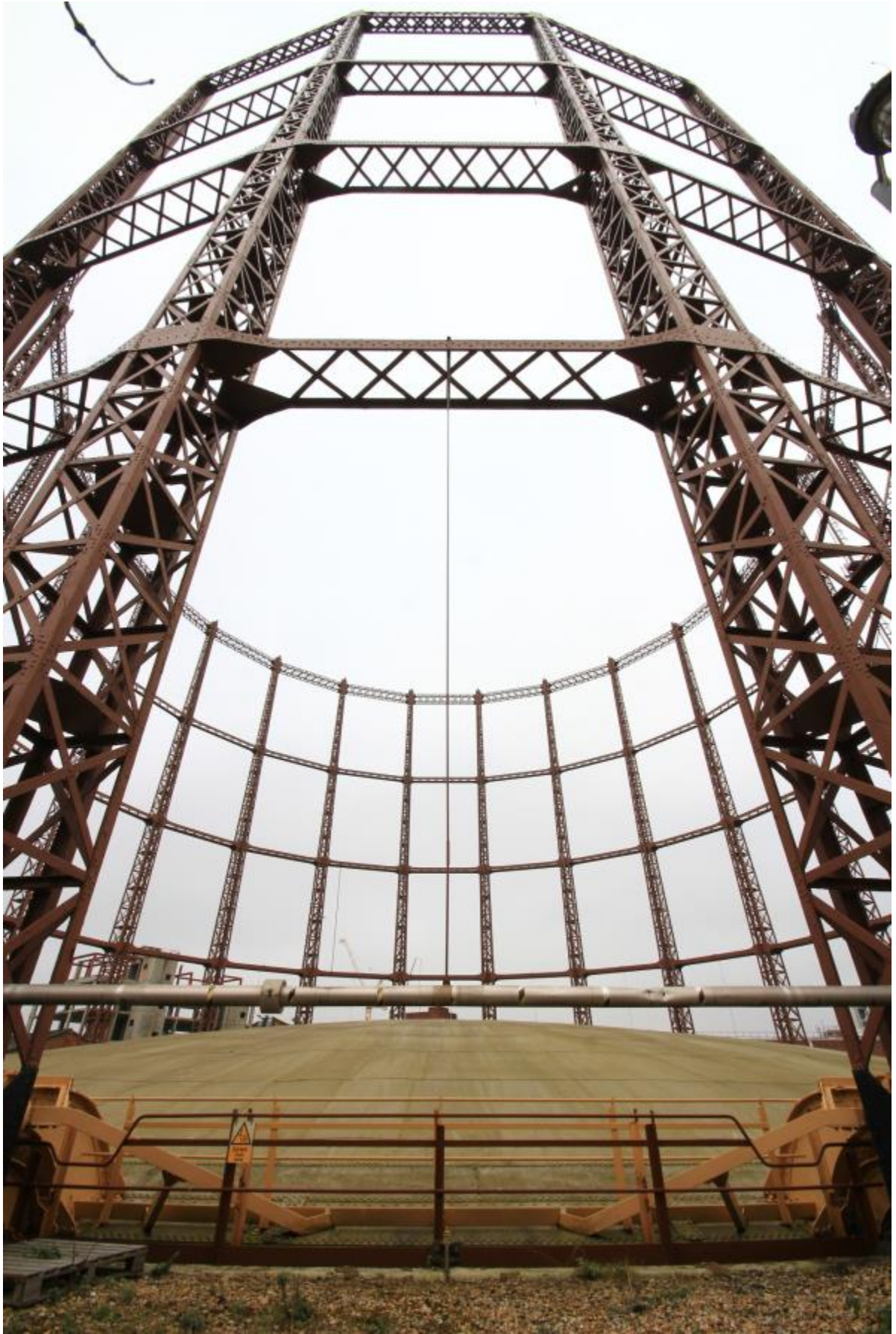


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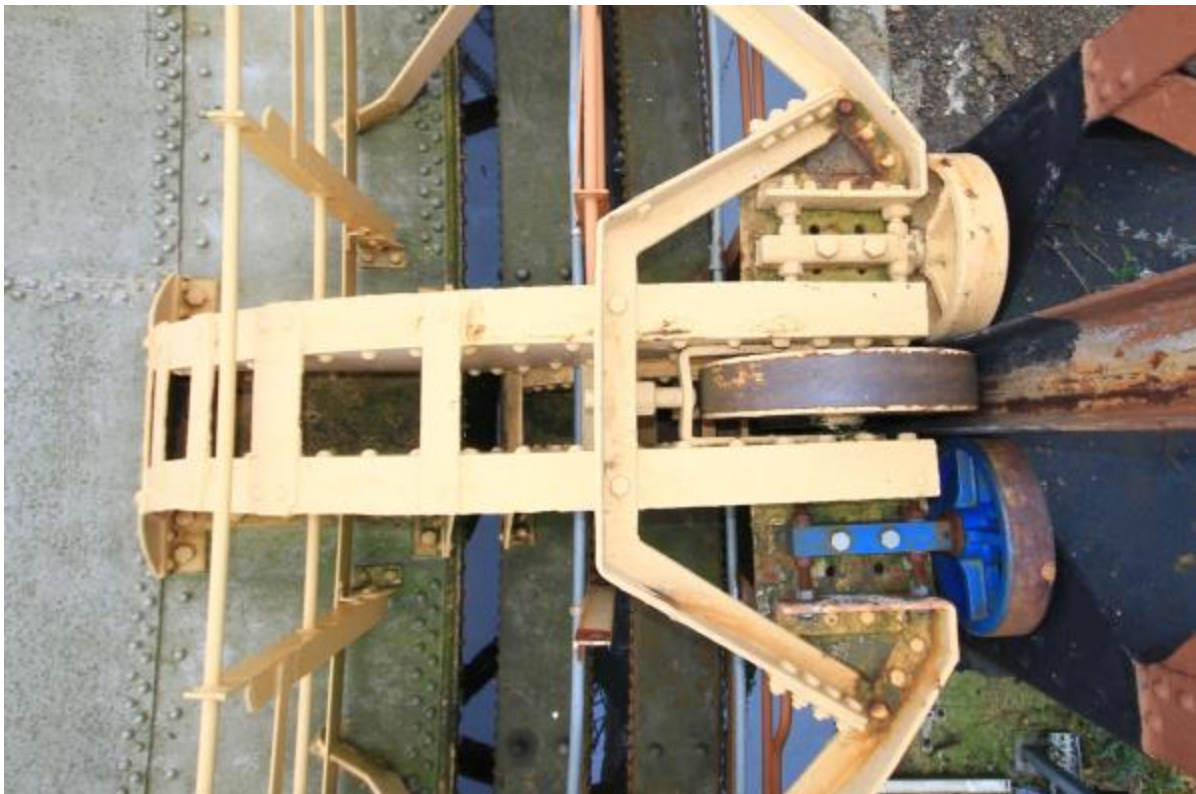


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Plate 70: East wall of the compound (MRA16-0297)



Plate 71: Blocked former exit to the canal right of way (MRA16-0293)

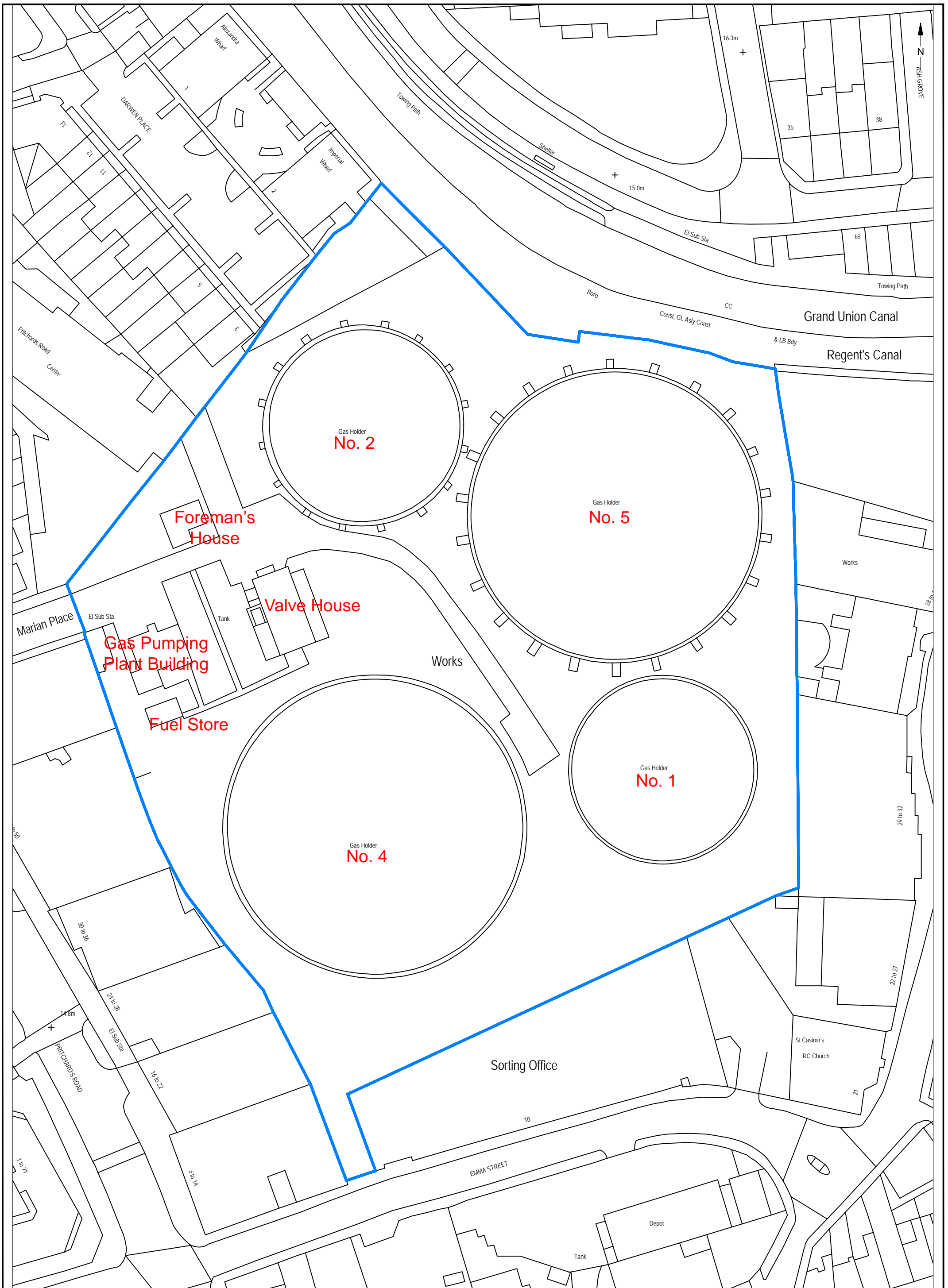


Plate 72: South boundary of the compound (MRA16-0359)



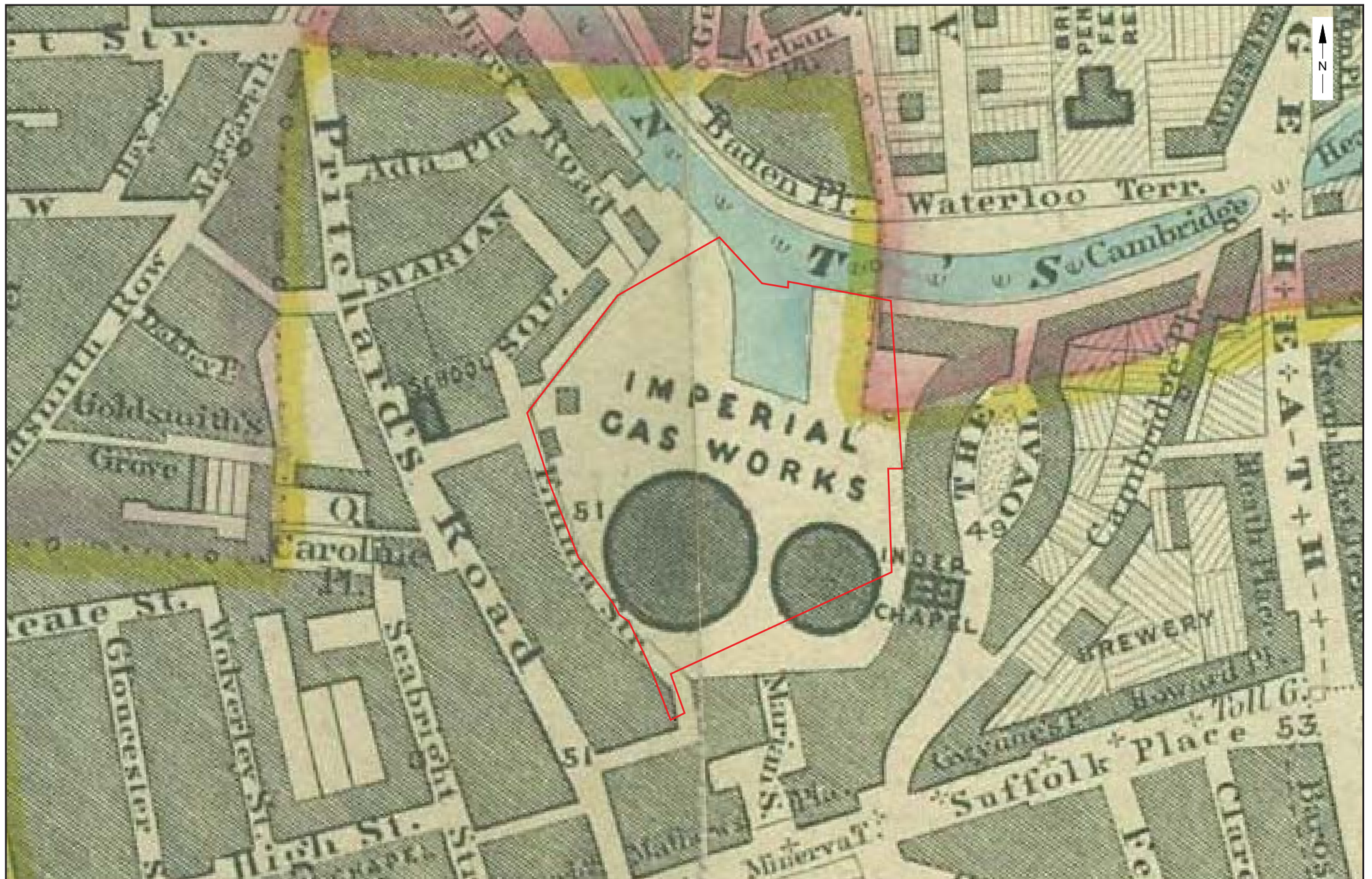
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Report Ref: 2016114	Drawn by: SP	Fig. 1	

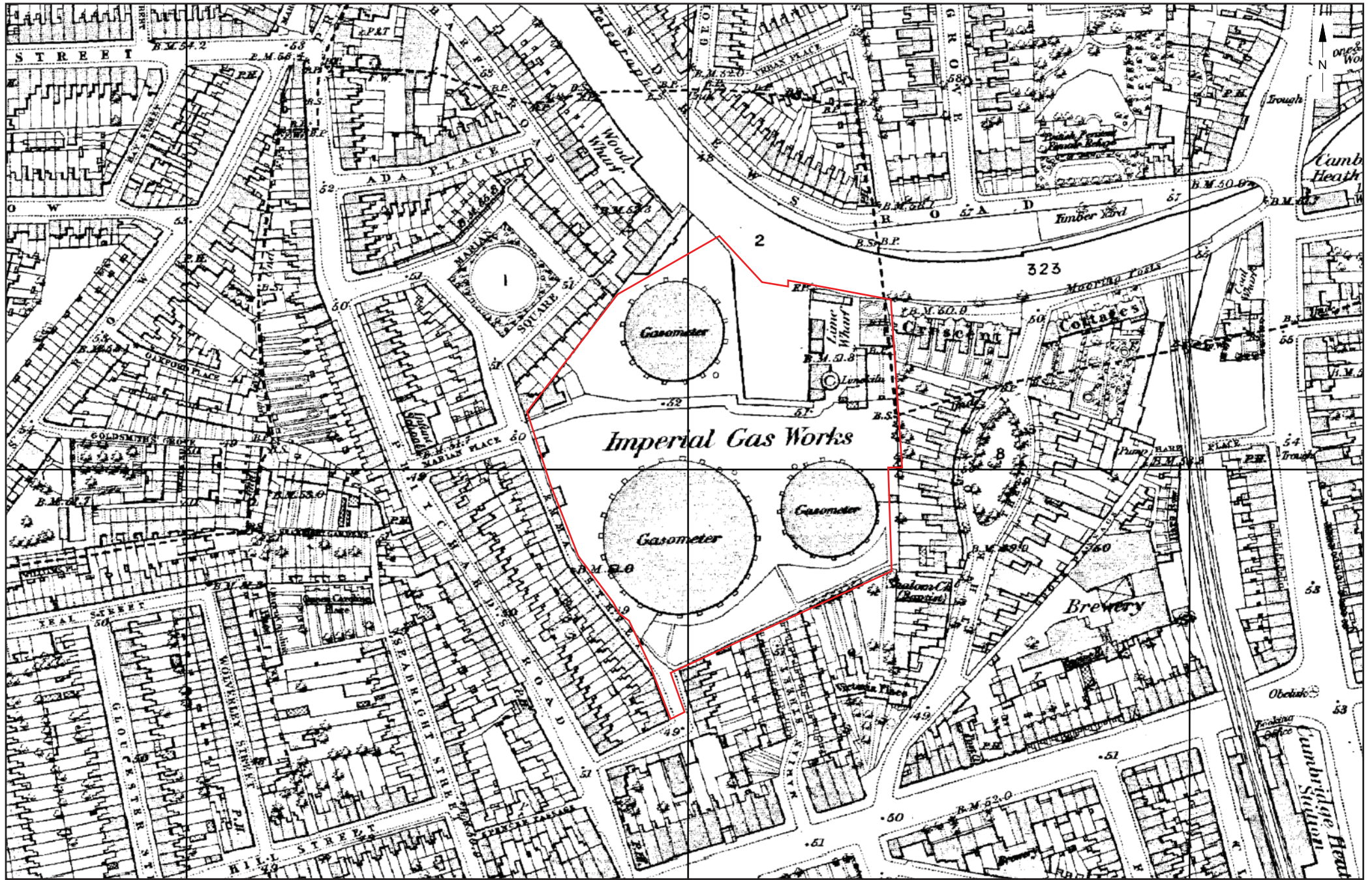




© Archaeology South-East		Bethnal Green Gasholders	Fig. 3
Project Ref: 160002	March 2016	Environs of London	
Report Ref: 2016114	Drawn by: SP	to a Distance of 32 Miles from St. Paul's Cathedral, 1829	



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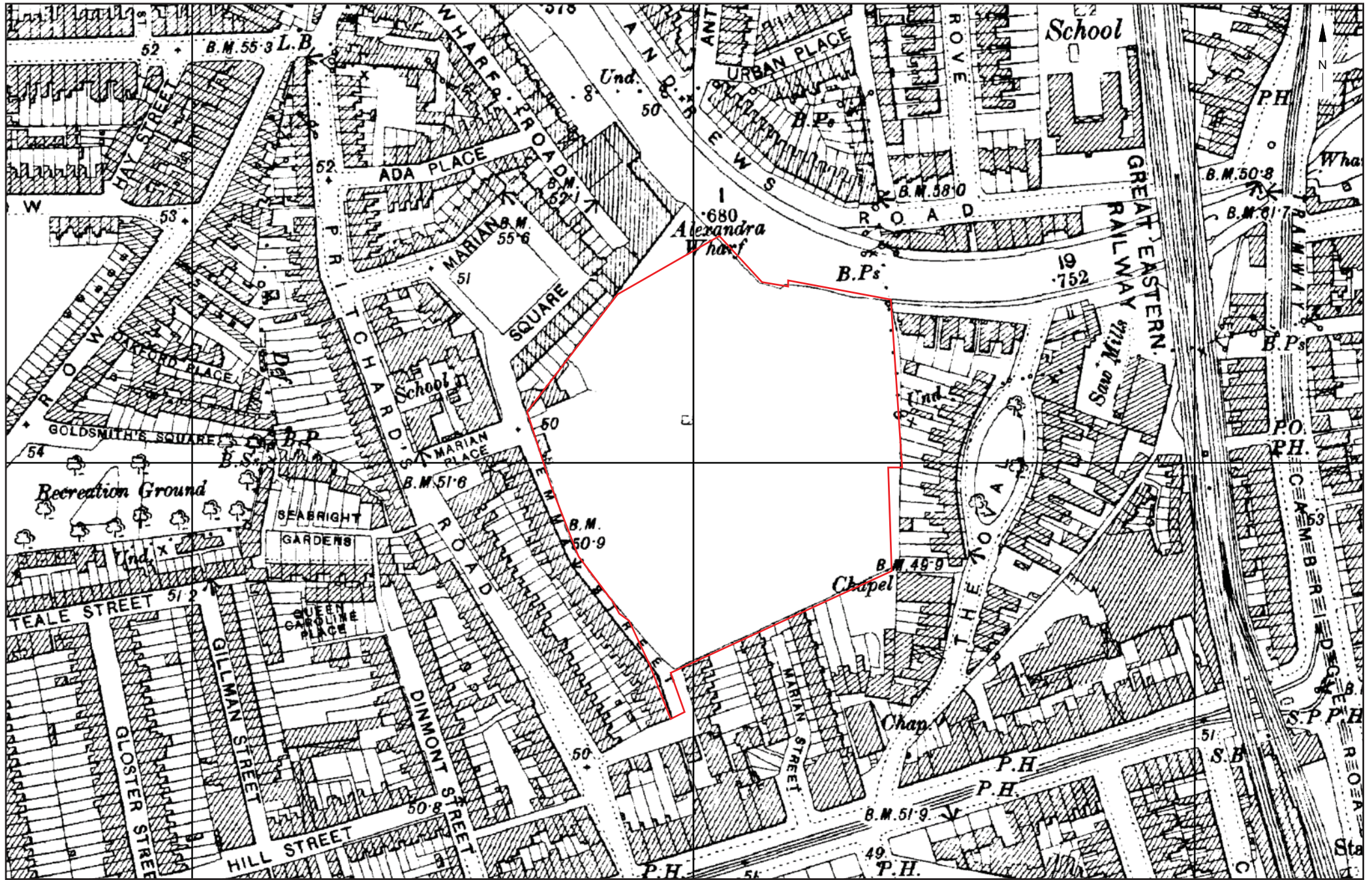
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Bethnal Green Gasholders

Ordnance Survey Map, 1873-1877

Fig. 5



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March 2016

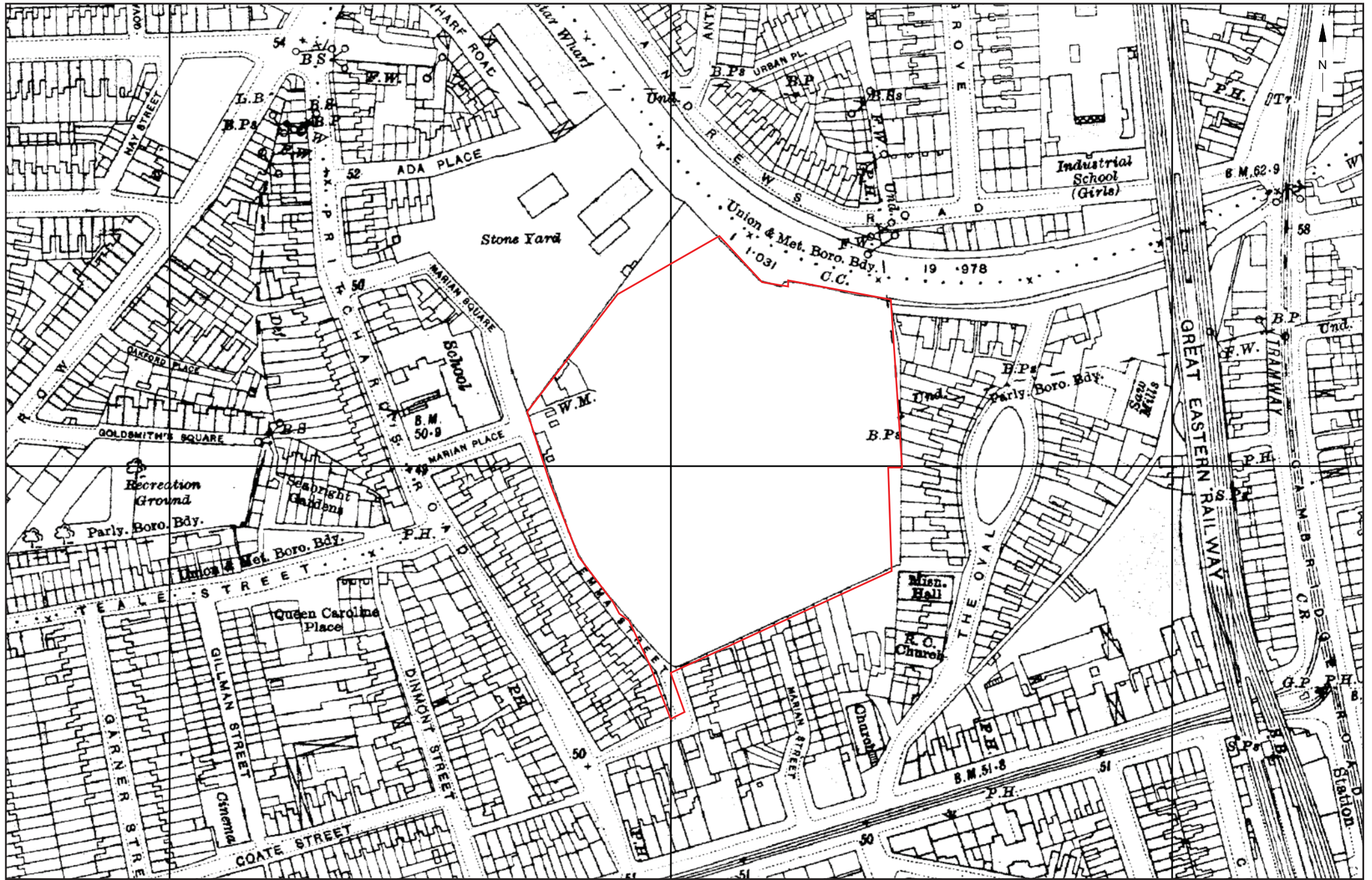
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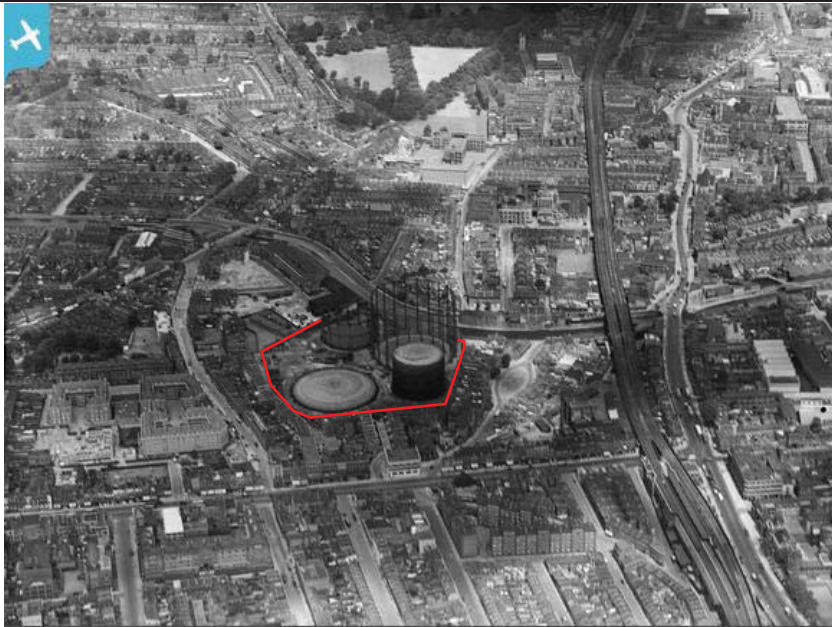
Bethnal Green Gasholders

Ordnance Survey Map, 1896

Fig. 6

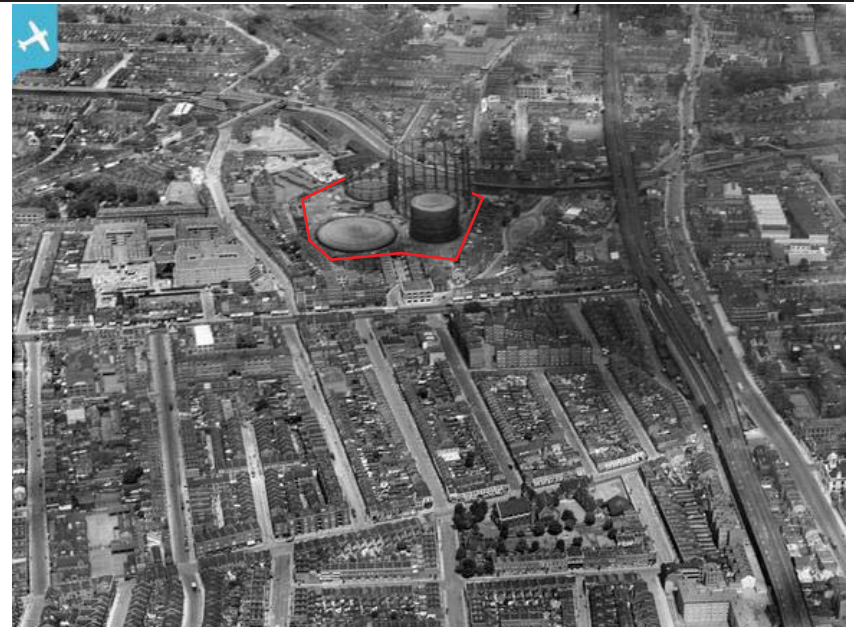


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Report Ref: 2016114	Drawn by: SP		



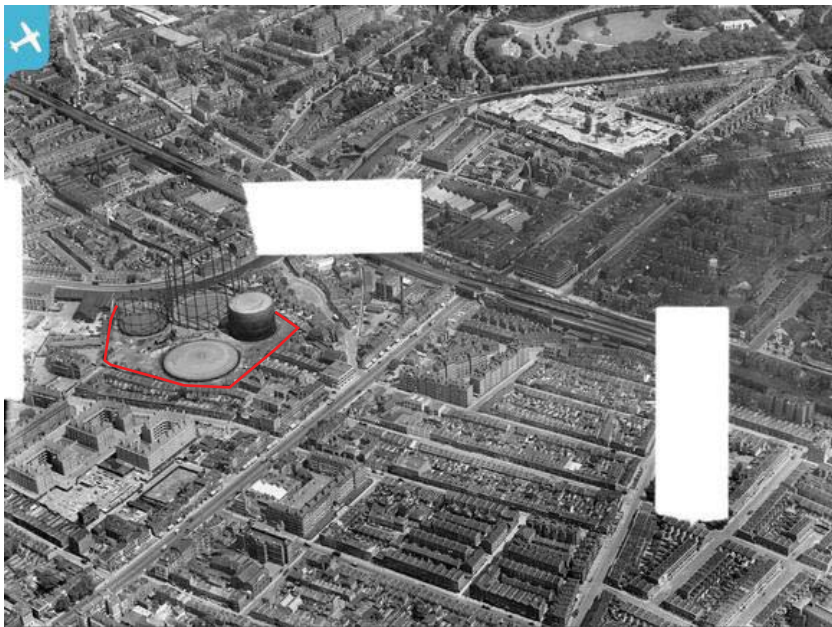
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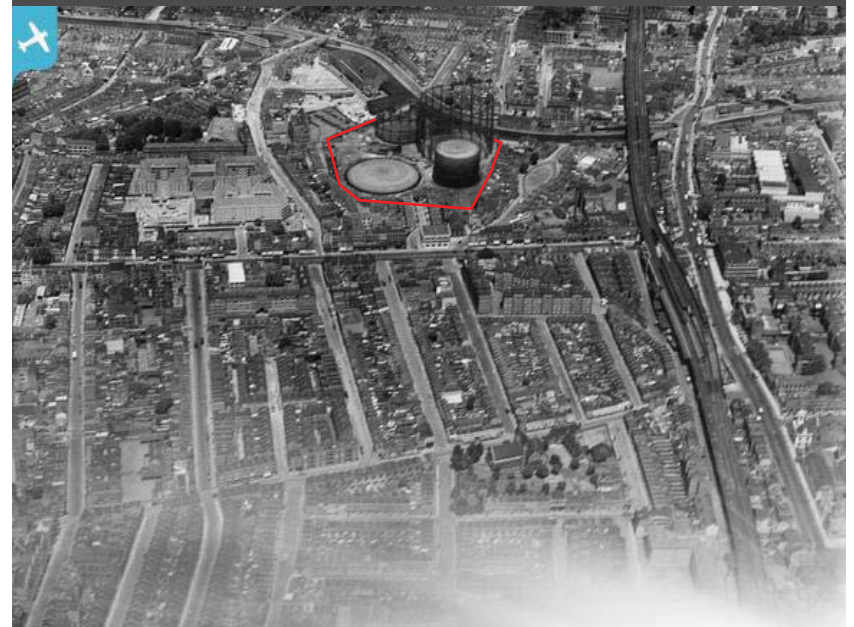
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Bethnal Green Gasholders

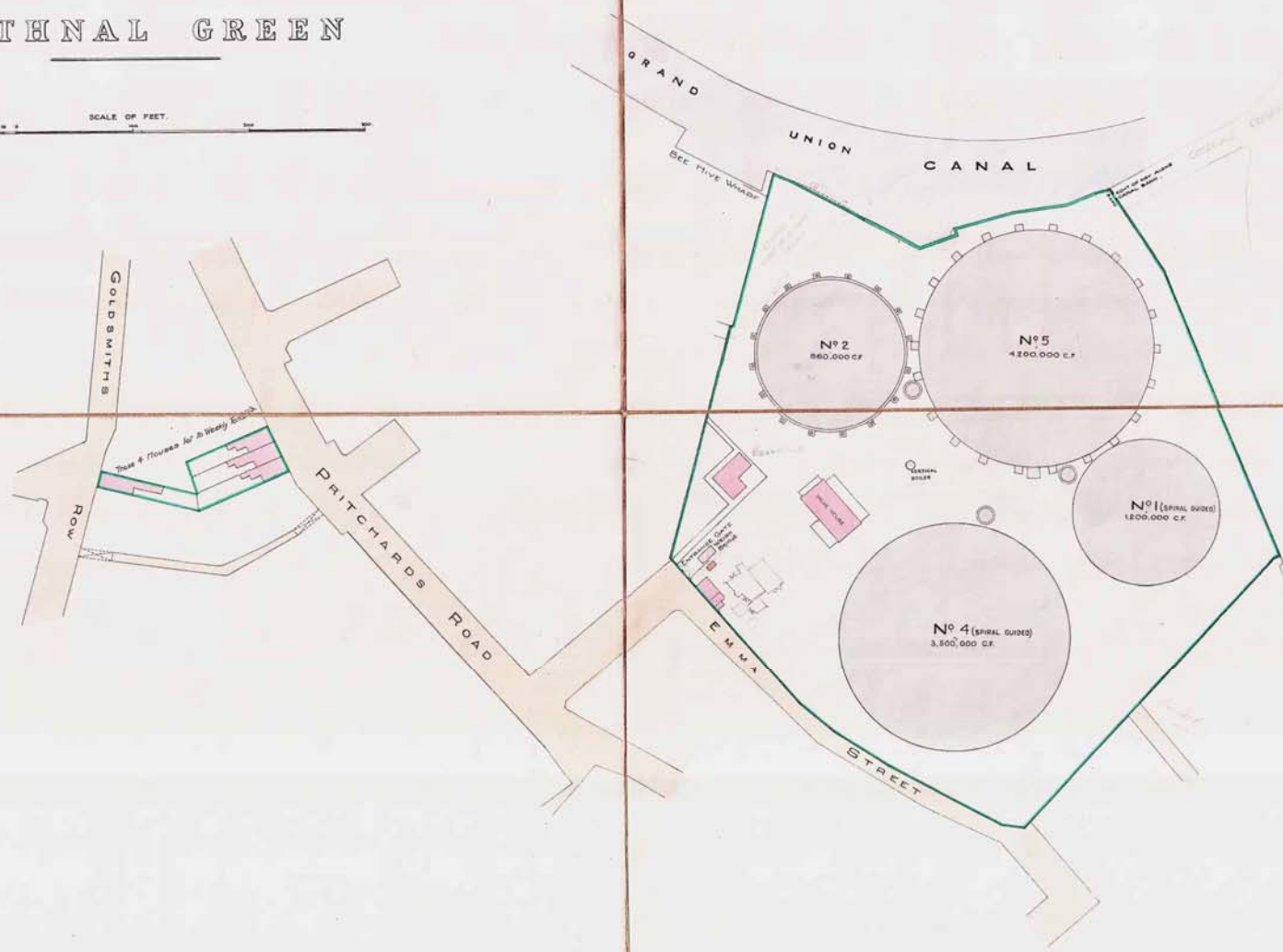
Bethnal Green Aerial Photographs, 1936

Fig. 8

THE GAS LIGHT & COKE COMPANY.

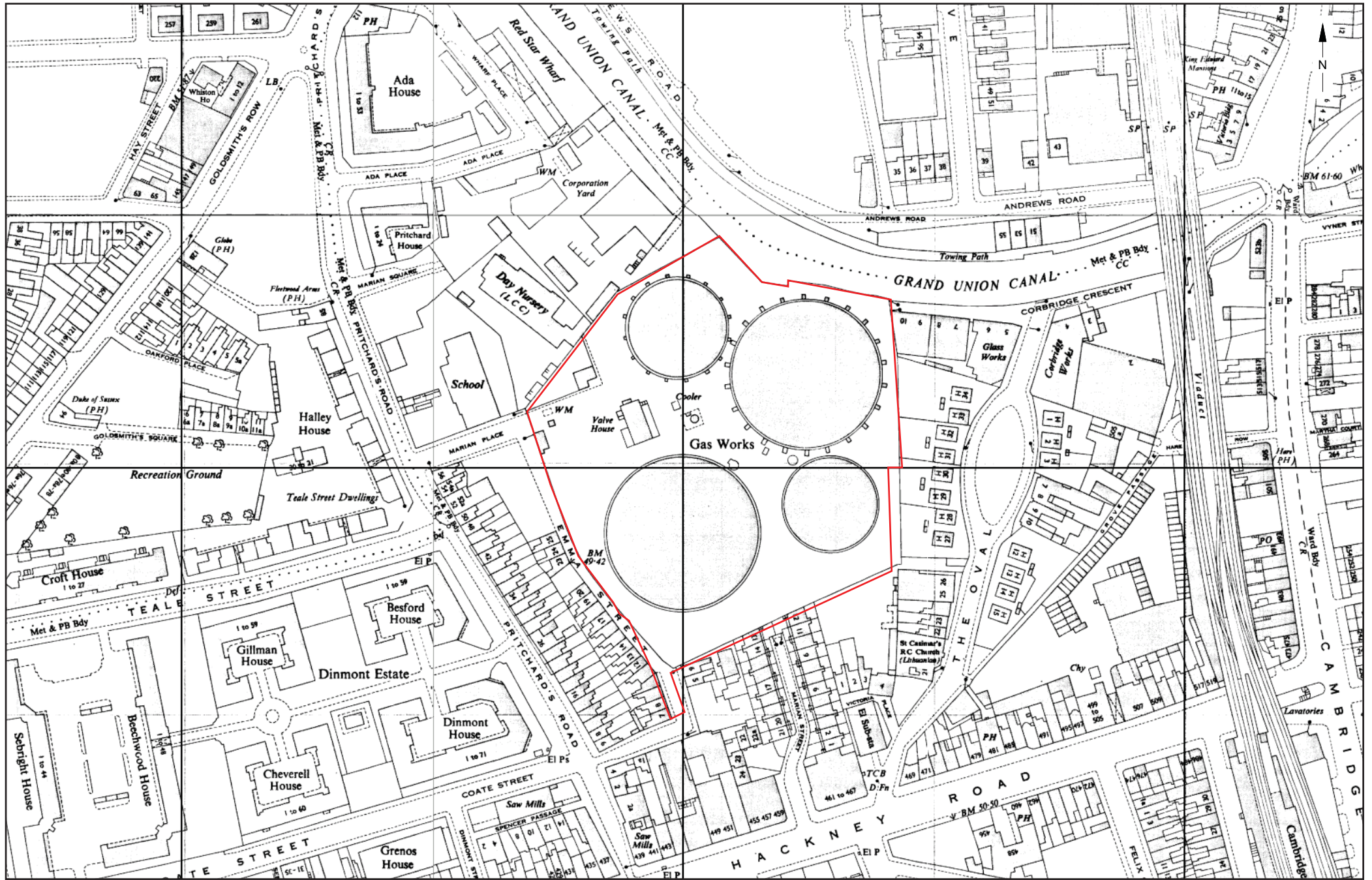
BETHNAL GREEN

SCALE OF FEET.



NTGAL/1111

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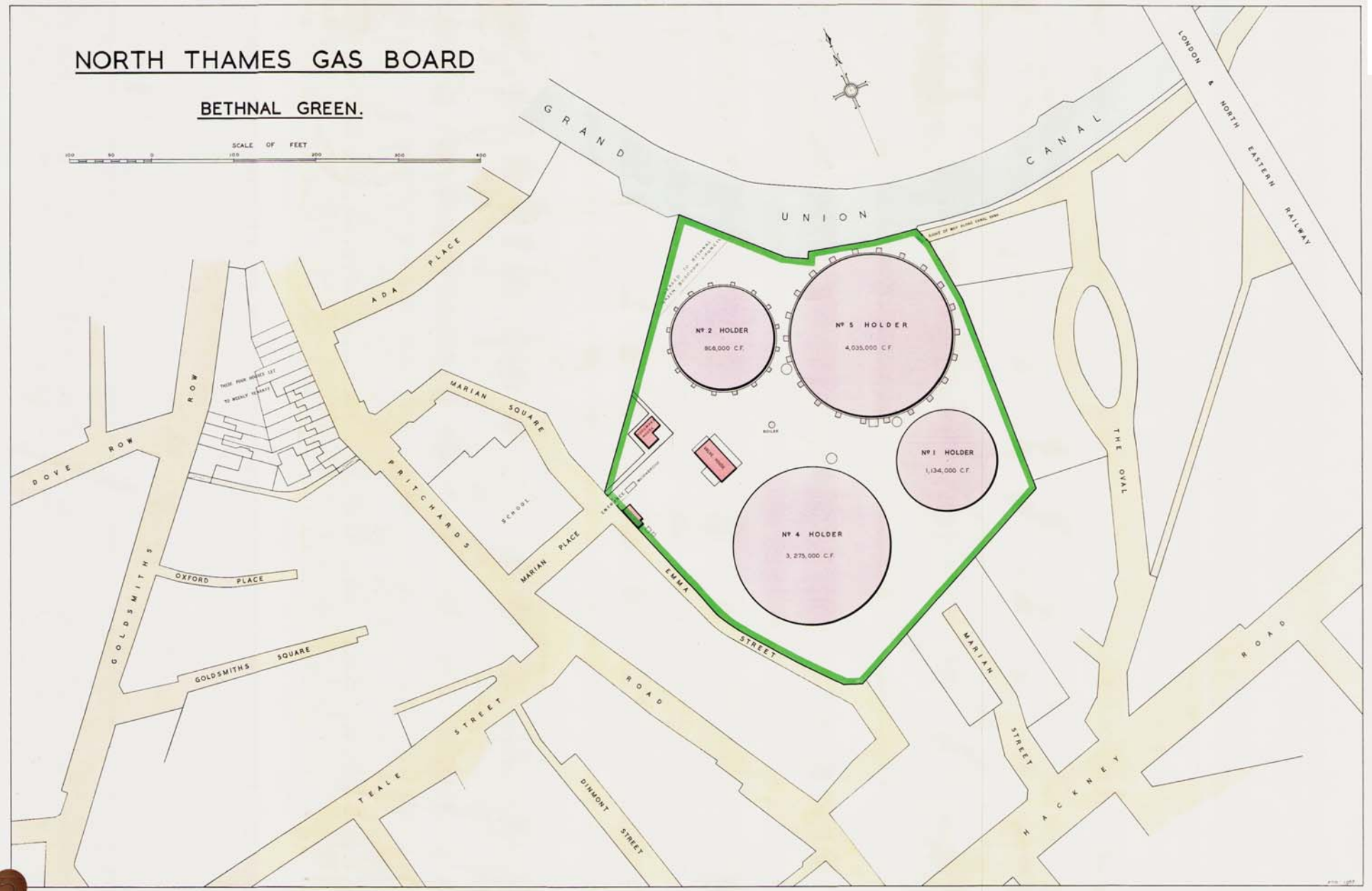


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Project Ref: 160002	March 2016	Ordnance Survey Map, 1948	
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NORTH THAMES GAS BOARD

BETHNAL GREEN.

SCALE OF FEET
 100 200 300 400



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Bethnal Green Gasholders

Project Ref: 160002
 Report Ref: 2016114

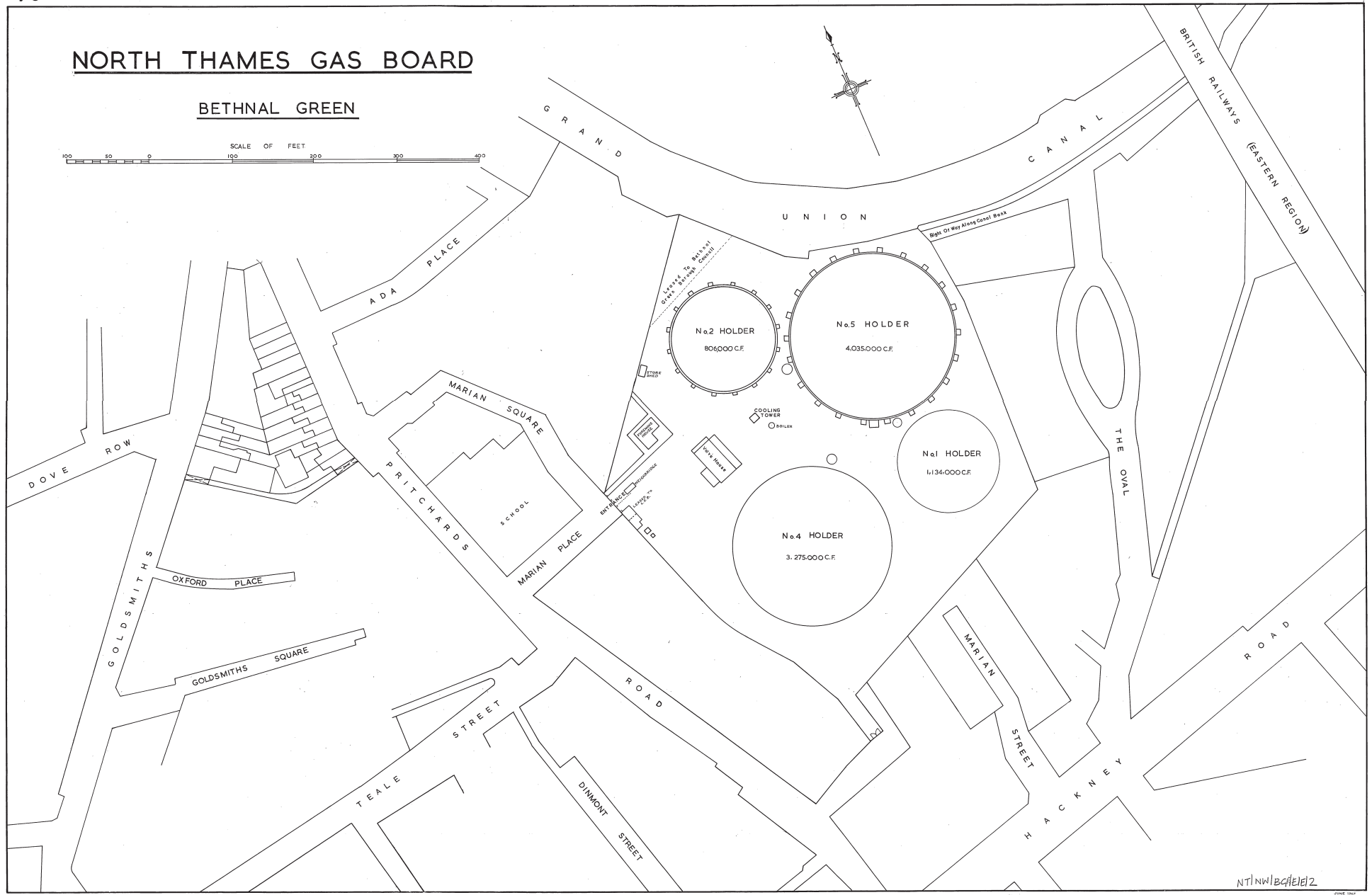
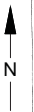
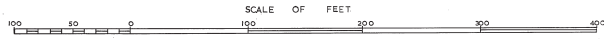
March 2016
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Bethnal Green Site Plan, 1957 (NG Archive: NT_NW_BGR_E_E_1)

Fig. 11

NORTH THAMES GAS BOARD

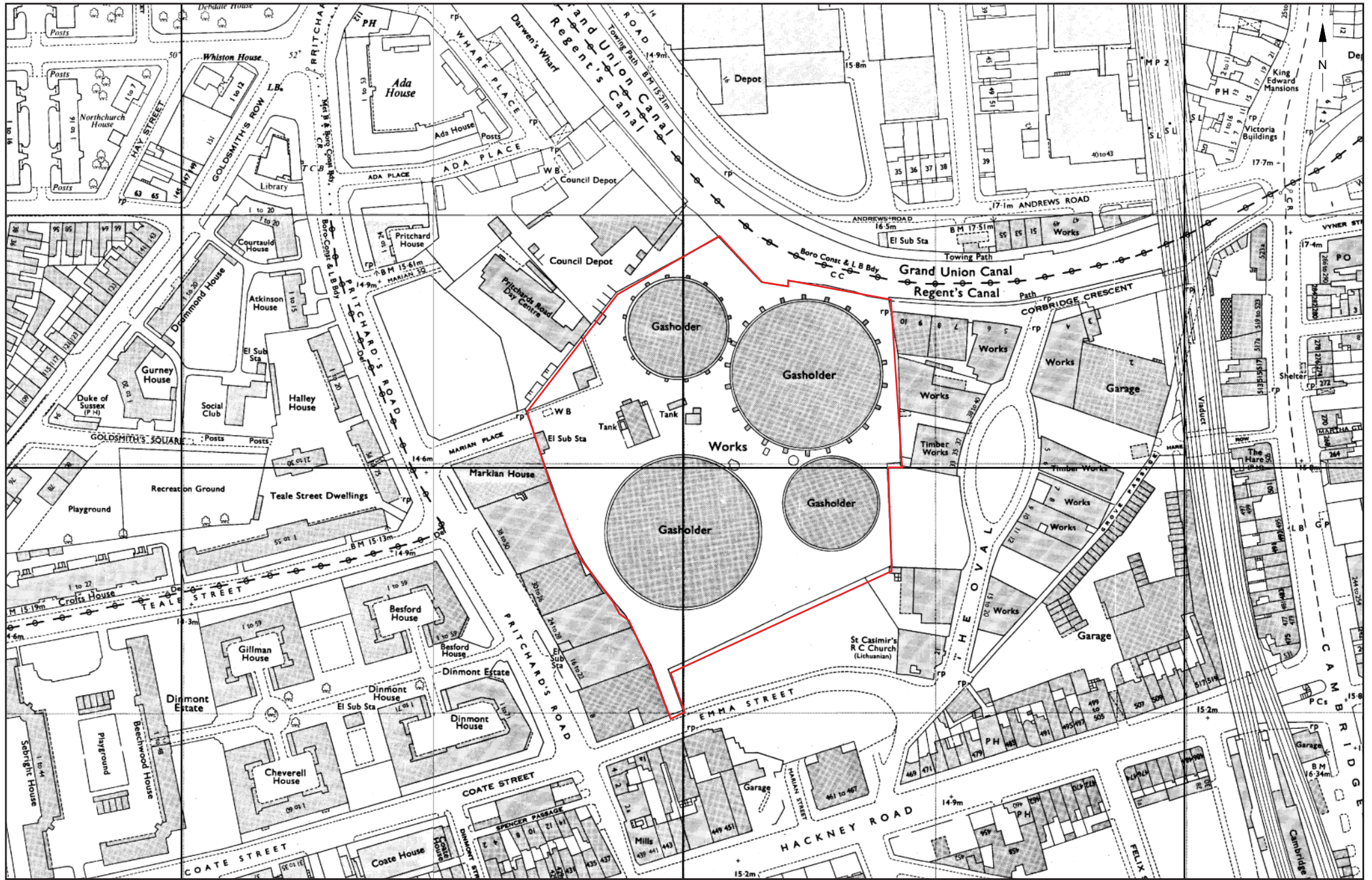
BETHNAL GREEN



NT1NW/BGR/E1/2

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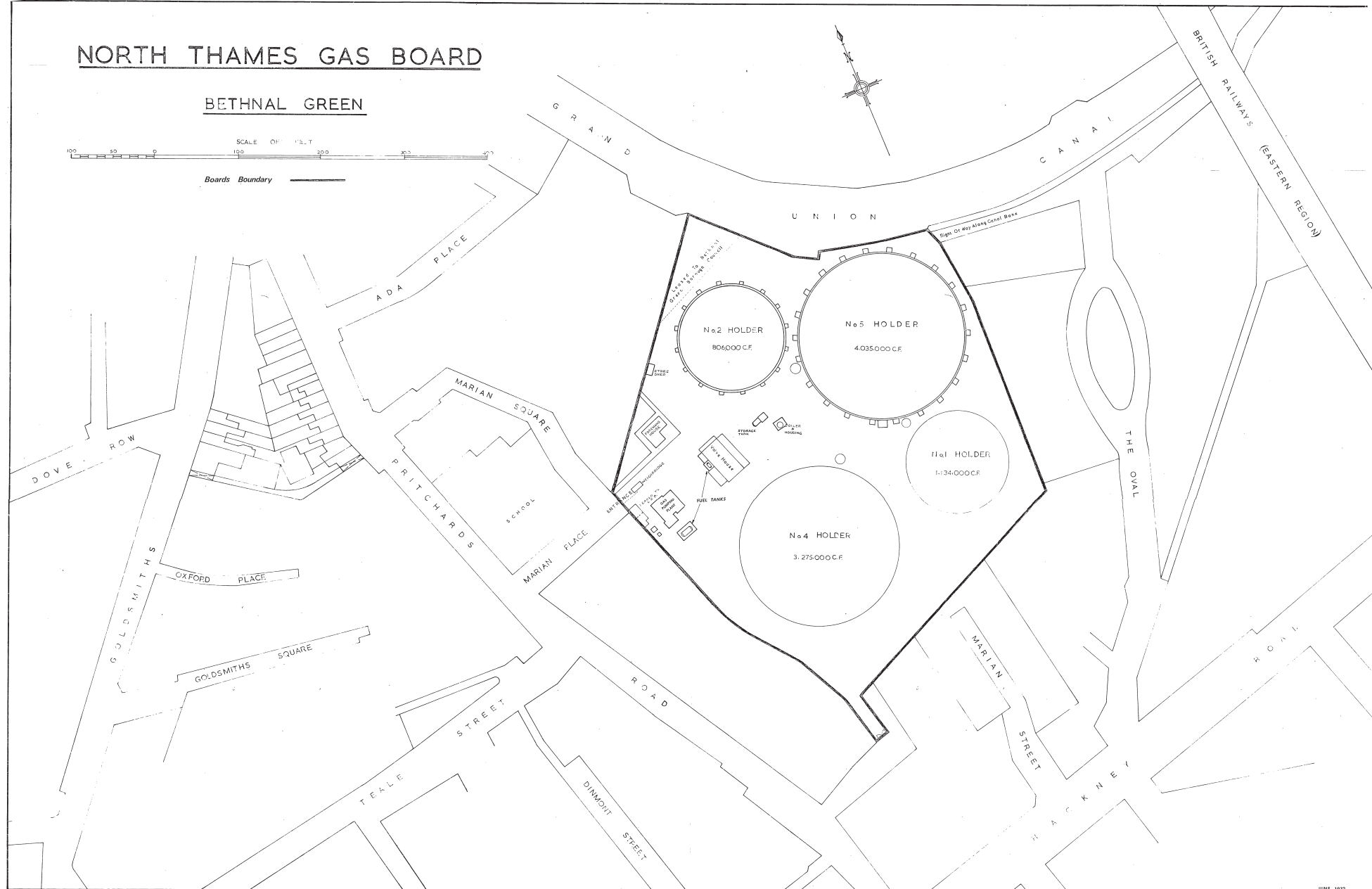
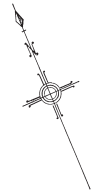
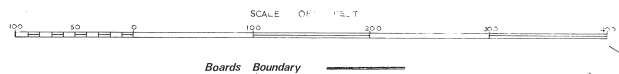
Fig. 12



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Report Ref: 2016114	Drawn by: SP		

NORTH THAMES GAS BOARD

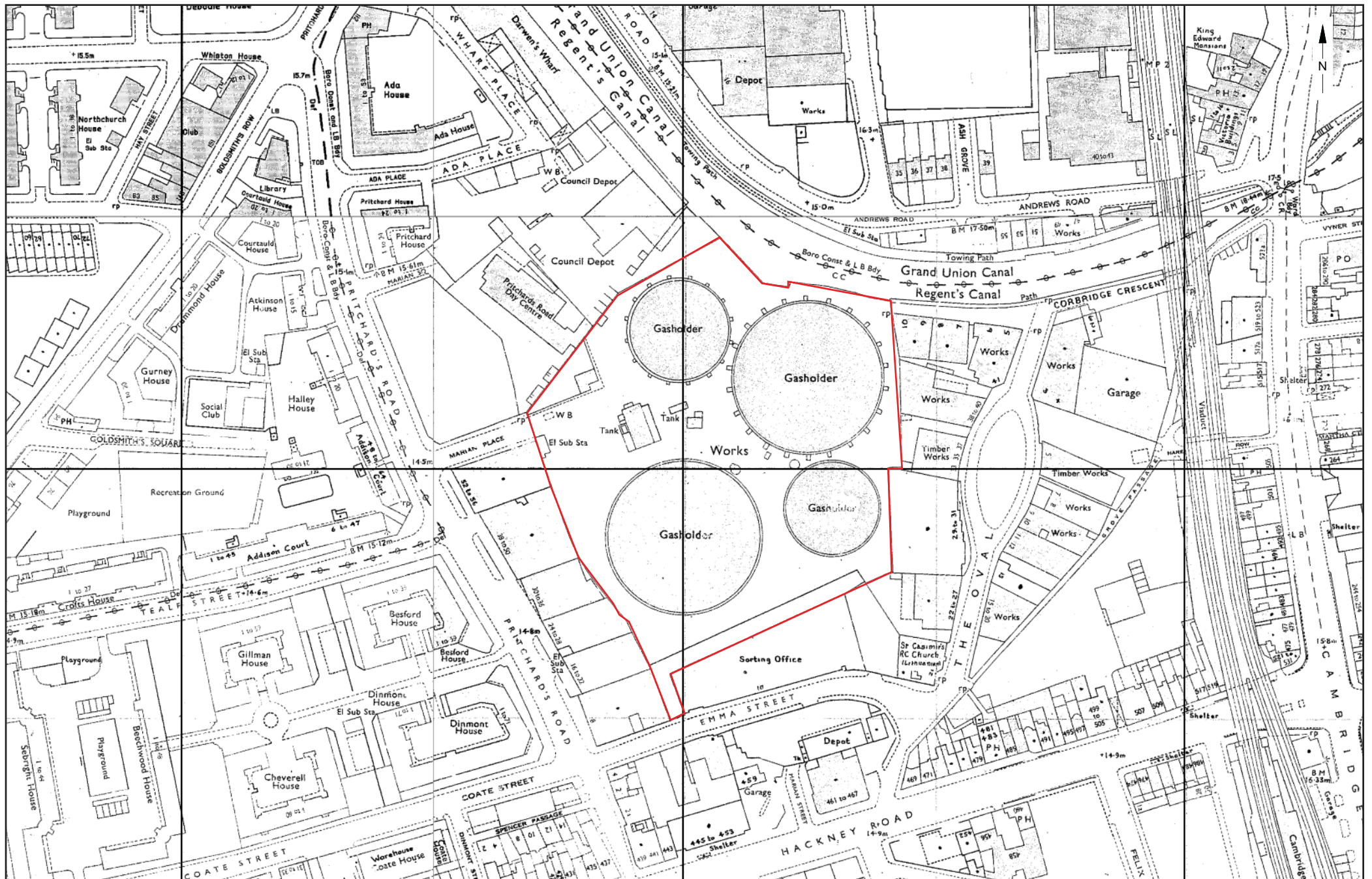
BETHNAL GREEN



JUNE 1972

NTINW/24/1/24

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Project Ref: 160002	March 2016	Bethnal Green Site Plan, 1972 (NG Archive: NT_NW_BGR_E_E_3C)	
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Project Ref: 160002	March 2016	Ordnance Survey Map, 1978-1983	
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Bethnal Green Gasholders

Project Ref:160002

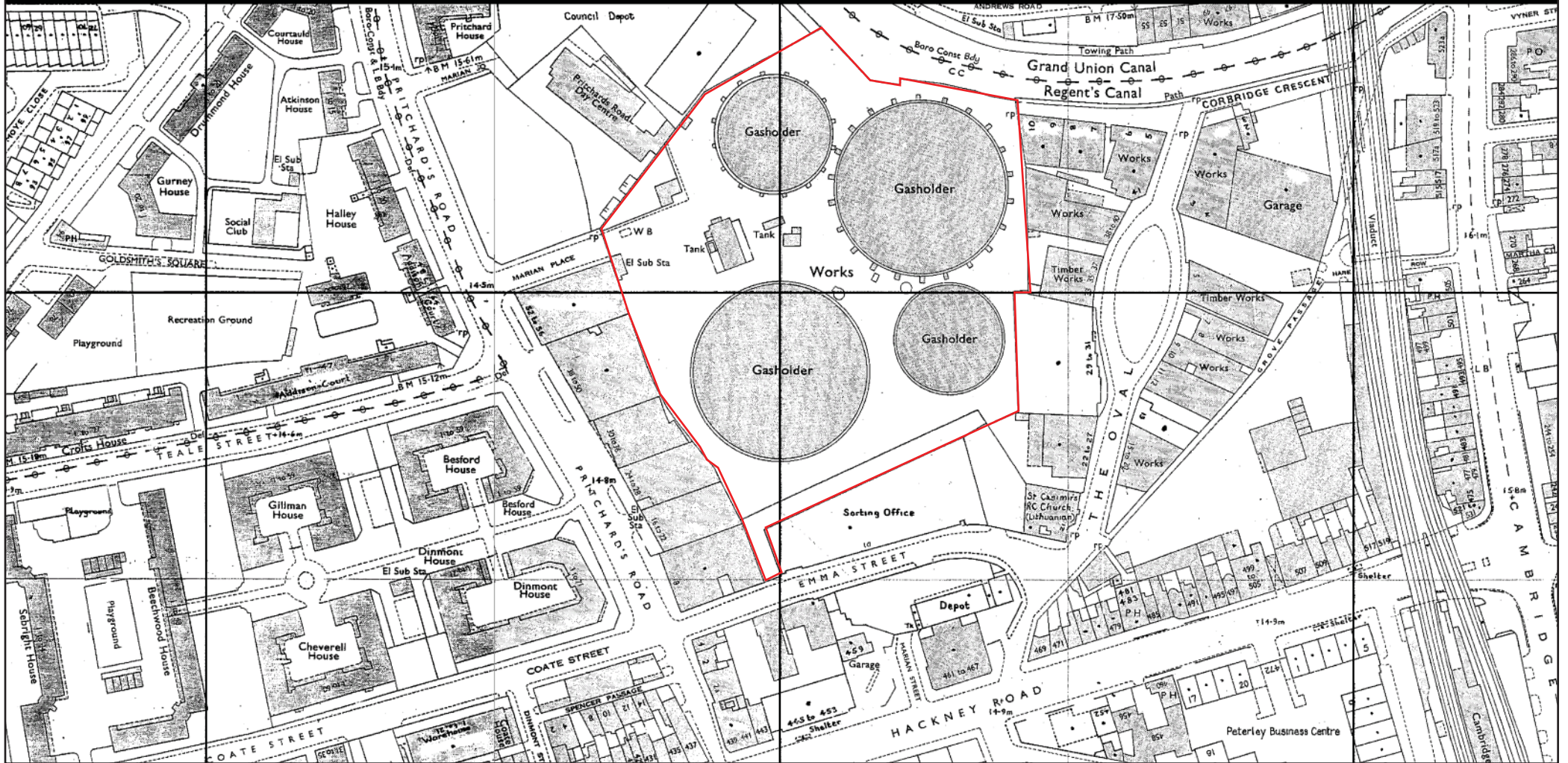
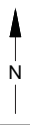
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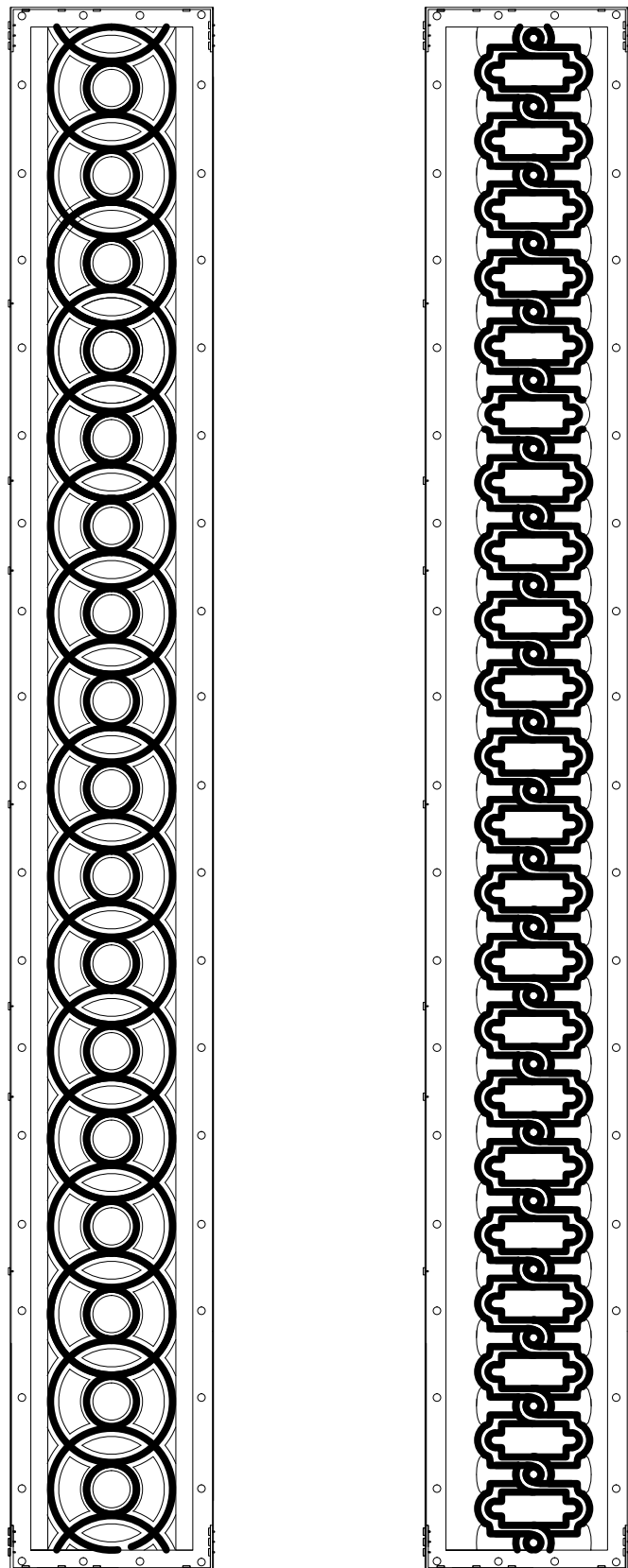
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Aerial Photograph, 1984 (NG Archive: NT/NTG/E/F/2/14)

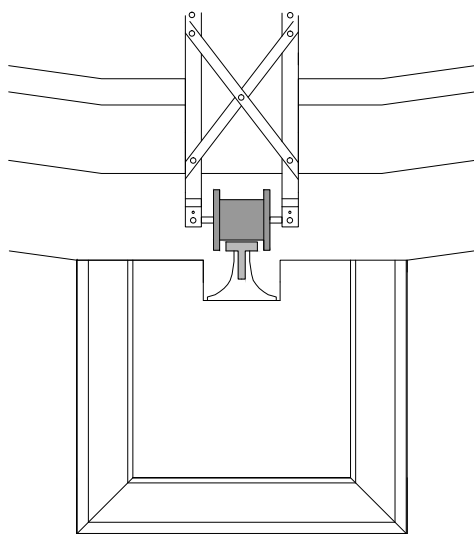
Fig. 16



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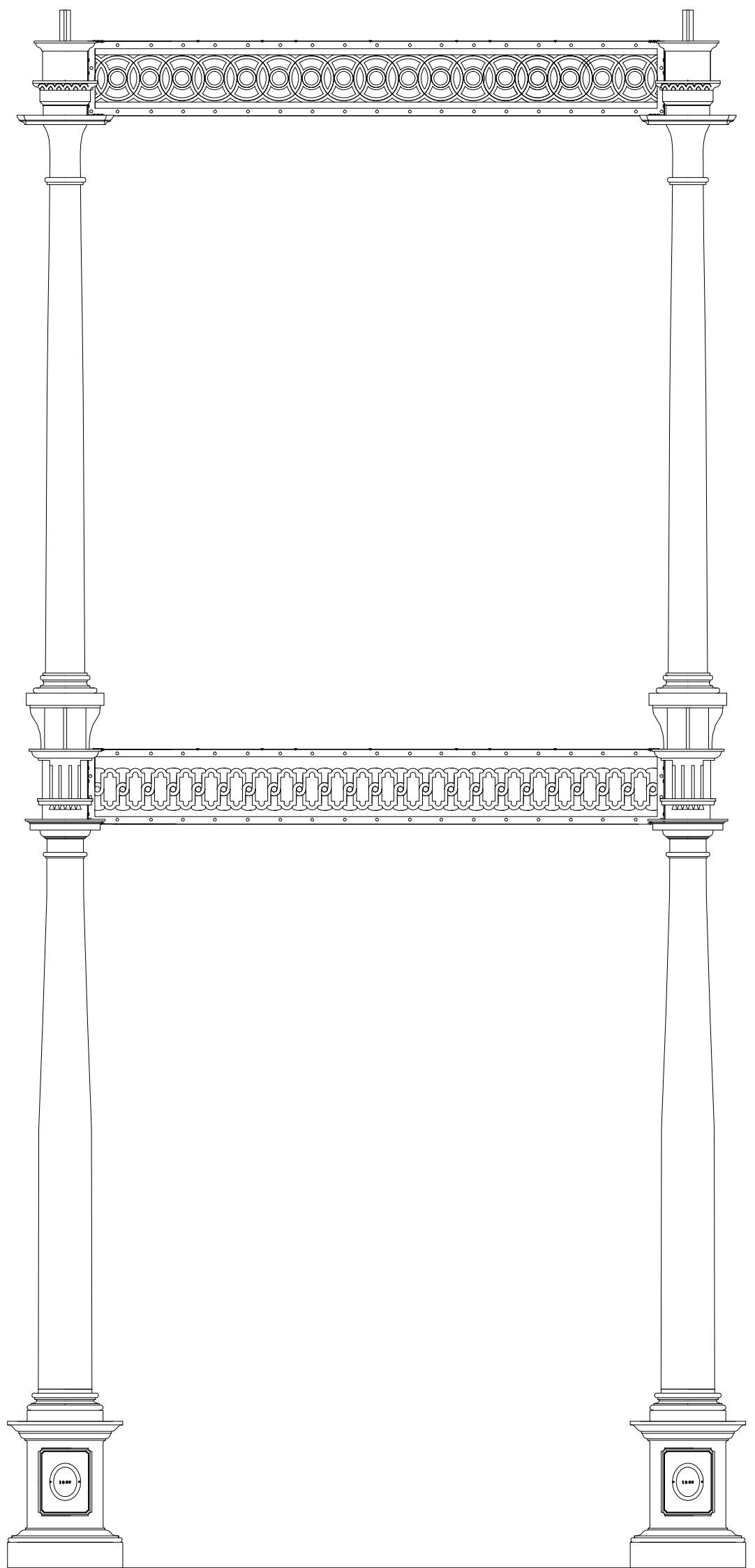


Detail of Girders (rotated through 90°)



Plan of Column Base

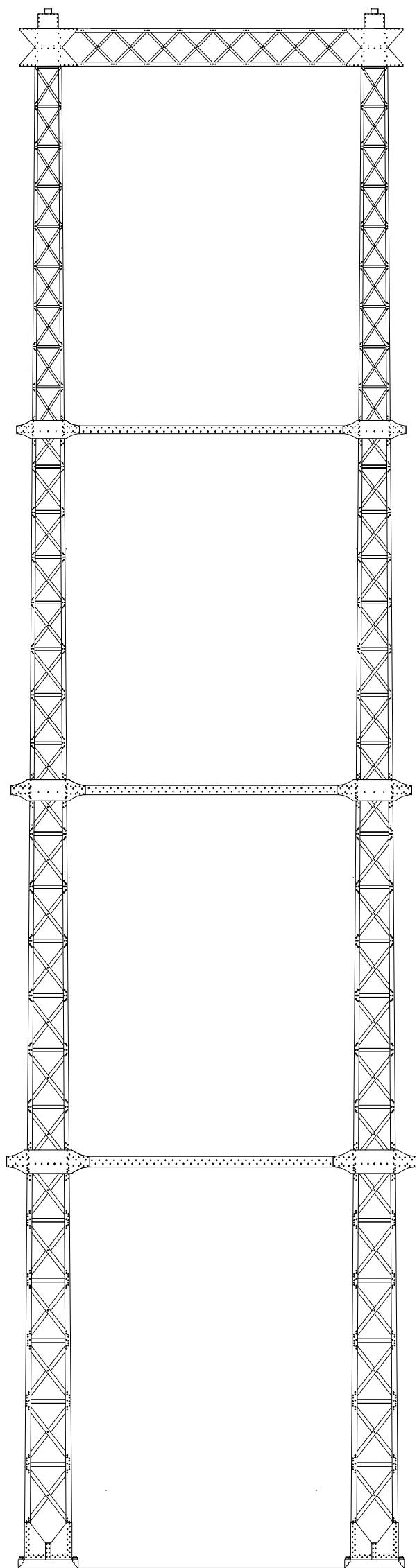
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Elevation

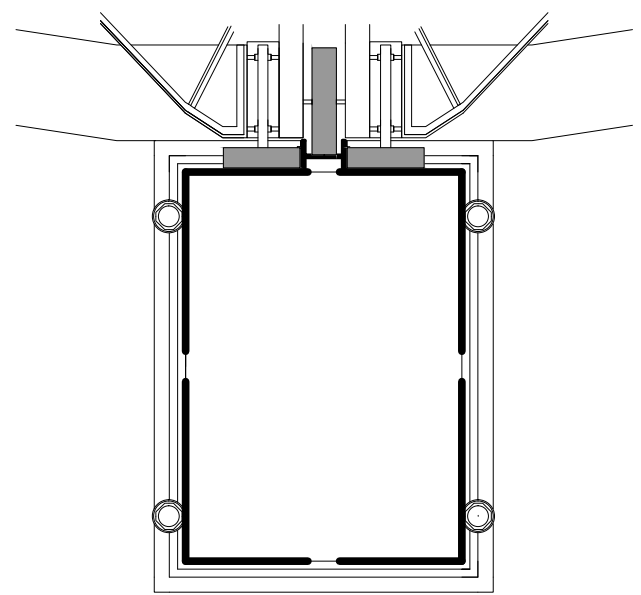
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Indicative Scale



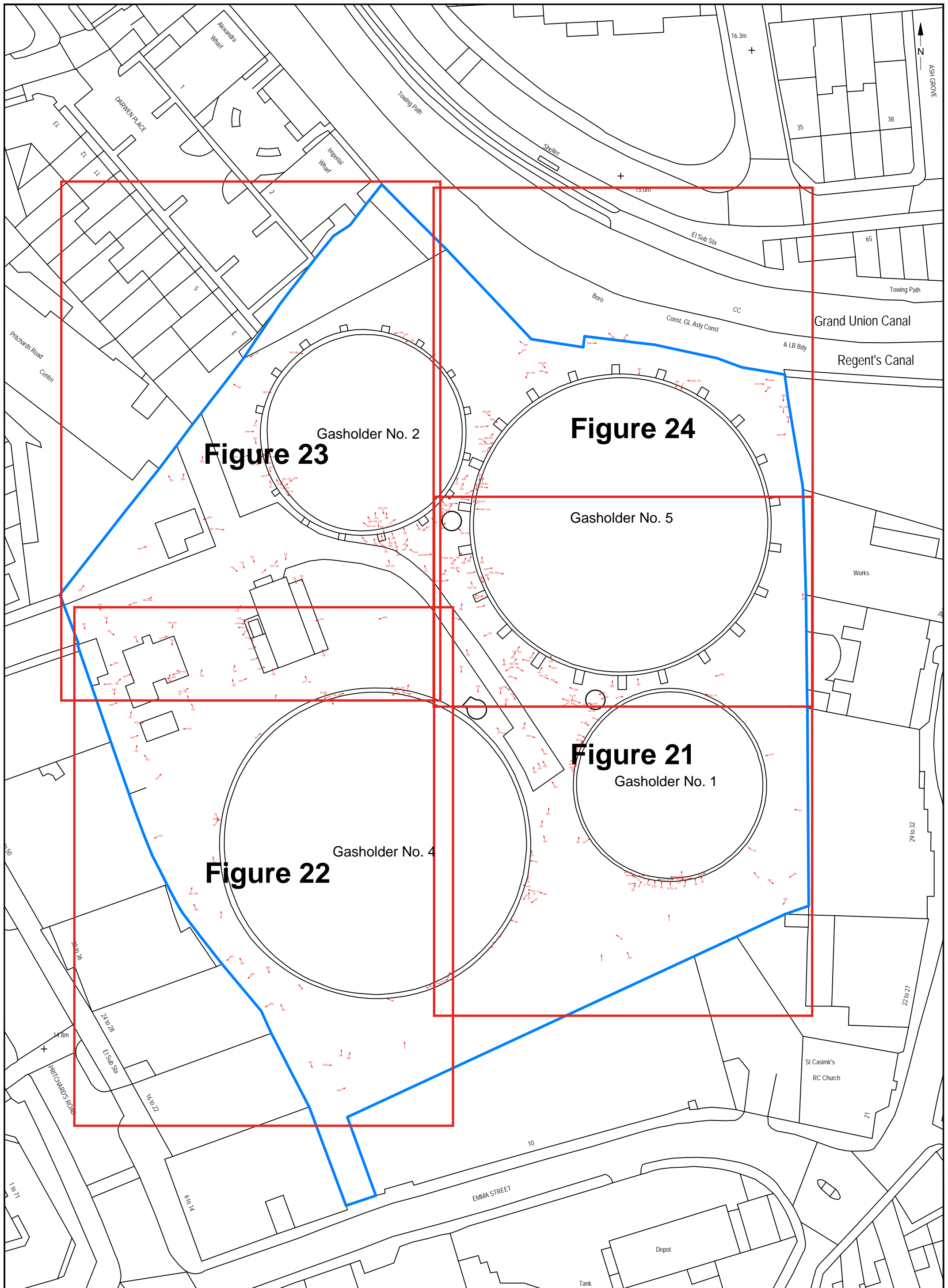
Elevation

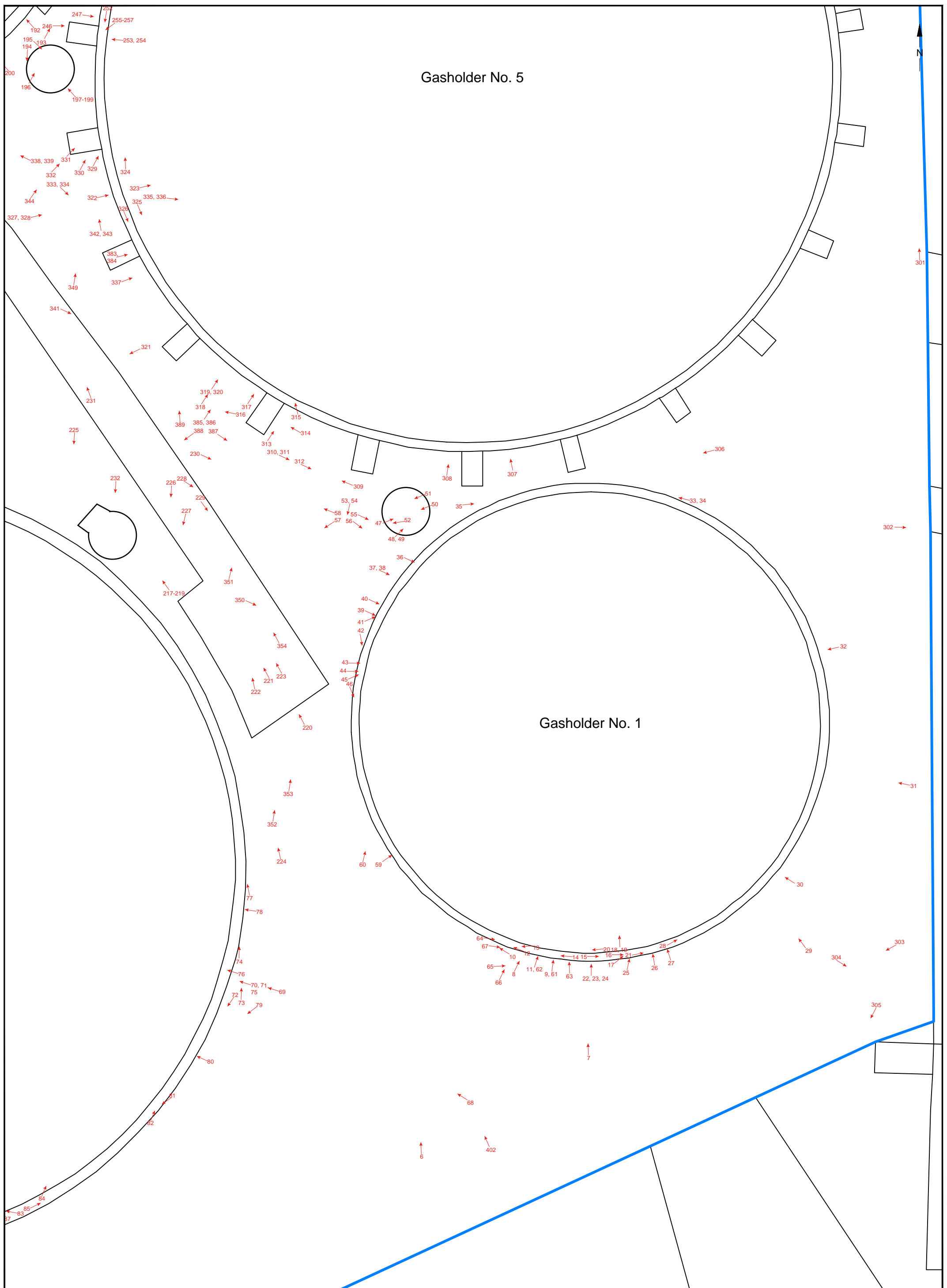
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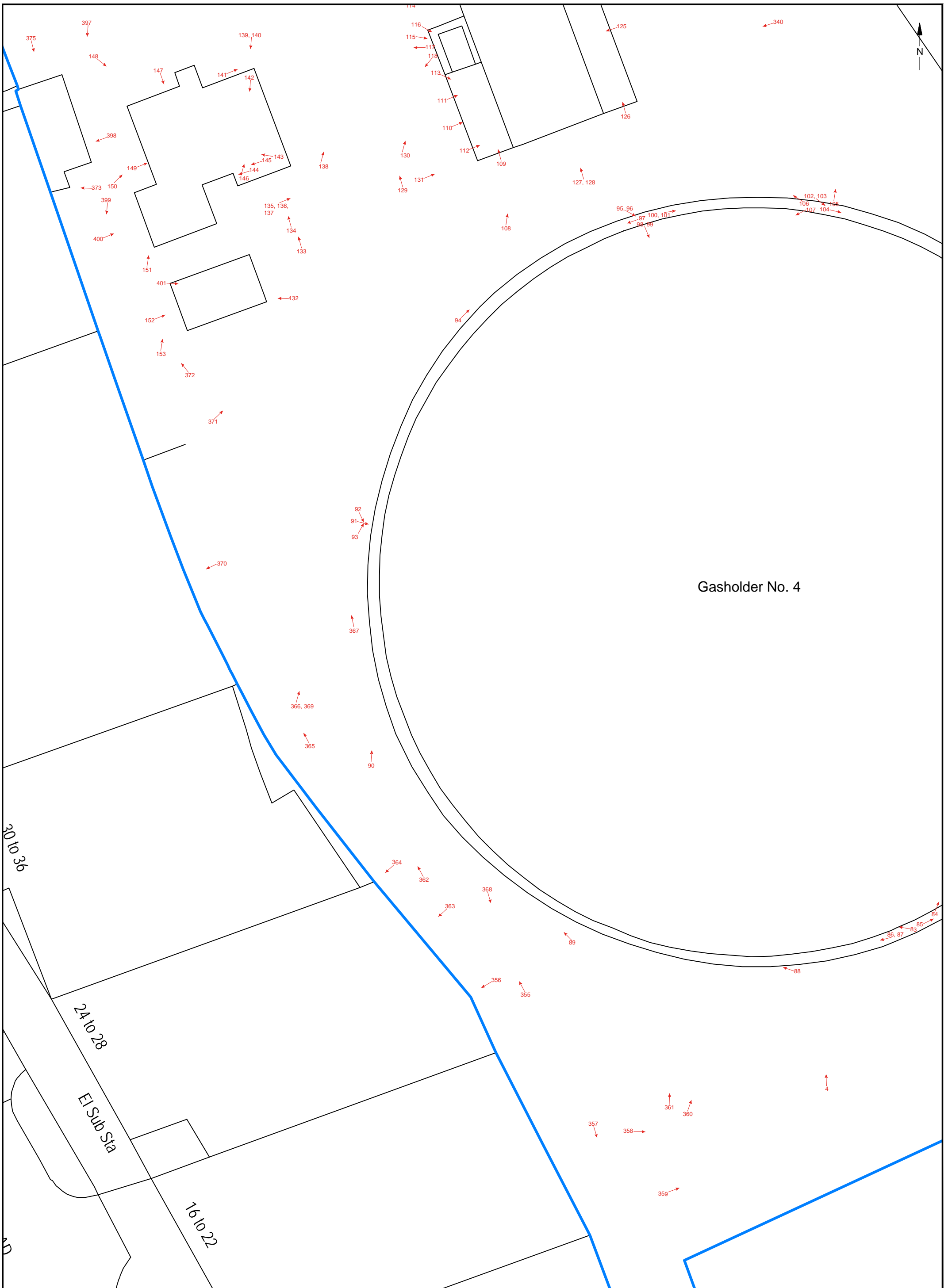
Plan of Standard Base

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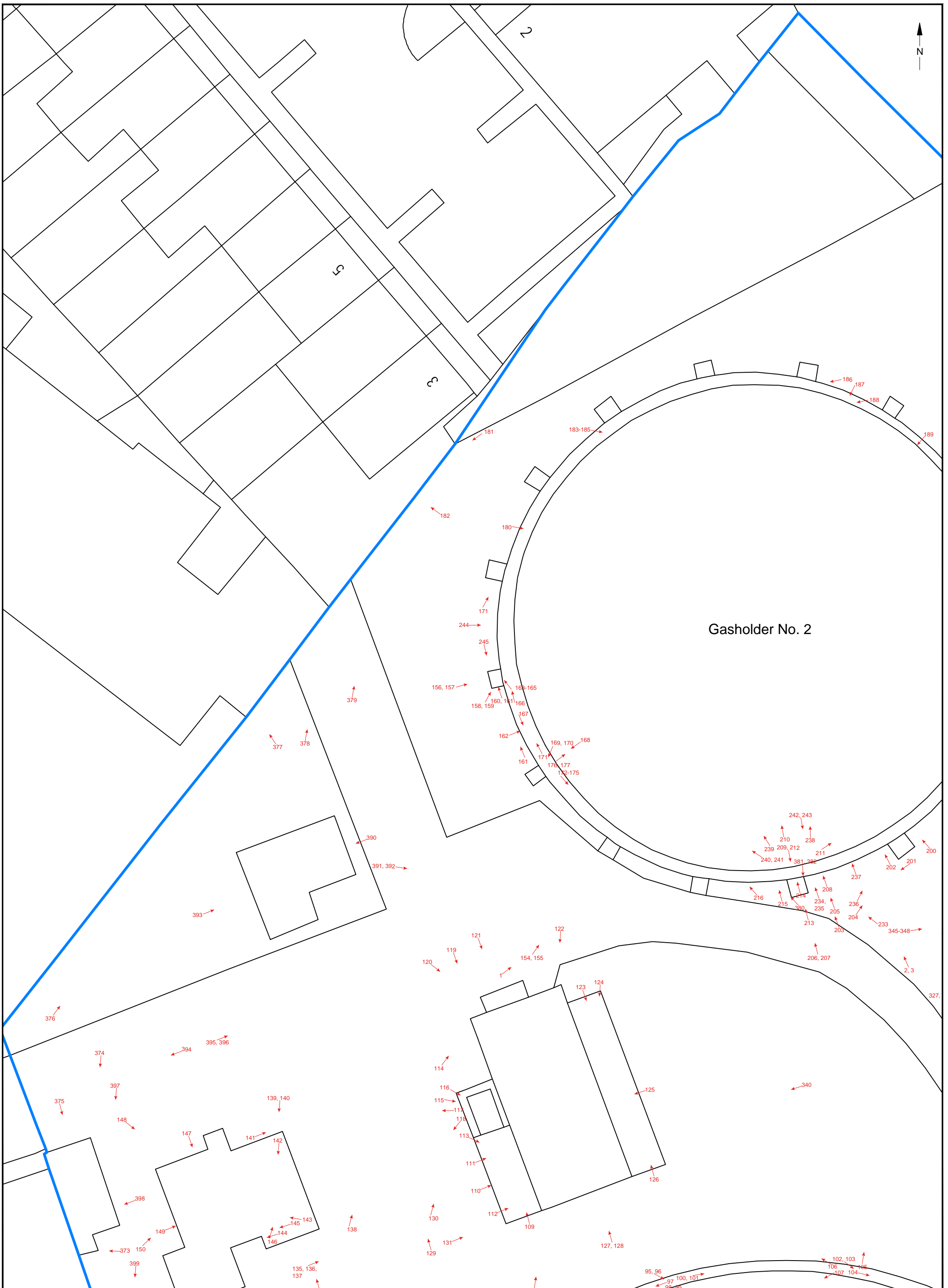




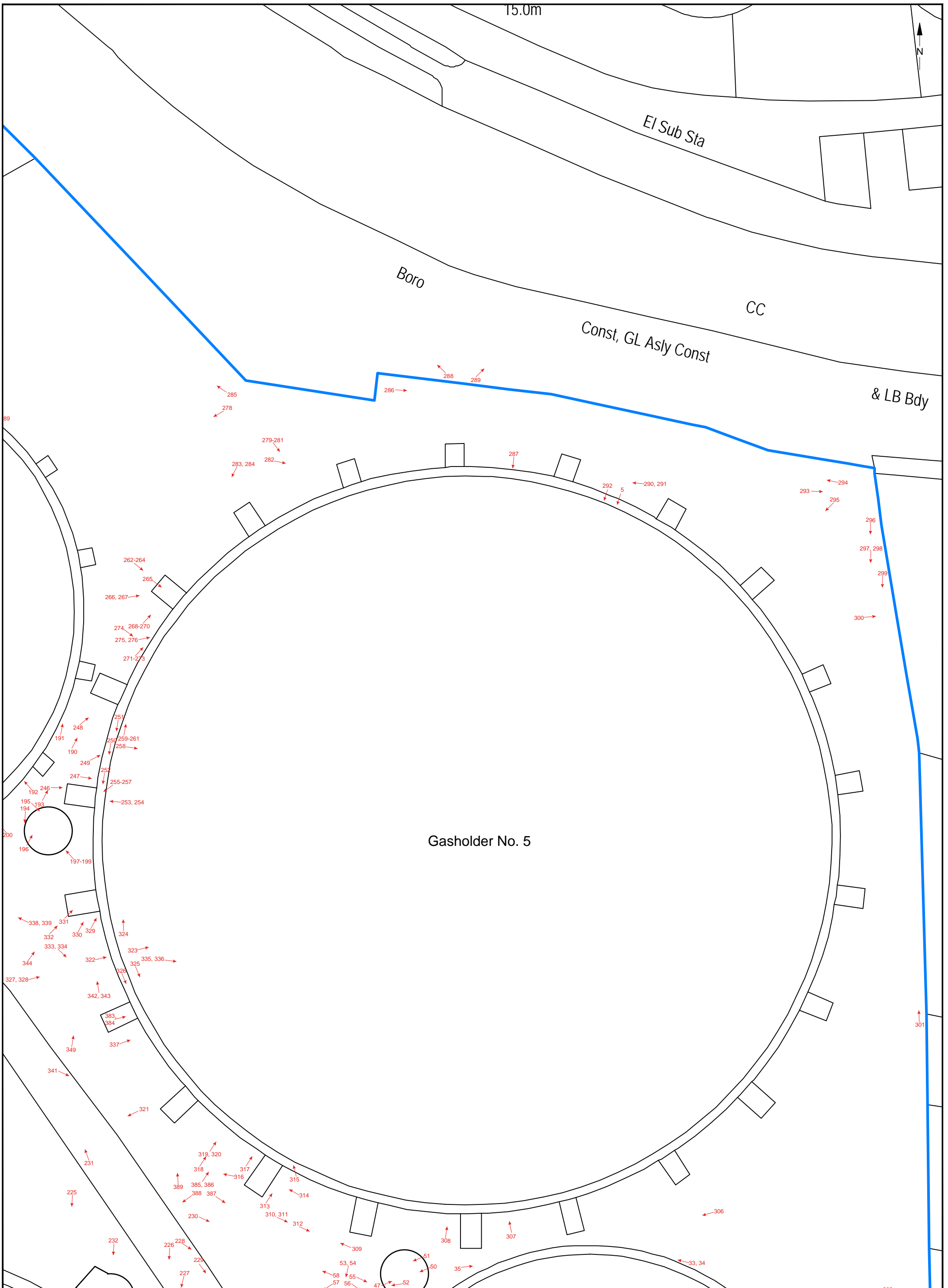
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Project Ref: 160002	March 2016	Photo Locations		
Report Ref: 2016114	Drawn by: SP			



© Archaeology South-East		Former Gasworks, Pride Park, Derby		Fig. 22
Project Ref: 160002	March 2016	Photo Locations		
Report Ref: 2016114	Drawn by: SP			



© Archaeology South-East		Former Gasworks, Pride Park, Derby		Fig. 23
Project Ref: 160002	March 2016	Photo Locations		
Report Ref: 2016114	Drawn by: SP			



© Archaeology South-East		Former Gasworks, Pride Park, Derby		Fig. 24
Project Ref: 160002	March 2016	Photo Locations		
Report Ref: 2016114	Drawn by: SP			

Appendix 1 Glossary of Gasholder Terminology

'Guide-frame' - the circular metal structure of vertical columns or standards linked by horizontal girders and sometimes, diagonal bracing, built around the perimeter of the tank and strongly bolted down.

'Bell' – the sheet-metal cylinder with a closed top which contains the gas in all water-sealed holders. It is the moveable part of the gasholder which rises and falls according to the volume of gas stored within. It descends back into the tank as it empties. The bell is usually telescopic and the upper part, known as the 'top curb', is constructed in thicker metal to provide strength.

'Lift and guide rollers' – the circumferential sections located around the bell which enable the bell to rise and fall telescopically. Each lift is mounted by a guide roller, which bears against vertical rails mounted on the standards of the guide frame. The guide rollers help to guide the bell by securing it against the wind.

'Tank' - the open-topped vessel into which the bell descends when empty of gas, and it is filled with water to provide a seal. Usually the tanks are constructed in cast iron or steel. Larger holders, have their tanks set in the ground in brick or mass concrete construction. The gasholder tank was the part of the gasholder which would house the lifts when down and contain the water in which the holder raised and descended depending on gas flow.

Appendix 2 Patent description of spiral-guided gasholder design by Gadd & Mason of Manchester

Patent Specification

Gasholder - No. 405,702

Patented June 25, 1889.

William Gadd of Manchester, England

Patent Application filed:

February 18, 1889` Serial No. 800,884. Patented in England October 6, 1887, No. 13,521; iii Luxemburg August 13, 1888, No. 1,017; in Belgium August 16, 1888, No. 82,788; iii Turkey August 24, 1888; in Canada August 28, 1888, No. 80,001; in Spain September 27, 1888, No. 8,584; in France October 6, 1888, No. 192,229; in New South Wales October 9, 1888, No. 988; in Gripe of Good Hope October 11, 1888, No. 477; in Italy October 13, 1888, No. 23,942; in Natal October 17, 1888; in Tasmania October 20, 1888, No. 6,278; in Brazil October 31, 1888, No. 626; in Victoria November 13, 1888, No. 628; in Sweden December 20, 1888, No. 1,651, Norway December 29, 1888, No. 1,040.

Be it known that I, William Gadd, a subject of the Queen of Britain, and a resident of the city of Manchester, England, have invented new and useful Improvements in Gasholder, of which the following is a specification.

The improvements relate to the construction of gasholders, and have for their object the supporting of the same in their working position in such a manner as to enable the external or upper guide-framing hitherto employed for that purpose to be dispensed with, and yet to give the requisite stability, although such a modified form of framing may be employed in connection with the improvements herein described when desired, and the present improvements form a modification of an invention for the same purpose, for which I have already applied for Letters Patent, filed August 28, 1888, Serial No. 284,024.

To accomplish these my present improvements, I affix round the well or tank, at or near the upper surface thereof and at any suitable intervals, tangential or angled radial rollers, or both, or in lieu thereof angled fixed friction-pieces. Attached to the outer surface of the bell or holder, and extending from top to bottom thereof, or thereabout, are rails of metal or other suitable substance, which are formed in the shape of quick helices or spirals or curved inclines of any working degree of inclination, which will be determined by the circumstances and design, forty-five degrees and sixty degrees from the horizontal being examples of working angles; but other angles may be employed. The spiral rails on the holder take or gear into the spaces between the rollers or their equivalent friction pieces, or it may be rollers and friction-pieces combined. As these spiral rails round the outer face of the holder rest and move upon the rollers or equivalents placed round the tank-by preference both over and under or between, according to the section of rail employed-it will be seen that as the holder becomes

raised by being filled with gas a screw-like motion is imparted to it, thus causing it to partially turn as it rises, and in similar manner allowing it to fall by gravity as the volume of gas is reduced.

The stability of the holder lies in the fact that it is constantly at all working positions supported at an equal height round its circumference, and thus presents a position of firm resistance to wind-pressure and other lateral strains under conditions somewhat similar to that of a holder placed on the ground and resting on its lower edge or rim.

The wheels, rolling sliding blocks, or equivalent devices may either be fixed tangentially with the side of the tank, and so come in contact with the top, or top and bottom, surfaces of the rails on the holder. Or may be arranged radially with the tank, but at the angle of spiral, or, and by preference, the two kinds may be combined and the rolling-surface of the rails adapted thereto or in any other suitable manner, and the rollers or sliding pieces, or equivalent devices, when placed tangentially, may be employed above and beneath the rails alternately or in couples, or otherwise, the rails being constructed in double line or double headed or faced for the purpose.

The improvements are also applicable to telescopic gasholders by employing similar helical or spiral rails, curved purlins, or grooves attached to the inner lift or lifts thereof, which ride upon or between the rollers or equivalent devices attached to the inner surface of the outer lift or lifts of such telescopic gasholders; but that the invention may be better understood, I will, by the aid of the accompanying drawings, proceed more fully to describe means employed in carrying out the same.

In the drawings, Figure 1 represents an elevation with half-plan of a gasholder in single lift raised to about its full height, and with the tank shown in section, of one arrangement in accordance with my invention; and Fig. 2 shows some detail in application of the method described.

The same letters indicate corresponding parts wherever they occur.

A A is the holder; B B, the tank or well within which the holder rises and falls by means of the helical, spiral, or inclined rails or surfaces E E riding on or between the rollers or equivalents.

C C are the tangential and D D the angled radial rollers, which in Fig. 1 are shown arranged separately from and alternately with the tangential rollers OC; but the two kinds of rollers may be arranged together, as shown in Fig. 2, wherein the rail may be formed of channel or other iron, or other substance, having a tangential roller on each side, with the angled radial roller between or the angled radial rollers may be dispensed with by flanges on the tangential rollers; or other means may be employed for keeping the holder centrally or the rails or guides thereof on or between the rollers or equivalents.

Although, in the interests of safety, I greatly prefer to employ either two sets of roller some above and the other below the inclined or spiral rails-or double rails with one or more sets of rollers between, in order to enable the same to securely grasp or to be grasped by the rails at various points around the edge of the holder, nevertheless it may be possible in some cases to dispense with the under set of

rollers or the over set of rails, as other means may be sufficient to cause the rollers to follow the inclines of the single rails.

Having fully described my invention, what I desire to claim and secure by Letters Patent is. In gasholders, the combination of rollers or equivalent friction-pieces, affixed to the edge or wall of the tank or well, with spiral guides on the outer face of the bell, substantially as set forth.

2. In gasholders, the combination of rollers or equivalent friction-pieces, affixed to the edge or wall of the tank or well, with spiral guides on or in the outer face of the bell, substantially as herein set forth.

3. In gasholders, the combination of angled radial rollers or equivalent friction-pieces, affixed to the edge or wall of the tank or well, with spiral guides on or in the outer face of the bell, substantially as herein set forth.

4. In gasholders, the combination of both angled radial rollers and tangential rollers or their equivalent friction-pieces, affixed to the edge or Wall of the tank or well, with spiral guides on or in the outer face of the bell, substantially as herein set forth.

5. In telescopic gasholders, the combination of rollers or equivalent friction-pieces, affixed to the inner face of an outer lift, with spiral guides on the outer face of an inner lift, substantially as herein set forth.

Signed at Manchester, England, December 31, 1838.

Witnesses:

John Lovelock

Edwin Mansfield

(No Model.)

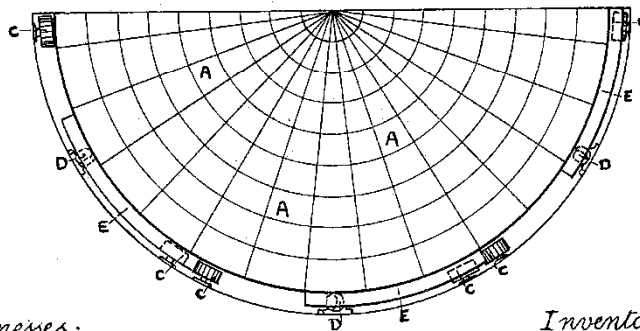
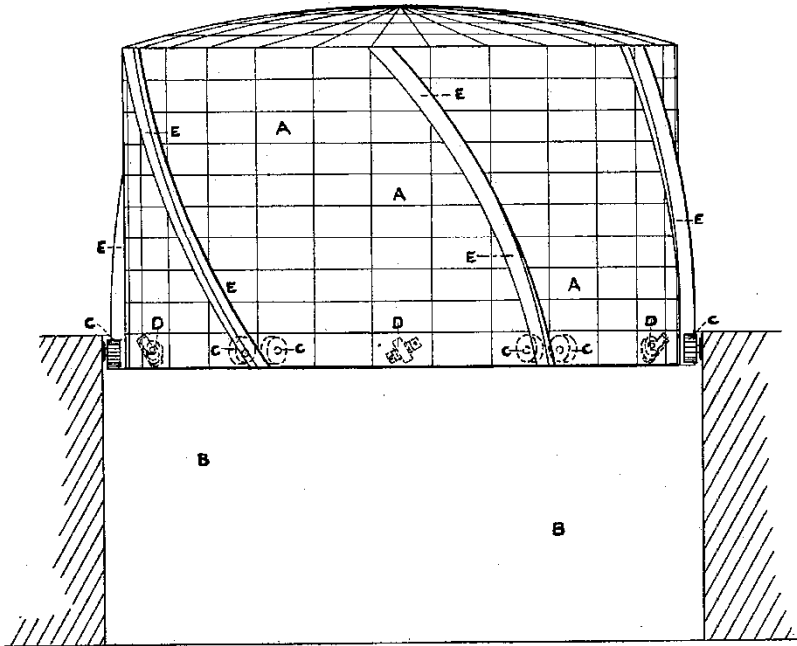
2 Sheets—Sheet 1.

W. GADD.
GAS HOLDER.

No. 405,702.

Patented June 25, 1889.

FIG. 1.



Witnesses:
George Frederick Gadd.
John Alexander Lovelock

Inventor.
William Gadd.

(No Model.)

W. GADD,
GAS HOLDER.

2 Sheets—Sheet 2.

No. 405,702.

Patented June 25, 1889.

FIG. 2.

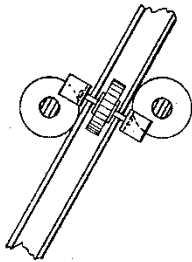


FIG. 3.

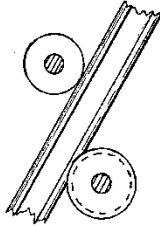


FIG. 4.

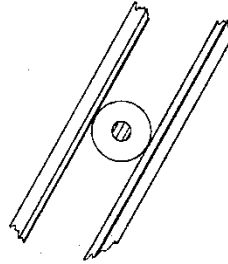


FIG. 5.

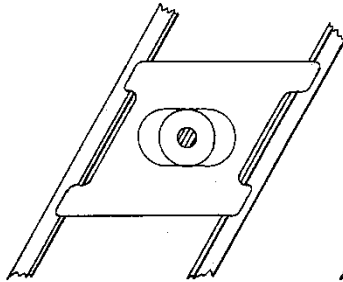


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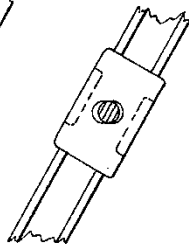


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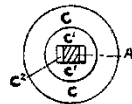
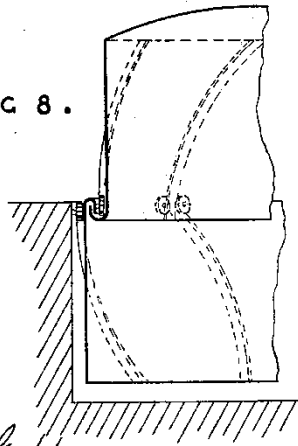


FIG. 8.



Witnesses:
George Frederick Gadd.
John Alexander Lovelock

Inventor.
William Gadd.

Appendix 3 Index of Digital Photographs



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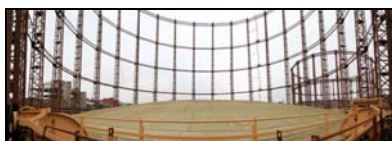
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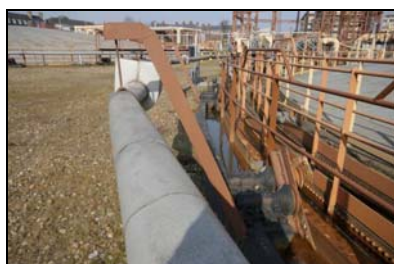
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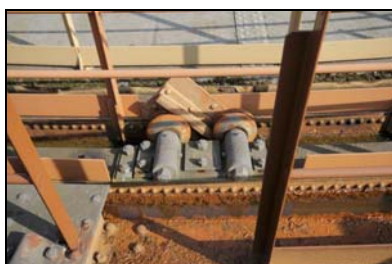
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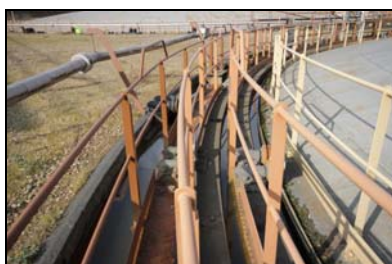
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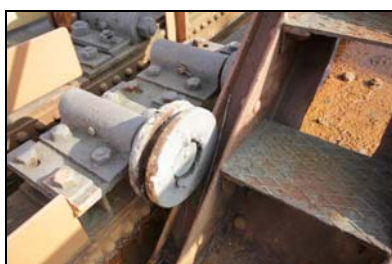
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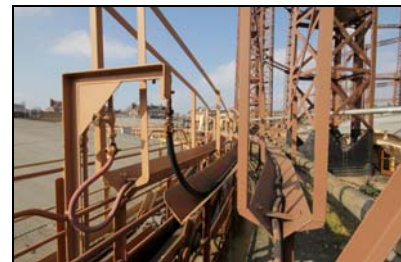
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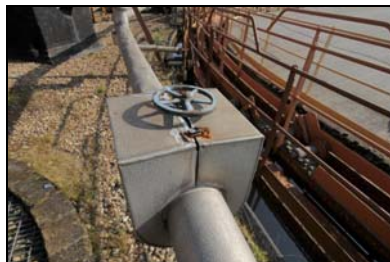
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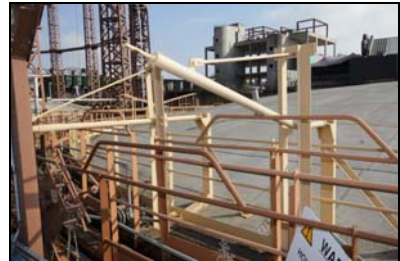
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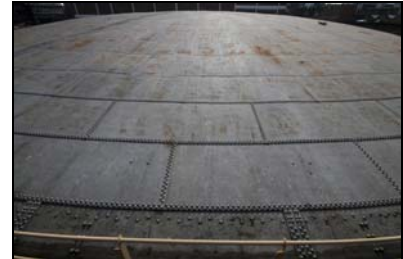
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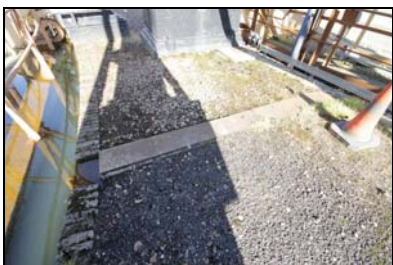
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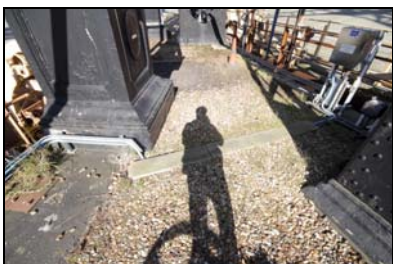
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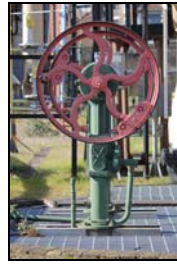
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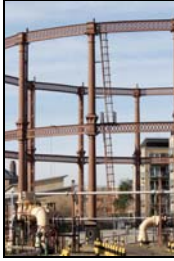
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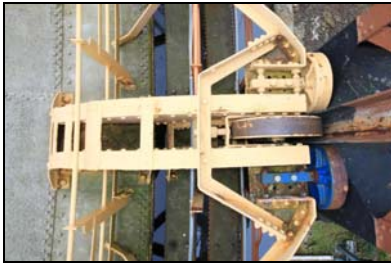
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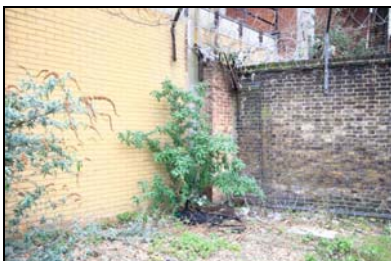
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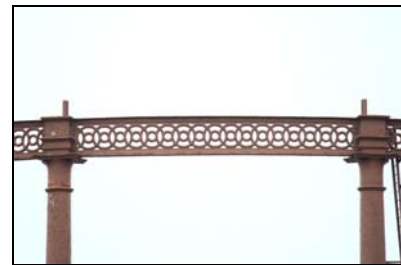
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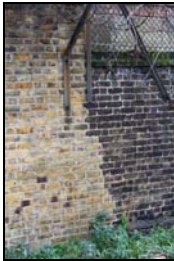
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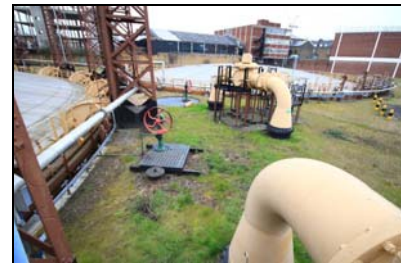
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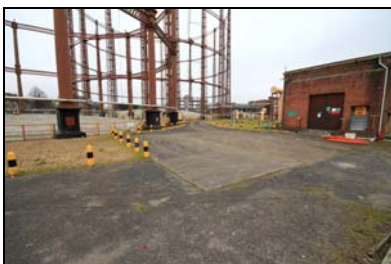
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Appendix 4 OASIS Data Collection Form

OASIS ID: [archaeol6-247787](#)

Project details

Project name	BETHNAL GREEN GASHOLDERS, LONDON
Short description of the project	<p>In March 2016 Archaeology South-East (a division of the Centre for Applied Archaeology, UCL) carried out a programme of historic building recording of the gasholder station in Bethnal Green, London (NGR: 534613 183410). The work was commissioned by Montagu Evans LLP on behalf of National Grid, in advance of the redevelopment of the site. The site occupies an area of land measuring c. 1.86ha. The site is located east of Marian Place in Bethnal Green, London, E2 9AX. The gasholder compound comprises four large gasholders: No. 2 to the north (built in 1866), with No. 5 to its east (built in 1889), No. 1 to the south-east (rebuilt in 1925), and No. 4 to the south-west (rebuilt in 1931). Gasholder No. 2 reflects one of the earliest surviving examples of a double-order two-tier gasholder, designed by Joseph Clark. Despite alterations to the columns the holder retains much of its character and grandeur - albeit lessened by its proximity to the might of Gasholder No. 4. Gasholder No. 4 is the most dominant feature on the site, and present in the skyline from the canal, train line, and nearby streets. The holder was the largest constructed at the time by the Gas Light and Coke Company. The holder is one in a series designed by George Trewby, the first example in fact of such a construction technique being used to such a scale (the first four being diminutive builds at St. Pancras). The two spiral-guided gasholders (Gasholders No. 1 and No. 4) represent fairly typical examples of 20th-century water-sealed spiral-guided design, based on a developed design by Gadd and Mason of Manchester (1887).</p>
Project dates	Start: 01-03-2016 End: 30-04-2016
Previous/future work	Yes / Yes
Any associated project reference codes	MRA16 - Sitecode
Any associated project reference codes	20160002 - Contracting Unit No.
Type of project	Building Recording
Site status	Conservation Area
Current Land use	Industry and Commerce 1 - Industrial

Monument type	GASHOLDERS Post Medieval
Monument type	GASHOLDERS Modern
Significant Finds	NONE None
Methods & techniques	"Measured Survey", "Photographic Survey", "Survey/Recording Of Fabric/Structure"
Prompt	Voluntary/self-interest

Project location

Country	England
Site location	GREATER LONDON TOWER HAMLETS BETHNAL GREEN Bethnal Green Gasholders
Postcode	E2 9AX
Study area	1.86 Hectares
Site coordinates	TQ 34613 83410 51.533029783253 -0.05901301191 51 31 58 N 000 03 32 W Point

Project creators

Name of Organisation	Archaeology South-East
Project brief originator	Montagu Evans LLP
Project design originator	Archaeology South-East
Project director/manager	Ron Humphrey/Amy Williamson
Project supervisor	Seth Price
Type of sponsor/funding body	National Grid

Project archives

Physical Archive Exists?	No
Digital Archive recipient	National Monuments Record, Swindon and National Gas Archive, Warrington
Digital Contents	"none"
Digital Media available	"Images raster / digital photography", "Text"
Paper Archive recipient	local museum
Paper Contents	"none"
Paper Media available	"Notebook - Excavation', ' Research', ' General Notes", "Photograph", "Report", "Unpublished Text"

Project bibliography 1

Publication type	Grey literature (unpublished document/manuscript)
Title	BETHNAL GREEN GASHOLDERS, LONDON HISTORIC BUILDINGS RECORD (HISTORIC ENGLAND LEVEL 2)
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