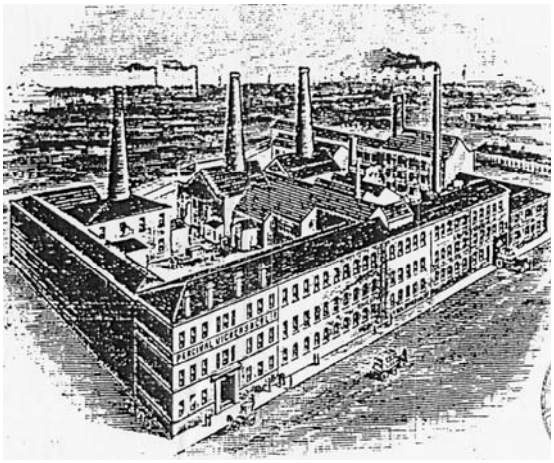

FLINT GLASS WORKS, JERSEY STREET, MANCHESTER

Greater Manchester

Post-Excavation Assessment

Oxford Archaeology North

December 2004

Urban Splash Ltd and
Lever Street Properties Ltd

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Prepared by:	Sean McPhillips	
Position:	Project Supervisor	
Date:	November 2004	
Checked by:	Ian Miller	Signed……..
Position:	Senior Project Manager	
Date:	December 2004	
Approved by:	Rachel Newman	Signed……..
Position:	Director	
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Oxford Archaeology North
Storey Institute
Meeting House Lane
Lancaster
LA1 1TF
t: (0044) 01524 848666
f: (0044) 01524 848606

w: www.oxfordarch.co.uk
e: info@oxfordarch.co.uk

© Oxford Archaeological Unit Ltd 2004
Janus House
Osney Mead
Oxford
OX2 0EA
t: (0044) 01865 263800
f: (0044) 01865 793496

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SUMMARY

The Percival, Vickers & Co Ltd British and Foreign Flint Glass Works on Jersey Street, Manchester, was established in 1844, and a purpose-built factory equipped with two glass furnaces, an annealing house, and associated workshops was erected on leased land in Ancoats (centred on SJ 8518 9869). The factory was one of an important group of glass works that was established in Manchester during the 19th century, and, by 1863, had become the largest of the city's glass factories, with a total workforce of 373 (Yates 1987). By 1880, the works had been expanded to include a third furnace, reflecting an increased demand for press-moulded wares in addition to traditional fine cut and engraved tablewares. However, the premises had been sold by 1914; the former office and warehouse building along the Jersey Street frontage was occupied subsequently by a clothing manufacturer, whilst the area to the rear was cleared of structures associated with the glass works and redeveloped.

During the 1990s, the site was assessed as part of English Heritage's Monuments Protection Programme (MPP), which recommended that the survival of buried remains should be investigated in the event of redevelopment. In accordance with this recommendation, an archaeological condition was attached to planning consent for a recent joint proposal by Urban Splash Ltd and Lever Street Properties Ltd to erect modern apartments on the site. In the first instance, the planning condition required a programme of archaeological evaluation and watching brief to assess the level of the survival of the glass works in advance of redevelopment. This work was undertaken by Oxford Archaeology North in October 2003.

The evaluation examined *c*5% of the proposed development area via the excavation of five targeted trenches. These revealed that extensive and well-preserved sub-surface remains of the glass works survived across much of the site. As a result, the Greater Manchester Assistant County Archaeologist recommended a programme of further archaeological excavation to provide a mitigation record of the site, as preservation *in situ* was not a practical option.

The targeted excavation, undertaken throughout November and December 2003, exposed considerable remains of the glass works and enabled a comprehensive record to be made of the three furnaces and annealing house. In particular, the excavation revealed the late furnace to incorporate several important design improvements, providing a valuable opportunity to elucidate details of the evolution of glass furnace technology during the second half of the 19th century. The excavation has also produced a large and significant artefactual assemblage, which has the potential to furnish important details of the glass manufacturing process and the range of glass wares that were manufactured at the works. The results of the excavation were enhanced by a further watching brief during site clearance work, which allowed an extensive plan of the glass works to be generated. The resultant dataset is clearly of regional, if not national, significance and merits a programme of further analysis.

This report provides a summary and assessment of the dataset, and presents a strategy for further analysis that will culminate in the publication of this important site.

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Oxford Archaeology North (OA North) is grateful to Tom Fenton, of Urban Splash Ltd, and Robin Tracey, of Lever Street Properties Ltd, for commissioning and supporting the project. OA North is also grateful to the staff at the Flint Glass Works for logistical support. Thanks are also expressed to Norman Redhead, the Assistant County Archaeologist for Greater Manchester, and Andrew Davison of English Heritage, for their considerable support and enthusiasm.

Special thanks are extended to Peter Beebe for sharing his extensive knowledge of the glass wares produced at the works, and to Bernard Champness and Mike Redfern of the Manchester Region Industrial Archaeology Society, for their interest in the project. Thanks are also extended to Dr John Prag of Manchester Museum, and Ruth Shrigley and Kate Day of Manchester Art Galley for their assistance during the course of the project, and the staff of the Greater Manchester County Record Office and the Manchester Reference Library for facilitating documentary research. Pauline Webb, Eleanor Moore and Jean Horsfall of The Museum of Science and Industry in Manchester are also thanked for their invaluable assistance, and also for compiling a video record of the excavation. Thanks are also expressed to Peter Bone for sharing his research findings of the Manchester glass industry. A very special mention should be made of the late Tom Percival, a direct descendant of one of the glass work's founding partners whose research during the 1990s highlighted the significance and archaeological potential of the site, and to Edwina Percival for her support.

Special thanks are also expressed to Dr David Martlew of the Science Support Group at Pilkington for considerable assistance with technological information, and to David Crossley and Dr Hugh Willmott of Sheffield University. OA North is also grateful to Sue Stallibrass and David Dungworth of English Heritage for their advice and for making the results of previous research available.

The evaluation and subsequent excavation was directed by Sean McPhillips, who was assisted by Chris Healey, Richard Jackson, Andrew Lane, Jon Onraet and Carli Douglas. The survey was completed by Chris Wild, Karl Taylor and Daniel Elsworth. John Hartley acted as a consultant, and provided specialist advice regarding the technical aspects of the glass works and associated refractory material. Steve Little undertook the historical research of the site for the period before the glass works was established. Ian Miller and Sean McPhillips compiled the report, which was edited subsequently by Rachel Newman, and Jon Onraet, Mark Tidmarsh and Emma Carter prepared the illustrations. Ian Miller was responsible for the management of all stages of the project.

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1. INTRODUCTION

1.1 CIRCUMSTANCES OF PROJECT

1.1.1 Urban Splash Ltd and Lever Street Properties Ltd recently submitted a joint development proposal to erect modern residential apartments and business units at 64a, Jersey Street, within the Ancoats area of Manchester. The site was formerly occupied by the Percival, Vickers & Co Ltd British and Foreign Flint Glass Works, which, by 1863, had become the largest of Manchester's glass factories (Yates 1987). However, the premises were sold in 1914, and the furnaces, annealing house, and associated workshops were demolished. During the 1990s, the glass industry as a whole was assessed archaeologically as part of English Heritage's Monuments Protection Programme (MPP), which recommended that the survival of buried remains of the Percival, Vickers & Co Ltd Glass Works should be evaluated in the event of redevelopment (Crossley 1996).

1.1.2 In order to secure archaeological interests highlighted by the MPP reports, Manchester City Council attached an archaeological condition to planning consent for redevelopment of the site, and a brief detailing the required archaeological works was devised by the Assistant County Archaeologist for Greater Manchester. In the first instance, a watching brief was required during the removal of concrete floors associated with the recent use of the site, followed by an archaeological evaluation which was aimed at establishing the extent of survival of the glass works, and particularly the furnace bases and flues.

1.1.3 The evaluation comprised the excavation of five targeted trenches, with a combined total length of 120m, and was undertaken in October 2003. This programme of work revealed the sub-surface remains of the glass works to be well-preserved and extensive, and indicated significant technological differences to exist between the three furnaces.

1.1.4 Following on from the results of the evaluation, the Assistant County Archaeologist for Greater Manchester, in conjunction with advice from English Heritage's Regional Inspector of Ancient Monuments, recommended that a programme of further excavation be undertaken, as preservation of the remains *in situ* was not a practical option. This element of the project was undertaken during November and December 2003, and was followed by a further watching brief between January and March 2004, which monitored earth-moving works along the northern and southern boundaries of the proposed development area.

1.2 SITE LOCATION, GEOLOGY, AND TOPOGRAPHY

1.2.1 The study area (centred on SJ 8518 9869) is situated within Ancoats, which forms part of the Township of Manchester, on the north-east side of the city centre (Fig 1). The site of the former glass works, including the recently-restored building that fronts Jersey Street, occupies an area of *c*3600 square

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metres, of which *c*2800 square metres is to be affected by the proposed development. The site is bounded by Jersey Street and the Rochdale Canal to the north and south respectively, with Radium Street lying to the west (Fig 2).

1.2.2 The solid geology of the area comprises Carboniferous sedimentary material and a series of Permo-Triassic rocks, consisting mainly of New Red Sandstone (Hall *et al* 1995, 8). The overlying drift incorporates Pleistocene boulder clays of glacial origin, and sands, gravels, and clays of fluviatile/lacustrine origin (Ordnance Survey Geological Survey 1970).

1.2.3 Topographically, the Manchester Conurbation as a region is within an undulating lowland basin, which is bounded by the Pennine uplands to the east and to the north. The region comprises the Mersey river valley, which is dominated by its heavily meandering river within a broad flood plain (Countryside Commission 1998, 125). Other river valleys, including those of the Irwell, Irk, Medlock, Tame, and Goyt, form important tributaries.

1.2.4 The topography within the environs of the study area, however, reflects the shallow valley of Shooters Brook, a rivulet which flows westwards from Newton Heath, through Ancoats and into the river Medlock (Ashworth 1987, 22). The glass works site lies on the northern crest of the Shooters Brook valley, which is depicted as flowing north-north-east to south-south-west on early cartographic sources for the area. The brook was culverted beyond New Islington during the early 19th century, and the valley has since been somewhat levelled as a result of development.

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2. METHODOLOGY

2.1 PROJECT DESIGN

2.1.1 Further to the Client's request for an archaeological watching brief and evaluation, a project design (*Appendix 1*) was submitted by OA North in August 2003. Following formal acceptance of this project design, OA North was commissioned to undertake the fieldwork, which commenced in October 2003. The work conducted was consistent with the relevant standards and procedures of the Institute of Field Archaeologists (IFA), and generally accepted best practice.

2.2 AIMS AND OBJECTIVES

2.2.1 The main research aim of the evaluation was to characterise the level of preservation and significance of the archaeological remains relating to the glass works, and to provide a good understanding of their potential.

2.2.2 The stated objectives of the archaeological evaluation were:

- to expose and determine the presence, character, and level of survival of the three glass furnaces, and to identify any technological variation between the furnaces;
- to expose and determine the presence, character, and level of survival of any flues associated with the glass furnaces;
- to expose and determine the presence, character, and level of survival of any evidence for ancillary processes, such as annealing, and storage;
- to expose and determine the presence, character, and level of survival of the workshops and other areas within the works.

2.3 WATCHING BRIEF

2.3.1 An archaeological watching brief was maintained during the breaking and removal of the concrete hard standing that formed the modern ground surface. The work followed the method statement detailed in the project design (*Appendix 1*).

2.4 EVALUATION

2.4.1 Following on from the removal of the modern concrete surface, five evaluation trenches were excavated across the site (Fig 2). The uppermost levels of overburden/demolition material were removed by a machine fitted with a toothless ditching bucket, to the top of the first significant archaeological level.

2.4.2 Machine excavation was then used to define carefully the extent of any surviving foundations and other remains within each of the trenches. Thereafter, structural remains were cleaned manually to define their extent,

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nature, form and, where possible, date. All information identified in the course of the site works was recorded stratigraphically, using a system adapted from that used by the Centre for Archaeology of English Heritage, with sufficient pictorial record (plans, sections and both black and white and colour photographs, the latter in 35mm and digital format) to identify and illustrate individual features.

2.4.3 All structures encountered during the course of the excavation were recorded three-dimensionally by EDM tacheometry using a total station linked to a pen computer data logger, the accuracy of detail generation being appropriate for a 1:250 output. The resultant digital plan was enhanced by manual survey on site using AutoCAD 14 within the pen computer, whilst selected components of the works were hand-drawn at a scale of 1:20. The positions of the evaluation trenches were located with respect to surrounding landscape features (Fig 2), and were also recorded using the total station.

2.5 EXCAVATION

2.5.1 Following on from the evaluation, and the Assistant County Archaeologist's recommendation for further work, an updated project design was submitted in advance of targeted excavation. The academic objectives of this programme of work were redefined thus:

- to obtain a complete record of the two original glass furnaces by determining their form, character and dimensions, and elucidate any differences in their construction and operation;
- to obtain a complete record of the late glass furnace and its associated working area, and to elucidate any differences between this furnace and its earlier counterparts;
- to obtain a record of the flues associated with each furnace, and elucidate an understanding of their operation;
- to determine the nature and extent of any working areas adjacent to the furnaces;
- to determine the form, character, and purpose of the linear building between the two original furnaces, and provide an understanding of the functional relationship between this structure and the furnaces;
- to identify any differences in the range of products produced in the late furnace compared to the earlier ones; in particular, to relate the findings to the upsurge in the production of press-moulded glass, which is thought to date from the late 1860s;
- to recover sufficient fragments of glass to allow a greater understanding of the range of products manufactured at the works.

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2.6 ARCHIVE

2.6.1 A full professional archive has been compiled in accordance with current English Heritage guidelines (1991a) and the *Guidelines for the Preparation of Excavation Archives for Long Term Storage* (Walker 1990). The project archive represents the collation and indexing of all the data and material gathered during the course of the project. The deposition of a properly ordered and indexed project archive in an appropriate repository is considered an essential and integral element of all archaeological projects by the IFA in that organisation's code of conduct.

2.6.2 A summary of the provisional results produced from the archaeological investigation has been submitted to the CBA North West for publication in their magazine (*Appendix 5*).

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3. HISTORICAL AND TECHNOLOGICAL BACKGROUND

3.1 THE DEVELOPMENT OF THE ENGLISH GLASS INDUSTRY

3.1.1 Glass-making was introduced to Britain by the Romans. However, the character and scale of glass production during this period is poorly understood, and it is unclear whether glass was made from raw materials, or melted from imported pre-manufactured material (Crossley 1993, 29).

3.1.2 During the Middle Ages the industry was concentrated in heavily forested areas as the glass-makers required a ready supply of wood to fuel their furnaces and bracken as a source of potash, and hence the traditional centre of glass-making was the Weald of Sussex and Surrey (Ashmore 1969, 123). Glass production during this period was carried out on a fairly small scale, and the glass was of a poor quality, reflecting the simple furnace design of the time, and the impurities within the potash that was used (Dungworth 2003, 2). The quality of glass improved dramatically during the late 16th century as a result of the influence of immigrant French glass workers (Vose 1980, 106-10).

3.1.3 In 1615, James I banned wood as a fuel for glass furnaces, effectively killing the forest glass industry and forcing glass-makers to redesign their furnaces to operate on coal. This required a solution to several technical difficulties; coal burns with a shorter flame than wood and therefore requires the heat source to be closer to the glass melting pots, and also demands much larger volumes of air. These requirements led to the introduction of furnaces with grates and deeper flues (Crossley 1990, 232-35). Vose (1980, 146) suggests that the most important feature of the coal-fired furnace was the iron bars which formed the grate. Christoper Merrett, writing in the mid-17th century, described the early grates as '*great iron bars crossing smaller ones which hinder the passing of the coals, but give passage to the descent of the ashes*' (Neri 1662). The use of coal necessitated modifications to furnace superstructures to facilitate the efficient venting of sulphur produced from burning coal. It is clear, for instance, that the English glass cone furnace was developed in order to remove the smoke and soot and to create a stable atmosphere, in addition to increasing the size of glass furnaces. This structure comprised an open-ended cone around and over the furnace, which increased the draught through the grate whilst maintaining a steady working temperature around the furnace (Parkin 2000, 8). After its introduction in the late 17th century, the cone furnace became widely recognised as a classic symbol of the English glass-making industry.

3.1.4 The sudden and total change from the use of wood to coal fuel also resulted in a shift in the focus of the English glass industry from the traditional centres in the south of the country to the coalfields of the north (Ashmore 1969, 123). Hence, Tyneside, South Lancashire and South Yorkshire all developed as important glass-making centres during the 17th century.

3.1.5 Whilst it has been argued that Britain became a net exporter of glass and was in the forefront of European glass-making during the 17th century (Charleston

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1984), the finest colourless glass was produced by Venetian workers and imported to Britain until the later part of the century. In 1676, however, George Ravenscroft succeeded in producing good quality colourless glass in England by introducing lead in addition to potash as a flux. The invention of colourless lead glass, which is also known as lead crystal or flint glass, had a profound impact on glass manufacture (Dungworth 2003, 5). Upon the expiry of Ravencroft's patent in 1681, the production of lead glass was taken up by numerous glass-makers; in a list of 88 glasshouses compiled in 1696, 27 were producing 'flint glass' (Vose 1980, 198-99).

3.1.6 It is widely thought that covered glass-making crucibles were introduced shortly after Ravenscroft's development of lead glass, although there is no historical or archaeological evidence to support this conjecture (*op cit*, 147). There are, however, accounts of open crucibles in use during the mid-17th century. Merrett, for instance, describes open crucibles that were 20 inches wide at the rim and narrowed down towards the base (Neri 1662).

3.1.7 A major advance in the industry was the introduction of plate glass, whereby glass was cast in thick plates and then flattened by heavy rollers. The glass was finished by grinding and polishing. The first company for the manufacture of English plate glass was established in 1773, and commenced its operations at Ravenhead, near St Helens (Redding 1842, 89). The workmen for this enterprise were brought over from France, but by the mid-19th century '*the great majority of persons employed are Englishmen*' (*op cit*, 90). Redding also claimed that English glass of the 19th century was superior to that of either the French or Venetian artisans as a direct result of '*the application of chemical and mechanical science to the improvement of several processes*', but noted that '*great jealousy is manifested by the proprietors in keeping secret the details of their processes*' (*ibid*).

3.1.8 The press-moulding technique of glass production was developed in America during the late 1820s. It was taken up in England in the 1830s, initially in the West Midlands, and eventually became a large industry in its own right. The first press-moulded glass known to have been produced in Manchester has been dated to 1848 (*3.1.12 below*), although it was not produced widely in the area until the 1860s. This broadly coincided with the introduction of tank furnaces and regenerative gas furnaces to the Pilkington glass works in St Helens. This German technology, developed by the Siemens brothers, played an important role in the growth of the glass industry there (Krupa and Heawood 2002), and these new methods began to replace the old glass cones and pots. The Manchester industry, however, does not appear to have taken advantage of this new technology, and continued to manufacture glass using the traditional crucibles, although the results of the archaeological investigation at the Pecival, Vickers & Co Glass Works implies that considerable modifications were made to the traditional cones which housed the furnaces.

3.1.9 Few details are available regarding the improvements made to glass furnaces during the 19th century, reflecting the situation that '*glass-making was a*

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closely guarded secret and little was recorded in the period 1826 to 1896' (Parkin 2000, 2). However, it is generally accepted that whilst the round reverbatory furnaces of the early 19th century contained two or four crucibles, the period 1835-50 saw enlargements to accommodate eight or ten crucibles, each with a capacity of up to five hundredweight of molten glass (*op cit*, 14).

3.2 THE DEVELOPMENT OF THE GLASS INDUSTRY IN SOUTH LANCASHIRE

3.2.1 The earliest evidence for glass-making in the Manchester area has been obtained from entries in the parish registers of Stockport and Ashton-under-Lyne for the years 1605-53 (Vose 1980, 146). The first coal-fired glasshouse in the region to have been excavated archaeologically was that at Haughton Green, near Denton, which was in production between 1636 and 1643 (Vose 1994). This early glass works was established on the west bank of the river Tame, and produced green, blue and black domestic glass, including decorated vessels, bottles and window glass. References to other 17th century glass works appear in a list of glasshouses in England and Wales compiled at the end of the century (Houghton 1696), which refers to two works in Lancashire, one near Warrington, erected in *c*1650 (Harris 1968), and one at Sutton that was established *c*1698. An expansion of the region's glass industry is attested by the erection of more glass works during the 18th century; a works opened at Prescot in 1719 (Buckley 1929), two works were established in Liverpool (Ashmore 1982, 14), a bottle works was put into production at Thatto Heath, near St Helens, and the products of a Salford glasshouse were advertised in local papers in 1759-60, and included bottles, vials, bell glasses, retorts, lamp glasses and garden glasses (Ashmore 1969, 124). In 1785, Imison and King opened a works in Newton Heath for the manufacture of '*all sorts of glass wares*', and references to the Manchester firm of Atherton and Whalley, cut and engraved glass manufacturers, date back to 1795 (Dodsworth 1980, 64). However, of these, the Haughton Green site is the only glass works in the region to have been included in the handlist of assessed sites in the *MPP Step 3 Report* (Crossley 1996, 15), highlighting the lack of research into the industry's development.

3.2.2 The first well-documented large-scale glasshouse in Lancashire was established at Ravenhead, St Helens, in 1773 (Redding 1842, 89). St Helens had become established as the main centre of plate-glass manufacture in the country by the 1860s, reflecting the local availability of raw materials such as coal, alkalis from the chemical works, and good supplies of suitable sand (Krupa and Heawood 2002). Manchester, however, also emerged as a major glass-manufacturing centre; the industry was well enough established by 1821 for glassblowers to take part in the processions which marked the coronation of George IV (Dodsworth 1980, 64), and by 1872 Manchester was the largest employer of glass-makers in England (Yates 1987, 29). Nevertheless, the industry there has not attracted the research and status it perhaps deserves. The Manchester industry, moreover, appears to have developed in some isolation from the other main glass-making centres; a contemporary observer noted that '*Manchester glass has a reputation of its own. There are distinct features about it that do not pertain to the glass of other districts*' (Pottery Gazette and

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Glass Trade Review 1898, 1120). The bulk of Manchester's 19th century glass works, and certainly the largest concerns, were contained within the Oldham Road and Ancoats area, although another concentration of works was also established in Hulme (Fig 3).

3.2.3 Baines (1825, 420) lists seven glass works within Manchester and Salford in his directory, although some of those appeared to be glass merchants or engravers rather than actual producers. Many of these were situated close to the city centre, such as William Johnson's manufactory on Deansgate (Dean 1809, 101). The earliest glass works in Ancoats, established in 1827, was that of Maginnis Molineaux and Co, which became the Molineaux Webb Ltd Co Manchester Flint Glass Works. In 1833, Jackson, Woolfall and Percival established the Manchester Glass Bottle Works at 6, Prussia Street, Ancoats. In 1844, however, Thomas Percival, the son of one of the partners in the Manchester Glass Bottle Works concern, established his own manufactory on nearby Jersey Street, after spending several years as the manager of the Molineaux Webb works (Children's Employment Commission 1843). Other significant glass-making firms that were established in Ancoats during this period included Burtles Tate Ltd at the Poland Street works, Thomas Kidd and Co at the Holt Town Glass Works, Ker Webb and Co at the Prussia Street Glass Works, the Ancoats Machine Glass Works on Pollard Street, and the Phoenix Glass Works on Collyhurst Street (Fig 3).

3.2.4 An important factor in the prosperity of the Manchester glass industry during the third quarter of the 19th century was the increased demand for press-moulded wares, although the pioneer firms of the area, such as Molineaux Webb and Percival, Vickers, began their production in the manufacture of traditional fine cut and engraved tablewares. These products were recognised as being of a high quality; '*it may be affirmed without prejudice to other manufacturers in localities where such business is now carried on, that the Manchester glass is in no way inferior to the best in the country*' (The Art Journal 1851, 290). The first Manchester firm to produce pressed glass is thought to have been Molineaux Webb, who were manufacturing such wares as early as 1848, although they did not begin to register designs regularly until the 1860s (Dodsworth 1980, 67).

3.2.5 Many of the Manchester works closed during the 1890s, largely as a result of the great depression in trade (Yates 1987, 37), and very few survived into the 20th century. This situation is reflected in a detailed survey of Manchester's industries undertaken during the 1920s, which makes no reference to glass manufacture in the city (Clay and Brady 1929).

3.3 THE DEVELOPMENT OF ANCOATS

3.3.1 At the beginning of the 13th century, Ancoats was known as *Elnecot*, derived from the Old English *ana cots*, which means 'lonely cottage' (Cooper 2002, 13). Ancoats retained a semi-rural aspect until the late 18th century, but by 1800 the area had been transformed into an effective industrial suburb.

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3.3.2 This transformation began in the 1770s, when land owned by the Leigh family was sold to Thomas Bound, a builder, who then sold it on to others for development. William Green's *Map of Manchester and Salford*, surveyed between 1787 and 1794, shows the focus for initial development to have been at the corner of Great Ancoats Street and Oldham Road, and depicts the main elements of the existing street plan laid out on former fields of the area (Fig 4). Building speculation then drove further expansion, with plots of land within a gridiron pattern of streets being sold for development. The principal driving force of development was the national demand for textiles, particularly cotton, and the introduction of steam-powered spinning mills (Williams and Farnie 1992, 3).

3.3.3 Several water-powered mills had, however, already been erected along Shooters Brook, situated to the south of Union (now Redhill) Street. The proposed line of the Rochdale Canal ran between Shooters Brook and the new focus of development, offering the potential of cheap and reliable transport for goods and materials. The completion of this canal in 1804 coincided broadly with the introduction of efficient steam engines capable of producing rotative power. A small number of enterprising firms seized the opportunity presented by this combination of factors, resulting in the creation of a new breed of mill building in Ancoats. The net result was the creation of 'the World's first industrial suburb', an edge-of-town industrial estate with associated housing, community facilities (churches, pubs and charitable refuges) and related businesses.

3.3.4 Apart from textile mills, numerous other industries became established in the area, including copperas works, iron foundries, steel works, sizing works, wire works, hat manufactories, and machine works, as shown on contemporary maps of the area. Ancoats also emerged as a major glass-making district, although the historical significance of these industries in general has tended to be eclipsed by the dominance of the textile trade, and glass manufacture by the pre-eminence of the St Helens industry (*3.2.2 above*).

3.4 EARLY USE OF THE JERSEY STREET SITE

3.4.1 Documentary research undertaken by Steve Little, summarised below, has provided information on the history of the site prior to the erection of the Percival, Vickers & Co Ltd Glass Works in 1844.

3.4.2 William Green's map of 1794 (Fig 4) shows Ancoats of the site at a time when there was a great deal of speculative building going on in the area – an answer to the rapid growth of the town in the latter part of the 18th century. The road layout shown was part of that speculation. Four streets bordered the site: Elliot Street (Jersey Street), German Street (Radium Street), Poland Street, and Union Street (Redhill Street). The line of the Rochdale Canal had not been laid out at this time, but subsequently ran to the south of Union Street to the west of the site, crossing the junction of German Street and Union Street and running along a line to the north of Union Street. A drawbridge made the connection between the two halves of Union Street. Silver Street is indicated

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on the map intersecting the site, but this street was never built and remained speculative.

3.4.3 The faint lines on Green's map, crossing the site, are almost certainly the line of what had been hedges and probably indicate land ownership at the time. The site was divided by what appear to be parts of at least five fields and therefore it was probably in a number of ownerships. This may suggest the reason why the site was developed at a slightly later date to the surrounding plots.

3.4.4 Three dwellings are shown at the corner of German Street and Elliot Street; these subsequently became part of Lomax's Court, a tenement block which was still standing in the 1880s. Otherwise the area was a 'greenfield' site. The land rose to a hillock at the north-east corner of the site according to Laurent's map, which was published in 1793. Strangely, Laurent appears to indicate a small shop on the land between the speculative Silver Street and Union Street – this would put it in the middle of the coal wharf that was later established (*3.4.5 below*). This map shows the line of the Rochdale Canal and the drawbridge across the canal at Union Street. Elliot Street is labelled as Jersey Street, and the area generally has been developed, although the site in question to a lesser extent.

3.4.5 An entry in the '*Manchester Directory*' of 1811 refers to a coal yard operated by an Edward Stelfox, coal merchant at 8 German Street. Evidence from subsequent directories appears to establish the coal yard as being the one at the bottom of German Street and, therefore, the entrance to the coal wharf must have been from German Street. Subsequent entries for the coal merchants and/or dealers on German Street provide the following information:

1817 - Andrew Stelfox, Son & Co. Drawbridge Wharf, German Street
1821 - Thomas Andrew. 7 German Street
1828 - Thomas Andrew. Coal Wharf, Drawbridge, German Street
1829 - Thomas Andrew. German Street
1832 - Thomas Andrew. 27 German Street
1838 - Thomas Andrew Drawbridge Wharf – mentioned elsewhere as 27 German Street.

Table 1: Owners of the coal yard as listed in trade directories

3.4.6 In 1829 the coal wharf site was assessed (rateable value) at 25/-, more than double the assessment of the highest rated house in the area. The site is marked as a '*coal yard*' on Bancks and Co's *Map of Manchester and Salford*, which was published in 1831 (Fig 5).

3.4.7 The last entry for Thomas Andrew, variously entered as coal merchant or coal dealer, was in 1843. The site is marked, however, as a coal wharf on the Old

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Series Ordnance Survey map, published in 1849, suggesting that coal continued to be trans-shipped from the canal during its period of use as a glass works.

3.5 THE PERCIVAL, VICKERS & CO LTD GLASS WORKS

3.5.1 The glass works was established in 1844 by Thomas Percival and William Yates, who are listed as '*flint glass manufacturers*' in a contemporary trade directory (Slater 1845, 251). Further evidence for the inception date of the works is provided by an apprenticeship indenture issued in 1845 between Benjamin Ramsbottom and Thomas Percival and William Yates (MCL/MISC/904). According to the indenture, Benjamin Ramsbottom, aged 15, was to be trained by Percival and Yates '*in the trade and business of a glass cutter*', for the sum of six shillings weekly, increasing to eight shillings during the fourth year of the apprenticeship.

3.5.2 It seems probable that the works was established initially to manufacture traditional fine cut and engraved tablewares, although they soon began to produce press-moulded designs. The earliest known pressed glass from the works dates to the 1860s (Dodsworth 1980, 67).

3.5.3 The earliest cartographic source to depict the glass works is the Old Series Ordnance Survey map, which was published in 1849. This shows the works in its original format, complete with two furnaces, a long rectangular structure between them, and a building along the Jersey Street frontage. The southern edge of the site appears to be open to the Rochdale Canal, and is marked as '*coal wharf*'. The subsequent map to depict the site is the First Edition 6": 1 mile Ordnance Survey map of 1851, which was surveyed in 1848-49 (Fig 6). This shows the same detail as the Old Series map, although the southern part of the site is not labelled as a coal wharf. Nevertheless, it would seem likely that coal continued to be trans-shipped from the canal to this part of the site. During the same year (1851), Adhead's '*Map of Manchester*' was also published (Fig 7). This shows the outline of the glass works, but gives no detail as to internal structures. It does, however, label the works as '*Percival, Yates and Vickers Flint Glass Manufactory*', indicating Thomas Vickers to have become a partner in the firm by 1851.

3.5.4 The company is similarly listed in a contemporary trade directory as the '*Percival, Yates and Vickers (flint) glass works*', located at both 62 Jersey Street and Cipher Street, off Oldham Road, and is accredited with employing 257 people (Slater 1852, 330). The Cipher Street works was situated slightly less than 0.5km to the north of Jersey Street, and was established by William Magginnis in 1832. It appears to have been occupied from 1833-44 by the firm of Atherton and Buckley as part of the Stourbridge Glass Works (Fig 3), and was taken over by Percival and Yates in 1844. Percival, Vickers & Co Ltd operated the site until 1880, when it was closed and converted to use as a fruit and vegetable warehouse (P Bone pers comm).

3.5.5 Kelly's *Post Office Directory of Manchester*, published in 1858, similarly lists Percival, Yates and Vickers as '*flint glass manufacturers*' of both Jersey Street

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and Oldham Road (the latter presumably referring to the works on Cipher Street), and a directory published three years later provides the same information (Slater 1861). William Yates appears to have left the company shortly afterwards, however, and in 1865 Percival, Vickers and Co was registered as a limited company of flint glass manufacturers, based at the British and Foreign Glass Works on Jersey Street. The works is listed as such in a trade directory of 1869 (Slater 1869), and retained the title of Percival, Vickers & Co Ltd for the remaining period of production.

3.5.6 Thomas Percival died in 1875, and appears to have been succeeded by his son Thomas. His second son, Walter Percival, is listed in a trade directory as the owner of a glass manufactory on Bolton Road, Pendleton (Slater 1879).

3.5.7 In 1881, Isaac Slater published his map of *Manchester and Salford in Parishes*, which appears to show the works fitted with three furnaces, although the detail is not very clear. The First Edition 1:2500 Ordnance Survey map, surveyed in 1888-91, provides clearer details of the site's remodelling (Fig 8). In addition to an extra furnace having been erected within the eastern part of the site, the buildings associated with the original two furnaces appear to have been expanded, and the main building fronting Jersey Street also seems to have been extended. This layout was retained throughout the remaining working life of the glass works, as the site is depicted as such on the Ordnance Survey 1:2500 map of 1908, which was surveyed in 1905.

3.5.8 An extremely useful source of information is a contemporary account, based on a guided tour of the works (MCL/942.7389/M204). This is undated, but in all probability was written during the late 19th century. The tour began in the clerk's office, from where the group of visitors were to descend '*some steps, cross one or two big yards and...enter the mixing house*'. Here, the raw materials were mixed ready for the furnace, and included '*large heaps of whitish sand, tubs of ash (pot-ash), and casks of red lead. This sand comes from Rouen, and is considered the best for the purpose, although other sands are occasionally used. It is burnt in an oven to free it from all impurities*'. This process, known as fritting, was undertaken in an oven called a calcar to liberate any gases and burn off impurities. It was common practice to add broken glass, or cullet, to the mixture.

3.5.9 The tour then proceeded to the furnaces, passing several workshops on the way. These included '*a workshop in which are being modelled the great clay melting pots used in the furnace. Each weigh about fourteen hundredweight...prepared for use by being placed in a sort of kiln or furnace*'. Special fireclay was used, although new clay was seldom used on its own, but was mixed with a small proportion of clay from old pots that had been ground down (Dodsworth 1982, 13). Before being used, each pot was placed in a kiln called the pot arch, where it was gradually fired up to the temperature it would sustain in the furnace. On average, a pot lasted approximately three months.

3.5.10 Other workshops mentioned included a room in which the steel moulds used in the press-moulding process were constructed, the engine house, and '*the cave underneath the great furnace, with its patent apparatus for forcing the fuel up*

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into the fierce fire overhead'. A similar apparatus is illustrated in an article published in the *Pottery Gazette* in 1898 that is described as a feeder in the centre of the grate by which the furnace is fed with fuel pushed up from underneath by a hopper worked by machinery (Fig 11). It has been estimated that a single furnace of this type would consume between 20 and 25 tons of coal weekly (The Pottery Gazette and Glass Trade Review 1898, 971).

3.5.11 A description of the furnaces is also provided in the eyewitness account (MCL/942.7389/M204): '*the great furnace-house is one of the most picturesque places conceivable. There are several furnace-houses, all constructed on the same lines...a great grimy place, with a dark, high roof, and having in the centre a brick-built erection, circular as to the ground plan and slightly conical as it rises, springing direct from the floor and passing upwards through the roof. This is the outer shell of the furnace. Around the base of this are pierced ten arches which rise to a convenient height for working purposes, having small openings through which access is gained to the pots of molten glass, one of which stands opposite each arch. Round the walls of the furnace-house are other fiery furnaces, all working at a great heat...*'. This description implies that the furnaces each contained ten melting pots, based on the number of arches that pierced the outer wall.

3.5.12 It has been estimated that a ten-pot furnace would measure 19ft (5.79m) in external diameter, and 4ft 6in (1.37m) in height from the siege (*ie* the platform upon which the melting pots rest) to the inside centre of the dome. The average measurement of the arches under which the pots rested was 3ft 1in (0.94m) wide by 3ft 3in (0.99m) high (Pottery Gazette 1898, 972).

3.5.13 Once blown, vessels were '*taken away to the annealing house...and the vessel passed into the oven, through which it has to travel by gradual stages until fully cooled and tempered*' (MCL/942.7389/M204). Annealing was a critical part of the glass-making process, without which different parts of the vessel would cool at different rates, setting up stresses that may have caused the glass to crack or shatter.

3.5.14 After annealing, the glass was ready to be engraved and cut. Indeed, the final room mentioned in the account was the cutting room, which comprised '*a very long workshop, full of hoppers and pulleys*' (MCL/942.7389/M204). The rotating wheels used for cutting glass were driven traditionally by hand or by foot treadle. After *c*1800 steam-powered lathes were introduced, which resulted in a deeper and more elaborate style of cutting (Dodsworth 1982). However, there is no direct reference to powered lathes having been used at the Jersey Street works; the account noted the almost complete absence of machinery other than '*one for pressing and moulding the common imitation of cut glass*', although it does allude to the presence of an engine house (MCL/942.7389/M204).

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3.6 GLASSWARE CATALOGUES

3.6.1 It is particularly fortunate that six catalogues for the products of the Percival, Vickers & Co Ltd works are known to survive (Beebe 2003). The earliest of these, and probably the first to have been produced, was issued in 1846. This contained 293 decanter, 51 tumbler, and 368 wine glass designs (*ibid*). All of these vessels were blown and cut, and some were engraved. In addition to clear glass, green vessels were also produced, including decanters and wine glasses (P Beebe pers comm). The two catalogues issued in 1881 included 800 items of press-moulded glass and almost 500 items of cut and engraved glass, some of which appeared in the two catalogues issued in 1893. One of the catalogues released in 1893 was dedicated to items '*specially designed for the electro-plate trade*', and probably represents an attempt to diversify into new markets in the face of a widespread depression in trade. The final known catalogue was that for '*Glass Shades for Electric Lights, Cut and Moulded*', issued in 1902. This catalogue is particularly useful as the cover bears an engraving of the glass works from which a wealth of detail may be observed (Plate 1).

3.6.2 The engraving clearly shows three large chimneys, which are almost certainly the flues of the glass furnaces. The two original furnaces appear to be within glasshouses of similar dimensions, separated by a long linear building that presumably contained the annealing ovens and workshops. The third furnace, however, is shown to be within a larger glasshouse of a clearly modified design. This was separated from the other glasshouses, and incorporated windows. The location of the annealing oven associated with this later furnace is not immediately apparent from the engraving, although it is tempting to associate this function with the large building forming the eastern boundary of the works (Plate 1). It is of note that there does not appear to be a wall between the southern edge of the site and the Rochdale Canal, hinting that the waterway may have continued to provide the transport route for the importation of raw materials, particularly coal; iron mooring rings built into the wall that formed the southern gable end of this building still survive.

3.6.3 A building with an asymmetrical pitched roof, reminiscent of a textile weaving shed, is shown to the north of the westernmost furnace (Plate 1). Such a design was aimed at providing even natural light within the building, hinting at this being the cutting and engraving workshops. In the north-west corner of the site a large chimney is depicted, belching black smoke. It is tempting to associate this structure with the production of steam power, and specifically as an exhaust for fumes generated within the boiler house.

3.7 POST-GLASS WORKING

3.7.1 It seems that the glass works had encountered serious financial difficulties by 1907, which led to the voluntary liquidation of the company in September of that year (Yates 1987, 39). However, the works is listed in Slater's trade directory of 1910, and appears to have remained in at least partial production for several years. Similarly, a reduction in manufacturing capacity is implicit from a contemporary reference that states that '*the central cone chimney was the last used*' (M266/2/6, 198). In January 1914, a large 'clearance sale' of the

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stock was arranged by the company's liquidators. The announcement of this sale, advertised in January 1914, states that the works had already been sold (The Pottery Gazette and Glass Trade Review 1914, 11).

3.7.2 The premises were purchased subsequently by an iron and steel machinery merchants, W and J Kayley Ltd, for the sum of £36,750 (Champness 2002), who seemingly demolished the glass furnaces and associated structures; the 1922 Ordnance Survey 1:2500 map, surveyed in 1915, shows the area of the furnaces as vacant land, and labels the warehouse building on the Jersey Street frontage as a '*waterproof factory*' (Fig 9).

3.7.3 Trade directories indicate that by 1919 the former office/warehouse building at 64 Jersey Street was occupied by SL Gotliffe and Sons Ltd, waterproof garments manufacturers (Slater 1919). A detailed survey of the site, undertaken in 1929 for insurance purposes (Goad's Map), depicts the office/warehouse building to have been used as a '*mantle and costume factory*'. The area to the rear was occupied by Lendrum Limited, and contained a waste paper warehouse, stores and a stables. The outlines of these buildings are depicted on the Ordnance Survey map of 1933 (Fig 10). A photograph taken in 1962 (Plate 2) indicates Lendrum Limited to have taken over the former office/warehouse building on Jersey Street. However, a revised Goad map, published in November 1966, marks the site as being owned by Bowater's United Kingdom Pulp and Paper Mills Ltd.

3.7.4 At some point between 1975 and 2001, the waste paper warehouse was demolished and a single storey factory building was erected, which is thought to have been used for the smelting of aluminium scrap. The site by this time was in the ownership of J Mark & Co (Champness 2002).

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4. RESULTS OF THE ARCHAEOLOGICAL INVESTIGATION

4.1 INTRODUCTION

4.1.1 In total, an area equivalent to approximately 2030 square metres was exposed and recorded (Fig 12). Four broad phases of archaeological activity could be defined across the site. Summary results of the investigation are presented below; the evidence obtained from the watching brief, evaluation and excavation elements of work have been combined to form a single narrative.

4.1.2 Broad phasing has been ascribed to the deposits and structures encountered during the investigation, and the results are presented below in chronological order. This phasing is provisional as is appropriate for an assessment of the site, and may be refined in the light of evidence produced from detailed analysis of the dataset.

4.2 PHASE 1

4.2.1 The earliest recognised activity pertained to the occupancy of the site prior to the construction of the glass works. The archaeological evidence for this phase appeared to be associated exclusively with the use of the site as a wharf and coal yard, as is documented for the first half of the 19th century (*3.2.5 above*); the buildings depicted on Bancks and Co's map of 1831 (Fig 5) had clearly been removed without leaving any physical remains, and there was no evidence for the site having been occupied prior to the coal yard.

4.2.2 Extensive deposits of silty clay (***586*** and ***591***) containing numerous fragments of coal, fuel ash and clinker were observed above the natural clay subsoil (***105***) across a large part of the site. These deposits were cut by the earliest of the glass works' structures (Phase 2, *4.3.2 below*), thus indicating the stratigraphic sequence. Structural evidence was represented by two parallel iron rails (***590***), set 0.40m apart on a north/south alignment (Plate 3), within the western part of the excavation area (Fig 13). These had been set into a shallow construction trench (***589***). It seems likely that they were the vestiges of a short plateway carrying coal from the Rochdale Canal towards the entrance of the coal yard on German Street.

4.2.3 A flagstone surface aligned parallel to the Rochdale Canal, and seemingly overlying natural subsoil ***105***, was revealed along the southern boundary of the site during the final watching brief (Fig 12). This may have represented the vestiges of the canal wharf associated with the coal yard, although the extent to which it had been modified subsequently, if at all, could not be established from the surviving physical evidence (Plate 4).

4.2.4 In the north-western part of the site an extensive spread of coal (***617***) was observed within a west-facing section excavated through Phase 1 deposits. The deposit was approximately 3m wide, and had a maximum thickness of 0.42m overlying natural clay. It was sealed by a 0.27m thick clay levelling layer (***616***) which provided a base or foundation for the later glass works. Deposit ***617***

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seems to have been the remains of a coal dump, and it is possible that this part of the site was used to store coal temporarily.

4.3 PHASE 2

4.3.1 The major phase of activity on the site comprised the construction of the glass works in its original form, as shown on the Ordnance Survey map of 1851 (Fig 6). This detailed cartographic source depicts the glass works to have incorporated structures revealed by excavation to include two furnaces, an annealing house, and workshops. Interestingly, the lines of the flues beneath the furnaces are shown, suggesting that they were, at least in part, exposed to view.

4.3.2 ***Furnace 1:*** a furnace was exposed immediately below the modern concrete surface in the western part of the site (Fig 12). The remains comprised an outer wall, a largely intact central flue, an inner fire chamber, and foundations of the siege (Plate 5). The diameter of the furnace, including the outer wall, measured 6.2m, and it survived to a depth of 2.70m.

4.3.3 The fabric of the outer wall (***206***), which survived to 13 courses in height, comprised an inner lining of refractory bricks, and hand-made bricks forming the exterior (Fig 13). The inner face was butted by two walls aligned north/south (***208*** and ***209***), representing the fire chamber (***207***), and was sealed by a three-course brick siege foundation (Plate 7).

4.3.4 A series of 11 rectangular sandstone blocks (***597***) was set within the fabric of wall ***206***. The blocks had been chamfered on the upper surface, sloping outwards to a brick-lined channel (***214***) that encircled wall ***206*** and butted the roof of the flue (***204***) to the north and south (*4.3.6 below*). The surface of each block had traces of iron residue forming a rectangular impression (Plate 5), suggesting a metallic object had been situated or set in the top of each block around the furnace.

4.3.5 Inside furnace wall ***206***, and parallel with sandstone blocks ***597***, was evidence of ten square scorch marks, forming regularly spaced scars around the edge of the refractory siege foundation. These almost certainly represented the position of the crucibles. The remnant of the siege foundation comprised a 0.24m thick layer of refractory tiles (***212***) bonded by fire-resistant mortar, which partially survived around the edges of the furnace chamber.

4.3.6 Channel ***214*** had a maximum width of 0.66m, a depth of 0.20m and was capped by thin flagstones. Its function remains uncertain, although it had clearly been carefully constructed. The sandstone capping was stratigraphically below a single course of hand-made bricks, laid bed-on to form a gently sloping surface (***595***) that survived to the east of the furnace (Plate 5). The edges of surface ***595*** butted an extensive flagged surface (***587***), which encompassed the furnace. The flagstones had been laid over a thin layer of bedding sand (***588***), which sealed deposits ***586*** and ***591*** (Phase 1, *4.2.2 above*).

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4.3.7 The furnace flue was exposed along a north/south alignment beneath the level of the siege foundation (Fig 13). Within the area of fire chamber ***207***, the flue was attached to sprung arches bonded to the walls of the inner furnace (walls ***208*** and ***209***), situated to the east and west respectively. Wall ***208*** survived to a height of 24 courses, and close to its base was a two-string wide and 1.80m long skin butting the face, which extended to a depth of 0.55m down to the furnace floor (Plate 7). The uppermost five courses of ***208*** over-hung the rest of the wall, forming a foundation level for the siege (***212***).

4.3.8 The upper courses of wall ***209*** were of a similar construction to ***208***, but with some significant differences. Positioned against the inner face of ***209*** at a depth of 1m below the siege foundation was a 1.20m wide and 0.40m deep recess. Above the recess, patches of vitrified glass (***211***) adhered to the wall, which could be detritus from a crucible that had cracked during melting. At the bottom of the recess was a north/south aligned channel with a sub-rectangular profile. This extended along ***209***, through the fire chamber below the flue roof, to a chamber built within the flue. The brick base was heavily sooted, indicating close proximity to the main body of the fire. Approximately 0.50m below the channel was a trough, measuring 0.15m wide and 0.90m long, that was filled with fuel ash. The trough appeared to head north through the outer skin of ***209*** toward the flue. This lower skin of ***209*** had a two string brick width and stretched over a distance of 1.86m with a maximum height of 0.50m. A 0.30m long flattened iron strip was attached to the upper surface of the skin below the trough, which was probably the collapsed remnants of the fire grate. There was no evidence of feeder apparatus within the fire chamber, which would imply the furnace would have been fed from above via a stoke-hole, although no physical evidence for this survived.

4.3.9 The original inner face of ***209*** continued south for a distance of 2.87m. Built within the wall in this area was an opening which formed an entrance to a three-faced chamber. The chamber measured 1.30m across and had a depth of 0.86m to the east of ***209***. A large sandstone flag with an iron plate attached to its upper surface was exposed on the floor of the chamber. The walls and floor were coated in a thick deposit of soot, and contained features seemingly associated with a doorway on either side of the opening, perhaps as a mechanism to control the flow of air into the furnace.

4.3.10 The floor of the furnace within the fire chamber (***600***) comprised a combination pattern of sandstone flags, refractory bricks, and hand-made bricks (Plate 6). The refractory brick component was centred predominantly below the fire hole, with flags to the north and south.

4.3.11 The entire fire chamber was filled with a loose, dark brown sandy silt (***210***), which contained abundant fragments of glass (Plate 7). The fragments comprised numerous vessels of various types, cullet and working waste in a variety of colours, including clear, opaque, blue, green, red and yellow. Some fragments were cut glass, but the majority appeared to have been press-moulded. The fill had clearly been deposited after the furnace had fallen into disuse.

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4.3.12 The furnace flue (***100***/***101***/***204***) survived largely intact, passing north/south beneath the floor of the furnace (Plate 7). The roof of the flue (***204***) extended 4.70m north from furnace wall ***206***, although its northern extent had been partially damaged by concrete foundation ***202***, associated with the later development of the site (Phase 4). The flue roof extended to the south behind the furnace chamber for approximately 4m, where it terminated into a rectangular room (***628***). The width of the roof varied from 1.50m at the flue junction in the south (Fig 15), to 1m near the concrete intrusion. The roof was two courses thick with a brick repair platform (***205***) bonded to the crown of the roof on its western side, adjacent to a damaged section of the flue structure.

4.3.13 During the watching brief, a section of wall (***504***) was exposed for a distance of 4m along an east/west alignment (Fig 12), which formed the southern external wall of the glasshouse. The wall survived to the north of room ***628*** at the south end of the flue. The east and west walls of the ***628*** butted the south external wall, giving overall dimensions of 4.5m by 2m and a maximum depth of 1.80m. The west wall of the room had been partially truncated by a shallow concrete trough (***629***) with a depth of 0.80m, that was associated with the later development of the site (Phase 4, *4.5.2 below*). The east wall of the room was a 1.50m continuation of the east wall of the flue, with a 0.50m gap in the south-east corner, possibly representing a threshold. Behind the east and south walls was a thick layer of redeposited natural clay. The room was backfilled by sandy-silt containing copious amounts of slate, which sealed a thin ashy waste deposit covering a sandstone flagged floor extending into the flue entrance. At the entrance to the flue, the roof had suffered extensive damage. The room provided a southern access to the furnace and was probably used for clearing waste and raking debris away from the furnace floor.

4.3.14 ***Furnace 2:*** a second furnace was revealed below the concrete in the approximate centre of the site (Fig 12). Its central core had been obliterated by the insertion of an east/west aligned concrete tank (***318***) associated with the subsequent use of the site (Phase 4, *4.5.2 below*). Similarly, a section of the flue to the north (***309***) had been removed completely by the insertion of a later wall (***413***). The remaining elements of the furnace, however, were reasonably well-preserved (Plate 8). The furnace was comparable to Furnace 1 in size and diameter, and similarly included an outer wall (***313***/***502***) surrounded by a perimeter channel, a brick-lined flue (***501***), and remnants of a fire chamber (***620***).

4.3.15 The floor (***547***/***599***) of the central flue was two courses thick, and comprised 80% refractory bricks and 20% sandstone flags. As was the case with Furnace 1 (*4.3.10 above*), the refractory bricks were localised beneath the position of the fire chamber. Below the upper course of bricks was a course of flagstones measuring on average 0.94m x 0.43m, which ran throughout the flue floor to the north. The level of the floor differed slightly from the floor of Furnace 1 in that the floor surface was on an uneven horizon, especially in the north near the flue terminal. The brick floor in the fire chamber area remained relatively intact below concrete tank ***318*** (Phase 4) and had been heavily charred. Situated below the brick floor was a ceramic drainpipe (***215***), which had been

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laid on a north-east/south-west alignment at a depth of 1.85m below the flue roof. The pipe had seemingly been incorporated as part of the original construction of the furnace although its precise function remains uncertain.

4.3.16 The channel (***310***/***503***) that surrounded the outer wall of the furnace was almost identical to ***214*** around Furnace 1 (*4.3.6 above*), and probably served a similar function. The channel comprised two parallel brick walls, each three courses high, rendered at the base by slate and capped by sandstone flags (***311***). This feature also incorporated into its build a two-course, square-shaped hollow brick stack (***557***), the inner face of which was blackened. The stack measured 0.50m^2 and 0.17m in depth (Plate 9).

4.3.17 The siege had been largely removed by concrete tank ***318*** (Phase 4, *4.5.2 below*), but remnants (***312***) survived in the north and south butting the flue (Plate 8), and in sections inside the outer wall (***313***/***502***). The remnants of the siege comprised a mixture of refractory and hand-made bricks. There was no evidence of crucible scars surviving on the refractory surface as had been noted in Furnace 1 (*4.3.5 above*), although traces of vitrified glass debris were present in places.

4.3.18 The diameter of the furnace, including the outer wall (***313***/***502***), measured 6.2m and it survived to a below ground depth of 2m. The core of the wall varied in width between 0.50m at the level of the siege foundation, to 0.90m where it had been cut into natural clay subsoil ***500***. The wider base incorporated a corbel-style construction with four visible steps that projected 0.50m from the outer face of the wall.

4.3.19 The east and west walls of the flue (***546*** and ***548*** respectively) were two strings thick, and comprised hand-made bricks bonded by a light reddish-brown lime-based mortar. Walls ***546*** and ***548*** each survived for a maximum length of 8.50m and depth of 1.80m. In total, 23 heavily sooted brick courses were exposed down the inner face of both walls in proximity to the fire chamber. The walls were obscured in the fire chamber by concrete tank ***318*** (Phase 4, *4.5.2 below*), but remained undisturbed through the siege foundation and the furnace outer wall for a distance of 6m until they were truncated by wall ***551*** (Phase 4) in the north. The outer face of ***546*** in this section was exposed to a depth of 2m, cutting the natural clay subsoil, and was bonded by a pale greyish-white mortar. At the flue terminal in the north, the east and west walls had three courses of rounded bull-nose bricks representing a sprung arch which attached the walls to the flue roof. The terminal width was slightly wider than the flue, with recesses in either face of walls ***546*** and ***548***. In this area there was evidence of a doorway revealed in the north-facing section through the flue roof. An iron hinge was attached to a pier projecting from wall ***546***, and a wooden upright remnant of a door jamb.

4.3.20 During the watching brief, the south end of the flue was observed to terminate at a brick-lined room (***321***) similar to that encountered at the rear of Furnace 1 (*4.3.13 above)*, and it probably served a similar function. The room had dimensions of 5m by 3m, and a surviving below ground depth of 1.85m. The east wall of the room butted an east/west aligned wall (***504***) representing the

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external wall of the glasshouse, identical to the construction behind Furnace 1 (*4.3.13 above)*. The south-west corner of the room had a stone pedestal sealed by slate rendering positioned upon the upper courses of the south wall; this pedestal overlaid a brick pier which housed an iron pipe. The pipe ran vertically within the pier down to the floor, and traversed the east side of the room into the entrance of the flue. Positioned in the north-west corner of the room was evidence of a doorway at the entrance to the flue. The detail was reflected by a section of *in situ* timber set vertically along the west jamb below the roof, and a recess cut into bull-nosed bricks which formed the east edge of the flue wall. The timber and brick detail of the doorway mirrored the evidence encountered at the entrance at the north end of the flue. The floor of the room was largely made up of blackened refractory and hand-made bricks, bordered in the east by a course of sandstone flags. The flags were sealed by remnants of what may have been the original east wall of the room. The wall survived to a height of 0.40m, running north/south for a distance of 2.15m, butted by the south external wall of the room. Behind the east wall was a thick deposit of clay, similar in composition to the clay behind the east wall of the room behind Furnace 1 (*4.3.13 above*).

4.3.21 The backfill (***619***) of the furnace and flue comprised a light brown, friable sandy silt (Plate 8), which contained large amounts of building rubble, but surprisingly few glass fragments.

4.3.22 ***Annealing House:*** the structure was characterised by a series of five brick-lined linear channels, aligned north/south across the central part of the site (Plate 10). The channels were of similar widths, but built to differing lengths, and were contained within retaining walls which formed the exterior walls (***561*** and ***578***, east and west respectively). The retaining walls had been re-used by later development, although wall ***561*** had been partially damaged by the insertion of a 2.7m wide concrete tank (***318***) associated with the subsequent use of the site (Phase 4, *4.5.2 below*). All of the internal channels terminated at their northern end into open areas, presumably representing workshops (Plate 10).

4.3.23 Wall ***561*** was 14.4m long and 0.84m wide with a maximum of eight brick courses exposed. The wall bordered an annealing channel (***518***) to the immediate west. The north end of the wall was butted by a square brick platform (***555***), which extended 2m to the east. The junction between platform ***555*** and wall ***561*** formed the south-east corner of the annealing workshop (***593***). Remnants of the west retaining wall (***578***) survived in the north for a distance of 1.72m, and a stretch of foundation was encountered close to the northern edge of the excavation. The longest surviving section of the wall was retained in the south with an 8m length of standing remains. Between the wall and the annealing channel wall (***303***/***508***) to the east, was a 0.64m wide gap, which was filled with redeposited clay; similar material had been used to fill many of the gaps and slots within the annealing house, hinting at a possible attempt to insulate the walls.

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4.3.24 At the south-western end of the annealing channels was a brick structure (***582***), which butted the west face of wall ***578***. Structure ***582*** appeared to have been intended to house a small engine (Plate 11). The position of structure ***582*** suggested that any such putative engine would have been designed to transmit power horizontally across the southern end of the annealing channels and control the movement of carriers within the annealing house.

4.3.25 Three of the channels (***518***, ***516***, and ***307***) in the eastern part of the annealing house terminated in the south, bordered by a 5m long by 1m wide east/west external wall (***435***). The west channels (***301*** and ***302***) extended south beyond wall ***435*** for 3.30m, and butted the external wall of the glass house (***504***). The overall lengths of the channels were 16.40m for the west channels (***301*** and ***302***), and 13.10m for east channels ***518***, ***516***, and ***307***. The differences in the wall lengths were the result of a structure lying to the immediate south of wall ***435*** and east of channels ***301*** and ***302***. Three contiguous walls formed the structure with an opening in the east resembling a room or cell. The function of this room or structure remains uncertain, though it quite possibly provided access to the annealing house from the south end of the site. The channels were separated by three-course high brick walls of identical surviving height and were truncated twice: in the south by concrete tank ***318*** (Phase 4, *4.5.2 below*), and in the central area by a 4m wide strip of grey concrete (***511***).

4.3.26 Channel ***301*** comprised a combination of full size and half size hand-made bricks laid edge-on, forming a 0.70m wide floor with a straight edged profile. The brick floors of all the channels were underlain by a layer of flagstones, which in turn had been set into a deposit of sand. A sub-dividing wall (***509***) in the east (bordering channel ***302***) and a 0.50m wide wall (***508***) in the west bordered channel ***301***. The floor at the south end of the channel sloped sharply on a steep gradient from the external wall of the annealing house to the north for a distance of 1.5m and levelled beyond the large concrete tank (***318***). The channel rose sharply in the north, where a layer of bricks formed a small hump or stalling ramp at the entry into a workshop (*4.3.28 below*). The small humps were a feature of all the annealing channels at the point of entry into the working floor of the chambers or workshops. The brick floors of all the channels had been blackened by exposure to heat and had incised grooves measuring 0.04m across and 0.02m deep, running off centre through the bricks (Plate 10). The grooves had probably been used to transport a wheeled carrier loaded with newly blown glass through the annealing house and thence to the workshops.

4.3.27 Wall ***303***, situated immediately to the east of channel ***302***, had a maximum length of 13.7m and width of 0.48m. The wall returned to the east for a distance of 0.29m. In total, 12 brick courses were exposed along the east face, which had been coated with lime wash. The lime wash would imply the wall had been used as an inner partition within the annealing house.

4.3.28 East of wall ***303*** was a narrow slot which separated the east and west channels within the annealing house. The slot (***304***) was filled by redeposited clay to a maximum depth of 0.60m. The east channels were bordered in the west by a

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similar partition wall to ***303*** (***305***). This also had a coating of lime wash lightly covering the external brick face.

4.3.27 An ancillary channel (***401***) was encountered to the east of the main annealing channels. The north end of this channel did not run directly into the workshop, but continued north beyond the edge of excavation. The central part of channel ***401*** was butted by a brick surface (***400***), which possibly represented access into the channel.

4.3.28 Workshops ***593*** and ***594*** were located in the north area of the annealing channels. The workshops were separated by a partition wall, which at some stage had been demolished to create a larger working floor. The larger workshop (***593***) had a floor surface that measured 4.78m by 4.16m, and was fed by three channels from the east side of the annealing house (Plate 12). The floor (***513***) within workshop area ***593*** comprised blackened hand-made bricks with three parallel wheel grooves aligned north/south. It sloped gently down to the south and rose at the junction with the stalling humps at the north end of the channels, and around the edges butted platform ***555*** and wall ***561***. Four worked stone blocks (***514***), distanced 1.26m apart at regular intervals, were laid within the floor of the workshop (Plate 12). One of the blocks had traces of iron staining on its upper surface, suggesting it had been used as a column base.

4.3.29 The floor within workshop ***594*** measured 4.30m by 2.07m and sloped gently west from the partition wall, and north from two channels which fed the workshop from the west side of the annealing house. Two sandstone blocks survived, set at a similar distance apart to those in workshop ***593***.

4.3.30 ***Ancillary Structures:*** a square-shaped, brick-lined pit (***408***) butted the east flue wall (***548***) of Furnace 2 in the north part of the excavation, and yielded a large assemblage (63 fragments) of crucibles. Feature ***408*** measured 1.78m^2, and had a maximum depth of 0.66m (Plate 13). Its walls were faced with refractory bricks sitting on a slate lining (***545***).

4.3.31 Above lining ***545*** was a sandstone-capped channel (***539***), which traversed the southern corner of the feature. The channel passed through the wall of structure ***408*** into a separate chamber (***540***) to the east. The south-western end of channel ***539*** passed through the south wall of the pit and connected to a rectangular air shaft (***410***) positioned behind the wall. Air-shaft ***410*** had an oblique angled descent, level with the top of the pit wall, running in the direction of the bottom of flue wall ***548*** in the west. The channel and the shaft were filled completely with fuel ash. The functions of these features were unclear, though the nature of the fills would suggest the convection of hot air through the structure.

4.3.32 Sealing the sandstone capping of ***539*** was a raised floor (***542***) made from a course of half-edge laid bricks, which in turn overlaid a layer of sandstone flags. The surface butted the inner walls of ***408***, and was roughly cut in the centre to form a smaller inner pit measuring 1.40m^2 .

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4.3.33 The fills of ***408*** (***409*** and ***543***) comprised dark brown sandy-silt, enriched with charcoal, fuel ash, and crushed brick. The crucible fragments were recovered mostly from the upper fill of the structure.

4.3.34 Close to the northern and southern edges of the investigated area were two brick-lined troughs (Fig 12) containing copious amounts of sand. The structures (***554*** and ***604***) were similar in construction, having a square-shaped outline with four internal curved walls at each corner (Plate 14). The curved walls were presumably designed to prevent sand from reaching the corners of the structure, to aid efficient retrieval. The trough at the south end of the site (***625***) was located to the east of Furnace 1 and butted the south face of wall ***504*** (Plate 15). Its dimensions were 2.80m^2 and it was excavated to a maximum depth of 1.40m. The upper fill of the trough comprised a layer of brick rubble sealing a lower fill (***626***) of light yellow-red sand resembling a type of builders' sand. Trough ***554*** was at the north end of the site and east of the annealing chambers, and was slightly bigger than ***625***, with overall dimensions of 3.20m by 2.90m (Plate 14). The base of the trough was encountered at a depth of 1.50m, had been filled by sand (***404***), and was lined with a deposit of clay. The upper fill of the trough comprised red sand with few contaminants, and could have been used as a source of material for making the clay crucibles, although there was no archaeological evidence of this process on the site. The lower sand in the fill had a burnt orange colour and sealed a layer of abundant sandstone lumps. The stones provided a hardcore foundation layer for the inner curved quadrant walls and sealed the clay lining of the trough.

4.4 PHASE 3

4.4.1 Phase 3 involved the construction of a third furnace in *c*1870 (*3.5.7 above*), and some remodelling of other elements of the existing site.

4.4.2 ***Furnace 3:*** a third furnace was exposed immediately below a stone yard surface (***436***) relating to later development (Phase 4, *4.5.6 below*). The remains of the furnace (Plate 16) comprised an outer wall with an internal circular passage, a north/south aligned central flue, a central fire chamber, and a siege foundation (Fig 14).

4.4.3 The exterior wall of the furnace (***425***) measured 0.84m wide with an overall diameter of 7.6m. The outer face of the wall was exposed to a depth of 2.20m, terminating in a stepped foundation that had been cut into the natural clay subsoil. The pattern of the bricks ran in a sequence, formed by a string of headers overlying seven strings of stretchers, bonded by a sandy, reddish-brown, lime-based mortar. The wall had been repaired in places, particularly in the south, as demonstrated by the presence of a pale white lime mortar. The western part of wall ***425*** had been removed to a depth of 1.2m below its uppermost surface by the insertion of a north/south aligned ceramic drainpipe (Phase 4). Further disturbance of the wall was encountered to the north, from an east/west aligned metal pipe (***428***), and in the south-west corner from a manhole (Phase 4). Despite this, traces of springer arches relating to the arched capping of the furnace flue (***422***) survived *in situ* (Plate 16).

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4.4.4 One of the notable differences between this furnace and those to the west was the incorporation of a 0.63m wide passage (***426***), within the internal perimeter face of the furnace wall (Plate 17). The floor of passage ***426*** lay 0.3m below the level of the central flue floor (Fig 16), and comprised refractory and hand-made bricks bordered by sandstone slabs. The passage walls were terminated by bull-nose bricks at each entrance east and west of the central flue. The floor and inner face of both walls within the east side of passage ***426*** were heavily sooted, whilst those to the west were relatively clean. This suggested that the passageway had acted, at least in part, as a mechanism for recycling exhaust gases from the furnace, and that air was circulated within the chamber in a clockwise direction. Remnants of brick arches over the passage were observed for most of the circumference, but were well-preserved in the north-western quadrant where a 1.4m section remained intact (Plate 19).

4.4.5 The furnace flue (***422***) had in most places collapsed, although ten courses survived north of the furnace, and traces of roof arches survived butting the fire chamber walls. The north area of the flue curved sharply 2m south of the unsurfaced track along the north edge of the excavation (Phase 4, *4.5.7 below*), returning west and running parallel to the track for 3m. No evidence of a flue entrance was encountered, hinting at a location further west. The curved section had seemingly been built as a later addition to the main body of the flue. The original curve seems to have beens semi-circular in plan, as illustrated on the 1893 Ordnance Survey Map (Fig 2). The rebuild was clearly demonstrated within the east face of the west wall by the pattern of the brickwork and a change of mortar type. The inner face of the curved section exposed heavily sooted bricks bonded by pale off-white lime mortar. The west-facing section through the flue showed an extensive post-abandonment deposit composed of ashy black waste, to a maximum depth of 2m.

4.4.6 The floor of the central flue (***437***) measured 8m in length and 1.6m in width within the excavated area (Fig 14). Bordering the south end of the furnace outer wall were two brick-built piers (***438***) which formed junctions with the central flue. The east pier was butted at the base by a 0.40m square sandstone block (***439***), lying on the floor. The piers and sandstone had iron fittings attached on their inner faces, which probably represented fittings for a shutter that controlled the air-flow into the furnace.

4.4.7 During the watching brief, two curved terminal walls south of the furnace were revealed forming the extension of the east and west central flue walls (***445*** and ***446***). The walls were bridged by a 1.5m high brick infill that may have been an attempt to block an entrance to the flue from the south part of the site. Evidence for the entrance was encountered below the foundations of the wall, by two steps. The flue did not survive in this area, although remnants of a flagstone floor butted the base of the steps.

4.4.8 Furnace floor ***437*** was varied in its construction, predominantly with rectangular sandstone flags (0.60m x 0.40m) south of the fire chamber, which gradually blended into a combination of flags and refractory bricks up to the curved section in the north. The flags were two courses thick throughout and

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overlaid a course of refractory bricks. The bricks were at the same depth as the inner chamber floors, and sat within a thin layer of yellow sand. In the central area of the floor, at the fire hole, was a rectangular, brick-lined pit (***440***), rendered at the base by a layer of slate (Fig 14). The pit measured 1.40m across the flue floor (Fig 16), 0.80m wide and had a maximum depth of 0.23m (Plate 18). The fill (***441***) contained fuel ash from the furnace, and, at its base, a ceramic drain pipe (***442***) that was aligned north/south (Plate 18). Upon removal of the flue floor, it was noted that the ceramic pipe connected at both ends to a brick-lined culvert that was the same width as the pipe.

4.4.9 Overlying the fuel ash pit was a two course brick-lined platform (***443***) measuring 1.2m wide x 0.24m deep. The platform possibly represented a remodelling of apparatus to fuel the fire below the furnace. At each corner of the platform were iron residue scars, which could be interpreted as the residue of legs supporting a feeder. Above these, on either side of the platform, were two refractory brick walls (***447*** and ***448***) four courses high, which stepped out one string from the flue walls. The walls were butted by the platform and probably represent the original cave area for the fire hole.

4.4.10 The fire hole (***444***) was positioned within a recess (***449***) along the west face of wall ***445***. The feature measured 1.15m in height and 0.43m in width. The burning of the fuel was raised 0.56m above the base of the recess. At the north face of the recess was a rectangular shaped air channel, which ran 1.6m south into the internal circular chamber.

4.4.11 The working floor of the siege had mostly been removed as a result of later development, although substantial foundations survived, revealing traces of pot scars on the upper surfaces. These foundations (***423*** and ***424***) comprised four courses of refractory brick bonded by a heat retardant mortar. The bricks were spread over the top course of the east recess, ***449***, and on wall ***446*** for an overall distance of 3.30m x 1.10m on either side of the flue. The east face of the recess exposed detritus or spillage from melting pots in the form of yellow and black compacted glass slag attached to the wall, and vitrified glass on the upper floor surface. Positioned within ***423*** in the east and west (***424***), were two 0.35m long ceramic pipes (***432*** and ***431***), passing through roof arches of the inner curved chamber (Plate 19). The function of the pipes was unclear, although it seems likely that they were part of an improved gas-flow design within the furnace.

4.5 PHASE 4

4.5.1 Phase 4 comprises the activity associated with the redevelopment of the site after 1914 (Fig 17). The bulk of the remains pertaining to this phase represented the waste paper factory known to have occupied the site since the 1920s (See *3.7.3* above). The largest building in the complex occupied the central and eastern parts of the site, with an annexe used as stables attached to the north-west side. The surviving remains associated with the factory comprised three concrete-lined tanks, two brick-lined troughs, external and partition wall foundations, an internal concrete floor surface, and a yard area to the east of the main building.

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4.5.2 Two of the concrete-lined tanks were rectangular in plan (Fig 12), and aligned east/west along the south end of the site. Tank ***318*** had overall dimensions of 12.45m by 2.5m, and was excavated to a maximum depth of 1.9m across the centre of Furnace 2. Tank ***627*** was encountered during the watching brief and was observed running further east, between Furnace 2 and Furnace 3. Both tanks were possibly used to soak paper and chemicals as part of a reconstitute process. A third tank (***629***), located in the south-west corner of the site, was encountered during the watching brief. The tank was aligned north/south, and had an approximate length of 5m and width of 1.8m, with a shallower depth of 0.5m.

4.5.3 The brick-lined troughs (***413*** and ***522***) were located at the north end of the site. Trough ***413*** was rectangular in plan and aligned east/west, cutting the flue associated with Furnace 2. The structure had dimensions of 7m by 2m, with an entrance along the eastern edge. The entire structure was filled with sand and rubble. It was not fully excavated, although the south wall was exposed to a depth of 1.80m below the ground surface, and was lined at the base by a concrete foundation. The surface of trough ***522*** was encountered along the eastern edge of the excavation between Furnace 2 and Furnace 3, cutting the east partition wall ***412***. The structure was very similar to ***413*** in that it was filled by rubble and sand, and had similar dimensions.

4.5.4 A thick layer (0.50m) of compacted grey concrete (***511***) with crushed brick inclusions was observed running east/west across the annealing channels for a distance of 6m. The concrete may represent the foundation or footings of the south wall to the stables, as shown on Goad's insurance plan of 1929 (Fig 17). No wall that relate to the stables survived in this area. Wall ***532*** along the northern edge of the site survived for a distance of 2.29m and a depth of 0.81m. The wall may represent a remnant of the north external wall associated with the main factory building.

4.5.5 A concrete platform or surface (***319***), bordering the western edge of Furnace 2, was observed over a distance of 3m. The concrete had a maximum thickness of 0.20m and was partially obscured by re-deposited clay (***608***) and sealed by demolition debris. The surface may represent a remnant of a floor within the factory warehouse.

4.5.6 Overlying Furnace 3 was an extensive cobbled surface (***436***). The cobbles were made up of rectangular shaped granite measuring 0.20m long by 0.10m wide and 0.15m deep. The cobbles were set within a loose brown soil, with no bonding. The surface was observed over a distance of 10m and probably represents the outside yard area, east of the main factory building.

4.5.7 An unsurfaced track, along the north edge of the excavation, extended between the costume factory building and the waste paper building, and was used to gain access to Radium Street in the west.

4.5.8 Physical evidence for the final use of the site as an aluminium recycling plant was limited to the concrete raft, which formed the uppermost surface of the site, and a series of concrete stanchions located within the south-western part

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of the excavated area. A record of this structure prior to its demolition was compiled by the Manchester Region Industrial Archaeology Society (Champness 2002).

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5. RESULTS OF THE ASSESSMENT

5.1 ASSESSMENT AIMS AND OBJECTIVES

5.1.1 The aim of this assessment was to evaluate all classes of data from the archaeological investigation undertaken, in order to determine the potential of the assemblage for further analysis. Should the case for analysis be proven, it would lead to the formulation of a project design for a programme of further analysis appropriate to the potential demonstrated by the site archive. A statement of the significance of the results from each element of the archive is given below. These statements are based on the assessment work undertaken, related to the original academic themes expressed in the project design.

5.1.2 The objectives of this assessment correspond to, and are prescribed by, *Appendix 4* of *Management of Archaeological Projects 2nd edition* (English Heritage 1991a). They are to:

- assess the quantity, provenance and condition of all classes of material: stratigraphical, artefactual and environmental;
- comment on the range and variety of that material;
- assess the potential of the material to address questions raised in the course of this project design;
- formulate any further questions arising from the assessment of this material.

5.1.3 This assessment will present:

- a factual summary, characterising the quantity and perceived quality of the data contained within the site archive;
- a statement of the academic potential of the data;
- recommendations on the storage and curation of the data.

5.2 MATERIAL ASSESSED

5.2.1 The entire paper, digital and material archive was examined for the purposes of this assessment. Quantifications are incorporated within the individual assessments.

5.3 PROCEDURES FOR ASSESSMENT

5.3.1 The method of assessment used varied with the class of information examined, although in each case it was undertaken in accordance with guidance provided by English Heritage in *Management of Archaeological Projects* (English Heritage 1991a). All classes of finds were examined in full, with observations supplemented by the finds records generated during the course of the fieldwork; full details of all the recovered finds reside within the project archive.

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5.4 STRUCTURAL AND STRATIGRAPHICAL DATA

5.4.1 Provisional broad phasing has been ascribed to all contexts, and the results are described in *Section 4* above, and summarised in *Appendix 2*.

5.4.2 ***Quantification:*** there is a total of 171 context records, which may be broadly divided between phases as follows:

Natural origin	2
Phase 1	8
Phase 2	116
Phase 3	26
Phase 4	19

5.4.3 Records pertaining to the structural remains of the glass works dominate the project archive. The archive comprises the following:

Plans	12
Sections	6
Digital survey file (AutoCAD)	5
Colour slides	10 films, totalling 350 slides
Monochrome prints	10 films, totalling 350 photographs
Digital photographs	250 images

5.4.4 ***Potential:*** the stratigraphic and structural data will provide the framework within which all other analyses will take place. The archaeological investigation has allowed as full as possible a stratigraphic record to be made of the development of the glass works. The key to understanding the chronology of the different types of activity, and the development of the site, resides within the layout and organisation of the site, which can be interpreted through a study of the artefactual and stratigraphic records. Individual contexts, moreover, offer a potential for understanding the manufacturing processes that were active on the site.

5.5 INTRODUCTION TO THE ARTEFACTS

5.5.1 The artefactual assemblage recovered during the course of the investigation comprised finds from various material categories, including glass vessels, industrial residues (glass production waste and cullet), clay crucibles, post-medieval pottery, clay tobacco pipes, metalwork (the majority iron but some copper alloy and lead), animal bone, leather, and crucibles.

5.6 GLASS

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5.6.1 ***Quantification*:** in total, 3628 fragments (112kg) of glass were recovered from the excavation. A variety of vessel types is known to have been manufactured on the site from the mid-19th century to the early 20th century, and a range of these is represented within the assemblage of material recovered. The vessels appear to be predominantly press-moulded variants, with a small proportion of blown glass. The decoration of the vessels ranged from cut glass to engraved goods produced in a range of colours and styles (Plate 20). Most of the glass fragments were collected from the backfilled material within each of the furnaces, with deposits ***210*** (Furnace 1) and ***622*** (Furnace 3) providing the largest quantities. A small proportion of blown glass was collected from the annealing channels, particularly from within workshops ***593*** and ***594***, and off-cut fragments were collected from ancillary buildings across the site.

5.6.2 ***Methodology*:** all artefacts were examined for the purposes of this assessment. Outline details of the objects were entered into an Access database in order to prepare a preliminary catalogue.

5.6.3 ***Evaluation:*** the fragments varied in size and for the most part were well preserved and in good condition, although some were slightly dulled and displayed surface deterioration in the form of visible patina revealed as iridescent layers, as a result of depositional conditions. The range of press-moulded vessels comprised jelly moulds, basins, bottles (some with patent marks), plates, tumblers, piano feet, candle rings, lamp shades and ornaments. The cut and engraved vessels represented included perfume bottles, jugs, wine goblets, decanters, spirit bottles, jars, and assorted cruet containers.

5.6.4 The fabric of the glass was composed largely of white opaque flint, with a smaller percentage of lead glass. The colours varied, with opaque green, blue, turquoise, ruby red, yellow and white represented. The clear glass came in green and blue. The backfilled material within the fire chamber of each furnace produced contrasting items, containing large amounts of flint glass in various forms, including moulds and large bowls, especially from Furnace 3 (***622***).

5.6.5 ***Potential:*** relatively few excavated post-medieval glass furnaces have produced similar quantities of material, and these are almost exclusively in the south of the country (eg Nailsea, near Bristol; Hopton Street, London). Indeed, this is the first 19th century assemblage to have been recovered from a Manchester glass works, and presents a unique opportunity for comparison with those from other regions. Consequently, the assemblage recovered from this site may be considered to be of national importance, and can help elucidate many of the industrial processes being undertaken there.

5.6.6 Potential research questions centre in two broad areas: firstly, the nature of the glass being produced at the site requires consideration. It is often (wrongly) assumed that most 19th century glass, certainly that used for tablewares, was made in a lead crystal metal. Detailed chemical analysis will allow the types of glass produced at the site to be identified, as well as the particular chemicals and elements used as colourants, decolourisers and opacifiers. Second, analysis of the working waste will identify the different types present, such as moils, paraison ends and decorative trimmings. These will help distinguish many of

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the working practices being undertaken at the site. Furthermore, it might help supplement the study of the vessels actually being produced at the site. This is particularly the case with the free-blown glass, an area that might be under-represented in the identifiable finished products or contemporary trade catalogues.

5.6.7 In order to achieve these aims, the analysis will be focused upon determining the composition of the glass and the raw materials used in its production. This will involve the typological and visual study of the working waste, combined with a structured programme of *Inductively Coupled Plasma Spectrometry* (ICPS) analysis on selected samples. This has to be undertaken in a fully integrated manner, as neither the typological nor the scientific analyses are mutually exclusive.

5.7 POST-MEDIEVAL POTTERY

5.7.1 ***Quantification:*** in total, 403 fragments (21.76kg) of pottery were recovered during the course of the investigation. The entire assemblage was, unsurprisingly, of a post-medieval date, the bulk of which (381 fragments) being recovered from a total of 16 stratified contexts.

5.7.2 ***Methodology:*** the assessment of the post-medieval pottery was undertaken in accordance with guidance provided by English Heritage in *Management of Archaeological Projects* (English Heritage 1991a), and the guidelines provided by the Medieval Pottery Research Group (2001). All the material was examined and recorded by sherd count and weight, and placed within broad groupings of vessel form and type. The data have been input into an Access database, and included comments on the condition of the pottery in order to help determine residuality and intrusion, and inform any consideration of the nature and development of the site.

5.7.3 ***Evaluation:*** in general terms, the pottery was in good condition and unabraded, and included several fragments from single vessels, indicative of contemporary dumping. The assemblage was predominantly mid- to late-19th century in date, although a small amount of 20th century material was also produced. The assemblage comprised kitchen and tableware forms typical of the period; there was no indication of any vessels that may have had a specialist or industrial function.

5.7.4 A relatively large group of pottery (146 fragments) was recovered from deposit ***210***, within the chamber (***207***) below the fire grate in Furnace 1. The group was dominated by stoneware bottles, of which a minimum of 23 vessels was represented. The majority of these (17) bore the trademark of '*Dales & Son*' of Philips Park Road, Beswick. Information obtained from commercial trades directories has shown that, until 1897, the firm of William Dales, '*botanic beer brewers*', was based on George Leigh Street in Ancoats. From 1897, however, the firm is listed at Philips Park Road (Slater 1897), although it is not until 1900 that the firm is referred to as '*Dales and Son*' (Slater 1900). The firm is not listed in Slater's trades directory for 1909, suggesting that they had ceased trading by this date. This group also contained two bottles bearing the

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trademark of '*R Nichols*'. This firm does not appear in contemporary trades directories until 1901, where they are listed as '*botanic beer brewers*', based at Irlam Street in Newton Heath (Slater 1901, 1479). This indicates that Furnace 1 was not abandoned and backfilled until the early 20th century.

5.7.5 Other firms represented by trademarks upon stoneware bottles recovered from deposit ***210*** included '*Robert Nuttall*' (three bottles) and '*P Dowd*' (one bottle), mineral water manufacturers of Ancoats and Beswick respectively (Slater 1899). The group also contained at least eight small stoneware jars of identical proportions, together with fragments of transfer-printed tea wares and dinner wares, relief-moulded jugs, and late industrial slipware bowls and jugs. These fragments are all of a late 19th or early 20th century date.

5.7.6 A broadly similar group of pottery was recovered from deposit ***621***, within the flue of Furnace 3 (***422***). This group included fragments of at least five stoneware bottles, of which four were stamped with '*Robert Nuttall*', and one '*John Higginbotham*'. The remainder of the group (11 fragments) comprised fragments of transfer-printed ware plates, bowls and dishes, tea wares, and a fragment of dark-glazed earthenware. A precise date cannot be ascribed to the group, although it is consistent with the early 20th century.

5.7.7 Fragments of three stoneware bottles were recovered from the fill of structure ***559***, associated with the annealing house. One of these had the stamp of '*Robert Nuttall*'. Similarly, the fill of structure ***582*** yielded fragments of four stoneware bottles. Two of these were stamped with '*Robert Nuttall*', and one with '*R Bowes & Son*' of Manchester. Neither of these features contained any other types of pottery. The fill (***408***) of feature ***409*** produced fragments of at least three more stoneware bottles. These all bore the trade mark of '*J Pratt & Son*', who are listed in a trade directory of 1879 as ginger beer makers based at 58 Leigh Street, Manchester (Slater 1879, 308). Robert Nuttall is not listed in trades directories from 1905 onwards, and J Pratt & Son do not appear in directories for 1909, implying that the firms had ceased trading by these dates. Again, no other types of pottery were recovered from this feature.

5.7.8 The fill (***622***) of the chamber beneath the grate within Furnace 3 yielded several fragments of industrial slipware, possibly from a single carinated jug or bowl. The vessel incorporated 'cat's eye' decoration, typical of the later 19th century. Other material recovered from deposit ***622*** comprised fragments of tea wares, including a pink lustre vessel of a probable late 19th century date.

5.7.9 The remainder of the assemblage comprised fragments of dark-glazed red earthenware storage jars, late industrial slipwares, English porcelain, blue shell-edge transfer-printed plates and vegetable dishes, and a variety of white earthenware vessels. An interesting fragment of late industrial slipware bowl, recovered from the fill of annealing channel ***573***, was decorated with the text '*T Percival*' and '*Murray's Arms*'.

5.7.10 ***Potential:*** the excavation has produced a moderate assemblage of stratified material. Much of the assemblage would appear to be associated with domestic activity, and as such may have originated from adjacent tenements, such as

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Lomax's Court (*3.4.4 above*). Conversely, the fragment of personalised tableware may be closely identified with the site, and hints at a managerial office furnished with ceramic tablewares.

5.7.11 None of the pottery assemblage appears to have had a specialist function, and it would therefore seem unlikely that further detailed study could add significantly to the interpretation of the site. An exception to this may be represented by the groups of stoneware bottles, probably deposited by glass-workers and recovered from deposits ***210***, ***408*** and ***621***, and structures ***559*** and ***582***. It is of interest that all of the firms represented by the trade marks on the bottles were based in Ancoats or adjacent districts, providing a valuable example of localised production and consumption. A note should be made of these bottles, which should highlight their local origin.

5.8 CLAY TOBACCO PIPES

5.8.1 ***Quantification:*** in total, 29 fragments of clay tobacco pipes were recovered from the excavation. Amongst the assemblage were four bowls, two stamped heels, and 21 stem fragments. The bulk of the material (89.7%) was recovered from stratified contexts.

5.8.2 ***Methodology*****:** the assessment was undertaken in accordance with the guidelines set out in English Heritage's *Management of Archaeological Projects* (1991a). All artefacts were examined and recorded by fragment count and weight, and the minimum number of bowls, using the terminology supplied by Oswald (1975). Outline details of the objects were entered into an Access database in order to prepare a preliminary catalogue.

5.8.3 ***Evaluation:*** a preliminary examination of the clay tobacco pipes revealed that the date range for the collection is likely to be in the 19th century. However, the bulk of the fragments were pipe stems, which are difficult to date with precision. The bowls are of a Dutch type, which was commonly copied by English pipemakers during the late 19th century. Many of the bowls bore DUBLIN stamps with rouletted decoration around the rim, which is of a style commonly produced between 1860 and 1900 (Oswald 1975).

5.8.4 ***Potential:*** the small assemblage of clay tobacco pipes recovered from the excavation does not contain enough examples to be statistically viable. Moreover, it appears that none of the fragments are likely to furnish close dating for any of the excavated deposits, and the material class as a whole cannot contribute to an understanding of glass-manufacturing processes.

5.8.5 In summary, it would seem unlikely that further detailed study of the clay tobacco pipes could add significantly to the interpretation of the site.

5.9 METALWORK

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5.9.1 ***Quantification:*** the metalwork assemblage comprised 104 fragments, and was recovered from a total of 18 contexts. The assemblage included 85 objects of iron, 13 objects of copper alloy, and six objects of lead.

5.9.2 ***Methodology*****:** all artefacts were examined for the purposes of this assessment. Outline details of the objects were entered into an Access database in order to prepare a preliminary catalogue.

5.9.3 ***Evaluation:*** a preliminary examination of the metalwork revealed a variety of tools and equipment associated with glass making, and other objects with an industrial function. The objects were in a fairly poor condition due to burial environments causing severe surface corrosion, which hindered accurate identification of the assemblage. Of the identifiable items, 41 objects derived from stratified contexts, comprising mostly iron and copper nails in a variety of types. The site provided fragments of iron associated with furnace equipment, such as bars and sleepers relating to fire grates, valves, cast pipes, and a damper that served to control air flow into the furnace. In addition, pincers, tongs, spring tools, and long hollow cylinders resembling blowing rods represented iron tools associated with the glass blowing process. Other ferrous material collected from across the site includes cast iron lintels, hinge plates, a latch-lifter, bucket handle, and two heavy cast iron wedges found in proximity to the annealing shed. Non-ferrous items were collected from furnace backfill deposits comprising copper alloy objects and lead fragments. The copper alloy items include tokens, containers, strips and small water pipes. The fragments of lead derive from structural items consisting of folded sheets and strips.

5.9.4 ***Potential:*** only a small percentage of the metalwork from the site can be identified with confidence, although X-ray photography of the heavily corroded objects would help to enhance the archive catalogue. Aside from the nails, the identifiable items illustrate the industrial functions during the lifetime of the site. Little is known of 19th century glass-making equipment, as very few items have been recovered from archaeological investigations in the country as a whole, and none from the Manchester area. The furnace items such as the iron bars, rods and sleepers, and the tools relating to the glass-making process, should be considered within the context of glass production. A full description of these objects would add to an understanding of equipment used in 19th century glass factories, and would enhance considerably the knowledge of glass-working processes.

5.10 ANIMAL BONE

5.10.1 ***Quantification:*** the site in general produced very little animal bone (30 fragments), the bulk of which being recovered from six stratified contexts.

5.10.2 ***Methodology:*** the entire assemblage was collected by hand, and subject to visual examination. The recording of the animal bones was completed following Halstead (1992), whilst separation of sheep and goat, where possible, followed Boessneck (1969).

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5.10.3 ***Evaluation:*** the material was in a good state of preservation, and allowed the identification of a range of species (Table 2).

Context	Quantity	Species	Element	Comment
210	1	Cow	Phalanx 1	Has adapose flecking suggesting it to be intrusive. Evidence of canine and rodent gnawing, and displays butchery (skinning) marks
210	1	Sheep/goat	Lumbar vertebra	Displays butchery (chopped) marks
210	3	Medium mammal	Rib fragments	Display butchery (chopped and filliting) marks, and evidence of rodent gnawing
409	1	Large mammal	Unidentified	
409	6	Fish	Vertebrae	
420	1	Large mammal	Rib fragment	
593	2	Medium mammal	Rib fragments	Some evidence of rodent gnawing and butchery (filliting) marks
593	1	Medium mammal	Lumbar vertebra	Displays butchery (chopped) marks
593	1	Sheep/goat	Cervical vertebra	
593	2	Medium mammal	Unidentified	Charred fragments
621	2	Large mammal	Rib fragments	Displays butchery (chopped) marks
621	1	Sheep/goat	Lumbar vertebra	Display butchery (chopped) marks
622	1	Dog	Tibia	Small dog
U/S	1	Cow	Phalanx 2	
U/S	8	Medium mammal	Rib fragments	

Table 2: Animal bones present within the assemblage

5.10.4 A proportion of the animal bone fragments displayed evidence of butchery, particularly the fragments of cow within the backfill (***207***) of Furnace 1 and the backfill (***621***) of the Furnace 3 flue. However, it would be most unlikely that the animal bones relate to any of the glass-working processes that had been active on the site and, as such, were probably discarded on the site from surrounding areas.

5.10.5 ***Potential:*** the sample size is too small to recommend any further analysis of the proportion of species or of metrical, butchery and mortality data. This class of material thus has little potential to inform the interpretation of the site

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further, other than a note of its presence or absence within stratigraphic deposits.

5.11 LEATHER

5.11.1 ***Quantification:*** in total, 21 fragments of leather in reasonable condition were recovered from the excavation. Amongst the assemblage were four shoes, four boot uppers and three belt straps collected from five contexts. The remaining fragments comprised small strips derived from demolition layers across the site.

5.11.2 ***Methodology:*** all artefacts were examined for the purposes of the assessment. Outline details of the objects were entered into an Access database in order to prepare a preliminary catalogue.

5.11.3 ***Evaluation:*** the stratified fragments came from the backfills of Furnaces 1 and 3 (***207*** and ***623***), and comprised several incomplete adult shoes and belt straps in reasonable condition. The shoes were of a similar size with several retaining soles with low heels (Plate 21). A collection of fragmented stitched boot uppers with lace eyelets was recovered from fill ***207***. The fragments were identical in style and size, with seven eyelets along the seam. No associated soles relating to the uppers were recovered. The differing styles of the shoes and boots from the fills of both furnaces probably date to a fashion popularly worn during the late 19th and 20th centuries. The belt strap fragments were in a poor condition, and did not bear enough surface detail to make an accurate assessment.

5.11.4 ***Potential:*** the presence of the leather shoe and boot fragments within the furnace backfills has some potential to inform the interpretation of the site further. In particular, the compilation of a typology of the patterns of footwear used within the glass works is recommended, as this would be valuable information on the use of specialised protective clothing in the glass-making industry.

5.12 CRUCIBLES

5.12.1 ***Quantification:*** in total, 68 fragments of ceramic crucibles, or glass melting pots, were recovered from the excavation. The bulk of the material (63 fragments) was recovered from a single deposit, the fill (***409***) of structure ***408*** (Phase 3). Fill ***210*** within Furnace 1 (Phase 3) yielded the remainder of the assemblage.

5.12.2 ***Methodology:*** all artefacts were examined for the purposes of the assessment. Outline details of the objects were entered into an Access database in order to prepare a preliminary catalogue. No ceramic fabric analysis has been carried out at this stage, although a representative sample of different types has been selected for chemical analysis.

5.12.3 ***Evaluation:*** a small range of refractory material was identified from a preliminary examination of the crucible fragments. Some of the crucible fragments bear a manufacturer's stamp.

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5.12.4 ***Potential:*** analysis of a selected group of crucible fragments would provide valuable information regarding the relative proportions of alumina and silica content of the refractory clay used within the bodies of the crucibles. This will inform an understanding of the refractory properties of the crucibles.

5.12.5 Chemical and micro-structural analysis of the clays would inform the temperature to which the crucibles were fired. It may also provide some information on furnace conditions and temperatures attained.

5.12.6 Stourbridge is frequently acknowledged as the main source of clay for refractory vessels used in the North West. Chemical analysis of the crucible fragments recovered from the Percival, Vickers & Co Ltd Glass Works may allow the identification of the source for these clays.

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6. CURATION AND CONSERVATION

6.1 RECIPIENT MUSEUM

6.1.1 It is anticipated that The Museum of Science and Industry in Manchester will be the ultimate place of deposition for the paper and material archive, as this is the nearest museum which meets the Museums' and Galleries' Commission criteria for the long-term storage of archaeological material:-

Address: The Museum of Science and Industry in Manchester
Liverpool Road
Castlefield
Manchester M3 4FP

Contact details: Pauline Webb (Collections Manager), Tel: 0161 606 0114

6.1.2 Arrangements have been made with the museum for the deposition of the complete site archive from the 2003/04 investigations.

6.2 CONSERVATION

6.2.1 Most of the assemblage is well-preserved and in good condition and thus the conservation requirement is low.

6.3 STORAGE

6.3.1 The complete project archive, which will include records, plans, both black and white and colour photographs, artefacts, and digital data, will be prepared following the guidelines set out in *Environmental standards for the permanent storage of excavated material from archaeological sites* (UKIC 1984, Conservation Guidelines 3) and *Guidelines for the preparation of excavation archive for long-term storage* (Walker 1990).

6.3.2 All finds will be packaged according to the museum's specifications, in either acid-free cardboard boxes, or in airtight plastic boxes for unstable material. Metalwork constitutes the only category which is potentially unstable and although the items will be packaged in airtight plastic boxes, they will need to be stored in controlled conditions.

6.4 PACKAGING

6.4.1 The assemblage is currently well-packed and will require no further packaging. Box lists are prepared and will be updated from the database when the identification of objects is complete.

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7. STATEMENT OF POTENTIAL

7.1 INTRODUCTION

7.1.1 In a recent overview of the region's industrial heritage, Fletcher (1996, 164) remarked that '*the threats to the survival of Lancashire's industrial fabric are both insidious and formidable. Industrial buildings commonly disappear under the constant pressure for redevelopment, or suffer wholesale refurbishment, where evidence for previous use is obliterated without record*'. This holds true despite a surge of interest in the Industrial Period during the last 30 years, although it is notable that parts of Ancoats have recently (November 2001) been placed on UNESCO's list of candidates for World Heritage site status on account of the unique range of 19th century industrial buildings. Whilst the site of the Percival, Vickers & Co Ltd Glass Works lies outside the present boundary of the proposed World Heritage Site, the comprehensive mitigation record of the works generated during the course of the archaeological investigation can offer a significant contribution to a broader understanding of this key industrial area.

7.1.2 Work undertaken as part of the Monuments Protection Programme emphasised the current lack of knowledge of urban centres of glass-making which developed from the 17th century onwards (Crossley 1993, 30). A functional understanding of many industrial processes in particular is required, which is one of the principal ways that industrial archaeology can contribute to the study of the past (Cranstone 2003). Moreover, archive sources that document the technological changes in glass-making during the 18th and 19th centuries are sparse; recent archaeological work in St Helens has demonstrated that in a period of rapid change in glass-making methods (ie during the 19th century), structures were modified from experience in ways which were not recorded by contemporaries (Krupa and Heawood 2002).

7.1.3 The few glass-working sites that have been investigated archaeologically within the north of England have been of a 17th or 18th century date, including those at Bolsterstone (Ashurst 1987), Gawber (Ashurst 1970), and Silkstone in South Yorkshire (Ashurst 1992), and Denton (Vose 1994) and Bickerstaffe (Vose 1995) in Lancashire. The dataset generated from the archaeological investigation of the Percival, Vickers & Co Ltd Glass Works offers a valuable opportunity to compare a 19th century works with those of an earlier date.

7.2 PRINCIPAL POTENTIAL

7.2.1 The greatest potential for analysis lies in the confirmation of the phasing and dating of the sequence of structures and archaeological deposits revealed by the investigation. The stratigraphic data will also provide the framework within which other analysis will take place.

7.2.2 ***Stratigraphic data:*** further analytical study of the stratigraphic record may elucidate a detailed, chronological sequence of events pertaining to the development of the site. In particular, this may inform an understanding of the

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implementation and development of technical innovations represented by the surviving structures on the site.

7.2.3 ***Documentary study:*** the significance of the excavation results is increased by the supporting primary documentary evidence available within the various county record offices and archives. An appraisal of these sources has been undertaken as part of this assessment (*Section 3 above*), although this has by no means been exhaustive. Further detailed examination of the primary documentary evidence could provide significant additional information.

7.2.4 ***Finds data:*** analysis of the glass fragments recovered during the course of the archaeological investigation will undoubtedly provide significant details of the glass-making processes and practices, and the precise chemicals and elements used as colourants, decolourisers and opacifiers. As Crossley commented (1990, 242), '*within the typology of glassware lies considerable variation in quality, reflecting choice of materials and competence of furnace operation. It is here that laboratory examination of furnace products is essential*'.

7.2.5 The lack of scientific analysis of lead glass compared to other types of glass has recently been highlighted as a result of detailed scientific examination of material recovered from the glass-working site at Silkstone, South Yorkshire (Dungworth 2003).

7.2.6 The assemblage of refractory material recovered from the investigations provides a valuable opportunity to explore the source, or sources, of the fireclay used to manufacture the furnace linings and the crucibles. A good quality fireclay was essential to the glass-making process; a burst crucible in the furnace could cause a great deal of damage from molten glass. However, there are few references to refractories in historical records (Vose 1980, 114), although Stourbridge is thought to have been an important source area.

7.2.7 The archaeological assemblage from the North West as a whole is probably one of the smallest from the country. Consequently, sites that generate stratified assemblages are of great importance.

7.3 NATIONAL PRIORITIES ADDRESSED BY THE SITE'S POTENTIAL

7.3.1 In 1991 English Heritage produced a document, *Exploring Our Past*, which included a strategy for dealing with the problems and opportunities which would be encountered during the following decade (English Heritage 1991b). Many of the ideas first raised in *Exploring our Past* were developed further in a draft document, *Research Agenda,* circulated to the archaeological profession in 1997. Section 7 of *Exploring our Past*, *The Way Forward*, and Section 3 of *Research Agenda*, *Archaeological Research Priorities*, outlined a series of broad academic objectives. Those of relevance to the present site are as follows:

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Processes of Change

- to enable archaeology to contribute to important debates and controversies which hitherto have been largely the preserve of economic historians (PC7);
- to examine the relationship between traditional and new industries during the period of industrialisation (PC8).

Themes

- to improve our understanding of single monument forms via site-specific study (T6);
- to contribute to an exposition of the remains of industrial archaeological sites (T6);
- to inform the development of new research frameworks for the management of the industrial archaeological resource (T6);
- to investigate a documented industrial site to compare the application of new technologies with the historical records of innovation and contemporary technical literature (T7);
- to assist analysis of the contrast between urban and rural industrial sites (T7);
- to study waste and process material from industrial sites to determine craft procedures (T7);
- to examine aspects of craftmanship and manufacture deduced from a study of the finished object (T7).

Methodological and Technical Development

- to inform the development and effective implementation of scientific techniques for analysis, which is considered to be a vital area of research (MTD6).

7.3.2 Whilst it is debatable whether the complete dataset from the investigated elements of the Percival, Vickers & Co Ltd Glass Works could fully address all of these, they should nevertheless be borne in mind when addressing more local issues.

7.4 LOCAL AND REGIONAL PRIORITIES

7.4.1 A research agenda for the North West has yet to be fully established, but it is clear that data gathering is still the most urgent necessity for many periods, including the post-medieval. This is particularly true of glass-manufacturing sites: of the numerous studies that have addressed the industrial development of Manchester since the late 18th century (eg Dodsworth 1980), remarkably

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few have focused on the glass industry. Indeed, the regional importance of Manchester's 19th century glass industry has only recently been acknowledged (Dodsworth 1980), and research is in its infancy. The Percival, Vickers & Co Ltd site is the only 19th century glass works in Manchester, and one of only a handful of similar sites within the country as a whole, that has been subject to detailed archaeological investigation.

7.4.2 The only other 19th century glass works that has been excavated archaeologically within the region is the No 9 Tank Furnace at the Hotties in St Helens (Krupa and Heawood 2002). However, this glass furnace was gas-powered and incorporated a Siemens regenerative system, representing very different technology to that employed at the Percival, Vickers & Co Ltd works, and it manufactured different types of glass products. The data generated from the Percival, Vickers & Co Ltd site thus provides a valuable contrast.

7.4.3 The relationship between the glass works and the Rochdale Canal is also of some significance, particularly in view of the historical and archaeological evidence for a wharf having existed on the site. Hitherto, the only example of a canal wharf known to survive within the curtilage of a glass works is that at Red House in the West Midlands.

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8. UPDATED PROJECT DESIGN

8.1 AIMS AND OBJECTIVES OF PROGRAMME OF ANALYSIS

8.1.1 ***Overall objectives:*** the overall objectives are:

- to secure the analysis and publication of the archaeological investigation of a 19th century Manchester glass works to act as a benchmark against which future work on similar sites in the region may be measured;
- to contribute to an understanding of English glass manufacture in the second half of the 19th century;
- to deposit the project archive into the public domain.

8.1.2 ***Specific objectives:*** the specific objectives which the data can address are:

1. to characterise and date the sequence of the archaeological structures and deposits revealed during the course of the investigation;
2. to elucidate an understanding of the glass-making technology inherent in the excavated structures, and the technological development of furnace construction represented by the noted differences between the excavated furnaces;
3. to determine the chemical composition(s) of the glass, and inform a wider understanding of the range of products manufactured;
4. to determine the chemical composition(s) of the crucibles;
5. to elucidate details of the glass-making practices and processes operating on the site;
6. to collate all the available archive sources pertaining to the site.

8.2 PRESENTATION OF RESULTS

8.2.1 In accordance with the guideline outlined in the English Heritage document *Management of Archaeological Projects 2* (English Heritage 1991a), it is proposed that the results of the project should be presented in the following stages:

1 Publication text: the dataset generated from the archaeological investigation at the Percival, Vickers & Co Ltd Glass Works is clearly of regional, if not national, significance and merits further analysis. A text detailing the results of the excavation will, in the first instance, be prepared suitable for publication as a journal article in the *Industrial Archaeology Review*. Additionally, the results of the excavation are to be presented at a forthcoming conference, the proceedings of which are to be published the Society for Post-Medieval Archaeology.

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2 **Project archive:** the completion of the project will result in an integrated archive, which will be deposited with The Museum of Science and Industry in Manchester.

8.3 PROGRAMME STRUCTURE

8.3.1 The post-excavation programme will be divided into the following stages:

- further research
- analysis
- synthesis
- preparation of draft text and illustrative material
- publication
- archive deposition.

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9. METHOD STATEMENT

9.1 INTRODUCTION

9.1.1 This statement relates the tasks outlined in the task list (*Appendix 4*) to the aims and objectives. The programme of works is tailored to address the specific objectives, which, when achieved, will secure the general objectives outlined in *Section 8.1* above.

9.2 START-UP

9.2.1 ***Tasks 1-5:*** to facilitate all objectives.

9.2.2 All members of the project team will be fully briefed by means of a project meeting, and a timetable will be established.

9.3 STRATIGRAPHIC ANALYSIS

9.3.1 ***Tasks 6-7:*** to address Objective 1, and contribute to all other objectives.

9.3.2 The stratigraphic sequence will form the contextual framework for an integrated report which, following the incorporation of artefactual data, will form the framework for the interpretation of the site. The interpretative framework will be based on the refinement of broad chronological phases into sub-phases reflecting changes in the organisation of the glass works.

9.3.3 Detailed structural analysis will be undertaken on those features identified as being of major interpretative importance to the site, namely the glass furnaces, their associated flues, and the annealing house.

9.4 CHEMICAL ANALYSIS OF THE GLASS

9.4.1 ***Task 9:*** to address Objectives 2, 3 and 5.

9.4.2 The fragments of glass manufacturing waste will be subjected to chemical analysis, which will allow the types of glass produced at the site to be identified, as well as the particular chemicals and elements used as colourants, decolourisers and opacifiers. The analysis of the working waste will also identify the different types present, such as moils, paraison ends and decorative trimmings, which will help distinguish many of the working practices being undertaken at the site. Chemical analysis will involve the typological and visual study of the working waste, combined with a structured programme of *Inductively Coupled Plasma Spectrometry* (ICPS) analysis on selected samples, which will be undertaken in a fully integrated manner.

9.5 THE CRUCIBLES

9.5.1 ***Task 10:*** to address Objective 4, and contribute to Objective 5.

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9.5.2 A selected sample of the glass melting pots will be subjected to chemical analysis, which will be focused upon determining the alumina levels.

9.6 DOCUMENTARY RESEARCH

9.6.1 ***Task 11:*** to address Objective 6.

9.6.2 Further documentary research will be undertaken to enhance the fieldwork results. This may include, for instance, a study of the available rate assessments for the site with a view to elucidating a precise date for the erection of the third furnace, as this addition to the works will have increased its annual value. Research will also be undertaken to identify comparable structures elsewhere, from either historical or archaeological sources.

9.7 IDENTIFICATION OF GLASS FRAGMENTS

9.7.1 ***Task 14:*** to address Objectives 2, 3 and 5.

9.7.2 Fragments of glass which may be identified with forms illustrated in surviving catalogues will be examined in detail to enhance the knowledge of vessel types known to have been produced at the works. Attention will also be paid to the identification of vessel types which do not appear in the catalogues, such as those supplied to industry.

9.8 ILLUSTRATION

9.8.1 During each part of the analytical programme, a selection will be made of appropriate material for illustration. This will cover general plans, phase plans, and artefacts. Experienced illustrators, using standard conventions, will compile these illustrations, either digitally for the plans, or manually as appropriate. A number of artefacts will be photocopied for the publication.

9.9 PRODUCTION OF TEXT

9.9.1 ***Tasks 18-20:*** a draft text and illustrative material will be produced and edited. Thereafter, the research archive will be finalised and the finds deposited with The Museum of Science and Industry in Manchester.

9.9.2 Following the completion of the full analysis of all the stratigraphic and artefactual evidence, a text suitable for publication as an article in the *Industrial Archaeology Review* will be drawn up. This will be in the format described in *Section 10*, and will incorporate as necessary any information from comparable excavations. This text will be submitted to internal revision, and will be submitted to all specialists after editing, for their comments. The edited text will be submitted to an external referee for formal academic review, after which it will be copy edited, ready for publication.

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10. PUBLICATION SYNOPSIS

10.1 INTRODUCTION

10.1.1 A text will be prepared suitable for publication as a journal article in the *Industrial Archaeology Review*. The article should not exceed 10,000 words in length, and will be accompanied with suitable illustrations.

10.2 THE STRUCTURE OF THE REPORT

10.2.1 The following section represents a likely breakdown of the proposed publication. It should be noted, however, that this synopsis can only be regarded as a draft, based on the current understanding of the article.

10.2.2 The text will be supported by a number of graphics, comprising drawings and photographs to illustrate the evidence, tables to summarise data and, where appropriate, interpretative phase drawings. The finished article will aim to present a high degree of integration between the structural/stratigraphical history of the site, the documentary evidence, and the finds categories.

10.3 OUTLINE SYNOPSIS

1. INTRODUCTION

1.1 Site location

1.2 Circumstances of project

2. BACKGROUND

2.1 Technological background

2.2 Summary history of Manchester's glass-making industry

2.3 Documentary evidence for the Percival, Vickers & Co Glass Works

3. THE ARCHAEOLOGICAL INVESTIGATION

3.1 Phased description of the structures encountered during the archaeological investigation

4. FINDS OVERVIEW

4.1 Summary of the glass products manufactured from documentary and excavation evidence

4.2 Results of chemical analysis of the glass and crucibles

4.3 Brief comment on other significant finds categories

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5. DISCUSSION

5.1 Chronological and technological discussion

5.2 Thematic context

Bibliography

Acknowledgements

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11. RESOURCES AND PROGRAMMING

11.1 NAMED PROJECT TEAM

11.1.1 The team consists of a combination of internal OA North staff and input from external consultants. The project will be managed by Ian Miller.

Name	Organisation	Tasks
Sean McPhillips	OA North	Stratigraphic analysis and publication report
Ian Miller	OA North	Project management, documentary research, and publication report
Rachel Newman	OA North	Internal quality control
Emma Carter	OA North	Illustrator
Jo Dawson	OA North	Finds analysis
Dr David Martlew	Science Support Group at Pilkington	Technology consultancy
John Hartley	Consultant	Refractory materials analysis
Peter Beebe	Consultant	Glass ware specialist
Dr Hugh Willmott	Sheffield University	Glass chemical analysis
Dr Caroline Jackson	Sheffield University	Glass chemical analysis
Dr Nick Walsh	University of London	Glass chemical analysis

11.2 MANAGEMENT STRUCTURE

11.2.1 OA North operates a project management system. The team is headed by the Project Manager, who assumes ultimate responsibility for the implementation and execution of this Project Design, and the achievement of performance targets, be they academic, budgetary, or scheduled. The Project Manager may delegate specific aspects of the project to other key staff, who both supervise others and have a direct input into the compilation of the report. They may also undertake direct liaison with external consultants and specialists who are contributing to the publication report. The Project Manager will define and control the scope and form of the post-excavation programme.

11.2.2 Communication between all concerned in the post-excavation programme is of paramount importance, and it is essential that the specialists involved liaise closely in order that comparable data are obtained. To this end, regular meetings and reviews are envisaged between all project staff and between particular groups of specialists. All information will be disseminated at regular intervals, thus ensuring that all concerned are aware of current progress, strategy and thinking.

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BIBLIOGRAPHY

CARTOGRAPHIC SOURCES

Map of Manchester and Salford, drawn from a survey by William Green, begun in 1787 and completed in 1794

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APPENDIX 1: PROJECT DESIGN

Oxford Archaeology North

August 2003

FORMER FLINT GLASS WORKS,

JERSEY STREET,

ANCOATS,

MANCHESTER

ARCHAEOLOGICAL EVALUATION PROJECT DESIGN

Proposals

The following project design is offered in response to a request from Mr Tom Fenton, of Urban Splash Ltd, for an archaeological investigation in advance of the proposed development of land at the former Flint Glass Works, Jersey Street, Ancoats, Manchester.

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1 BACKGROUND

1.1 CIRCUMSTANCES OF PROJECT

1.1.1 Urban Splash Ltd has recently submitted a development proposal to erect modern residential apartments and business units within the Ancoats area of Manchester (centred at NGR SJ 8518 9869). In order to allow for the early archaeological evaluation of the site, Urban Splash Ltd have obtained Planning and Conservation Area consent for the demolition of structures associated with a metal works at 64a Jersey Street, Ancoats. The site was formerly occupied by the Percival, Vickers & Co Ltd British and Foreign Flint Glass Works, which expanded with the growth of demand for press-moulded glass in the mid-nineteenth century.

1.1.2 In order to secure archaeological interests, Manchester City Council have attached an archaeological condition to planning consent for redevelopment of the site, and a brief detailing the required archaeological works has been devised by the Assistant County Archaeologist for Greater Manchester. In the first instance, an archaeological watching brief is required during the removal of concrete floors associated with the recent use of the site, followed by an archaeological evaluation which will be aimed at establishing the extent of survival of the glass works.

1.1.3 This project design is for the required programme of archaeological works, and has been formulated to meet the requirements of the specification produced by the Assistant County Archaeologist for Greater Manchester.

1.1.4 Glass making was established in Manchester by the late eighteenth century, and by *c*1830 Ancoats had evolved as an important centre for this industry (UMAU 2003). Percival, Vickers & Co Ltd British and Foreign Flint Glass Works was established in 1844, and a purpose-built factory equipped with two glass furnaces was erected on leased land in Ancoats. By 1863, it had become the largest of Manchester's glass factories, with a total workforce of 373 (Yates 1987). By 1888, the number of furnaces had been increased to three, one of which was used for coloured goods (*ibid*). The firm went into liquidation in 1907, and in 1914 the site was taken over by a metal merchant. The site has been assessed as part of English Heritage's Monuments Protection Programme (MPP), which recommended that the survival of buried remains of flues/furnaces bases should be assessed in the event of redevelopment.

1.2 PREVIOUS WORK

1.2.1 The proposed development area has not been subjected to any archaeological work previously. A recent desk-based assessment, produced by the University of Manchester Archaeological Unit (UMAU 2003), examined the part of Ancoats designated for redevelopment as the proposed Millennium Village. Whilst this work did not include Percival, Vickers & Co Ltd British and Foreign Flint Glass Works, it has identified a number of industrial sites of archaeological significance within the immediate vicinity, including the site

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of the Manchester Flint Glass Works, and places the manufacture of glass in a broader industrial context.

1.3 OXFORD ARCHAEOLOGY

1.3.1 Oxford Archaeology has over 30 years of experience in professional archaeology, and can provide a professional and cost effective service. We are the largest employer of archaeologists in the country (we currently have more than 200 members of staff) and can thus deploy considerable resources with extensive experience to deal with any archaeological obligations you or your clients may have. We have offices in Lancaster and Oxford, trading as Oxford Archaeology North (OA North), and Oxford Archaeology (OA) respectively, enabling us to provide a truly nationwide service. Watching briefs, evaluations and excavations have taken place within the planning process, to fulfil the requirements of clients and planning authorities, to very rigorous timetables. OA is an Institute of Field Archaeologists Registered Organisation (No 17), and is thus bound by the IFA's Code of Conduct and required to apply the IFA's quality standards.

1.3.2 Given the geographical location of Manchester, it is intended to co-ordinate the project from our northern office in Lancaster, though the project team will use the most appropriate resources from both offices. Between our two offices our company has unrivalled experience of working on post-medieval sites, and is recognised as one of the leading archaeological units in the country with regard to dealing with industrial archaeological projects. OA North has considerable experience of the assessment, evaluation and excavation of sites of all periods, and has particular experience of industrial archaeology in the North West having undertaken in recent years excavation, survey, building recording and post-excavation projects in both urban and rural environments; *inter alia* (locally to Manchester) the survey, excavation, recording, analysis, consolidation, publication and consultancy relating to the 'Hotties' continuous glass tank furnace at St Helens (Krupa and Heawood 2002). During the course of this project, OA North (under its former title of the Lancaster University Archaeological Unit) organised a two-day seminar, sponsored by English Heritage, which addressed the problems relating to the study of glass manufacture in the post-medieval period. Other relevant work undertaken by OA North includes the excavation of the former Calprina Works in Stalybridge (OA North 2003a), the excavation and survey of the Macintosh Mill in Manchester (OA North 2003b), and a continuing programme of archaeological investigation at the Torrs in New Mills. Of particular relevance, OA North has recently been invited by Urban Splash Ltd to undertake the archaeological work associated with the New Islington development, also within the Ancoats area of Manchester.

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2 AIMS AND OBJECTIVES

2.1 ACADEMIC AIMS

2.1.1 The main research aim of the investigation, given the commercial nature of the development, will be to characterise the level of preservation and significance of the archaeological remains relating to the glass works, and particularly the furnaces, and to provide a good understanding of their potential.

2.2 OBJECTIVES

2.2.1 The objectives of the project may be summarised as follows:

- to expose and determine the presence, character, and level of survival of the three glass furnaces, and to identify any technological variation between the furnaces;
- to expose and determine the presence, character, and level of survival of any flues associated with the glass furnaces;
- to expose and determine the presence, character, and level of survival of any evidence for ancillary processes, such as annealing, and storage;
- to expose and determine the presence, character, and level of survival of the workshops and other areas within the works.

3 METHOD STATEMENT

3.1 The following work programme is submitted in line with the aims and objectives summarised above, and in accordance with the project brief supplied by the Greater Manchester Assistant County Archaeologist.

3.2 FIELDWORK

3.2.1 The archaeological fieldwork will be undertaken once the buildings currently occupying the site have been demolished and the rubble removed. Once this has been completed, the concrete floors will be broken out and removed by the demolition contractor. A suitably qualified archaeologist will undertake a watching brief during this process and will advise as to safe levels of excavation in the areas of archaeological interest. It is assumed that the site will then be made available for archaeological evaluation.

3.2.2 ***Watching brief during removal of concrete floors***: a programme of field observation will accurately record the location, extent, and character of any surviving archaeological features within the specified areas. This work will comprise the observation of the process of excavation for these works, the systematic examination of any deposits exposed during the course of works,

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and the accurate recording of all archaeological features, and any artefacts, identified during observation.

3.2.3 During this phase of work, recording will comprise a full description and preliminary classification of features or materials revealed, and their accurate location (either on plan and/or section, and as grid co-ordinates where appropriate). All archaeological information collected in the course of fieldwork will be recorded in standardised form, and will include accurate national grid references. A photographic record will be undertaken simultaneously. In normal circumstances, field recording will also include a continual process of analysis, evaluation, and interpretation of the data, in order to establish the necessity for any further more detailed recording that may prove essential. The recording techniques and procedures employed by OA for such detailed recording represent current best practice.

3.2.4 It is assumed that OA North will have the authority to stop works to enable the recording of important features, and to call in additional archaeological support if a find of particular importance is identified. This would only be called into effect in agreement with the client and the archaeological curator, or his representative, and will require a contingency sum.

3.2.5 ***Evaluation Trenching***: it is proposed that the site be investigated initially via six trenches, two of 30m length each and four of 10m length each. The two 30m long trenches will be placed to investigate the survival of flues and structural elements of the works, including workshops and storage areas. The four 10m long trenches have been placed to investigate the level of survival of the furnaces and associated flues, whilst avoiding the concentration of contamination. The proposed positions of the trenches are shown in Figure 1. It should, however, be noted that these proposed positions may be subject to relocation, pending the results of the initial trenches and the level of contamination encountered. Any relocation of trenches will be subject to consultation with the Assistant County Archaeologist.

3.2.6 Following the excavation of these trenches, a further 20m of trenching will be placed across the site, the precise locations of which will depend upon the results of the initial trenches, and following discussions with the Assistant County Archaeologist and the consultant specialist in nineteenth century glassware production.

3.2.7 Excavation of the uppermost levels of modern overburden/demolition material will be undertaken by a machine fitted with a toothless ditching bucket to the top of the first significant archaeological level. The work will be supervised by a suitably experienced archaeologist. Spoil from the excavation will stored adjacent to the trench, and will be backfilled upon completion of the archaeological works.

3.2.8 Machine excavation will then be used to define carefully the extent of any surviving furnaces, foundations, flues, and other remains. Thereafter, structural remains will be cleaned manually to define their extent, nature, form and, where possible, date. It should be noted that no archaeological

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deposits will be entirely removed from the site. If the excavation is to proceed below a depth of 1.2m, then the trenches will be widened sufficiently to allow the sides to be stepped in.

3.2.9 All information identified in the course of the site works will be recorded stratigraphically, using a system adapted from that used by the Centre for Archaeology Service of English Heritage. Results of the evaluation will be recorded on *pro forma* context sheets, and will be accompanied with sufficient pictorial record (plans, sections and both black and white and colour photographs) to identify and illustrate individual features. Primary records will be available for inspection at all times.

3.2.10 A full and detailed photographic record of individual contexts will be maintained and similarly general views from standard view points of the overall site at all stages of the evaluation will be generated. Photography will be undertaken using 35mm cameras on archivable black and white print film as well as colour transparency, and all frames will include a visible, graduated metric scale. Extensive use of digital photography will also be undertaken throughout the course of the fieldwork for presentation purposes. Photographs records will be maintained on special photographic *pro-forma* sheets.

3.2.11 The precise location of the evaluation trenches, and the position of all archaeological structures encountered, will be surveyed by EDM tacheometry using a total station linked to a pen computer data logger. This process will generate scaled plans within AutoCAD 14, which will then be subject to manual survey enhancement. The drawings will be generated at an accuracy appropriate for 1:20 scale, but can be output at any scale required. Sections will be manually drafted as appropriate at a scale of 1:10. All information will be tied in to Ordnance Datum.

3.2.12 Human remains are not expected to be present, but if they are found they will, if possible, be left *in situ* covered and protected. If removal is necessary, then the relevant Home Office permission will be sought, and the removal of such remains will be carried out with due care and sensitivity as required by the *Burials Act 1857*.

3.2.13 Any gold and silver artefacts recovered during the course of the excavation will be removed to a safe place and reported to the local Coroner according to the procedures relating to the Treasure Act, 1996.

3.2.14 ***Finds policy:*** finds recovery and sampling programmes will be in accordance with best practice (following current Institute of Field Archaeologists guidelines) and subject to expert advice in order to minimise deterioration. OA has close contact with Ancient Monuments Laboratory staff at the University of Durham and, in addition, employs in-house artefact and palaeoecology specialists, with considerable expertise in the investigation, excavation, and finds management of sites of all periods and types, who are readily available for consultation. Finds storage during fieldwork and any site archive preparation will follow professional guidelines (UKIC). Emergency access to conservation facilities is maintained by OA North with the

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Department of Archaeology, the University of Durham. Samples will also be collected for technological, pedological and chronological analysis as appropriate. OA North employs palaeoecology and soil micromorphology specialists with considerable expertise in the investigation, excavation and analysis of sites of all periods and types, who are readily available for consultation.

3.3 HEALTH AND SAFETY

3.3.1 OA North provides a Health and Safety Statement for all projects and maintains a Safety Policy. All site procedures are in accordance with the guidance set out in the Health and Safety Manual compiled by the Standing Conference of Archaeological Unit Managers (3rd Edition, 1997). OA North will liase with the client/main contractor to ensure all current and relevant health and safety regulations are met.

3.3.2 A risk assessment will be completed in advance of any on-site works. This will be formulated with reference to the ground investigation report compiled by Casella Stanger, which provides a detailed description of contaminants present on the site. OA North staff will be equipped with the appropriate PPE, including disposable overalls and gloves, and welfare facilities including a washing facility will also be provided.

3.3.3 OA North has professional indemnity to a value of £2,000,000, employer's liability cover to a value of £10,000,000 and public liability to a value of £15,000,000. Written details of insurance cover can be provided if required.

3.3.4 Normal OA North working hours are between 9.00 am and 5.00 pm, Monday to Friday, though adjustments to hours may be made to maximise daylight working time in winter and to meet travel requirements. It is not normal practice for OA North staff to be asked to work weekends or bank holidays and should the client require such time to be worked during the course of a project a contract variation to cover additional costs will be necessary.

3.4 OTHER MATTERS

3.4.1 Access to the site will be arranged via the client/main contractor.

3.4.2 The client/main contractor will be responsible for the provision of a secure enclosed area for the archaeological work to take place within.

3.4.3 The client/main contractor is asked to provide OA North with information relating to the position of live services on the site. OA North will use a cable detecting tool in advance of any machine excavation.

3.5 POST-EXCAVATION AND REPORT PRODUCTION

3.5.1 ***Archive:*** the results of the fieldwork will form the basis of a full archive to professional standards, in accordance with current English Heritage guidelines (*The Management of Archaeological Projects, 2nd edition, 1991*)

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and the *Guidelines for the Preparation of Excavation Archives for Long Term Storage* (UKIC 1990). The project archive represents the collation and indexing of all the data and material gathered during the course of the project. The deposition of a properly ordered and indexed project archive in an appropriate repository is considered an essential and integral element of all archaeological projects by the IFA in that organisation's code of conduct.

3.5.2 The paper and finds archive for the archaeological work undertaken at the site will be deposited with The Museum of Science and Industry in Manchester, as this is the nearest museum which meets Museums' and Galleries' Commission criteria for the long term storage of archaeological material (MGC 1992). This archive can be provided in the English Heritage Centre for Archaeology format, both as a printed document and on computer disks as ASCii files (as appropriate). The archive will be deposited with The Museum of Science and Industry in Manchester within six months of the completion of the fieldwork.

3.5.3 Except for items subject to the Treasure Act, all artefacts found during the course of the project will be donated to the receiving museum.

3.5.4 A synthesis (in the form of the index to the archive and a copy of the publication report) will be deposited with the Greater Manchester Sites and Monuments Record. A copy of the index to the archive will also be available for deposition in the National Archaeological Record in London.

3.5.5 ***Report:*** four copies of a bound and collated final report will be submitted to the client within six weeks of the completion of the fieldwork. Further copies will be sent to the Manchester Planning Department, the Assistant County Archaeologist, the Greater Manchester Sites and Monuments Record, The Museum of Science and Industry in Manchester, and the Manchester Region Industrial Archaeological Society. The final report will include a copy of this project design, and indications of any agreed departure from that design. It will include an historical and archaeological background to the study area, an outline methodology of the investigation, and present, summarise, assess, and interpret the results of the programme of archaeological works detailed above. It will also include an assessment of the finds, which will be accompanied by relevant proposals for detailed finds analysis and conservation with costs. In addition, recommendations for any further mitigation works and details of the final deposition of the project archive will also be made.

3.5.6 A summary of the results produced from the archaeological investigation will be published in the CBA North West magazine, although a more detailed article will be provided should the results be of sufficient merit.

3.5.4 ***Confidentiality:*** the final report is designed as a document for the specific use of the client, and should be treated as such; it is not suitable for publication as an academic report, or otherwise, without amendment or revision. Any requirement to revise or reorder the material for submission or presentation to third parties beyond the project brief and project design, or for any other

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explicit purpose, can be fulfilled, but will require separate discussion and funding.

4 WORK TIMETABLE

4.1 A three week period is required to excavate, record and backfill the evaluation trenches.

4.2 A report will be submitted within six weeks of the completion of the fieldwork.

4.3 OA North can execute projects at very short notice once an agreement has been signed with the client.

5 STAFFING PROPOSALS

5.1 The project will be under the overall charge of **Ian Miller BA AIFA** (OA North Project Manager) to whom all correspondence should be addressed. Ian has considerable experience and particular research interests in Industrial Archaeology and, amongst numerous other projects, was involved in the excavation recording, analysis and publication of the Netherhall blast furnace site in Maryport, Cumbria, the excavation, recording and publication of work at Carlton Bank alum works in North Yorkshire, and the excavation of Macintosh Mill in Manchester.

5.2 The evaluation and watching brief will be undertaken by **Sean McPhillips BA** (OA North Project Supervisor). Sean is an highly experienced field archaeologist, who has a particular interest in Industrial Archaeology, and especially that of Manchester. Sean recently directed the archaeological investigation of a complex of textile mills at the Torrs in New Mills, and has been selected to undertake an archaeological watching brief and evaluation of the textile mills in Ancoats associated with the Millennium Village project. Sean also played a key role in the recent excavations at Calprina Works, Stalybridge, and Macintosh Mill, Manchester.

5.3 Assessment of any finds from the excavation will be undertaken by OA North's in-house finds specialist **Christine Howard-Davis BA MIFA** (OA North Finds Manager). Christine has extensive knowledge of all finds of all periods from archaeological sites in northern England, and is a recognised expert in the analysis of glasswork.

5.4 Any requirement for conservation work will be undertaken by **Jennifer Jones**, the AML contract conservator based at the University of Durham. Jennifer is a nationally-recognised specialist in conservation, and is readily available to provide advice on the treatment of any delicate finds recovered from the evaluation.

5.5 Specialist advice regarding the production of nineteenth century glassware will be provided by **John Hartley**. John is a consultant specialising in

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refractories for glass furnaces, and was previously Head of Refractories for Pilkington Glass. John has spent over 30 years in glassmaking, and has developed considerable expertise in the production of glass and the operation of glass furnaces.

6. MONITORING

6.1 Monitoring meetings will be established with the client and the archaeological curator at the outset of the project. Monitoring of the project will be undertaken by the Greater Manchester Assistant County Archaeologist, who will be afforded access to the site at all times. Resources have been allocated for at least one site meeting between all interested parties, including a consultant specialist in the production of nineteenth century glassware, to review the archaeological work.

6.2 Resources have also been allocated to allow for a site visit by special interest groups, which include Bernard Chapness from the Manchester Region Industrial Archaeology Society, and students from the Historical Archaeology course at Manchester University.

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APPENDIX 2: SUMMARY CONTEXT LIST

Context	Description	Phase
100	Furnace 1: west flue wall	2
101	Furnace 1: east flue wall	2
102	Furnace 1: flue floor	2
103	Demolition deposit between ***100*** and ***101***	3
104	Blue brick yard surface, north-western corner of site	4
105	Natural clay subsoil	-
200	Yard surface, same as ***104***	4
201	Demolition/levelling horizon below ***200***	4
202	Concrete foundation	4
203	Furnace 1: east/west curtain wall	2
204	Furnace 1: flue roof	2
205	Brick repair within ***204***	?3
206	Furnace 1: outer wall	2
207	Furnace 1: fire chamber	2
208	Furnace 1: west wall of ***207***	2
209	Furnace 1: east wall of ***207***	2
210	Furnace 1: backfilled deposit within ***207***	?3
211	Furnace 1: vitrified glass on the inner face of ***207***	2
212	Furnace 1: refractory brick surface overlying ***207***	2
213	Furnace 1: rectangular hole built into inner face of ***208***	2
214	Furnace 1: perimeter channel surrounding ***206***	2
215	Furnace 2: ceramic drain below ***599***	2
300	North/south annealing wall west of ***301***	2
301	Sloping annealing channel	2
302	Annealing channel	2
303	Partition wall east of ***302*** (same as ***508***)	2

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304	Slot between walls ***303*** and ***305***	2
305	Partition wall east of ***304***	2
306	Annealing wall	2
307	Annealing channel east of ***306***	2
308	East curtain wall of annealing house	2
309	Furnace 2: roofed flue	2
310	Furnace 2: perimeter channel surrounding wall ***313***	2
311	Furnace 2: sandstone flags overlying ***310***	2
312	Furnace 2: refractory brick surface within furnace	2
313	Furnace 2: outer wall	2
314	Furnace 2: east curtain wall	2
315	Machine base within wall ***314***	?2
316	Slag dump	?1
317	Inner wall east of Furnace 2	2
318	Concrete tank associated with waste paper factory	4
319	Concrete platform	4
320	Redeposited clay below ***307***	2
321	Furnace 2: room at south end of flue	2
400	Brick surface butting ***401***, eastern part of annealing house	2
401	Annealing channel west of ***400***	2
402	West quadrant wall of sand trough ***554***	?2/3
403	East quadrant wall of sand trough ***554***	?2/3
404	Fill of sand trough ***554***	?2/3
405	Wall bordering walls ***402*** and ***403***	?2/3
406	Brick surface	2
407	Furnace 2: flue roof	2
408	Brick-lined ‘clay pot’ pit	2/3
409	Fill of ***408***	3

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410	Square brick-lined shaft south of ***408***	2/3
411	Small east/west wall butting ***408***	2/3
412	Primary curtain wall bordering ***408*** and ***540***	2/3
413	Rectangular brick-lined structure containing sand and rubble (same as ***551***)	4
414	Concrete platform sealing floors ***415*** and ***526***	4
415	Refractory tile surface	2
416	North/south wall at north area of site, possible external wall of annealing house	2
417	Rectangular brick-lined sand pit	3/4
418	Wall with machine base flagged capping, internal glasswork wall	3
419	North/south wall with curved terminal, external glass work wall as seen on 1893 OS Map	2/3
420	Furnace 3: west curtain wall	3
421	Wall east of Furnace 3	4
422	Furnace 3: central flue	3
423	Furnace 3: refractory brick floor foundation (west)	3
424	Furnace 3: refractory brick floor foundation (east)	3
425	Furnace 3: outer wall	3
426	Furnace 3: inner perimeter flue	3
427	Truncation at the north-east corner of ***425***	4
428	East/west metal pipe cutting north end of Furnace 3	4
429	Tip lines west of ***420***	3
430	Concrete foundation cutting ***411***	4
431	Furnace 3: refractory pipe (east) within ***424***	3
432	Furnace 3: refractory pipe (west) within ***423***	3
433	Furnace 3: east/west wall to the rear of furnace, cut by ***422***	3
434	North/south wall west of Furnace 3	?3
435	East-west wall bordering annealing channels ***307***, ***516*** and ***518***	2
436	Furnace 3: stone sett yard surface	3

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437	Furnace 3: Flue floor	3
438	Furnace 3: Brick piers overlying ***437***	3
439	Furnace 3: Sandstone block butting the base of ***438***	3
440	Furnace 3: Rectangular pit below fire hole ***444***	3
441	Furnace 3: Fill of ***440***	3
442	Furnace 3: Ceramic water pipe within ***440***	3
443	Furnace 3: Brick platform machine base sealing ***440***	3
444	Furnace 3: Fire hole	3
445	Furnace 3: East wall of flue ***422***	3
446	Furnace 3: West wall of flue ***422***	3
447	Furnace 3: East refractory wall of 'cave'	3
448	Furnace 3: West refractory wall of 'cave'	3
449	Furnace 3: Recess associated with fire hole ***444***	3
450	Furnace 3: Air channel through ***449***	3
500	Natural clay subsoil east of Furnace 2	-
501	Furnace 2: central flue	2
502	Furnace 2: outer wall (same as ***313***)	2
503	Furnace 2: perimeter channel surrounding wall ***502***	2
504	South external wall of glass house	2
505	Furnace 2: sandstone flags overlying ***503*** (same as ***311***)	2
506	Furnace 3: refractory brick surface (same as ***312***)	2
507	Concrete platform cutting ***502*** and ***506*** (same as ***319***)	4
508	Annealing wall west of ***301*** (same as ***303***)	2
509	Annealing wall east of ***301***	2
510	Slot between partition walls ***305*** and ***306*** in Annealing House	2
511	Concrete running east/west through annealing channels	4
512	East/west wall north of channels ***301*** and ***302*** in Annealing House	?2
513	Brick floor within workshop ***593***	2

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514	Group context for sandstone blocks within ***513***	2
515	Annealing wall east of ***307***	2
516	Annealing channel east of ***515***	2
517	Annealing wall east of ***516***	2
518	Annealing channel east of ***517***	2
519	Annealing wall east of ***518***	2
520	Annealing wall east of ***513***	2
521	North/south wall east of Furnace 2	2
522	Waste paper factory room, cutting ***521***	4
523	East/west wall butting the east side of ***521***	2
524	East/west wall butting the east side of ***521***, parallel to ***523***	2
525	Glass waste deposit within ***523*** and ***524***	2
526	Refractory tile floor butting ***534***	2
527	East/west wall butting floor ***526*** overlying ***535***	?2
528	Original north/south wall of 'heat chamber'	2
529	Inner wall repair? of heat chamber	?3
530	Wall east of heat chamber	?3
531	Machine bed and refractory floor east of heat chamber	?2
532	Re-used post-glasswork wall north of ***530***	4
533	Rebuilt wall overlying floor ***526***	4
534	North/south wall butting ***533***	2
535	Clinker/ashy waste deposit below wall ***527***	?3
536	Inner east/west wall of heat chamber	2
537	Sooted refractory floor within heat chamber	2
538	East/west channel/air hole within east face of pit ***408***	2
539	North-east/south-west sandstone-capped channel below pit ***408*** and heat chamber	2
540	Coal hole	?2
541	Brick stack/box drain? Within heat chamber	?2

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542	Upper floor within pit ***408***	2
543	Ash waste, fill below ***542***	2
544	Inner east/west wall of pit ***408***	2
545	Slate rendering below ***543***	2
546	Furnace 2: east flue wall	2
547	Furnace 2: flue floor	2
548	Furnace 2: west flue wall	2
549	North/south wall butted by surface ***400*** and wall ***402***	2
550	Redeposited clay below fill ***404*** within ***554***	2
551	Waste paper factory room (same as ***413***)	4
552	Brick floor butting surface ***400***	?3
553	East/west wall below ***552***	?2
554	Sand trough containing ***402***, ***403***, and ***404***	?2
555	Square brick platform bordering annealing house	2
556	Redeposited clay and sand backfill butting wall ***405***	2
557	Furnace 2: brick stack associated with channel ***310***	2
558	Ashy dump deposit butting channel ***310*** in the south-west of Furnace 2	?2
559	Sub-circular channel south of the annealing house	?2
560	Remnant of east/west channel cut by ***559***	?2
561	East retaining wall of annealing house	2
562	Annealing channel west of ***561***	2
563	Annealing wall (same as ***517***) exposed during watching brief	2
564	Annealing channel (same as ***516***) exposed during watching brief	2
565	Annealing wall (same as ***515***) exposed during watching brief	2
566	Annealing channel (same as ***307***) exposed during watching brief	2
567	Annealing wall (same as ***306***) exposed during watching brief	2
568	Slot between ***567*** and ***569*** (same as ***510***)	2
569	Lime-washed partition wall west of ***568*** (same as ***305***)	2

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570	Slot between ***569*** and ***571*** (same as ***304***)	2
571	Partition wall west of ***570*** (same as ***303***)	2
572	Sandstone machine base overlying ***572***, associated with fly wheel mechanism ***582*** to the west	2
573	Annealing channel (same as ***302***)	2
574	Annealing wall west of ***573*** (same as ***509***)	2
575	Sloping annealing channel west of ***574*** (same as ***301*** in the north)	2
576	Annealing wall west of ***575*** (same as ***300*** and ***508***)	2
577	Flagstone base within ***579***	2
578	West retaining wall of annealing house	2
579	Rectangular slot associated with ***582***	2
580	Eastern wall of structure ***582***	2
581	Brick platform west of ***578***	2
582	Small engine house	2
583	Drive shaft housing within wall ***580***	2
584	Square air shaft east of wall ***561***, probably associated with channel ***559***	2
585	Fill of ***584***	2
586	Ashy/charcoal waste deposit below ***588***	1
587	Furnace 1: sandstone flag yard butted by surface ***595***	2
588	Bedding sand below ***587***	2
589	Construction trench for parallel rails ***590***	1
590	Parallel iron rails running north/south in western part of site	1
591	Compacted grey slag/clinker fill of ***589***	1
592	Brick layer sealing ***591***	2
593	Annealing room east	2
594	Annealing room west	2
595	Furnace 1: sloping brick surface butting yard ***587***	2
596	Sand bedding below ***595***	2

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597	Sandstone block (?machine beds) on top of outer cone wall (***206***) of Furnace 1	2
598	Clay pot scars imprinted on refractory floor	2
599	Furnace 2: flue floor (same as ***547***)	2
600	Furnace 1: flue floor within furnace fire chamber	2
601	East/west wall butting platform ***603***	2
602	North/south wall possibly an extension of ***601***	?2
603	Rectangular brick platform retained by walls ***601*** and ***604***	2
604	East/west retaining wall below ***603***	2
605	Rectangular brick-lined machine pit	?2
606	Glass works demolition layer	4
607	Dark brown sandy silt dump layer below ***606***	?3
608	Redeposited clay levelling layer below ***607***	?3
609	Dump layer below ***607***	?3
610	Dump layer below ***607***	?3
611	Mortar lens below ***610***	?3
612	Levelling layer below ***608***	2
613	Levelling layer below ***612***	2
614	Levelling layer below ***613***	2
615	Levelling layer below ***614***	2
616	Levelling layer below ***615***	2
617	Dark greyish-black deposit below ***616***	1
618	Grey/brown disturbed natural clay subsoil below ***617***	1
619	Furnace 2: backfilled material within furnace	2
620	Furnace 2: fire pit area	2
621	Furnace 3: backfilled material within flue (***422***)	3
622	Furnace 3: backfilled material within east side of perimeter flue ***426***	3
623	Furnace 3: backfilled material within west side of perimeter flue ***426***	3
624	Brick structure west of ***507***	3

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625	Brick-lined sand pit at the south end of the site	2
626	Fill of ***625***	2
627	Concrete tank associated with waste paper factory	4
628	Furnace 2: room at the south end of the flue	2
629	Concrete trough associated with waste paper factory	4

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APPENDIX 3: SUMMARY FINDS CATALOGUE

Context	Material	Type	Quantity (Count)	Weight (Kg)	Phase
210	Animal bone	Phalanx 1, lumbar vertebra, rib	1	0.015	2
210	Ceramic	Disc	11	6.695	2
210	Ceramic	Clay pots	5	-	2
210	Ceramic building material	Brick	3	0.175	2
210	Glass	Cullet	834	16.010	2
210	Glass	Production waste	761	58.26	2
210	Glass	Vessel	1262	36.14	2
210	Industrial residue	Charcoal	2	0.03	2
210	Industrial residue	Slag	12	1.575	2
210	Iron	Object	99	3.07	2
210	Pottery	Sherd	146	10	2
210	Stone	Disc	1	0.185	2
210	Textile	Leather	13	2.24	2
310	Pottery	Sherd	2	0.26	2
312	Glass	Cullet	3	0.015	2
312	Glass	Production waste	8	0.055	2
312	Glass	Vessel	19	0.76	2
312	Industrial residue	Slag	4	0.095	2
312	Pottery	Sherd	1	0.005	2
313	Ceramic	Bung	1	0.025	2
313	Glass	Production waste	3	0.39	2
313	Glass	Vessel	1	0.015	2
313	Industrial residue	Slag	70	5.77	2
313	Iron	Object	4	0.48	2
313	Pottery	Sherd	18	0.76	2
401	Glass	Cullet	3	0.035	2

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Context	Material	Type	Quantity (Count)	Weight (Kg)	Phase
401	Glass	Vessel	8	0.375	2
401	Pottery	Sherd	2	0.03	2
404	Glass	Production waste	2	0.11	2
404	Glass	Vessel	16	0.655	2
404	Iron	Object	11	1.58	2
404	Pottery	Sherd	20	0.29	2
404	Wood	Plank	2	0.18	2
409	Animal bone	Vertebrae	6	0.004	3
409	Ceramic	Bung	5	1.7	3
409	Ceramic	Clay pots	63	-	3
409	Ceramic	Disc	3	0.12	3
409	Glass	Cullet	282	0.93	3
409	Glass	Production waste	292	5.23	3
409	Glass	Vessel	29	1.125	3
409	Industrial residue	Slag	45	7.375	3
409	Iron	Object	2	0.45	3
409	Pottery	Sherd	8	1.01	3
409	Stone	Slate	1	0.01	3
420	Animal bone	Rib	1	0.005	3
420	Glass	Cullet	51	1.28	3
420	Glass	Production waste	74	2.7	3
420	Glass	Vessel	388	6.575	3
420	Industrial residue	Slag	1	0.02	3
420	Iron	Object	2	0.455	3
516	Glass	Cullet	3	0.11	2
516	Glass	Vessel	51	1.94	2
516	Industrial residue	Slag	5	0.895	2
516	Iron	Object	9	3.205	2

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Context	Material	Type	Quantity (Count)	Weight (Kg)	Phase
516	Pottery	Sherd	2	0.045	2
518	Glass	Cullet	1	0.1	2
518	Industrial residue	Slag	2	0.555	2
518	Iron	Object	1	0.695	2
518	Pottery	Sherd	13	0.345	2
540	Industrial residue	Slag	2	1.84	2
540	Iron	Object	3	1.135	2
547	Glass	Cullet	3	0.107	2
547	Industrial residue	Slag	15	6.425	2
547	Iron	Object	6	8.93	2
548	Ceramic	Disc	1	0.225	2
548	Glass	Production waste	1	0.04	2
548	Glass	Vessel	5	0.13	2
548	Industrial residue	Slag	3	0.17	2
548	Iron	Object	4	0.265	2
548	Leather	Strap	2	0.001	2
548	Pottery	Sherd	1	0.02	2
557	Glass	Cullet	12	0.075	2
557	Glass	Production waste	1	0.055	2
557	Glass	Vessel	8	0.22	2
557	Pottery	Sherd	5	0.115	2
558	Glass	Cullet	44	1.11	2
558	Glass	Production waste	50	5.87	2
558	Glass	Vessel	15	0.085	2
558	Industrial residue	Slag	22	1.99	2
558	Iron	Object	6	1.245	2
558	Pottery	Sherd	33	0.81	2
559	Glass	Cullet	6	0.105	2

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Context	Material	Type	Quantity (Count)	Weight (Kg)	Phase
559	Glass	Production waste	3	0.615	2
559	Glass	Vessel	6	1.255	2
559	Pottery	Sherd	5	0.55	2
582	Glass	Cullet	13	0.195	2
582	Glass	Production waste	2	0.76	2
582	Glass	Vessel	29	2.07	2
582	Industrial residue	Charcoal	2	0.015	2
582	Industrial residue	Slag	1	0.325	2
582	Iron	Object	10	1.415	2
582	Pottery	Sherd	6	1.495	2
582	Stone	Flagstone	1	0.09	2
591	Industrial residue	Slag	1000	1.215	2
593	Animal bone	Vertebrae, rib	6	0.02	2
593	Ceramic	Bung	26	1.31	2
593	Ceramic	Disc	1	0.335	2
593	Glass	Cullet	29	0.83	2
593	Glass	Production waste	2	0.435	2
593	Glass	Vessel	69	2.865	2
593	Industrial residue	Slag	19	1.235	2
593	Iron	Object	7	1.14	2
593	Pottery	Sherd	20	0.615	2
594	Glass	Production waste	3	0.05	2
594	Glass	Vessel	83	2.87	2
594	Industrial residue	Slag	4	1.185	2
594	Iron	Object	4	10.64	2
594	Pottery	Sherd	11	0.235	2
619	Glass	Cullet	13	0.225	2
619	Glass	Production waste	19	1.385	2

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Context	Material	Type	Quantity (Count)	Weight (Kg)	Phase
619	Glass	Vessel	37	0.555	2
619	Industrial residue	Slag	24	4.375	2
619	Iron	Object	3	1.415	2
621	Animal bone	Rib, vertebra	3	0.085	3
621	Ceramic	Bung	27	1.695	-
621	Ceramic	Disc	5	0.28	3
621	Glass	Cullet	183	6.33	3
621	Glass	Production waste	226	16.94	3
621	Glass	Vessel	1387	50.095	3
621	Industrial residue	Slag	40	10.555	3
621	Iron	Object	17	3.14	3
621	Pottery	Sherd	28	1.985	3
621	Stone	Slate	2	0.465	3
622	Animal bone	Tibia	1	0.01	3
622	Glass	Cullet	132	1.715	3
622	Glass	Production waste	86	8.425	3
622	Glass	Vessel	115	2.82	3
622	Industrial residue	Slag	6	5.185	3
622	Iron	Object	7	0.36	3
622	Pottery	Sherd	6	0.28	3
622	Textile	Leather	1	0.02	3
623	Ceramic	Bung	5	1.645	3
623	Ceramic building material	Brick	2	5.43	3
623	Glass	Cullet	28	1.01	3
623	Glass	Production waste	37	2.87	3
623	Glass	Vessel	60	6.025	3
623	Industrial residue	Slag	25	7.335	3

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Context	Material	Type	Quantity (Count)	Weight (Kg)	Phase
623	Pottery	Sherd	30	0.707	2
623	Stone	Object	1	0.18	3
623	Textile	Leather	7	0.375	3
Unstrat.	Animal bone	Phalanx 2, rib	8	0.08	-
Unstrat.	Ceramic	Disc	7	2.405	-
Unstrat.	Ceramic building material	Brick	4	1.29	-
Unstrat.	Glass	Cullet	45	0.7	-
Unstrat.	Glass	Production waste	7	32.03	-d
Unstrat.	Glass	Vessel	46	2.055	-
Unstrat.	Industrial residue	Charcoal	60	0.655	-
Unstrat.	Industrial residue	Slag	31	9.13	-
Unstrat.	Iron	Object	4	3.83	-
Unstrat.	Pottery	Sherd	7	1.35	-

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APPENDIX 4: TASK LIST

Task No	Task	Days	Resources
Task 1:	Project Set up	0.5	IM
	Contact / Liaise with Project Team	0.5	IM / SMcP / JD / EC / JH / PB
Task 2:	Upgrading of context database	1	SMcP
Task 3:	Refine Phasing	3	SMcP
Task 4:	Edit site matrix	1	SMcP
Task 5:	Compilation of phased illustrations	1	EC
Task 6:	Stratigraphic Analysis	5	SMcP
Task 7:	Update site narrative	5	SMcP
Task 8:	Upgrading of finds database	1	JD
Task 9:	Chemical Analysis of the Glass	15	HW / CJ / NW
Task 10:	Chemical Analysis of the crucibles	1	JH
Task 11:	Documentary Research	3	IM
Task 12:	Leather Analysis	2	JD
Task 13:	Ironwork Analysis	2	JD
Task 14:	Identification of Glass Fragments	15	PB
Task 15:	Production of draft publication text	10	IM / SMcP
Task 16:	Production of illustrations	2	EC
Task 17:	Submission of draft publication to externals	0.25	IM
Task 18:	Editing of Publication	1	IM
Task 19:	Quality assessment or check of Publication	1	RMN
Task 20:	Prepare Archive for Deposition	1	PS

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APPENDIX 5: COMPLETED PROJECT SUMMARY FORM

PROJECT NAME: Percival, Vickers & Co Ltd Flint Glass Works, Jersey Street, Manchester

PROJECT LOCATION County: Greater Manchester NGR: SJ 8518 9869
District: Manchester
Parish: Ancoats

TYPE OF PROJECT: Excavation and watching brief

RESPONSIBLE ORGANISATION: Oxford Archaeology North PROJECT CODE: L9312

PROJECT OFFICER(S): Ian Miller, Sean McPhillips

COMMISSIONED/FUNDED BY: Urban Splash Ltd and Lever Street Properties Ltd

REASON(S) FOR WORK: Development

DATE PROJECT STARTED: October 2003 DATE FINISHED: July 2004

SUMMARY OF RESULTS: (Industrial Period)

The report provides a summary and post-excavation assessment of the dataset generated from an archaeological investigation of the former Percival, Vickers British & Foreign Co Ltd Flint Glass Works, and presents a strategy for further analysis that will culminate in the publication of this important site. The glass works was established in 1844, and a purpose-built factory equipped with two glass furnaces, an annealing house, and associated workshops was erected on leased land in Ancoats. The factory was one of an important group of glass works that was established in Manchester during the 19th century, and, by 1863, had become the largest of the city's glass factories, with a total workforce of 373. By 1880, the works had been expanded to include a third furnace, reflecting an increased demand for press-moulded wares in additional to traditional fine cut and engraved tablewares. However, the premises had been sold by 1914; the former office and warehouse building along the Jersey Street frontage was occupied subsequently by a clothing manufacturer, whilst the area to the rear was cleared of structures associated with the glass works and redeveloped as a waste paper factory.

The archaeological work exposed considerable remains of the glass works and enabled an extensive plan of the glass works to be generated and a comprehensive record to be made of the three furnaces and annealing house. In particular, the later furnace incorporated several important design improvements, providing a valuable opportunity to elucidate details of the evolution of glass furnace technology during the second half of the 19th century. A large and significant artefactual assemblage was also recovered, which has a potential to furnish important details of the glass manufacturing process and the range of glass wares that had been manufactured at the works.

REPORT REFERENCE: OA North 2004-05/268

PROP0SED ARCHIVE REPOSITORY: The Museum of Science and Industry in Manchester, Liverpool Road, Castlefield, Manchester M3 4FP

CONTACT NAME (FOR INFORMATION/ENQUIRIES): Ian Miller

ADDRESS: OA North, Storey Institute, Meeting House Lane, Lancaster LA1 1TF

TEL: 01524 848666

E-MAIL: i.miller@oxfordarch.co.uk

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ILLUSTRATIONS

Figures

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Plates

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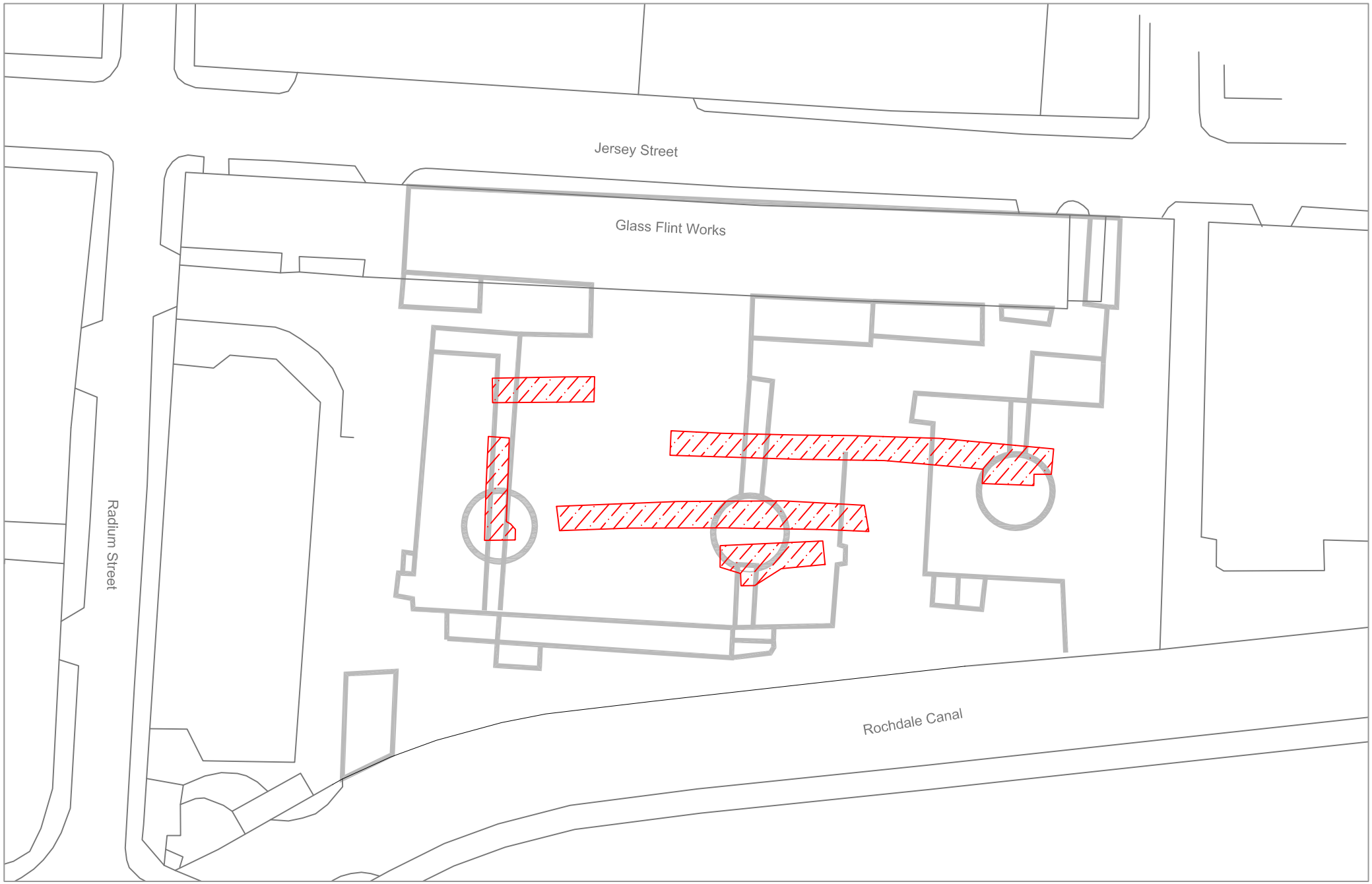
Figure 1: Location Map



based upon the Ordnance Survey 1:50000
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Scale 1:500

0 10m

Figure 2 : Position of Evaluation Trenches Superimposed on OS 1893 Map

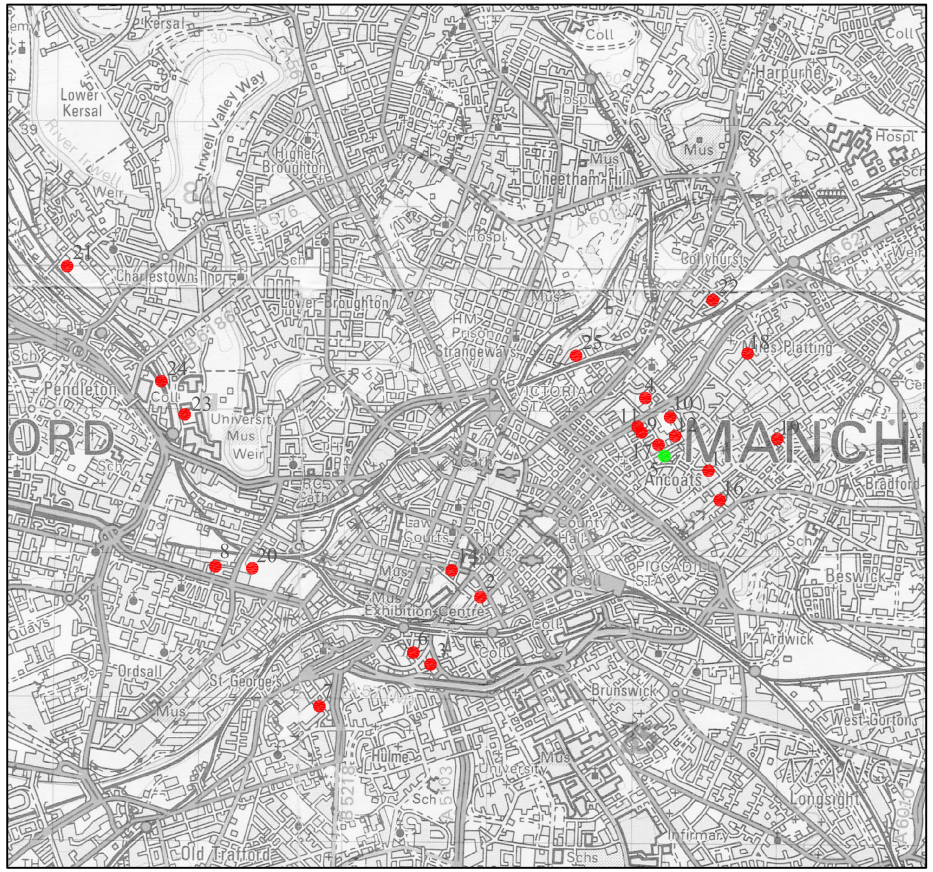


Figure 3: Principal Glass Works of Manchester and Salford, 1827 - 1964

1. Manchester Flint Glass Works (Molineaux Webb) 1827-1931
2. Bale Street Works 1830-34
3. Medlock Street Glass Works (Wm Robinson and Co) 1834-80
4. Stourbridge Glass Works (Atherton and Buckley) 1836-73
5. Percival, Vickers British & Foreign Flint Glass Works 1844-1914
6. British Union Flint Glass Works (James Derbyshire) 1858-1923
7. Bridgewater Flint Glass Works (James Derbyshire) 1866-82
8. Regent Flint Glassworks (James Derbyshire) 1872-1904
9. George Leigh Street Works 1858-63
10. Poland Street Works (Burtles Tate Ltd) 1858-1925
11. German Street Works (Butterworth's) 1888-1924
12. Manchester Glass Bottle Works (Woolfall and Percival) 1833-?
13. Newton Heath Glass Works (Butterworth's) 1868-1962
14. Mount Street Works 1860-1872
15. Ancoats Glassworks, Stone Street (Wm Nelson) 1872-1890
16. Ancoats Machine Glass Works 1890-1920
17. Prussia Street Glass Works (Ker, Webb and Co) 1868-94
18. Varley Street Glass Works (Thomas Webb and Co) 1875-93
19. Holt Town Glass Works (Thomas Kidd and Co) 1868-1920
20. Perseverance Glass Works (Hampson's) 1872-1964
21. Pendleton Flint Glass Works 1874-90
22. Phoenix Glass Works 1873-1908
23. Excelsior Glass Works 1882-1918
24. Frederick Road Glass Works (Alfred Webb) c1915-35
25. Water Street Glass Works (Wm Marsden) c1858-65

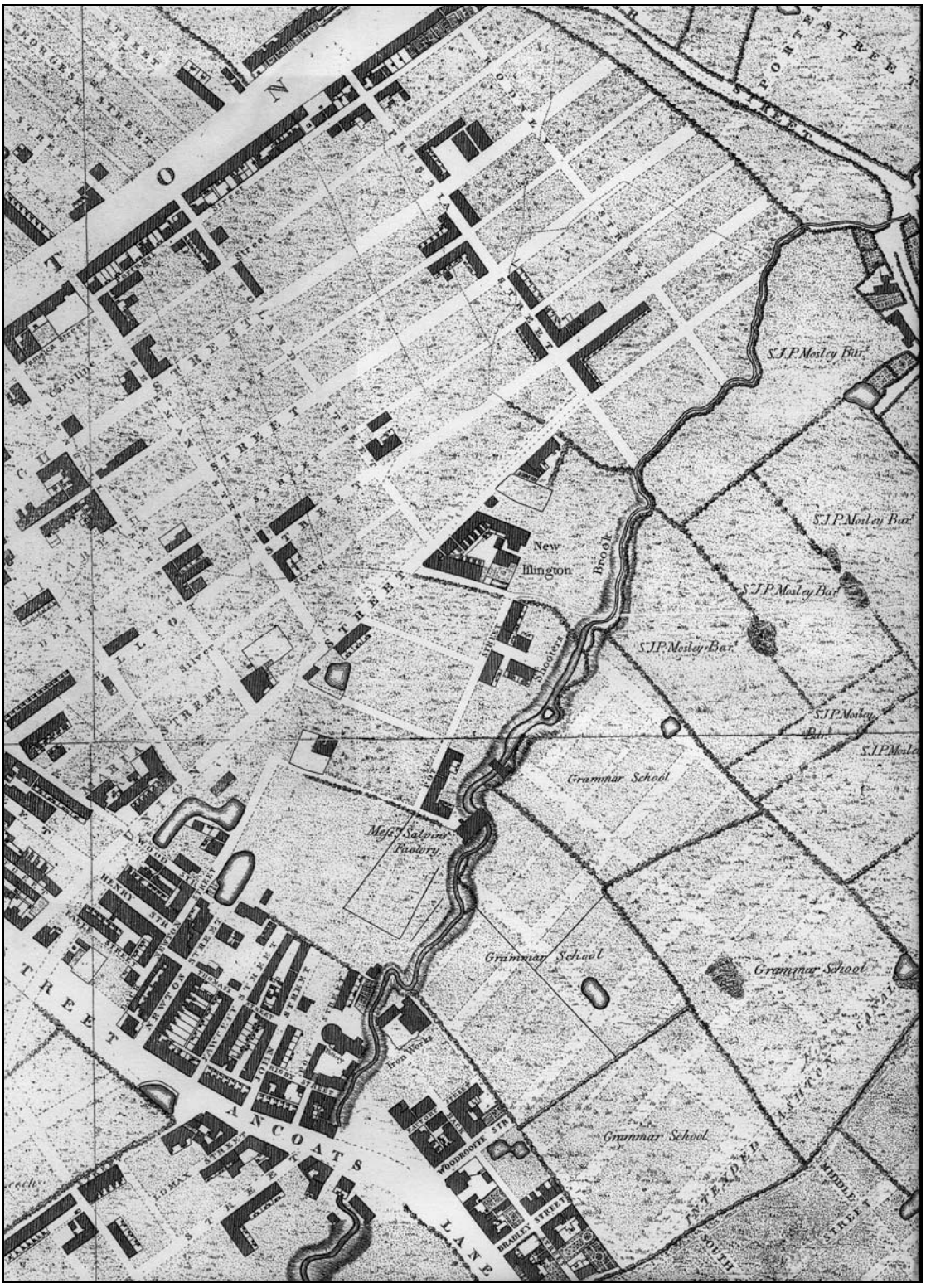


Fig 4: William Green's *Map of Manchester and Salford*, 1794

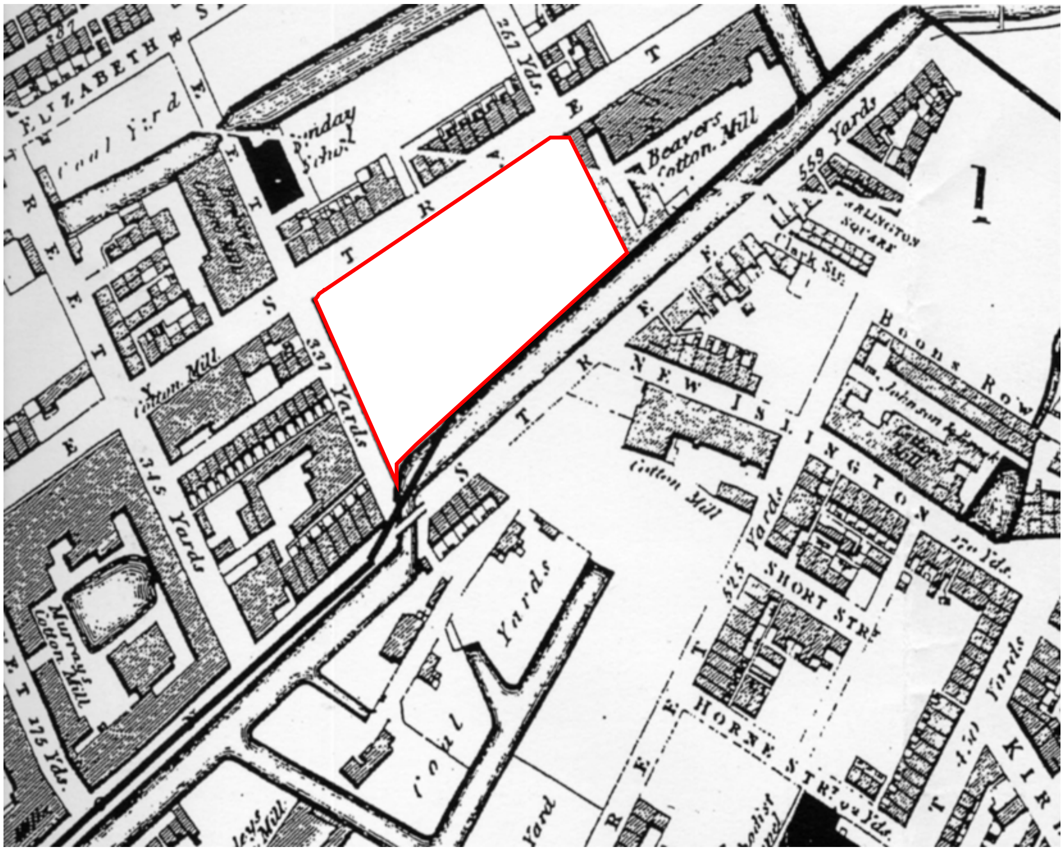


Fig 5: Extract of Bancks and Co's *Map of Manchester and Salford* (1831), showing the site prior to the erection of the glass works

Fig 6: Extract of the Ordnance Survey 6": 1 mile map (1851), showing the original layout of the glass works

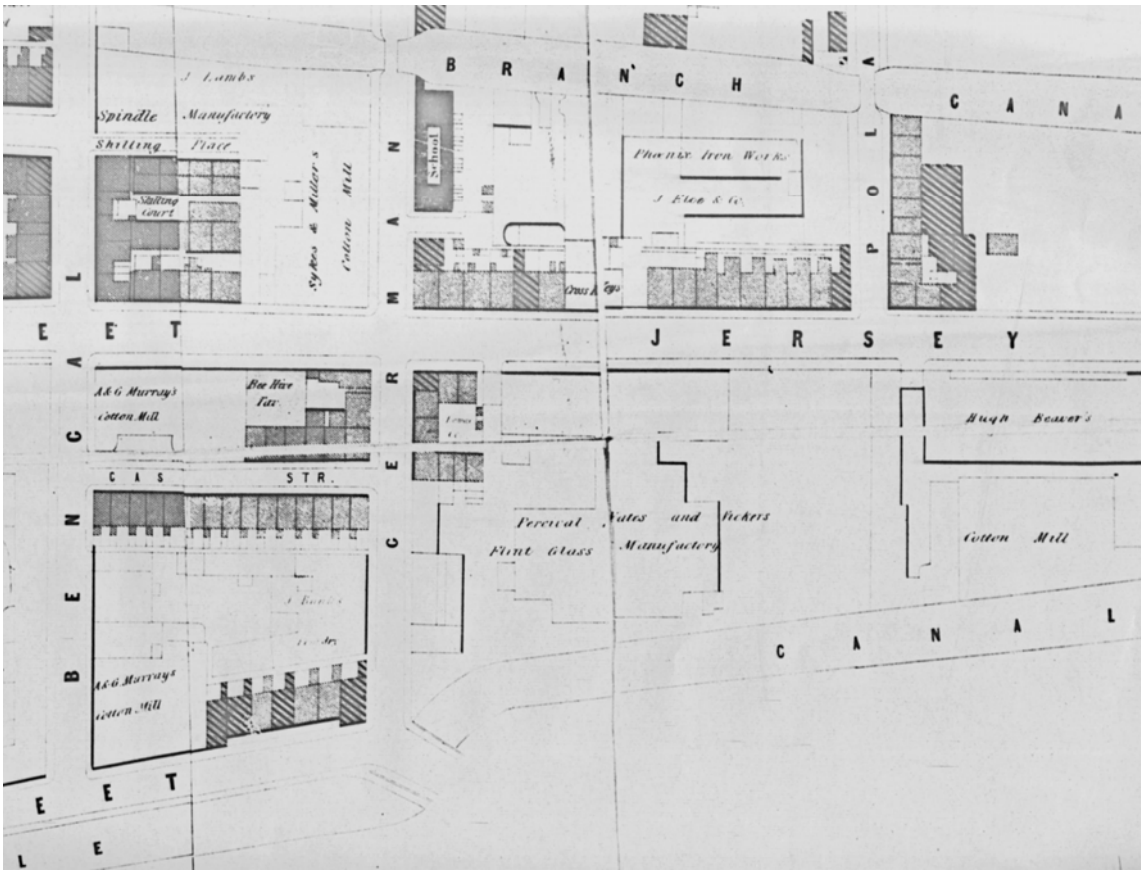


Fig 7: Extract of Adshead's *Map of Manchester* (1851)

Fig 8: Extract of the Ordnance Survey 1:2500 edition map of 1893, showing the glass works to have been equipped with three glass furnaces

Fig 9: Extract of the Ordnance Survey 1:2500 edition map of 1922, showing the glass works to have been largely demolished, and the street frontage building used as a '*Waterproof Factory*'

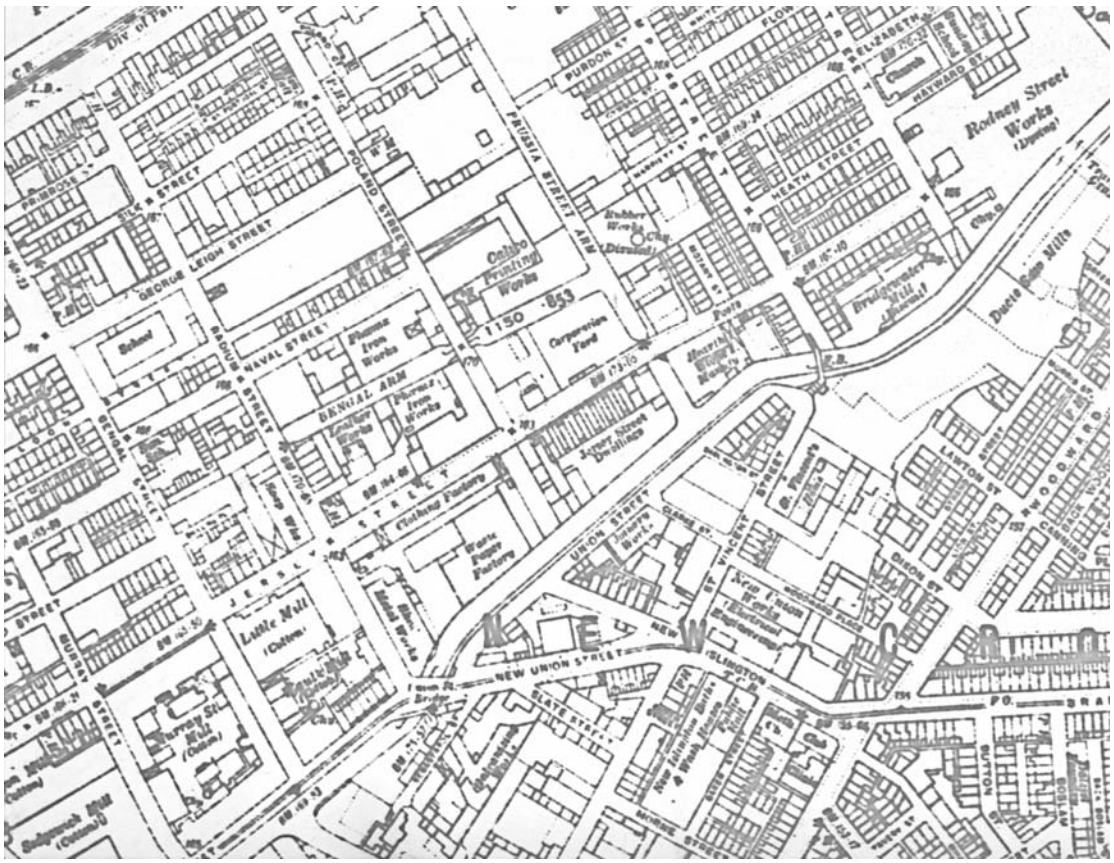


Fig 10: Extract of the Ordnance Survey 1:2500 edition map of 1933, showing the study area to have been redeveloped as a waste paper factory

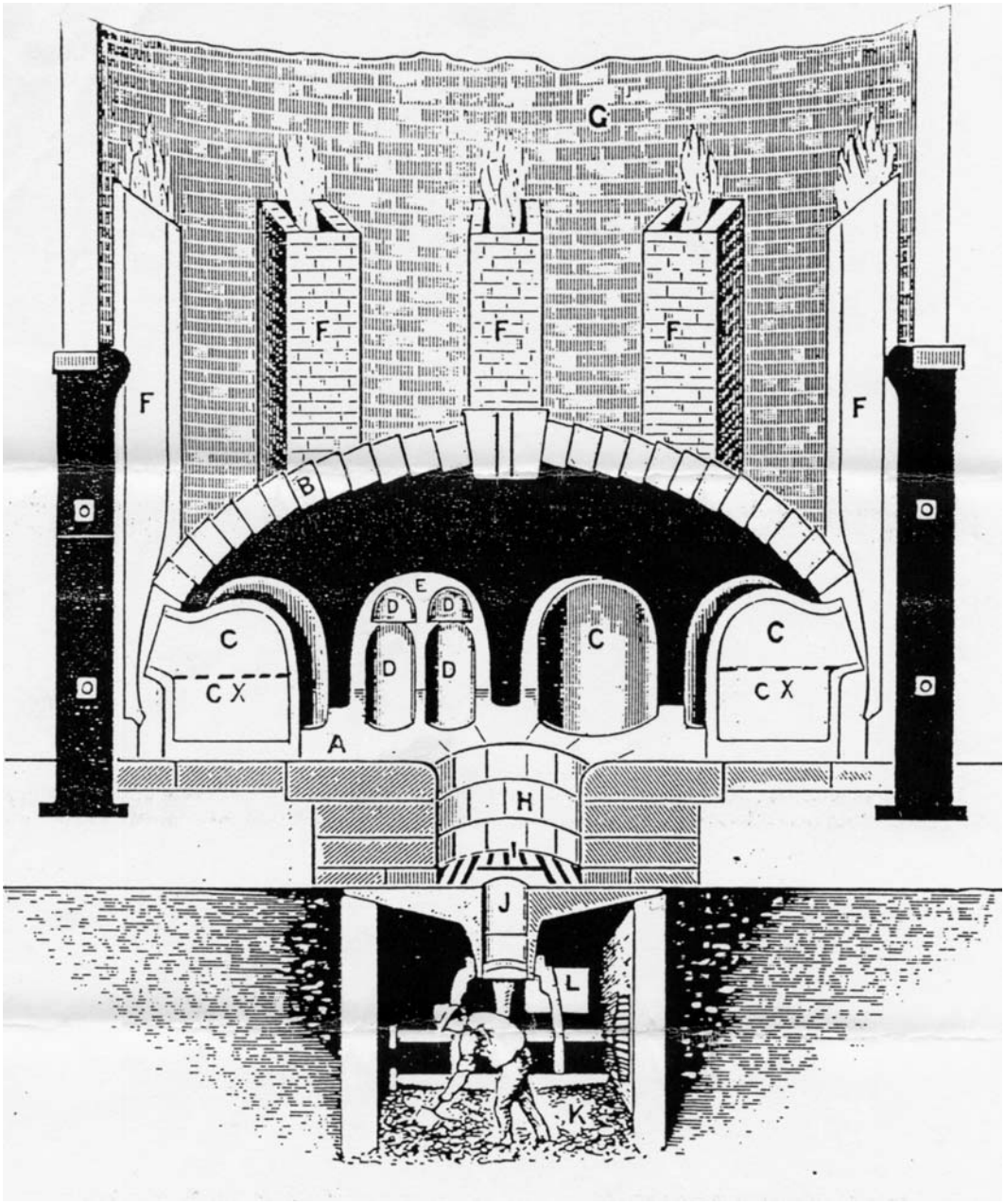


Figure 11: A Cross-Section of a Direct-Fired Glass Furnace
(after The Pottery Gazette and Glass Trade Review 1898)

KEY

A	The siege
B	The crown, or dome, of the furnace
C	Pots for crystal glass
D	Oval pots and dandies for coloured metals
E	Furnace arches
F	Furnace flues
G	Chimney or stack
H	Fire hole, which holds the fuel
I	Fire grate
J	Patent fuel feeder
K	The ‘cave’
L	Entrance to the ‘cave’

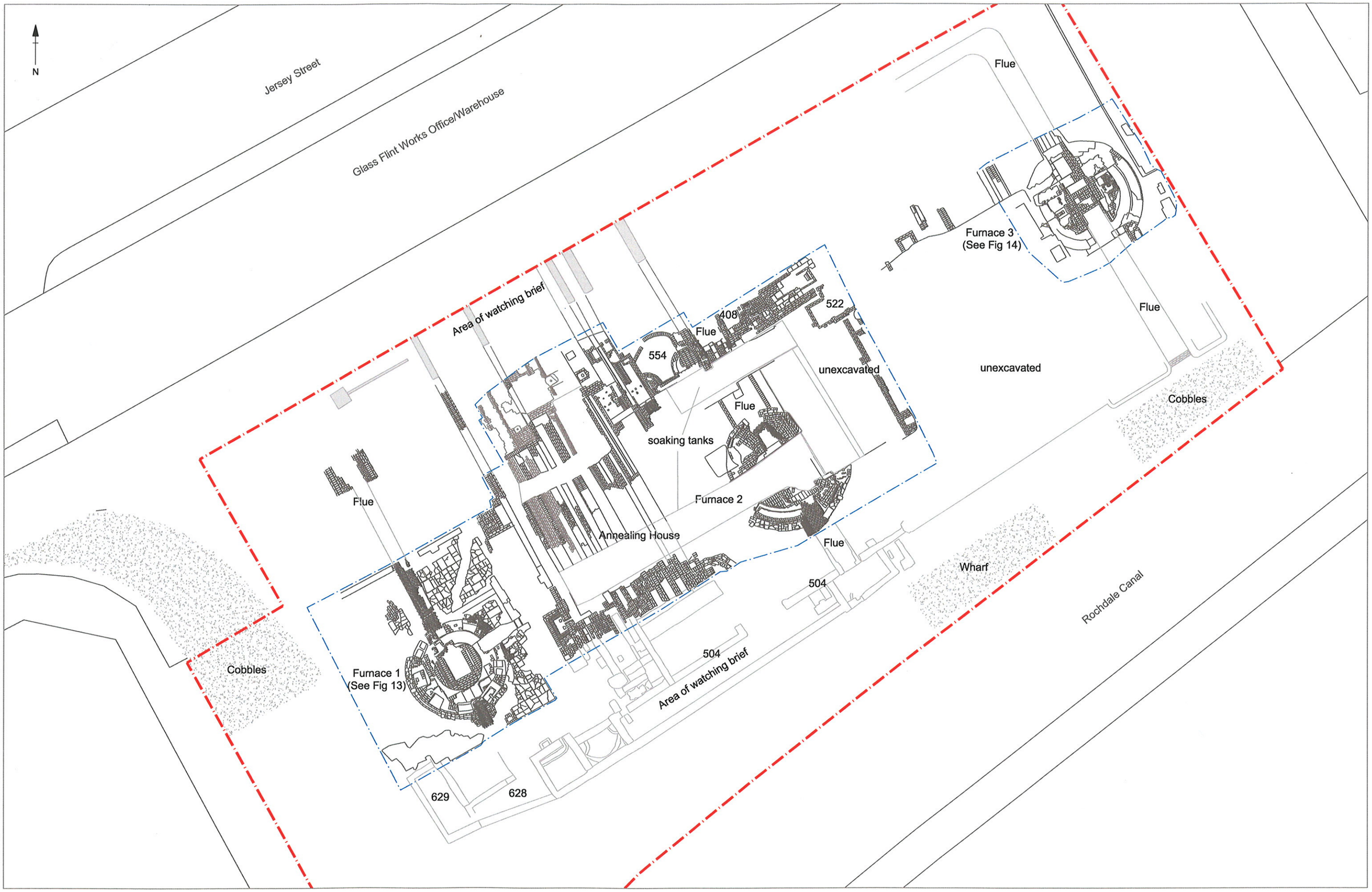


Figure 12: Site plan, superimposed onto the Ordnance Survey1:2500 map of 1893

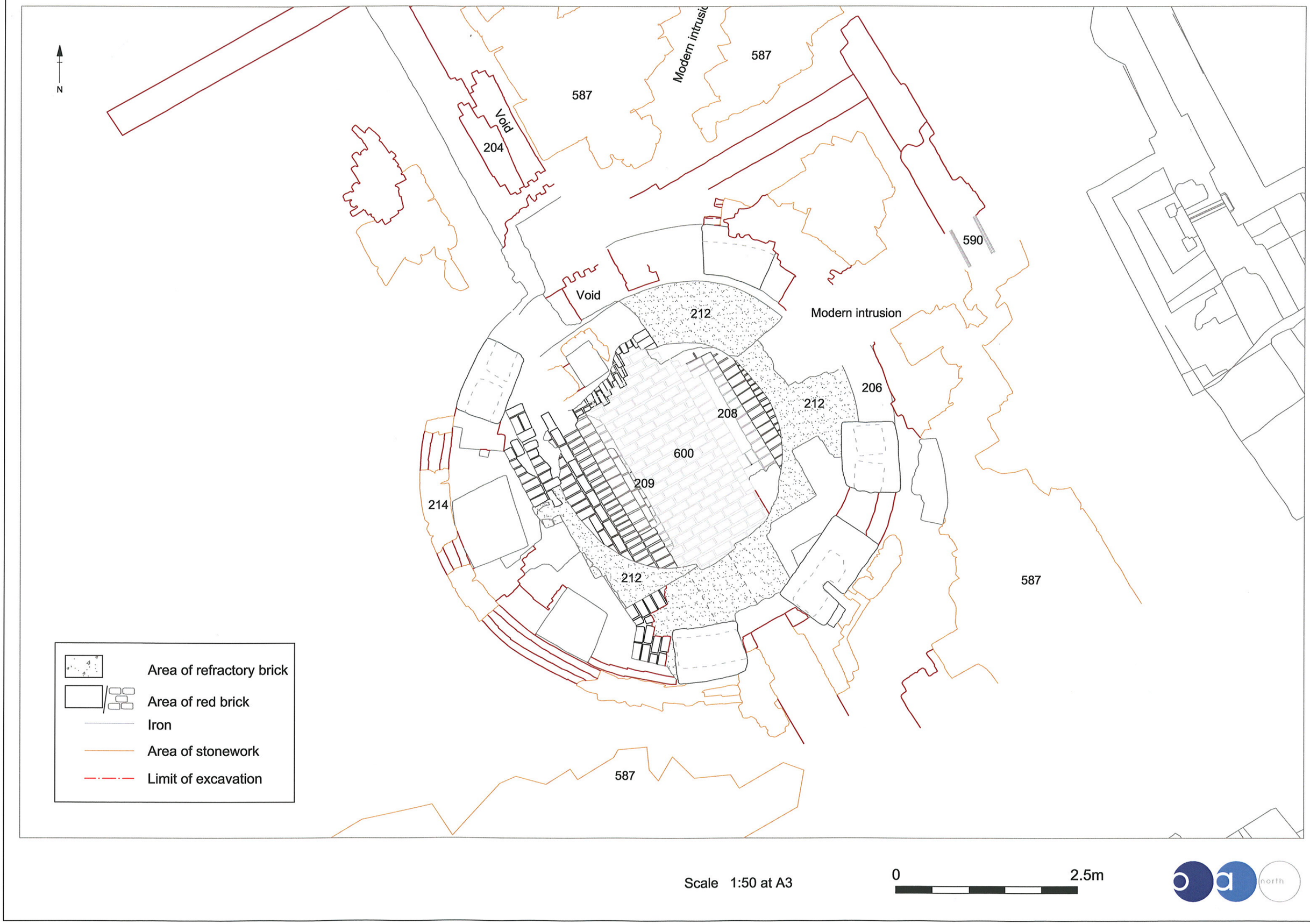


Figure 13: Plan of Furnace 1

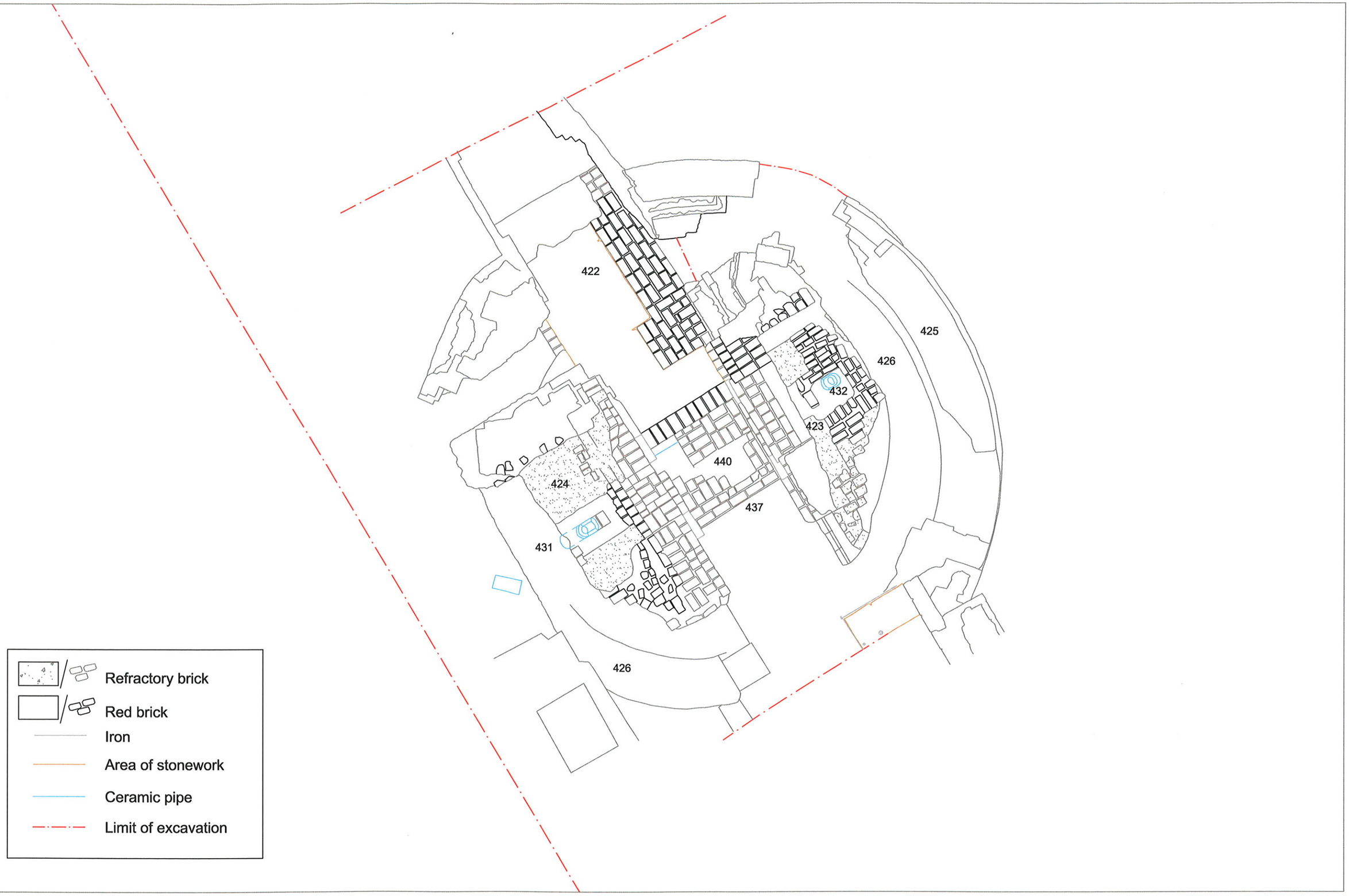
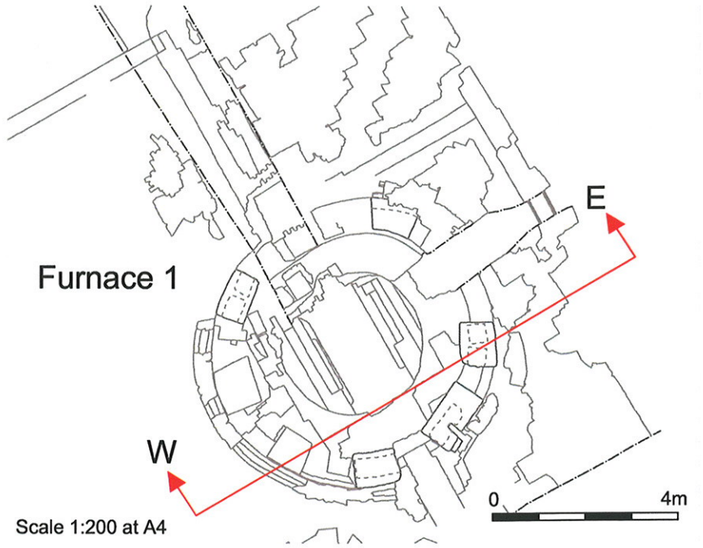
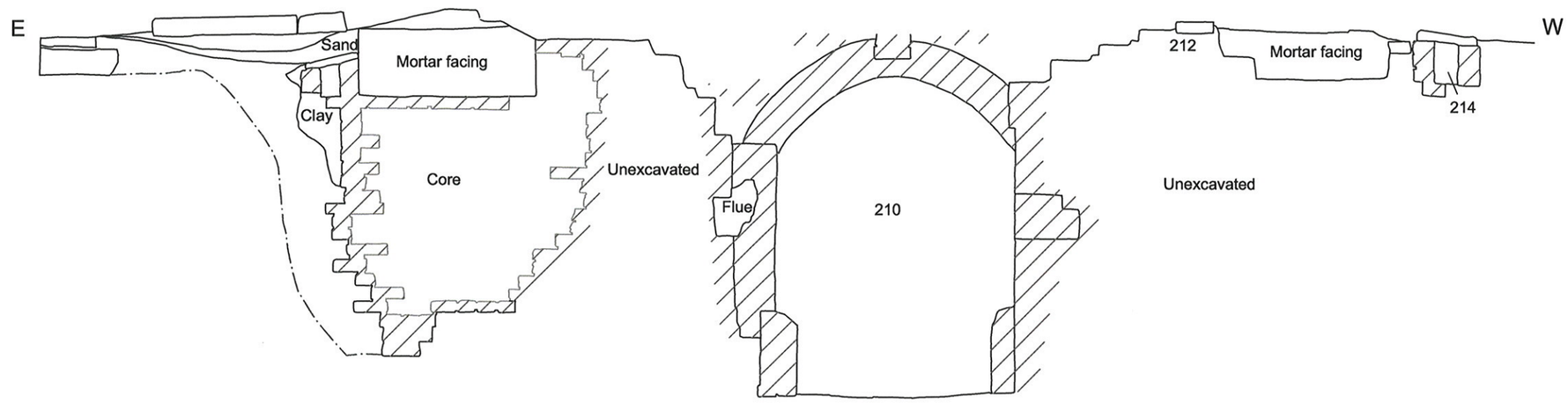


Figure 14: Plan of Furnace 3



Scale 1:200 at A4



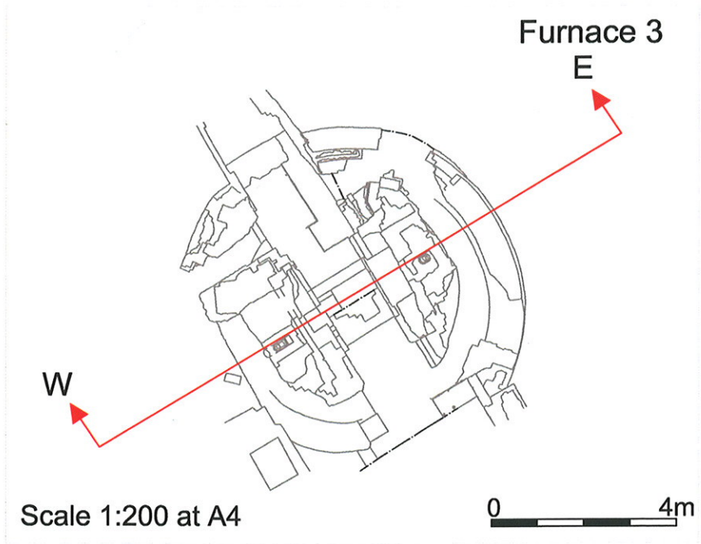
Key

- Facing bricks
- Brick edge
- Wall core

0 1m

Scale 1:50 at A4

Figure 15 : North-west facing section through Furnace 1



Key

- Facing bricks
- Brick edge
- Wall core

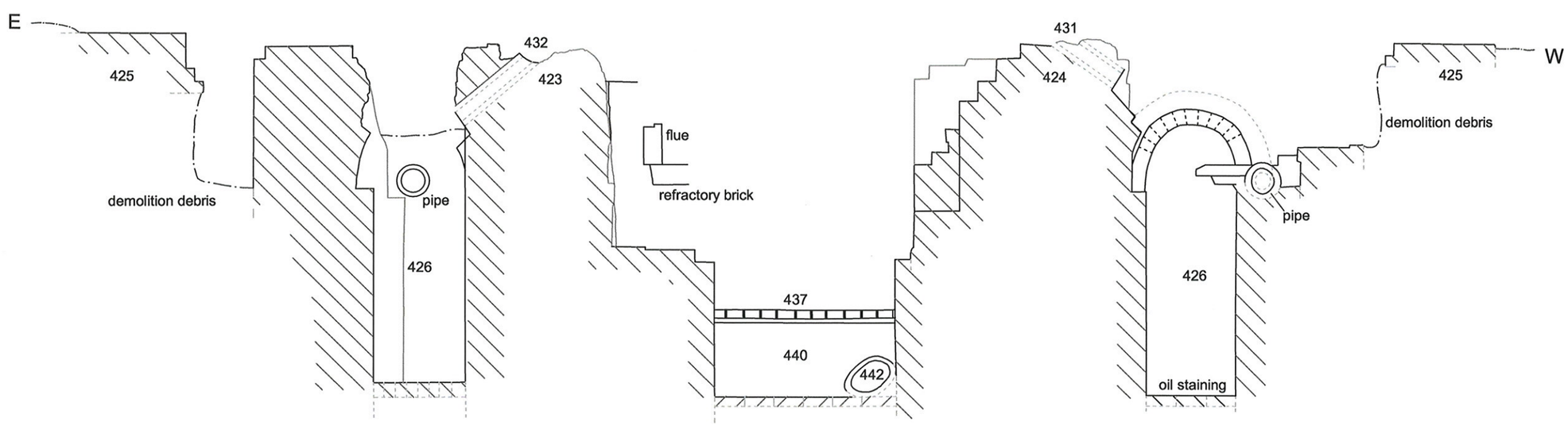
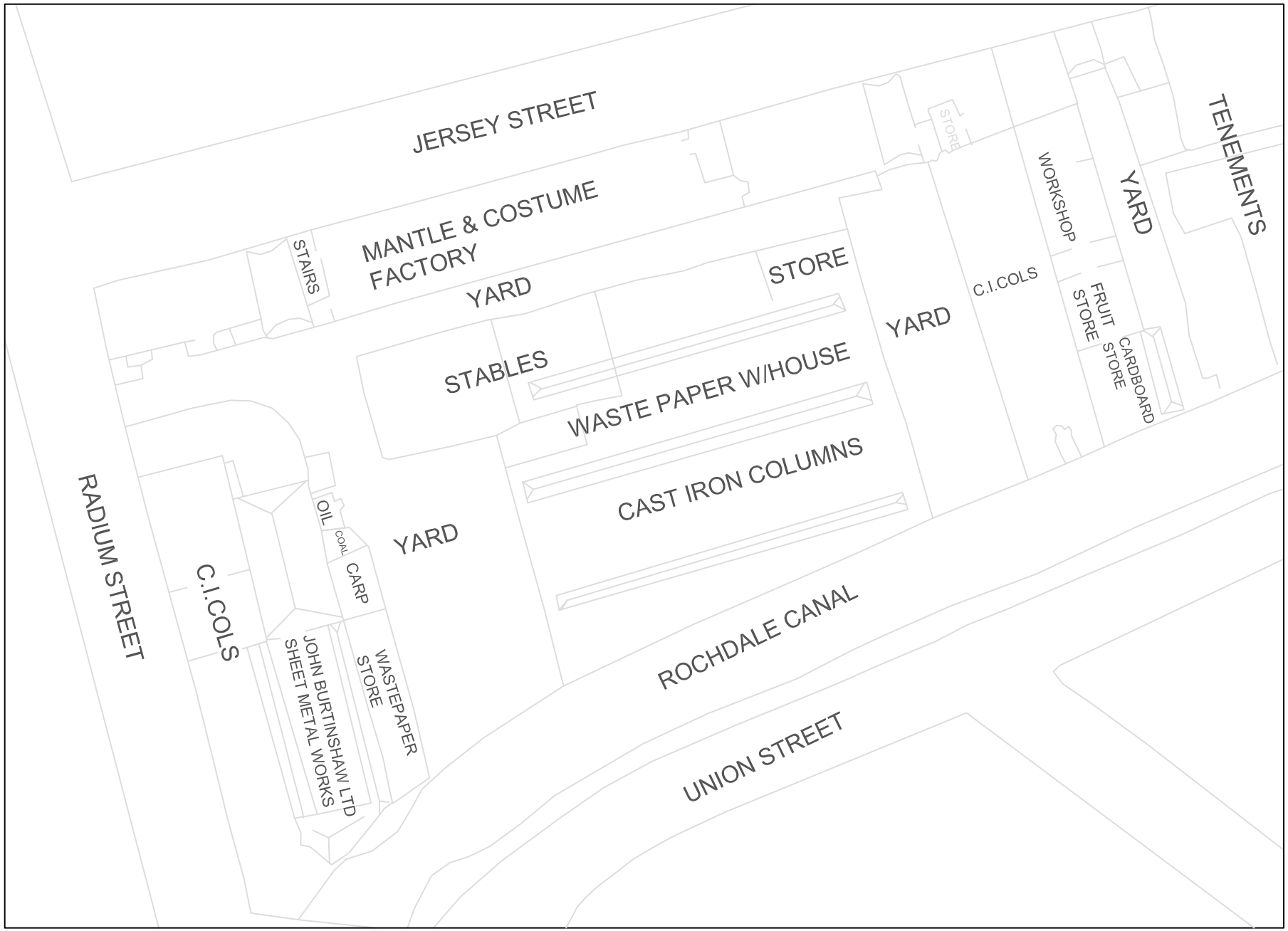


Figure 16 : North-west facing section through Furnace 3



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Scale 1:500 at A4

0 10m

Figure 17 : Plan of the site in 1929 (after Goad's Insurance Plan)

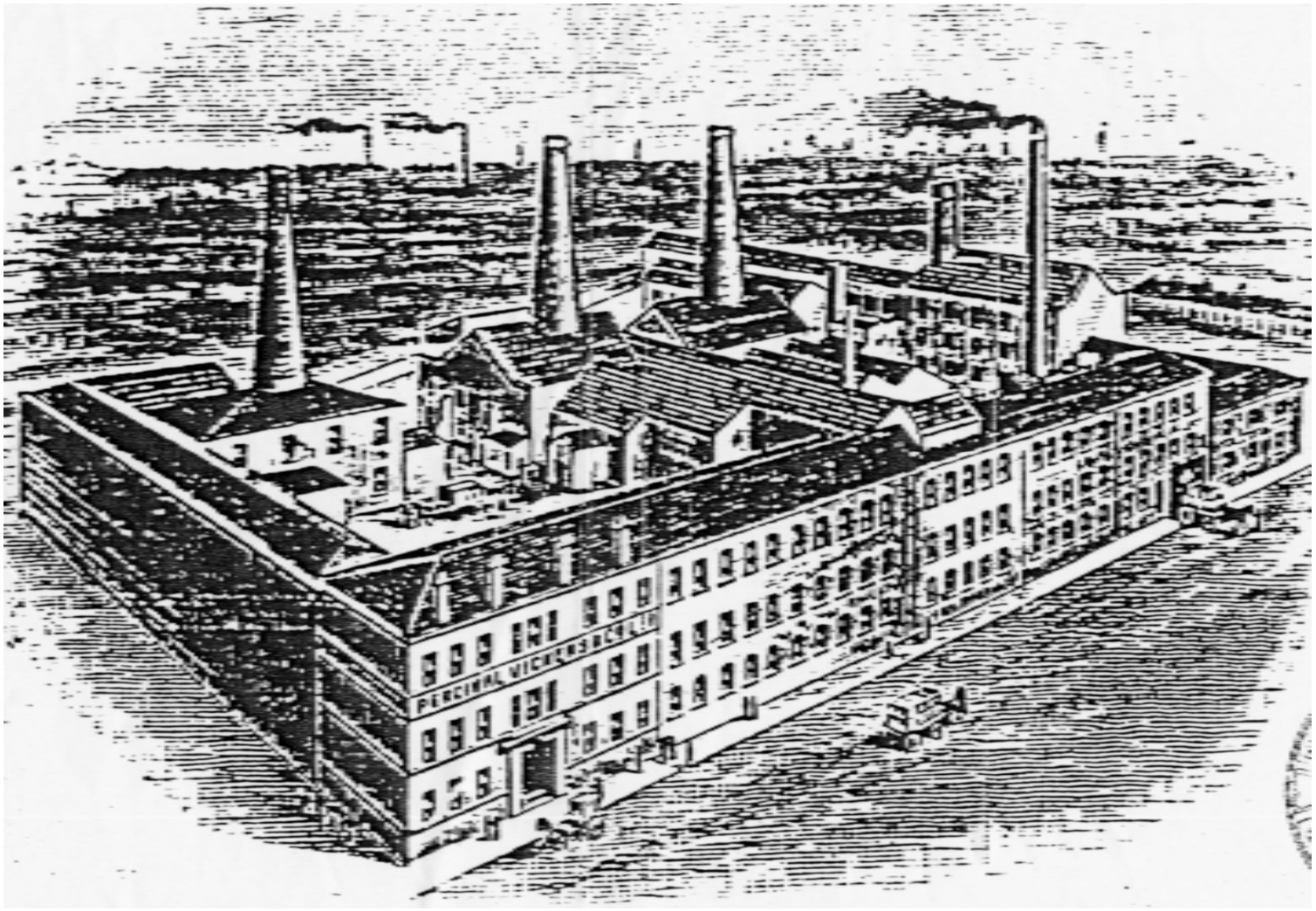

Plate 1: An engraving of the Percival, Vickers and Co Ltd Flint Glass Works taken from the 1902 company catalogue

Plate 2: The warehouse/office building on Jersey Street in 1962

Plate 3: Iron rails ***590***, representing the vestiges of a short plateway

Plate 4: Flagstone surface along southern boundary of the site

Plate 5: Furnace 1, situated in the western part of the site

Plate 6: Looking south along the floor of Furnace 1

Plate 7: The northern part of the flue associated with Furnace 1

Plate 8: The remains of Furnace 2

Plate 9: Flagstone capping ***311*** over channel ***310***, and brick stack ***557***

Plate 10: Looking south across the remains of the annealing house, with workshop area in the foreground

Plate 11: Machine housing ***582***, showing drive shaft housing within wall ***580***

Plate 12: Workshop area at north-eastern end of the annealing channels

Plate 13: Pit ***408***, looking south

Plate 14: Storage trough ***554***

Plate 15: Storage trough ***625***, exposed during the watching brief

Plate 16: Furnace 3 fully excavated

Plate 17: Part of passage ***426*** around the internal perimeter of Furnace 3

Plate 18: Ceramic drain below the flue floor within Furnace 3

Plate 19: Looking east across Furnace 3, showing gas-flow pipes within foundation floor in the foreground

Plate 20: A small selection of glassware types recovered from the excavation

Plate 21: Fragments of leather footwear recovered from fill ***210***, Furnace 1