



University of
Salford
MANCHESTER

Archaeological Post-Excavation Assessment

North View,
Dantzic Street,
Manchester

Client:

Leftfield Investment
(Holdings) Limited

Planning Ref:

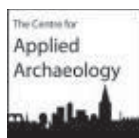
114860/FO/2016

Technical Report:

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Report No:

SA/2020/6



Location: The study area lies at the rear of the former Farlam Reclamation yard, between Dantzic Street and the railway viaduct within the Irk Town area of Manchester

NGR: NGR 384639 399460

Project: North View, Dantzic Street, Manchester

Planning Ref: 114860/FO/2016

Internal Ref: SECL0119

Report No: SA/2020/6

Prepared for: Leftfield Investment (Holdings) Limited

Document: Archaeological Post-Excavation Assessment Report

Version: Version 1

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Date: January 2020

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Date: January 2020

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Summary

In October 2019, Salford Archaeology was commissioned by Leftfield Investment (Holdings) Limited to undertake an archaeological excavation at North View, Dantzic Street, Manchester (*Plate 1*). The archaeological work was required to mitigate the impact of redevelopment of the site on known significant archaeological remains. The excavation followed on from a desk-based assessment of the site carried out in 2016 and an evaluation carried out by Salford Archaeology in 2017. The evaluation determined that remains of a former 19th-century glassworks survived below ground on the site and merited full excavation.

The excavation was carried out by Salford Archaeology in November 2019 and comprised a single 25.2m by 14.3m open-area trench. The remains of the glassworks main building survived with substantial remains of the glass furnace. The furnace showed numerous modifications and rebuilds and produced a significant amount of glass-manufacturing waste with the potential for chemical analysis to produce important information on the processes and techniques of glass production and the development of the important 19th-century glass industry. Although a key industry, of which Manchester was one of the leading centres throughout the second half of the 19th century, relatively little is known about industrial period glass making. This is largely due to a combination of a lack of physical evidence with few excavated glassworks, alongside scanty contemporary documentary evidence from the industry about the development of technology and processes. The evidence from the North View excavation has great potential to add a wealth of information to this aspect of study into the history and archaeology of the industrial period in Britain and can also link to the overall study of social and economic history.

Following completion of the fieldwork, an assessment has been made of the project archive, with a view to defining the costs of completing an appropriate programme of post-excavation analysis and publication. This assessment examined the results of the excavation and assessed the potential for further analysis of each category of data with regard to the project's research aims. The process has been designed to correspond to the objectives laid out in guidance documents. The results obtained from the assessment have concluded that the dataset has considerable potential for further analysis, specifically the assemblage of glass manufacturing waste and the furnace structure. Alongside this there is also great potential for detailed historical research and comparison with other excavated glassworks. This programme of work is in line with the guidelines set out in the National Planning Policy Framework and addresses research questions set out in the North West Archaeological Regional Framework. An updated project design is therefore presented, and an appropriate programme of analysis outlined. It is recommended that, after analysis, the results are published in an appropriate manner.

1. Introduction

1.1 Background

Leftfield Investment (Holdings) Limited has obtained planning permission for a major new development to the north-east of Manchester city centre, within the former Farlam Reclamation yard, between Dantzic Street and the railway viaduct, within the Irk Town area of Manchester city centre (Plate 1; Figure 1).



Plate 1: Recent aerial view across the site, looking north, with the site area shaded in red

In order to support the original planning application for the proposed development a desk-based assessment was initially commissioned to establish the significance of the below-ground archaeological resource (Nash 2016). This study concluded that the proposed development area had some potential to contain buried remains of archaeological interest dating to the 18th and 19th centuries, including elements of domestic housing and industrial buildings, and in particular remains of the mid-19th century Portland Glassworks. Following on from the conclusions of this study an archaeological evaluation by trial trenching was commissioned during 2017 (Mottershead 2017). This concluded that substantial remains relating to the former glassworks survived below ground which would be removed by groundworks associated with the development and therefore and merited further investigation in line with the National Planning Policy Framework (NPPF; Department for Communities and Local Government, 2012).

Following consultation with the Greater Manchester Archaeological Advisory Service (GMAAS), in their capacity as archaeological advisors to Manchester City Council, it was recommended that it would be appropriate to undertake a programme of archaeological excavation in advance of development works. A Written Scheme of Investigation (WSI) was produced which detailed the methodology for the excavation and subsequent post-excavation assessment report (Mottershead 2018). The excavation fieldwork was carried out during October and November 2019.

Following completion of the fieldwork, an assessment has been made of the project archive, with a view to defining the necessary tasks and associated costs of completing an appropriate programme of post-excavation analysis and publication, in accordance with the wording of the condition attached to planning consent for the proposed development (Planning Ref: 114860/FO/2016; condition 6). The culmination of this process is a revised project design, presented here.

2. Original Research Priorities

2.1 Research Aims

The aim of the excavation was to fully excavate and record any archaeological remains of the former glassworks that survived below ground, and to produce a post-excavation assessment of all recovered material and data. This was a process which fits with several of the initiatives for archaeological research of the industrial and modern periods stated in the current *Archaeological Research Framework for North West England* (Newman and McNeil 2007; McNeil and Newman 2007). These include, but are by no means limited to, the following:

- *Initiative 7.35* Industry specific studies are needed for those industries that have received little archaeological attention (Newman and McNeil 2007, 154);
- *Initiative 7.41* The retention of all later period artefacts and their routine analysis as part of all archaeological excavation projects (Newman and McNeil 2007, 156);
- *Initiative 7.42* Examination, mapping and evaluation of the occurrence of vernacular materials and objects in 19th century contexts (Newman and McNeil 2007, 156);

The principal aims of the project were:

- to produce a record of the form of the 19th-century glassworks and associated buildings;
- to retain material associated with glassworking and sample industrial deposits and residues for analysis;
- to determine any changes to processes and economic focus over time;
- to further understanding of the changing urban landscape of Manchester through the late 18th and 19th centuries;
- to compile an archival record of any archaeological remains within the development area;
- to produce a post-excavation assessment report of recovered data and materials to inform the requirements for final analysis, reporting and publication; and
- to make available the results of the work.

2.2 Objectives

The programme of archaeological excavation was designed to preserve by record any archaeological remains within the designated excavation area that were to be removed by the proposed development.

The principal objectives of the archaeological investigation were:

- to carry out full archaeological excavation of the open-area trench (Figure 2);
- to produce a written and illustrated post-excavation assessment report of the findings of the excavation;
- to provide sufficient information to enable an informed decision to be made about the requirements for final analysis, reporting and publication;
- to produce an ordered archive for the project; and
- to make available the results of the work.

3. *The Setting*

3.1 *Location, Topography and Land use*

The development site (centred on NGR 384639 399460) lies to the north-east of Manchester City Centre, on the south-east side of Dantzic Street, encompassing the former Farlam Reclamation site, associated pre-fabricated sheds, and a car park to the north-east (Figure 2). The excavation trench lay within the yard of the former Farlam Reclamation site. The south-east edge of the site was bounded by the railway viaduct. The yard in which the trench was located was surfaced with concrete.

Although concealed by development the topography of the area reflects the natural slope of the river valley, falling gently to the west from a height of 30m above Ordnance Datum (aOD) on Atherton Street to approximately 26.8m on Water Street.

3.2 *Geology*

The site is located on superficial Devensian glacio-fluvial sand and gravel deposits, formed up to 2 million years ago. The bedrock within the site consists of sandstones of the Cheshire Formation, formed during the Triassic Period 250 million years ago (British Geological Survey, 2018).

4. Historical Background

4.1 Prehistoric Period

Prehistoric archaeological evidence is generally sporadic in the North West of England and is often based on chance finds. Prehistoric activity tends to be confined to well-drained areas usually located on sands and gravels that are in close proximity to watercourses or wetlands, rather than on impermeable boulder clays that form the geology of the majority of the region.

Although archaeological evidence for the prehistoric period in Manchester is scarce, it is reasonable to suggest that the Castlefield area, situated c 250m to the south-east of the site may have been a suitable place for prehistoric settlement due to its location on sands and gravels and riverside location (Miller 2017). The most promising evidence for prehistoric activity in Manchester was excavated at Liverpool Road in Castlefield, where two Mesolithic flints, one Neolithic/Bronze Age waste flake, and a single fragment of late Bronze Age/iron Age pottery were recovered, although none were found in securely stratified deposits (Gregory 2007, 181).

4.2 Romano – British Period

The first military occupation of Manchester was established during the governorship of Agricola (AD 77-84), and commenced with a five-acre wooden fort, known as *Mamucium* (Gregory 2007). The site of the encampment is marked today by Camp Street in the Castlefield area of Manchester city centre. During the 2nd century, the fort was expanded and a substantial extramural settlement, or *vicus*, developed to the north of the military fort (Grealey 1974, 11). A network of Roman roads extended from the fort of *Mamucium* leading to several military settlements including Ribchester to the north, Castleshaw (near Oldham), Slack and York to the north-east, Wigan to the north-west, Northwich and Chester to the south (Gregory 2007), and Buxton to the south-east.

4.3 Medieval Period

Following the collapse of Roman administration in Britain during the early 5th century, the area is likely to have been a sparsely populated and isolated part of the country demonstrated by a lack of archaeological evidence in the North West region as a whole. Literary sources indicate that Manchester came under the ownership of several kingdoms but, by AD 620, Edwin conquered and occupied Manchester, possibly establishing a settlement in the town around the cathedral (Farrer and Brownbill 1908).

During the Anglo-Saxon Period, in AD 919, Edward the Elder established a fortified base, or *burh*, at Manchester, which lay within the area of the cathedral. The cathedral provided a focus for the settlement, which by the 11th century was defined by the Rivers Irwell and Irk, Hanging Ditch and Toad Lane.

Following the Norman Conquest of 1066, William I assigned most of the land between the Ribble and Mersey rivers to Roger of Poitou, who retained the manor of Salford demesne (Tupling 1962, 116), but divided his other newly acquired land into several fiefdoms (Kidd 1996, 13). The largest of these was the landholding centred on Manchester and was granted to Albert Grelley, the first baron of Manchester (Tupling 1962, 116). The Grelley family established a castle on the site of Chetham's school as well as a manor house and the parish church of St Mary, located over 1km to the north of the site. The manor house was the Grelley family's main residence and provided a suitable base to govern both the manor and extensive barony. The township of Manchester subsequently developed around the manor.

By 1223, the right to hold an annual fair was obtained, and the town was important enough to be granted a charter in 1301 by Edward I (Kidd 1993, 14). During this period, the site remained undeveloped and likely comprised field systems.

4.4 Post-Medieval and Industrial Periods

Manchester continued to prosper during the post-medieval period by which time the town's market lay at the centre of a fledgling textile industry (Miller 2006). The size and wealth of the town during this period was reflected in the decision of the Lord of the manor to rebuild St Mary's church in 1421 as a collegiate institution (Hartwell, Hyde & Pevsner 2004). By 1539, Manchester was described by John Leland as 'the finest and busiest town in the whole of Lancashire, with the best buildings and the greatest population' (Chandler 1993). During this time Manchester emerged as the centre for the textile-finishing processes as cloth was brought into the town for bleaching and dyeing and its market expanded for trading the finished cloth (Miller 2007).

From the early 17th century a flourishing business community developed within Manchester which was dominated by wealthy merchant's, manufacturers and fustian dealers, most notably the Chethams, the Booths, the Wrigleys and the Byrom's (Miller 2007). These families formed the social elite below the landed gentry such as the Stanley's and Strange families, whose estates incorporated Cheetham and the open agricultural land around the present study area. However there are no known remains of this period within the study area and it is likely that during this period the study area remained undeveloped.

In his tour of the country during the early 18th century Daniel Defoe noted that Manchester had extended in a surprising manner reflecting the town's further expansion into the textile trade (Miller 2007). By the 1790's Manchester's thriving export market was beginning to displace London as the centre of overseas trade in cotton cloth reflecting great improvements to the transport networks within the North West, most significantly the completion of the Mersey Irwell Navigation in 1734 which formed a link to the expanding port of Liverpool. The introduction of steam power to cotton spinning during the late 18th century was the catalyst for the massive expansion of Manchester as a manufacturing centre and with this came the rapid growth of the town's population from 22,481 in 1773 to 75,281 by 1801 (Miller, 2006).

By the late 18th century the study area and its immediate surroundings formed part of the Newtown district of Manchester. During this period Newtown was experiencing the first phases of industrialisation with its open agricultural plots being sold for industrial and residential development. Green's map of Manchester dated 1787-94 shows that during this period a grid-iron of streets had begun to be laid out on the east side of the River Irk, and along these streets several blocks of residential and commercial buildings had begun to develop (Figure 3).

Green's map shows that three roads had been laid out across the study area. Along the northern edge of the study area was Portland Street, which followed the line of a pre 18th-century routeway which formed the main thoroughfare through Newtown. Running in a south-easterly direction from Portland Street was Bilsborough Street which ran along the western edge of the study area. Two blocks of properties are depicted along the eastern side of Bilsborough Street. The most northerly block was comprised of two properties with an enclosed rear yard, whilst the southerly block comprised a terrace of four properties each with its own rear yard and privy. Running eastwards from Bilsborough Street was a third road named Flag Row which ran across the entirety of the study area. Along the north side of Flag Row, a terrace of four properties is depicted and along the south side of Flag Row a terrace of six, larger properties with enclosed rear yards is shown. To the rear of these terraces was a large rectangular structure with a small square protrusion and yard along its western extent.

The Manchester Township rate books of 1795 and 1820 list the buildings on Bilberry Street and Flag Row as houses, and show that the assessed annual rents of these properties were around £1.10.0d to £2.10.0d. Census returns from the mid-19th century confirm that the houses were largely occupied by industrial workers and their families. The only exception to this was the most southerly property which functioned as a Grocer's Shop / Provisions dealer.

Newtown continued to be industrialised during the early 19th century with Bancks and Co's map of 1831 showing several industrial works (Dye, Starch, Chemical & Gas, Silk & Cotton) to the south and west of the study area (Figure 4). Bancks & Co's map shows that within the study area Bilborough Street had been renamed Bilberry Street and the large rectangular structure to the south of Flag Row had been demolished. Furthermore, the terrace of properties fronting Bilberry Street had been substantially extended rearwards and a seventh property had been added to the terrace on the south side of Flag Row. In addition to these alterations, the study area had also been subject to further development largely owing to the laying out of Water Street and Dixon Street.

Along the north side of Flag Row, at its junction with Water Street, a row of six back to back properties had been constructed. Within the north-eastern corner of the study area, encompassed by the new roads, a quadrangle of properties had been built. The northern row fronting Portland Street comprised two large properties, the eastern row fronting Dixon Street comprised a terrace of five smaller properties, the southern row fronting the north side of Flag Row comprised a single small property and a passage way leading into the central courtyard and the western row fronting Water Street comprised a terrace of five properties.

The Lancashire and Yorkshire Railway and associated viaduct had been constructed by the time of the Ordnance Survey Town Plan of 1851 (Figure 5). The increasing industrialisation of Newtown resulted in the laying out of several new roads and the construction of more housing to accommodate the increasing working population. This map shows that a terrace of five properties had been constructed along Portland Street. To the immediate south of this the most northerly block of properties fronting Bilberry Street had been extended and appeared to comprise four rather than two properties. The back to back properties fronting the north side of Flag Row appeared to have been reduced from six to four houses, and a substantial extension had been constructed within the courtyard to the rear of one of the houses which fronted Water Street.

Manchester Township rate book of 1845 and 1850 list the properties on Portland Street as houses, a workshop and yard, and show that the assessed annual rents of these properties were £5.10.0d for the houses and £2.10.0d for the yard and workshop. The properties on Water Street and Dixon Street are all listed as houses with assessed annual rents of £2.10.0d. Mid-19th-century Census Returns and trade directories indicate that the properties were mixed commercial and residential premises with a public house named the White Hart, a provisions store and a draper's shop listed. In contrast, the properties on Water Street and Dixon Street were domestic dwellings occupied by industrial workers and their families.

The Ordnance Survey Town Plan of 1891 shows that the study area and its immediate surroundings had undergone a substantial phase of industrialisation which saw the clearance of some of the older building stock and the construction of new residential and industrial buildings in the areas which had been previously undeveloped (Figure 6). This period saw the expansion of the Lancashire & Yorkshire Railway, the construction of the Newtown Sidings and the Rochdale Road Gas Works to the south of the study area, the construction of a large rubber works to the west of the study area, and the construction of two large gasometers opposite the study area on the north side of Portland Street.

Within the northern extent of the study area the 1891 mapping showed that the properties fronting the west end of Portland Street had been extended eastwards through the construction of a further four properties and yards (Figure 6). To the east of this a new roadway named 'Beesley Street' had been laid out, and between Beesley Street and Water Street a terrace of 12 properties had been constructed. To the south of Portland Street, along the east side of Bilberry Street, the four most northerly properties had been amalgamated into two larger buildings and the large extensions to the rear of the southerly properties had been demolished and replaced by small enclosed yards. Rate books from 1850 to 1873 show that one of the houses had a workshop and yard which was occupied by a Thomas and Peter Bradshaw who were listed as pipe manufacturers. Late 19th- through to mid-20th-Century Census Returns and trade directories show that these properties continued as mixed commercial and residential properties, whilst the other domestic properties within the study area appeared to be purely residential, being occupied by industrial workers and their families.

Within the central section of the study area, along the north side of Flag Row, the 1891 map showed that the back-to-back properties first identified on Bancks & Co's map of 1831 had been cleared and a terrace of 12 properties identical to those along Portland Street had been constructed between Beesley Street and Water Street.

On the south side of Flag Row a further two properties had been added to the western end of the older terrace, and several of the older houses appear to have been subject to some alteration. The rate book of 1859 showed that during this period the assessed annual rents for the properties on the south side of Flag Row had risen to between £4.0.0d and £8.10.0d. A large proportion of these houses were recorded as being owned by a William Houghton, who's family were listed as occupying number 10 Flag Row from the 1840's through to 1880's. Unlike the other properties, which were listed as being domestic dwellings, number 10 was listed as a beer house and coal yard. The 1861 Census records number 10 as the 'City Arms' and William Houghton is recorded as a pipe manufacturer. It is unclear whether William Houghton operated a pipe works from this property or on premises elsewhere, but the 1861 Census does list nine of the 14 occupants of number 10 as being pipe makers or pipe finishers, which would support the former.

Although it is unclear from the documentary records which property number 10 was, trade directories from the late 19th and early 20th century list the most easterly property in the terrace as being occupied by a beer retailer named Percival in 1895, who is listed subsequently as a ham and bacon curer up until the early 1950's (Kelly 1895, 1910, 1925, 1940, 1945 & 1954). It is therefore likely that Houghton's Beer House is the large property on the corner of Flag Row and Water Street.

It is the southern extent of the study area which saw the most redevelopment during this period. The 1891 Ordnance Survey mapping showed that a large enclosed yard, accessed from Water Street, had appeared to the rear of the houses on Flag Row. Within the yard were two adjoining structures; the first occupied the northern half of the yard, was roughly 'U'-shaped in plan and contained a square chimney, while the second occupied the southern half of the yard and was rectangular in plan with a circular chimney at its centre. The Manchester Township rate books of 1858 through to 1865 list the site as a glassworks owned by Robert and later William Marsden. The 1861 trade directory describes William Marsden as a 'flint glass manufacturer', however trade directories from the 1870's onwards show that the glassworks had been subdivided, with the northern building being occupied by a Joseph Halliday & Co, engineers up until the 1890's and the southern building by P Jeffers, tripe dresser and neatsfoot oil dealer, (Post Office: 1873, Slater: 1886 and Kelly: 1895, 1910, 1925, 1940, 1945 & 1954).

To the west of this yard a second yard containing two roughly rectangular structures was depicted on the east side of Bilberry Street. Slater's trade directory of 1890 identified these as Victoria Bolt & Nut Works, which was listed as being occupied by Richard Davies & Sons, producers of all kinds of engineering bolts and nuts, bright finished nuts, set screws, washers and rivets. Richard Davies & Sons appear to have occupied the site until 1945, when the site is listed as Collinghurst Foundry Ltd, iron founders (Kelly 1890, 1899, 1908, 1925, 1940 & 1945).

The immediate surroundings continued to be increasingly industrialised during the first decade of the 20th century, with the further expansion of the Lancashire & Yorkshire Railway and the construction of a large rubber works to the west of the study area. However, from the 1920's onwards, Ordnance Survey mapping suggests that the Newtown district had entered into a period of decline. During this period some of the industrial works depicted on earlier mapping had been cleared or labelled 'disused' and the former streets, originally packed with terraced housing, had begun to be cleared.

The Ordnance Survey 25" map of 1908 records some small scale changes within the study area (Figure 7). The eastern block of structures along the south side of Portland Street appeared to have been altered and extended whilst the northerly block of properties along the east side of Bilberry Street had been amalgamated into one larger structure.

The largest change to be recorded was the extension of the Victoria Bolt & Nut Works, which had been extended eastwards to amalgamate with the northern half of the former glassworks, and also westwards across Bilberry Street. The southern half of the former glassworks remained separate and several small workshops had been erected within its eastern yard. The Ordnance Survey 25" map of 1922 shows that Portland Street had been renamed Dantzic Street, and the only recorded change to the study area was the demolition of the southernmost building within the Victoria Bolt & Nut Works (Figure 8).

The 1949 Ordnance Survey 1:2500 map showed that parts of the study area had begun to be cleared (Figure 9). During this period the houses which fronted Bilberry Street, Water Street and Dixon Street had been demolished along with some of the houses along Dantzic Street and Flag Row. In place of the Bilberry Street and Flag Row houses, an enclosed yard had been erected which contained two rectangular features labelled 'Tanks'. This mapping also showed that the Victoria Nut & Bolt Works had been renamed 'Collyhurst Foundry' and the former glassworks building was named 'Tripe Works'.

The Ordnance Survey 1:2500 map of 1966 showed that the housing fronting Dantzic Street had been subject to further clearance with only the early 19th-century White Hart public house and the late 19th-century terraced housing surviving (Figure 10). The enclosed tank yard on the corner of Bilberry Street and Flag Row had been extended northwards to Dantzic Street and a large square structure had been constructed to the north of the tanks. Historic photographs dating to 1958 show that the building here was a single-storey unit, constructed from corrugated metal sheets, (Manchester Local Image Archive - m01279). During the same period, the houses on the southern side of Flag Row had been demolished along with the Collyhurst Foundry, which had been replaced by a large square structure and yard which appeared to be associated with the rubber wWorks that lay beyond the western extent of the study area.

Later Ordnance Survey mapping shows that by 1999 the study area had been cleared with the exception of the tripe works, which still appeared to survive although it had been truncated at its northern extent. During this period the rubber works had been substantially extended eastwards into the study area, and the large rectangular structure identified on the 1966 mapping was amalgamated into this extension.

During the early 21st century the Rubber Works was demolished with the exception of a small office block fronting Dantzic Street, which sat within the north-west corner of the study area, and a large rectangular structure of the same scale as the structure depicted on the 1966 mapping, which sat within the centre of the study area; this block was demolished in 2015 and the site is currently occupied by a large rectangular structure and associated car park occupied by Astra Signs Ltd, along with a handful of pre-fabricated structures along the southeastern boundary of the study area, associated with the former Farlam Reclamation site (Figure 11).

4.5 *The Development of the Glass Industry in South Lancashire*

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). 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 glassworks 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 glassworks 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 glassworks during the 18th century; a works opened at Prescott in 1719 (Buckley 1929), two works were established in Liverpool (Ashmore 1982), 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). 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). 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), highlighting the lack of research into the industry's development.

The first well-documented large-scale glasshouse in Lancashire was established at Ravenhead, St Helens, in 1773 (Redding 1842). 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), and by 1872 Manchester was the largest employer of glass-makers in England (Yates 1987). 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 Glass Trade Review* 1898). 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.

Baines (1825) lists seven glassworks 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). The earliest glassworks 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.

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). 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).

Many of the Manchester works closed during the 1890s, largely as a result of the great depression in trade (Yates 1987), 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).

5. Excavation Results

5.1 Introduction

The following sections provide a technical description of the excavation results. The excavation consisted of a single open-area trench measuring 25.2m by 14.3m (Figure 2). It was overlain by concrete on a mixed rubble bedding which was removed mechanically to open the trench.

As part of the post-excavation assessment process, each of the features encountered during the investigation have been ascribed to one of four phases of activity (Figure 14):

- *Phase 1:* The first phase of glassworks furnace and associated structures, built in c. 1858;
- *Phase 2:* The second phase of glassworks furnace and associated structures;
- *Phase 3:* The later 19th-century phase of the works following its conversion to a tripe dressers and neatsfoot oil manufacturers;
- *Phase 4:* Conversion of the works area into a yard following demolition of the buildings between 1966 and 1970.

5.2 The Furnace (Phase 1)

The original furnace wall foundations (155) had been dug into natural clay (003). The cut [135] could be seen at a distance of 1m from the circumference of (155) (Plate 2; Figure 13), with excavated material (136) used to backfill it containing fragments of broken brick. From the bottom upwards, the brick courses stepped in by half-a-brick after five, three, seven and then another three courses. The top course of each step had been laid in header bond, whilst the courses below had been laid in stretcher bond. The top layer seen in Plate 3 did not step in towards the west but gradually stepped in towards the east. It is possible that this course demarcated the start of the second phase (016) or later rebuild. Lime mortar bond had been used in the construction. The entire structure was circular and had been truncated at the south-east edge by the insertion of a concrete stanchion (005) (Plate 4) with a steel upright I-beam, which had supported a workshop probably dating to the last decade of the 20th century.



Plate 2: Foundation cut [135] for the furnace wall foundation (155) cut into natural clay, seen at the bottom right, filled with re-deposited material (136). The furnace wall seen to the left of the foundation cut is the later phase (016), looking north-east



Plate 3: Detail of the furnace foundation wall (155), looking north-west. Scale 2m



Plate 4: The first phase furnace (155) fully excavated, showing a truncated section to the right, looking north. Scale 2m

After stripping the furnace back to the earliest structure, compartments were found on the inside of each half behind walls (153) and (154) and below later brick layer (137) (Plate 5). Three north/south-aligned brick walls (147, 148 and 149) separated the eastern half into four segments (128, 144, 145 and 146), each filled with rubble and furnace waste clearly dating to the early furnace. The rubble from each segment consisted of red sand with very high quantities of broken brick and large sub-rounded whole and broken pebbles. In smaller quantities were fragments of 19th-century iron-glaze pottery, broken firebrick and broken crucible with adhered melted glass (Plate 6).

The segments were not evenly spaced in width measuring, left-to-right, 0.87m, 0.39m, 0.50m, 0.90m. Nor did they match the segments on the opposite, western half. The bottom of the three internal walls was not reached, but probably went as deep as the foundations of wall (155). The rubble fill within the compartments ended at the level visible in Plate 7, where the water table was reached. All bricks were hand-made and bonded with lime mortar, two brick-courses wide and keyed into the outer wall (155).



Plate 5: Segment exposed after the collapse of part of wall (153) and the fill (128) partly removed. Brick layer (137) was still in place covering the segment, looking north-east



Plate 6: A selection of the material retained from rubble fill (128)



Plate 7: The eastern half of the early furnace showing internal walls, left to right, (147), (148), (149) after the removal of the rubble fill in each segment (128), (144), (145), (146), Scale 2m

The western half of the furnace was very similar to the eastern half, with slightly different measurements (Plate 8). The segments contained very similar rubble to those on the east side, however, each produced high volumes of melted glass waste, broken crucible with melted glass adhered to it and a few pieces of broken firebrick with adhered melted glass, which could have represented the siege on which the crucibles would have rested.



Plate 8: The structure in the western half of the furnace, left-to-right walls, (152), (151), (150), compartments (140), (143), (142), (141), looking southwest. Scale 2m

5.3 The Furnace (Phase 2)

A brick-vaulted flue ran through the centre of the furnace aligned north-west/south-east, which measured 1.35m wide (Figure 12). The central flue walls survived on either side with wall (153) to the east and wall (154) to the west (Plate 9). Part of the arch survived where it had passed through the south-east furnace walls (155) and (016), but this collapsed during excavation (Plate 10). Walls (153) and (154) sealed up the segments on both sides of the furnace. The segments had also been sealed over the top by a thick layer of bonded brickwork, which upon inspection had clearly been built directly on top of the rubble filling the segments. This brick layer (137) on the east and (139) on the west, consisted of five brick-courses of hand-made bricks bonded with hard, grey and white lime mortar which had bonded the brickwork to the inner circumference of the furnace and the tops of the segment walls (Plate 5). The uppermost brick-courses (024) on both sides of the later phase furnace had shown an unusual, off-centre semi-circular brick pattern on the surface (Plates 17 and 18), sealing the original furnace structure (155), as described above.

The pair of central flue walls each had a projecting buttress (025) in the centre running across the front of the original compartments. The brickwork stepped inwards from the top down, creating an inverted slope, and was keyed into walls (153) and (154) suggesting they were part of the rebuild (Plate 9). These buttresses may have been built to form part of an automatic coal feeder. Natural clay was reached at the base of the central flue with no evidence of a floor surface.



Plate 9: Western side of the furnace showing Phase 2 central flue wall (154) and inverted buttress (025), looking south-west

Whilst the central flue within the furnace was not covered, as suggested by brick arch (026), the flue continued to the south-east and north-west as a vaulted tunnel, which exited the workshop buildings. At the south-east end, part of the vaulted arch (131) survived, built into workshop wall (085). The tunnel exited into a square, brick chamber formed by wall (132), the cut [133] for which could be seen in the natural clay (Plates 11 and 12). No evidence was found of a staircase inside the chamber or any other form of access.

To the north-west, both side walls of the central flue (077)/(078) and part of the vaulted ceiling (073) were found in a sondage dug through re-deposited clay (Plate 13). The cut [048] into natural clay for wall (078) was partly excavated. The sides were roughly cut but vertical and the narrow foundation trench had been backfilled using cinder and large amounts of waste glass (047). Hand-made bricks bonded with lime mortar had been used in the construction of the flue. The roof of the flue was found to have already been damaged and the tunnel backfilled, which suggests it had gone out of use before the structures above had been constructed (Plates 14 and, 15). The continuing line of the flue to the north-west could be traced via slumping in the brickwork of possible machine beds above, which suggests that the flue might not have been completely infilled for its entire length (Plate 16). The north-west terminus of the flue lay just outside of the excavation area, as did most of the north-west wall of the workshop.



Plate 10: Brick-vaulted arch (026) at the south-east end of the central flue, looking south-east



Plate 11: Evidence of the vaulted flue (131) passing through the south-east wall (085) of the workshop, looking south-east. Scale 1m



Plate 12: The central flue exiting the workshop into a brick chamber (132) through wall (085) to the south-east. The foundation cut [133] can be seen on the right of the photo, looking north-west. Scale 1m



Plate 13: The central flue walls (077)/(078) running below later features, looking west



Plate 14: Remains of the central flue vaulting (073) including flue walls (077) on the right and (078) on the left, looking south-east



Plate 15: Central flue wall (078), associated cut [048] and partly excavated cinder fill (047)



Plate 16: The north-west end of the central flue seen lining up with the centre of the furnace. Slumped brickwork within the foreground structure confirmed the line of the flue, looking south-east



Plate 17: Off-centre circular brick pattern in surface (024) east, and features (138) (right) and (064) (left) built into furnace wall (016), looking north-east. Scale 1m



Plate 18: Off-centre circle brick pattern in surface (024) west, looking south-west. Scale 1m

The main furnace wall (016) of the re-build had been built on top of (024). The entire interior of this phase of the furnace and central flue was filled with black and red soot (017) and (018). The top of the furnace was filled with demolition material made up of black soot and brick rubble (015). Wall (016) measured 0.56m thick equating to five brick-courses and survived to a height of 0.70m. A modern service trench had truncated the circumference to the north-west where the central flue would have passed through. The modern electric cable found within the service trench was live and therefore could not be disturbed.

A brick arch (026) had been built into wall (016) to the south-east, demarcating the entrance to the south-east end of the central flue. The arch comprised two brick-courses and had a mix of both standard and refractory bricks. These appeared to have been used randomly, and it is possible the refractory bricks had come from the sieges of the original structure. The construction of the arch did not match on both sides (Plate 10).

The south-western half of wall (016) had a brick channel (008) running through it, which was filled with soot and brick rubble (019). After removal of this fill it could be seen that the feature was a flue running west then turning north-west. The flue had been constructed by the crude addition of walls either side of the gap, one of which contained bull-nose bricks (Plates 19 to 22).



*Plate 19: Brick channel (008) running through furnace walls (016) and (155), looking south-west.
Scale 1m*

The eastern half of furnace wall (016) had two features built into it. A ceramic pipe (138) led from the main chamber, through the wall exiting on the other side, leading into a brick-built man-hole (102) and sloping downwards to the south-east (Plates 17, 23, 24). The man-hole had been constructed using hand-made bricks bonded with grey mortar and had been capped with a flagstone. The chamber contained water at the depth where the ceramic pipe entered, preventing any further excavation.



Plate 20: Brick channel (008) running through furnace walls (016) and (155), looking west. Scale 1m



Plate 21: Brick channel (008) running through furnace walls (016) and (155), looking north-west. Scale 1m



*Plate 22: Brick channel (008) running through furnace walls (016) and (155), looking north-west.
Scale 1m*

A second drainage feature (064) had been built into furnace wall (016). A soot-filled opening was found on the interior of wall (016), which passed through the wall and below a rectangular brick feature (063), continuing east (Plate 17). The drain had been constructed using hand-made bricks bonded with sandy lime mortar and capped with a layer of purple slate. The feature was 0.40m wide and was excavated to a length of 2.90m, after which the feature either ended or had been truncated (Plates 17, 25 to 27). This feature aligned east/west, with channel (008) to the west on the opposite side of the furnace (Plate 27).



Plate 23: Large ceramic pipe (138) built into furnace wall (016), looking north-west. Scale 1m

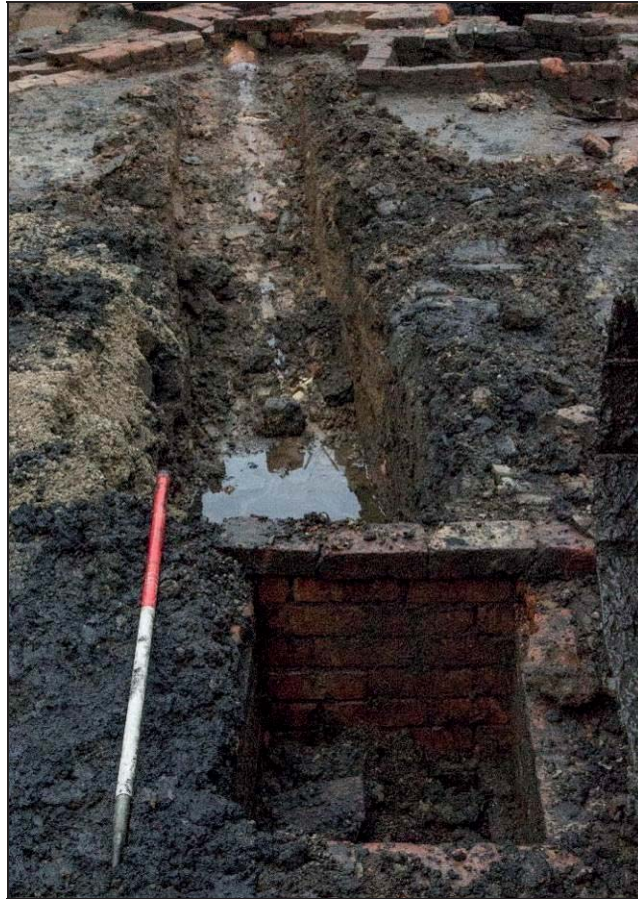


Plate 24: Ceramic pipe (138) running into brick-built man-hole (102), looking south-west. Scale 1m



Plate 25: Drainage feature (064) running below brick feature (063), looking west. Scale 1m



Plate 26: Drainage feature (064) continuing east beyond (063), looking west



Plate 27: Feature (064) fully excavated, cutting through furnace wall (016), looking west. Scale 1m



Plate 28: Features (030), (029), (028) and (027), looking north. Scale 1m

Evidence of four brick-built structures were found around the south-west, south, south-east and east perimeter of the upper furnace wall (016). The south-western structure (030) was situated close to the trench edge enabling only partial excavation. Three sides of the feature were uncovered comprising hand-made bricks, including some refractory, bonded with gritty, lime mortar, excavated to a length of 0.53m by 0.95m (Plate 28).

Structure (029) was situated at the southern edge of the furnace and was rectangular in shape, although slightly narrower at the end closest to the furnace, measuring 2m by 1.38m. The sides comprised mostly two brick-courses in width with part of an extra course along the western side. In the western corner of the feature there were either some bricks missing or a gap in the feature. Bricks were mostly hand-made with a few refractory mixed in, and bonded with sandy lime mortar. The interior of the feature was filled with black cinder (Plate 28). Two drains from Phase 3 had been constructed over the top of this structure.

Structure (052), situated on the south-east edge of the group, appeared similar in shape to (029) consisting of two sets of parallel walls, narrower nearest the furnace, with a three brick-course wide wall crossing in between. The wider part did not have an end wall. The whole feature had been filled with a black deposit of cinder

with fragmented brick and stone (053), below which was a crude brick floor made up broken hand-made bricks (Plate 29).

Structure (063) was situated on the east edge of the furnace, overlying drain (064). It was rectangular in shape, measuring 1.03m by 1.50m, and constructed using hand-made bricks, some of which were broken. The north and south walls were two brick-courses wide, whilst the east and west wall had only one (Plate 25).



Plate 29: Structure (052), looking west. Scale 1m

5.4 The Workshop (Phases 1 and 2)

Historic maps show the furnace enclosed in a rectangular workshop building, inside which the glassmakers would have worked (Figures 12 and 15). Four sections of the south-east wall of the workshop were found (011, 013, 034 and 085). The remains of wall (085) consisted of three brick-courses in width of hand-made bricks bonded with lime mortar, aligned north-east/south-west (Plate 30). The remains to the south-west walls (011 and 013) had only the bottom course surviving, four brick-courses wide (Plate 31); the remains of wall (013) had been truncated by modern concrete stanchion (005). The middle section (085) contained the remains of the central and appeared to have a stopped-end (Plate 12). Further remains of wall (034) to the north-east had been truncated by a 20th-century concrete stanchion and continued beyond the trench edge to the east. Measurements suggested the corner of the workshop lay about 1m beyond the trench edge.

Either side of wall (085) was filled to a depth of 0.20m by black cinders, (087) on the south-east side and (090) on the north-west side. When removed, these deposits contained significant amounts of waste glass, which was collected for analysis.



Plate 30: Three sections of the south-east wall - (013) centre foreground, (085) centre and (034) top centre, looking north-east. Scale 1m



Plate 31: South-west end of the workshop wall - (011) foreground, (013) truncated by concrete stanchion (005), foundation cut seen on the right of (011), looking north-east

The north-east wall of the workshop was represented by walls (103) (111) and (119). Wall (103) was found close to the trench edge alongside wall (106), which was likely to have been a continuation of the same wall, making this wall three brick-courses wide as seen in sections (111) and (119). On the north-eastern side were the remains of a flagstone (104), which lined up with a rectangular feature on the exterior of the building, not shown on maps until the Ordnance Survey National Grid maps of 1949 and 1960. Wall (105) abutted wall (103) on the north-east side, situated on the south-east side of flagstone (104). This wall also matched the rectangular feature shown on the later maps.

The workshop wall had been truncated by modern services between wall sections (103) and (119). Section (119) was three brick-courses wide, and the bricks were hand-made bonded with lime mortar (Plate 32). Keyed in at the meeting point of (119) and (111), was wall (156) at right-angles, two brick-courses wide (Plates 32 and 33). This wall aligned with a separate building shown on historic maps, attached to the workshop on the northern corner. A later addition of a single row of modern, frogged bricks (120) had been added to the north-east sides of (111) and (156) (Plates 32 and 33).



Plate 32: Wall sections (119) and (111) of the workshop wall and (156) to the right of the photo, looking north-west. Scale 1m

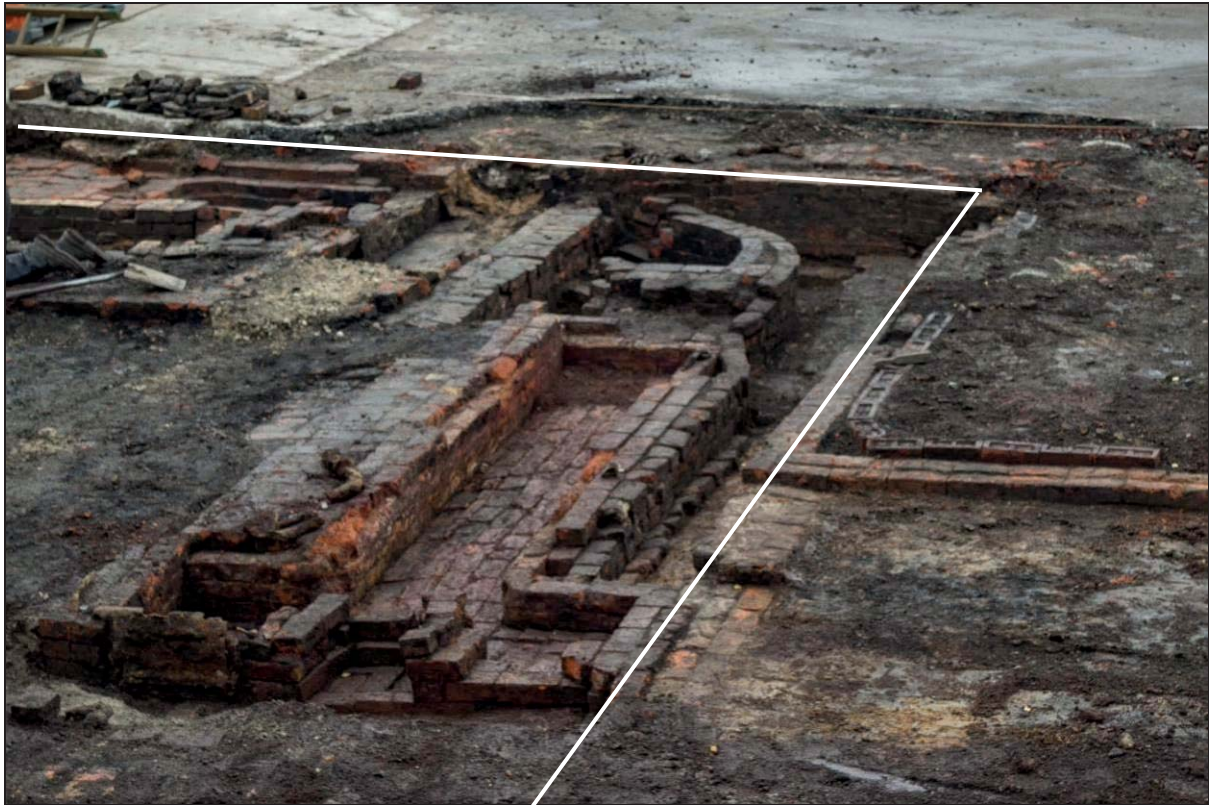


Plate 33: The white line shows the north-east (119)/(111) and north-west (108) walls of the workshop. Wall (156), belonging to a separate building, is visible on the right, looking north-west



Plate 34: Brick floor (016) inside the northern corner of the workshop, black cinder and waste glass layer (121) lie below, looking north-east. Scale 1m

Part of a brick floor (016) was found abutting the walls of the north corner of the workshop (108) and (111), which had been truncated by the later addition of a curved, brick flue (112). A small sondage down the side of the truncated floor and foundation of wall (108) revealed a cinder layer (121) below the floor, which contained fragments of waste glass, and the foundation cut [157] for wall (108), filled with cinder deposit (158) and yellow clay (159) above (Plates 34 and 35).



Plate 35: Workshop wall (018) showing a foundation course, foundation cut [157] with two fills; (158) black cinder and (159) yellow clay above, looking south-west. Scale 1m

5.5 Post-glassworks Activity (Phase 3)

After the glassworks ceased production around 1868-69, the building was rented by other industries until its demolition between 1966 and 1970. Research suggests the former glassworks building was occupied by P. Jeffers, tripe dresser and neatsfoot oil dealer until around 1954. A substantial amount of animal bone found in the northern corner of the workshop, overlying partial brick floor (116) ties in with this research. It is likely the following features belonged to this period of activity, in which it appeared that at least one boiler had been installed inside the workshop. A number of drains had also been installed (Figure 12).

The most notable feature was a brick-built boiler bed that would likely have housed a Cornish boiler, situated in the north corner of the workshop, abutting workshop wall (119) (Plates 36-38).

The structure contained mainly hand-made brick, but also wire-cut and refractory bricks bonded with lime mortar. The diagram in Plate 37 helps illustrate which parts of the structure survived. The side flues (117) can be seen either side of the central or bottom flue (118) and a small recess, front, centre, which housed the 'blow-down valve'. One of the metal doors either side of the blow-down valve, as seen in Plate 37, survived on the west side. The side flue (117) brought the exhaust gases from the furnace tube inside the boiler, round the sides of the boiler then down into the central/bottom flue where they will have eventually passed to a chimney. Part of the two brick-course wide side walls survived to the east and west but the side flue had been truncated (Plate 36).

At the northern end of the structure, a small, rectangular chamber formed partly by walls (113) and (114) may have been part of the boiler chimney system, although it is more usual for the flues to vent to a separate chimney. On the northern side of wall (113) a pair of curved, parallel, hand-made brick walls bonded with black ash mortar, with an associated brick floor (112), curved to the west where they had been truncated and blocked by wall (115). A narrow foundation cut [122] for wall (112) was visible, cutting through the workshop wall (Plates 35 and 39).



Plate 36: Remains of Cornish boiler bed (118/117/124), looking north. Scale 1m

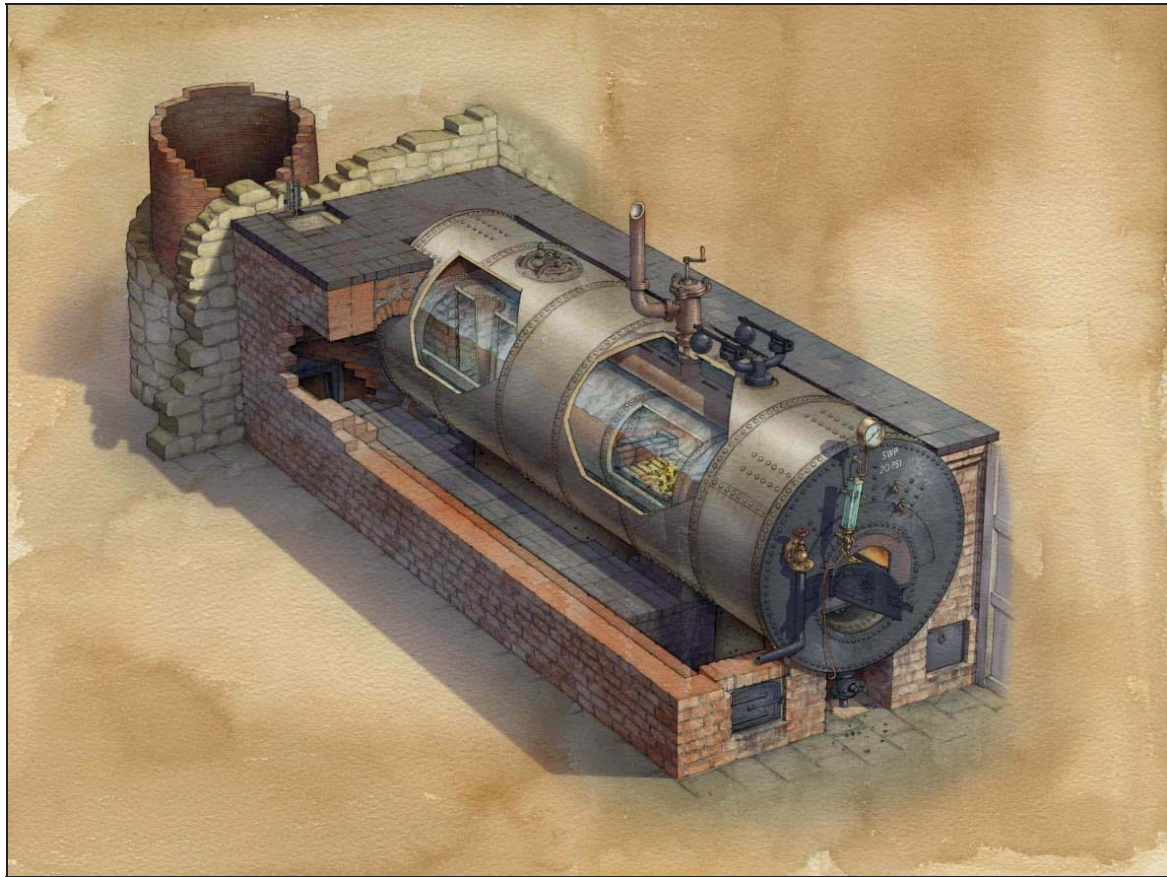


Plate 37: Diagram of a Cornish boiler with integrated chimney, from Combe Mill

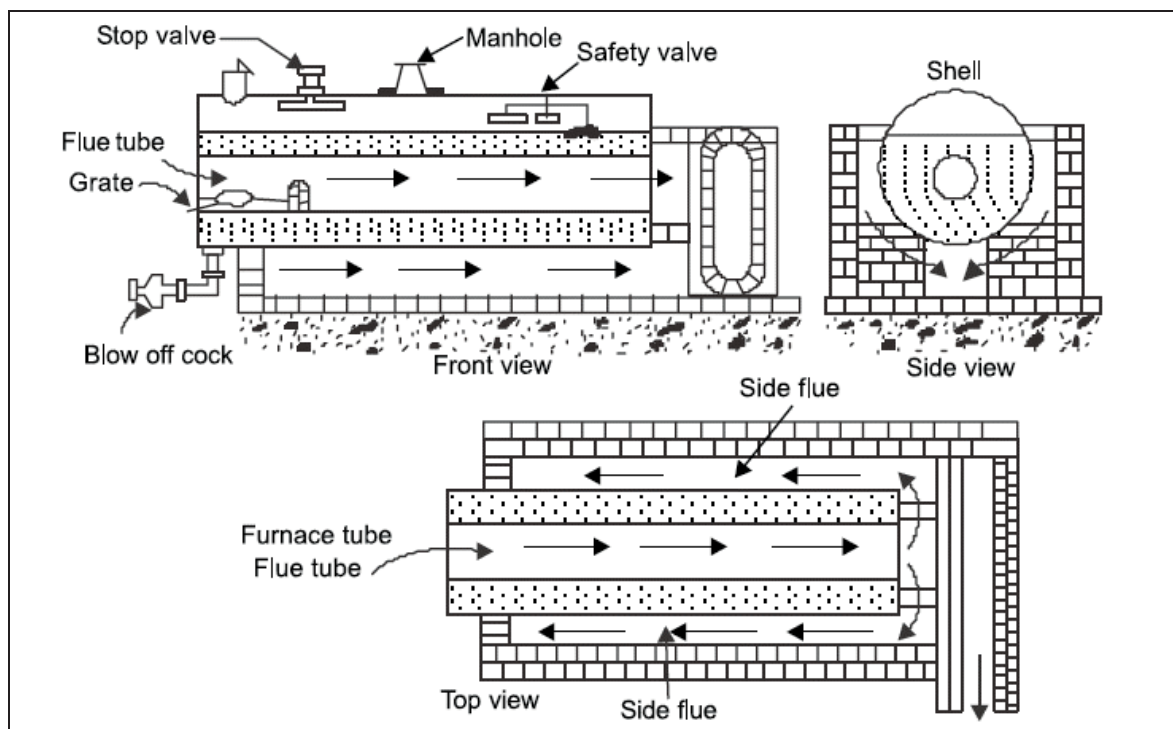


Plate 38: Cornish boiler system



Plate 39: The north end of the Cornish boiler bed showing walls (112), (113) and (114), possibly once part of an integrated chimney, looking north-west

An area measuring 0.80m wide on the west side of wall (115) contained the remains of unidentifiable features, which had been truncated by the installation of a modern, yellow, plastic pipe. The remains of three flagstones (100) survived along with the remains of (126), a 0.18m wide pipe set vertically into the ground at the north end of the flagstones (Plate 40).



Plate 40: Area between two flue systems truncated by modern pipe, wall (115) is shown on the left, looking north-west. Scale 1m

Another possible boiler bed formed by structures (081/083/084) had been constructed against the north-west wall of the workshop. There appeared to be the side flues and central/bottom flue surviving complete with a brick floor (Plate 41). The central flue had been filled with large chunks of very hard, heavy, grey material which was curved and about 50mm thick. The north-east end of the central flue had bullnose bricks on either side, the centre of which may have housed the blow-down valve. However, a set of steps (097) had been built into the space, comprising 80mm thick, stone treads supported by a row of bricks. The bottom step rested on three bricks laid stretcher-on-edge, whilst the two surviving steps above were supported on a row of bricks laid header-on-edge (Plate 42).

The sides of the central flue (083) and the upper surface of the side flues (081) and (084) contained refractory bricks, which suggests the feature would have been subjected to high temperatures associated with a boiler or flue system (Plate 41). The south-west end of the central flue was blocked by a wall which did not appear to be keyed in to the side walls at either side, suggesting it was a later modification. The north-west side flue stepped downwards.



Plate 41: Remains of a boiler bed or flue system showing the side and central flues, looking south-west. Scale 1m



Plate 42: Steps (097) built into central flue (081/083/084), looking north-east. Scale 1m

A structure found to the north-west edge of the furnace had also been truncated by the electricity cable trench. Aligned north-east/south-west, the structure (069), was probably part of a flue, indicated by the red/black soot that had filled it. A brick floor was flanked by two brick walls, comprising two courses of refractory and hand-made bricks bonded with sandy lime mortar. The feature was excavated to a length of 4.20m, 1.20m wide and survived to a height of 0.17m (Plate 43). The feature had also been truncated on its north-west side by a modern service trench (071).

On the south-east side of (069) were the partial remains of two more brick structures (070). Adjacent to the south-east wall of (069) was part of a brick wall or surface, two brick-courses at the south-west end, widening half way along to three courses wide. Alongside, to the south-east, was a small stretch of wall, three brick-courses wide and 12 bricks long. Both features contained refractory, wire-cut and hand-made brick bonded with grey, sandy mortar, suggesting a late addition built from re-used material (Plates 43 and 44).

To the north-west of structure (069) and service trench (071) was a small square pad of bricks (072) measuring 0.80m by 0.60m, two brick-courses thick, overlying a small pit seen in the sondage section, 0.40m above the remains of the furnace central flue arch (073). The bricks were a mix of refractory and wire-cut bonded with black ash mortar, again suggesting a late addition (Plate 44).



*Plate 43: Flue (069) and (070) on the left, small brick pad (072) towards the right, looking south-west.
Scale 1m*



*Plate 44: Structures (069) and (070), (072) is shown towards the top left corner, looking north-east.
Scale 1m*

5.6 Post-demolition Activity (Phase 4)

Overlying the previously described remains, the southern end of the site comprised a stone-flagged floor (032) and (037), with inset concrete stanchions, dating to the mid-20th century (Plates 45 and 46; Figure 12). The flagstones partially overlay the external furnace walls and therefore post-dated the furnace. Tarmac was found in patches adhered to the surface of the flagstones, which probably was left from the asphalt company which occupied the site from at least 1961. Long-time employee since 1979, Tommy, told us he remembered the flagstone floor and confirmed they were there when the asphalt company occupied the premises. He also remembered the cobbled surface (023) and (042), which had covered the northern end of the site (Plates 47 to 49). Although highly truncated, the cobbles appeared in places to abut the exterior walls of the boiler bases suggesting that they may have been contemporary.

A damaged and sunken area of brick floor (054) was found along the north-east side of the trench, adjacent to some of the flagstones (056). The area measured 3.40m by 2.63m and was made up of hand-made bricks laid stretcher-on-edge (Plate 50).

The current landowner has occupied the site since 2000. He confirmed the modern concrete slab was already installed when he took over the site, hence it was probably laid by the plant hire company who occupied the site after the asphalt company.



Plate 45: Remains of a stone-flagged floor (037), looking north-east



Plate 46: Flagstones (032) east of the furnace, looking south-west. Scale 1m



Plate 47: Cobbled floor (042) east of the furnace, looking west



Plate 48: Cobbled floor (023) between the furnace and boiler bed, looking north



Plate 49: Cobbled floor (042) covering the northern end of the workshop, truncated by modern services, looking south



Plate 50: Damaged brick floor (054) with flagstones (056) on the right, looking west. Scale 1m

6. Material Assessed

6.1 Introduction

The entire paper and material archive generated from all stages of the fieldwork was examined to ascertain its potential for further study. 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*, 2nd edition (English Heritage 1991a) and subsequently updated by MoRPHE (Historic England 2015). All classes of finds were examined in full, with observations supplemented by the records generated during the course of the fieldwork and maintained within the project archive. Quantifications are incorporated within the individual assessments. A breakdown of the paper and photographic archive appears in Table 1.

Total Contexts	154
Total Digital Photographs	260

Table 1: Quantification of the paper archive

6.2 Aims and Objectives

The aim of the assessment was to evaluate all classes of data from the investigations, in order to formulate 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. The quantification and assessments represent an amalgamation of the total body of work undertaken in 2019. The objectives of this assessment correspond to *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;
- to comment on the range and variety of that material;
- to assess the potential of the material to address questions raised in the course of the project;
- to formulate any further questions arising from the assessment.

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 for the storage and curation of the data.

6.3 Stratigraphic Data

The paper archive represents a percentage of the overall data gathered during the course of the excavation (*Appendix 1*). In total, 154 contexts were recorded.

Assessment: the context record has confirmed the identification of areas where significant remains have survived and where they have been truncated by later development and have allowed several broad phases of activity throughout the operating period of the glassworks, and its later conversion to other industrial uses, to be established for the site. Overall, the main features of significance can be grouped into four main phases. The original early furnace and associated structures were built c. 1858 (Phase 1). Following this the furnace was re-modelled during the 1860s and several new structures were added (Phase 2). Following closure of the glassworks in c. 1867 the buildings were converted to an engineering works which remained into the early 20th century (Phase 3). The complex was finally demolished between 1966 and 1970 and area converted into the current works yard (Phase 4).

Potential: analysis of the stratigraphic data has the ability to refine the site sequence and to add value to the structural and artefact analysis. The current stratigraphic sequence is simple, but has the potential to be refined through cross-referencing with further historical study and analysis of the glass-manufacturing processes. The exact sequence of developments after the construction of the Phase 1 kiln is, at present, unclear and will require further in-depth analysis of the stratigraphic sequence combined with the historical research.

6.4 Photographic Data

Quantification: in all, there are high-resolution digital 260 images. The photographs cover the whole of the excavation works (*Appendix 2*).

Assessment: the images are an invaluable aid in all aspects of post-excavation analysis. They provide a general and detailed pictorial record of the site throughout all phases of its excavation and recording.

Potential: the images include archaeological features and finds, and record how the site was excavated. They have aided in the stratigraphic analysis through the assessment process and have been integrated into the site database to provide a visual element, which is helpful when dealing with a large corpus of information. A number of the excavation photographs may also be used to create digital elevation and cross-section drawings using a combination of Agisoft Photoscan and AutoCAD.

6.5 Digital Data

Quantification: in all, there are six AutoCAD .dwg files, 42 raw survey data files (.txt, .cvs and .tml files), 18 PDF scans of site drawings and 136 mapping image files.

Assessment: the digital data include all the records of survey undertaken using total station theodolite, GPS, mapping images and photogrammetric data.

Potential: the digital data forms an integral element of the project archive. This data has been integrated into the dataset as part of the assessment process but has the potential for further refinement by cross-referencing with further historical study.

6.6 *The Finds Evidence*

Introduction

A moderately-sized artefactual assemblage was recovered from the excavation and comprises a significant archaeological resource, particularly in terms of glass manufacture. The artefactual assemblage comprises finds from various material categories, mainly glass-manufacturing waste (clinker and crucible), pottery (post-medieval and modern), animal bone, clay pipes, clay pipe manufacturing waste and metalwork. An assessment of each class of artefact will be made below. The aim of the finds assessment is to evaluate all classes of archaeological material from the excavation to assess their research potential and regional significance. No environmental samples were recovered from the site.

Methodology

Pottery, animal bone, glass waste and clay tobacco pipes were collected from the site. Any unstratified animal bone and ceramic building material was noted on context sheets and discarded. All material was returned to the Salford Archaeology finds laboratory in sealed and labelled polyethylene bags. All finds were washed, except metal and organic material, which were dry brushed, and grouped by material for assessment. All material was counted and weighed apart from the glass waste and crucible which was just recorded by weight. Glass waste and crucible fragments were sent for specialist assessment and will be dealt with in *Section 6.7* below.

Overview

The excavation resulted in the recovery of 581 artefacts weighing 159.1kg. Most of the assemblage derives from rubble fills from within the glass furnace areas, as well as demolition deposits and a small portion from ploughsoil patches. The assemblage dates from the late 18th to the mid-20th century, except for a single sherd of Midlands Purple pottery which dates to the 15th-16th century.

As most of the material recovered from the site represents backfilling and redeposited material, the only material with potential further research potential is the glass waste from the production debris associated with the 19th-century glassworks, as well as a small portion of clay pipe kiln waste which suggests tobacco pipe production near to the glassworks during the 19th century.

Material	Contexts	Count	Weight (g)	Period
Animal bone	10	84	1821	Unknown
Brick	2	2	1036	Post-medieval
CBM	1	1	1441	19 th -20 th century
Clay pipe	11	60	181	18 th -20 th century
Clay pipe kiln waste	2	9	2148	19 th century
Glass	16	71	2577	19 th -20 th century
Glass waste (crucible, clinker)	17	-	123.5kg	19 th century
Metalwork	5	6	805	Modern
Pottery	23	328	25362	15 th -20 th century
Tile	1	2	36	20 th century
Shell	5	18	206	Unknown
Total		581	159.1kg	

Table 2: All materials present in the North View assemblage

The Pottery

The pottery assemblage is fragmentary and consists of 328 sherds, weighing 25.4kg. Most of the pottery dates to the late 18th century or later and derives from demolition fills and from within the rubble furnace deposits, as well as a small proportion from ploughsoil deposits. The earliest pottery from the site consists of a single sherd of Midlands Purple or North West Purple from the fill of a chimney (050) which dates to the 15th-16th century.

Pottery Class	Contexts	Count	Weight (g)	Period (century)
China	7	49	592	19 th -20 th century
Dark-glazed coarseware	18	193	21452	18 th -20 th century
Dark-glazed fineware	2	5	60	19 th century
Midlands Purple	1	1	20	15 th -16 th century
Mottled ware	3	7	323	18 th century
Self-coloured ware	1	1	9	18 th century
Slipware	6	12	134	18 th -19 th century
Stoneware	12	56	2490	19 th century
Unglazed pot	2	2	200	19 th -20 th century
Yellow slip-coated ware	1	1	42	19 th century
Yellow ware	1	1	40	19 th century
Total		328	25362g	

Table 3: Catalogue of all the pottery from the North View excavation

Dark-glazed coarseware

Dark-glazed coarsewares form 59% of the pottery assemblage from North View, totalling 194 sherds. This includes a single sherd of Midlands or North West Purple, which dates to the 15th-16th century from the fill deposit in the chimney (050) (Plate 51). The majority of the coarseware derives from 19th-century storage jars and pancheons identified from rim forms (Plate 52). Dark-glazed coarsewares were ubiquitous in the North West of England and largely consist of kitchen or dairy wares. They are inherently difficult to date and continued to be produced into the late 19th century. Notable groups have been recovered from Wigan, Lancaster and Liverpool, and more recently in Manchester and Salford including sites at Chapel Wharf and Greengate Towers (Philpott 1985, OA North 2008, OA North 2014, Mottershead and Garrett 2008).

Dark-glazed fineware

In total, five sherds of fineware were retrieved from the site from cinder or demolition deposits, dating to the 19th century. These sherds are very fragmentary but probably derive from cups or dishes.

Self-coloured ware

A single sherd of self-coloured ware was retrieved from a ploughsoil deposit on the site (043). This sherd is very small, but probably derives from a dish or plate. The ploughsoil had been disturbed and included material ranging from the 18th to 20th centuries.

Slipware

A total of 12 slipware sherds were retrieved from the excavation. This includes eight sherds of 19th-century industrial or mocha ware and four sherds of 18th-century dark-glazed or yellow slipware (Plate 53). The dark-glazed slipware was recovered from the ploughsoil layer (043) indicating that 18th-20th century material was contained within the ploughsoil deposits on site.

Mottled Ware

In total, seven sherds of mottled ware were recovered from the site. The sherds are fragmentary but probably derive from small cups or jars. Mottled wares date predominantly to the 18th century, and the nearest known production centre is Prescott in modern-day Merseyside, although it is likely that such pottery was also made in Manchester in a hitherto unidentified kiln site.

Yellow ware

Only two sherds of modern yellow ware were recovered. This includes a small cup sherd from a cinder deposit (061), and a sherd of yellow slip-coated ware from the ploughsoil deposit (043). Both are likely to date to the 19th century.

Stoneware

In total, 56 sherds of stoneware were recovered from deposits on the site. The majority are from 19th-century brown stoneware vessels, including storage jars or small bottles to contain ginger beer, water or preserves. The sherds are fragmentary and mainly come from backfill deposits or the infill of the glass furnace.

China

A total of 49 sherds of china was collected from the site. This includes plain white and blue and white transfer printed sherds from cups and plates.

Unglazed pot

Two sherds of unglazed pottery were recovered from backfills of the furnace, likely to derive from modern plant pots.

Tile

Two pieces of blue bathroom tile were collected from an unstratified deposit.

Potential

The pottery assemblage is very fragmentary and represents backfilling and stray material from late 18th- to 20th-century activity around the site. The majority of the pottery is typical urban dark-glazed coarseware utilitarian wares. A single sherd of Midlands Purple was recovered from the site, indicating activity in the vicinity during the 15th-16th century. Due to the industrial nature of the site and the redeposited material, the pottery assemblage has very limited further research potential.



Plate 51: Small sherd of Midlands/North West Purple from deposit (050)



Plate 52: Examples of dark-glazed coarseware storage jar rims from deposit (138)



Plate 53: Rim sherd of dark-glazed slipware from ploughsoil deposit (043)

Clay Tobacco Pipes

Assessment

A total of 60 clay tobacco pipe fragments were retrieved from 11 contexts during the excavation. All the pipes appear to be late 18th century or later in date and were recovered from deposits associated with the glass furnace backfills. The pipes consist of ten complete or partially complete bowls, one mouthpiece, and 49 stem fragments (Table 4).

Bowl	Stem	Mouthpiece	Total
10	49	1	60

Table 4: Number of pipe fragments retrieved during the excavation

Makers' Marks

Only one pipe stem fragment was stamped 'No. 441' referring to its reference or batch number, which is likely to date to the late 19th century (Plate 54).

Bowls

Ten bowl fragments were recovered from the excavation. This includes a complete late 19th-century pipe bowl with a bordered stamp 'DUBLIN' which was a popular style of pipe produced by manufacturers in the North West. Two further complete plain pipe bowls were recovered from deposits (049) and (043), both of which date to c. AD1840-80 (Plate 55).

Catalogue

1. Stamped bowl with spur and moulded milling 'DUBLIN', context (061), c. AD1880-1920.
2. Plain bowl spur, context (049), c. AD1840-80.
3. Plain bowl with spur, context (043), c. AD1840-80.

Potential

The clay tobacco pipe assemblage is relatively small and consists of a limited number of stamped or decorated bowls. Though there is evidence of pipe manufacturers living very close to the site during the mid-19th century (William Houghton 1861), based on the number of pipes recovered from the site it is unlikely they were manufacturing them on the site. Therefore, the collection provides little further research potential.



Plate 54: Stamped stem from deposit (061) reading 'No 441'.



Plate 55: Pipe bowls from deposits (061), (049), and (043) dating to the mid- to late 19th century

Clay Tobacco Pipe Kiln Waste

Assessment

In total, four lumps of slag or stem laminate were retrieved from deposit (146), which contained lines of clay tobacco pipe stems embedded in the slag (Plate 56). This is likely to be waste from a pipe muffle kiln where it was sealed upon closure of the kiln prior to firing the pipes. Four pieces of saggar or kiln furniture were also recovered from the same deposit, two of which contained crushed pieces of pipe fragments as grog (Plate 57). A single wad was also recovered from ploughsoil deposit (043) which is made out of tobacco pipe ball clay and would have been used as a separator in the pipe kiln (Plate 58). The remains of clay pipe kiln waste imply pipe production in the nearby area, especially as several pipe makers were residing in the local area during the mid- to late 19th century, when the glassworks were in operation. However, due to the small quantity of pipe waste from the site, it is likely these kiln fragments represent strays from a nearby pipe works, rather than them being manufactured on the site of the glassworks itself.

Potential

The presence of pipe kiln waste on the site is intriguing and further research could be carried out into pipe manufacture in the area to ascertain where the waste material has derived from. The material should be retained for further study and for the site archive. Study of this material, alongside further historical research, may provide information that could add to our understanding of the clay pipe industry in Manchester.



Plate 56: Pipe slag/stem laminate from deposit (146) Plate 57: Kiln furniture containing crushed clay tobacco pipes



Plate 58: Fragment of wadding from a clay pipe kiln (043)

Glass Vessels

Assessment

In total, 71 fragments of glass were retrieved from 16 separate contexts on site (Table 5; Plate 59). Most of the glass consists of late 19th- to 20th-century partial bottles. They were mainly found in demolition deposits as opposed to directly being associated with the furnace rubble deposits. They likely represent used and waste glass material as opposed to glass being produced on the site.

Potential

The glass material from the excavation is very fragmentary and represents broken utilised glass of late 19th- to 20th-century in date, typical of disturbed and demolition deposits in urban centres. The glass has no further research potential.

Context	Description	Count	Weight (g)
001	Bottle glass fragments	3	37
002	Green bottle glass fragments	2	140
003	Blue opaque glass	1	7
020	Window glass	3	52
038	Brown beer bottle base and sherds of clear glass	9	231
043	Green bottle glass	8	201
046	Green bottle glass	1	39
049	Two complete sauce bottles with plastics tops, a 'Fletchers Selby' sauce bottle, and fragmentary medicine bottle	13	824
050	Green bottle glass	2	39
051	Green bottle glass	3	146
059	Clear bottle glass	4	44
061	Window glass	2	43
062	Window glass	1	23
116	Window glass	4	123
136	Green bottle glass	1	34
U/S	Green bottle glass	14	594

Table 5: Catalogue of all the glass material from North View



Plate 59: 20th-century sauce bottles from deposit (049)

Metalwork

Assessment

In total, six metal objects were recovered from the site from deposits within the fill of a chimney (050) and unstratified deposits (Table 6). This includes a copper gas regulator fitting, an iron strip with protruding nails, two horseshoes, a hooked nail and a silvered token depicting a dragon and the word 'fairplay'.

Potential

None of the metalwork is of archaeological significance and no further research is required.

Context	Description	Count	Weight (g)
050	Hook nail	3	366
	Copper gas regulator		
	Horseshoe		
006	Iron strip with nails	1	36
U/S	Horseshoe	2	403
	Token		

Table 6: Catalogue of all the metalwork from the site

Animal Bone

Assessment

In total, 84 fragments of animal bone were recovered from ten contexts from the site, weighing 1821g. The majority of the bones are domesticated animal leg bones from cow and sheep, including a small horn which probably derives from a goat. Several the bones witness cut and butchery marks (Plate 60), suggesting processing near to the site before they have been discarded. All the bones were retrieved from 19th century or later contexts and probably represents stray material deriving from the later use as a neatsfoot oil manufacturers. One bone was recovered from deposit (043), which is noted as a patch of ploughsoil.

Potential

The animal bone provides little further research potential for the site, and the majority is likely to represent redeposited waste animal debris.



Plate 60: Cut bone from deposit (043) with knife marks

Organics

Assessment

In total, 18 shells were retrieved from five contexts on the site. This mainly consists of oyster and clam shells and represent stray organic deposits on the site.

Potential

The shell from the site is likely to have been redeposited on the site and is therefore essentially unstratified, providing little further research potential.

6.7 Glassworking Debris

Introduction

All of the material submitted was examined visually and recorded following standard guidance (English Heritage 2011) (Table 7). The material identified includes the following categories:

Material	Description
Glassworking waste	Fragments of glass in random shapes and often with abundant fracture surfaces. Some examples show flow (drips, etc), and a few mol fragments are also present.
Devitrified glass	Usually amorphous lumps of glassy material that are also opaque. The range of colours displayed is varied (eg green, blue, amber and/or black). Some of this material may have undergone microphase separation rather than devitrification (cf Dungworth and Paynter 2011)
Crucible	Refractory ceramic vessel in which glass was melted.
Refractory ceramic	Refractory ceramic but lacking a form that allows the certain identification as crucible or brick (usually because present as relatively small fragments).
Brick	Pale-coloured ceramic, usually tempered with grog (and possibly quartz). Often with black or maroon glazed surfaces, confirming exposure to high temperatures (and probably coal-fired).
Clinker	The vitrified ash of coal, usually black (sometimes maroon at the surface), and often porous.

Table 7: Categories of glass production material

Most of these categories are also present as intermediate or hybrid materials (Plate 61). Glassworking waste is frequently found adhering to the interior surfaces of crucibles, but it is also found on the surfaces of bricks and mixed with clinker (or even partially burnt coal). Mixtures of glassworking waste, clinker (and especially fragments of partially burnt coal) suggest that glass has escaped from a crucible and has flowed into the fuel bed (an unfortunate occurrence but one which was by no means rare). Most crucibles would end their life due to cracks (and escaping glass). In most cases, the volume of glass that escaped from a crucible would be modest, but the catastrophic failure of a crucible could lead to the escape of enough glass that it could smother (and even extinguish) the fire in the furnace. Similarly, mixtures of clinker and crucible (or other refractory ceramics) suggest failure of crucibles and the incorporation of crucible fragments in the fuel bed. Small quantities of very mixed material were present: these incorporate glassworking waste, clinker, and fragments of crucible or other refractory material.

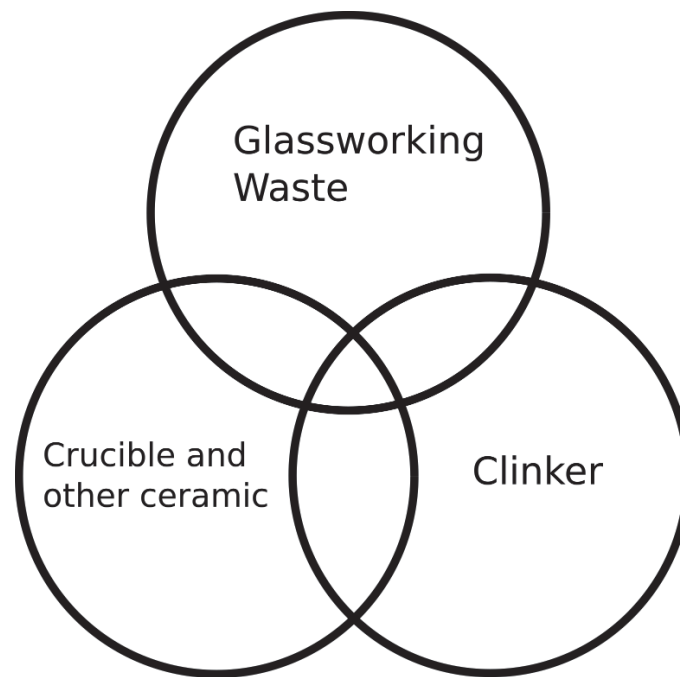


Plate 61: Some glassworking waste is homogeneous and can be traced to a single material/process but many intermediate or hybrid waste products are also formed

Some of the refractory ceramics have a clear 'glazed' surface that is consistent with the attack of furnace ceramics by alkali vapour. The glass-melting furnace would operate at a sufficiently high temperature that sodium (and potassium) in the glass would tend to volatilise. These highly corrosive alkalis would then condense on cooler surfaces (such as the ceiling of the furnace and around openings in the furnace) and form clear glazes.

Crucibles usually have a clear or slightly green glazed interior surface but a black or maroon outer surface. The interior surface represents reactions between the crucible fabric and the glass within the crucible (Dungworth 2008), while the outer surface results from reactions with the ash (and vapour?) from the coal.

Results

The assessment of the glassworking debris has identified several categories that confirm glass was melted in crucibles, and that the crucibles were in turn heated in a coal-fired furnace. In total, 123.5kg of material was recovered (Table 8) and this includes a range of glass and refractory ceramic material (Plate 62).

Context	Type	Comment	Weight
15	Tarmac	Fragment of window glass incorporated	272
38	Glass waste	Random shapes, fractured. Colourless-green	271
38	Clinker-glass		596
46	Clinker-glass		118
46	Crucible		6.7
46	Glass waste	Random shapes, fractured. Colourless-green	19.9
47	Clinker-glass		598
47	Refractory tile?	Buff-grey, coarse grog. Tapered section. Glazed on one side. Door/lid?	755
47	Glass waste	Random shapes, fractured. Colourless-green	327

Context	Type	Comment	Weight
51	Glass waste	Random shapes, fractured. Colourless-green	109
51	Refractory Brick	Buff, coarse grog, vit surface	24.7
51	Tarmac		2.7
51	Glass waste	Random shapes, fractured. Pink	366
53	Coal		15.1
53	Glass waste	Random shapes, fractured. Colourless-green	84.4
53	Clinker-glass		24.5
59	Glass waste	Random shapes, fractured. Colourless-green	237
59	Refractory Brick	Buff, coarse grog, vit surface	564
59	Clinker-glass		393
60	Clinker-glass		144
60	Glass waste	Random shapes, fractured. Colourless-green	281
61	Vessel glass		1.4
61	Glass waste	Random shapes, fractured. Colourless-green	116
61	Clinker-glass		78.8
62	Glass waste	Random shapes, fractured. Colourless-green	68.2
62	Clinker		33.1
66	Clinker-glass		238
66	UID	White stone/mineral	11
121	Refractory Brick	Buff, coarse grog.	38.4
121	Clinker-glass		22.8
121	Vessel glass	Rim	1.4
121	Moil		8.5
121	Glass waste	Random shapes, fractured. Colourless-green	94.3
128	Crucible		2145
128	Clinker	Dense	1309
128	Refractory Brick	Buff, coarse grog, vit surface	2546
128	Crucible		6980
128	Refractory Brick	Buff, coarse grog, vit surface	4629
128	Clinker-Glass-Ceramic		942
128	Crucible		5384
128	Clinker		243
128	Refractory Brick	Buff, coarse grog, vit surface	5011
140	Crucible		110
140	Refractory tile?	Buff-grey, coarse grog. Tapered section. Glazed on one side. Door/lid?	526
140	Refractory Brick	Buff, coarse grog, vit surface	3326
140	Refractory Ceramic	Buff, no vis grog, vit surface, not obviously crucible	6885
140	Glass-clinker		3256
140	Clinker		433
140	Clinker-Ceramic		561
140	Glass waste	Opaque white (devit?) mixed with ceramic (pot burst?)	931
140	Glass waste	Random shapes, fractured. Colourless-green	448
141	Refractory Brick	Buff, coarse grog, vit surface	4424
141	Crucible		708
141	Refractory Ceramic	Buff, no vis grog, vit surface, not obviously crucible	5396
141	Clinker-Glass-Ceramic		190
141	Clinker-glass		2118
141	Clinker		637
141	Refractory Ceramic	Buff, no vis grog, vit surface, not obviously crucible	8368
142	Glass waste	Random shapes, fractured. Colourless-green	291
142	Glass waste	Fragment of devitrified/phase-separated puddle	68.1
143	Refractory Brick	Buff, coarse grog, vit surface	2470
143	Crucible	1 fragment	5980
143	Refractory Ceramic	Buff, no vis grog, vit surface, not obviously crucible	2284
143	Refractory Brick	Buff, coarse grog, vit surface	1642
143	Clinker-Glass-Ceramic		1115
143	Crucible		8459
143	Glass-ceramic	Opaque white (devit?) mixed with ceramic (pot burst?)	1499
Context	Type	Comment	Weight

143	Refractory Brick	Buff, coarse grog, vit surface	241
143	Clinker-glass		238
143	Glass waste	Random shapes, fractured. Colourless-green	275
143	Glass waste	Opaque white (devit?) mixed with ceramic (pot burst?)	660
143	Refractory Brick	Buff, coarse grog, vit surface	3262
143	Refractory Ceramic	Buff, no vis grog, vit surface, not obviously crucible	11871
143	Clinker-Glass-Ceramic		68.2
144	Refractory Brick	Buff, coarse grog.	337
144	Crucible	Odd shape (possibly furnace)	407
144	Glass waste	Fragment of 'puddle'	184
144	UID	White stone/mineral	216
144	Crucible		792
144	Refractory Brick	Buff, coarse grog, vit surface	2450
146	Refractory Brick	Buff, coarse grog, vit surface	5252

Table 8: Glass production material from North View

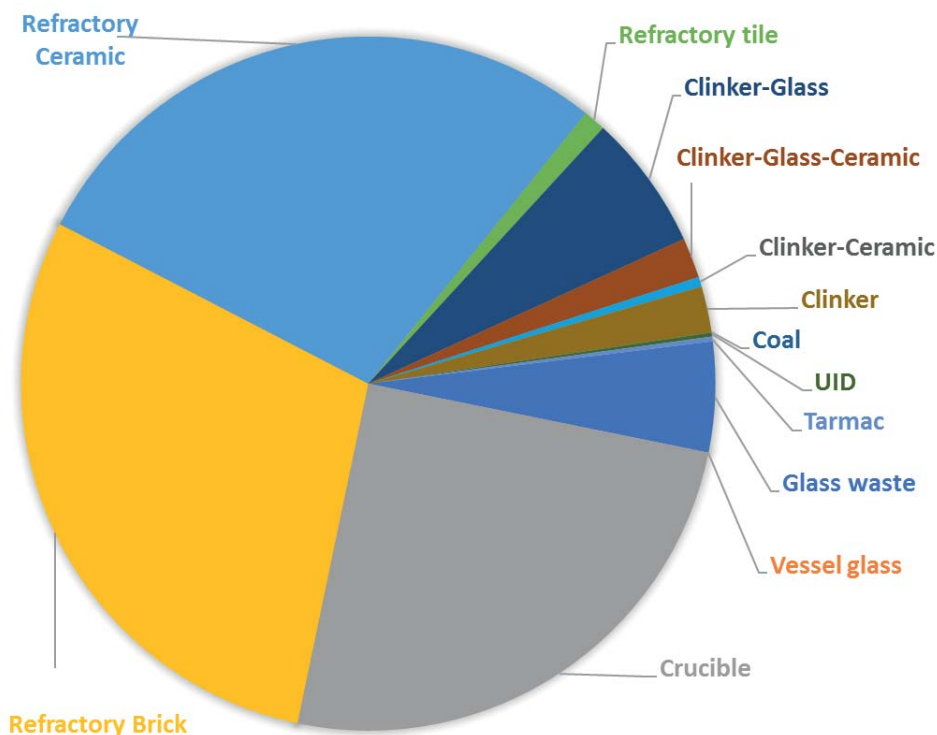


Plate 62: Proportions of different glassworking debris from North View Manchester

The most significant glassworking debris examined comprises fragments of glass (6.4kg) that were accidentally produced during glass manufacture and forming (Plates 63 to 66). Some of this material is virtually colourless, but most has a discernible green colour or tint (Plates 63 and 64). The more strongly coloured examples of this glassworking waste often also show the incorporation of small amounts of clinker and/or partially burnt coal. It is possible (likely?) that the green colour seen in much of this category of debris represents accidental contamination rather than the deliberate attempt to produce a green-coloured glass. This glass waste is usually highly fractured due to fast cooling and so the original forms are uncertain.

The assemblage includes several colourless glass moils and a small proportion of drips and dribbles. The colourless glass waste has strong potential to provide information on the nature of the glass manufactured. The potential of the green-coloured glass is less clear; however, chemical analysis will be able to determine whether this glass was deliberately coloured (or accidentally produced by contamination by clinker, coal ash, etc).

Two examples of coloured (or possibly coloured) glass are present: pink and a possible opaque white. A fractured lump of pink glass (Plate 65) was recovered from (051). An apparently opaque white glass (Plate 66) was recovered from (140) and (143). This material is usually present as highly fractured lumps, often mixed with fragments of refractory ceramic. While the form (and association with ceramic material) suggests that this material leaked from a crucible, the absence of any clinker contamination cannot easily be explained. In addition, it is not certain if the current colour of this glass waste represents the deliberate intention of the glassmakers. The apparent colour of this material could be due to the effects of heating and cooling as it leaked from a crucible. Glass which is kept at a high temperature will tend to devitrify (or undergo phase separation — Dungworth and Paynter 2011) and this could conceivably turn a colourless glass into a white glass.



Plate 63: Glassworking waste from (047). A few examples are effectively colourless but most have a discernible green colour. The darker green examples usually show some contamination by clinker and/or partially burnt coal



Plate 64: Glassworking waste from (140). Some examples are effectively colourless but most have a discernible green colour. The darker green examples sometimes show some contamination by clinker and/or partially burnt coal



Plate 65: Pale red or pink glassworking waste from (051).



Plate 66: Opaque white glassworking waste from (143).

Some of the glass waste shows much more severe contamination by clinker (Plates 67 and 68) and often effectively comprises lumps of clinker (see below) with small regions of translucent green glass (7.8kg). It is likely that this material was generated by reactions between spilt glass (escaping through small cracks in crucibles) and coal ash and/or clinker in the fuel bed of the furnace. Such material is so heavily contaminated by coal ash and clinker that it has little potential to provide detailed information on glass manufacturing at North View.



Plate 67: Clinker-glass waste from (038).



Plate 68: Clinker-glass waste from (047).



Plate 69: Clinker from (140).



Plate 70: Clinker-ceramic from (140).

The assemblage also includes 2.7kg clinker (Plate 69). Such material is formed at high temperatures when the ash from the combustion of coal fuses. It is black in colour, although the surface is usually maroon (due to the oxidation of iron). The formation of clinker depends on the nature of the coal (especially the proportion and character of the ash) and the extent of the heating (temperature and duration). Clinker formation is often negligible in domestic fires but is a significant issue when coal is burnt at higher temperatures. Nevertheless, the presence of clinker is not specifically diagnostic for glassworking; clinker can be produced whenever coal is burnt at a sufficiently high temperature, *eg* a stationary engine, pottery kiln, etc.

While some of the clinker incorporates glass spillages (Plate 67 and 68), other contamination is also present (Plate 70). Some of the clinker contains recognisable fragments of refractory ceramic (0.6kg). While some erosion of the furnace structure (and its refractory ceramic components) by clinker, molten glass, or volatile alkalis from the molten glass is inevitable, the size of the ceramic inclusions in the clinker-ceramic suggests significant high-temperature failure of ceramic components (Plate 70). The assemblage also includes some material which is essentially clinker but which also has recognisable glass *and* ceramic inclusions (2.3kg).

Refractory ceramic materials comprise (by weight) over 80% of the assemblage (Plates 71–76). The refractory ceramics have been divided into three main categories: crucibles (31.0kg), furnace components (bricks, tiles, etc, 37.5kg), and unidentified or miscellaneous refractory ceramic materials (36.2kg).

The crucible fragments are occasionally identifiable by their form (Plate 71), although some fragments are so small that the identification of them as crucibles is uncertain. Similarly, some of the brick (Plate 72) fragments are sufficiently large to allow identification by form. Nevertheless, a proportion of the ceramic materials are too fragmentary to allow certain identification of them as either crucibles or ceramic materials used in the construction of the furnace (bricks, tiles, etc).



Plate 71: Fragment of a crucible with adhering glass from (143).

Plate 72: Refractory brick with black-maroon vitrified surfaces from (143).

Where the crucible fragments were sufficiently large, it was usually possible to identify a range of diagnostic features (Plate 71). In all such cases, the crucible was built with a base and walls that were at least 50mm thick (some fragments appear to be up to 80mm thick). The bases are flat and the walls vertical. The exterior surfaces are usually black or maroon due to reactions with coal ash and clinker while the interior surfaces are usually pale green. It is not clear if the green colour represents the nature of the glass manufactured: it is possible that iron from the crucible fabric leached into and contaminated the glass (cf Dungworth 2008). The curvature of the crucible fragments is consistent with a diameter of the order of 1m. No rim fragments have been identified at this stage and the height of the crucibles is uncertain (more than 0.5m but less than 1m?).

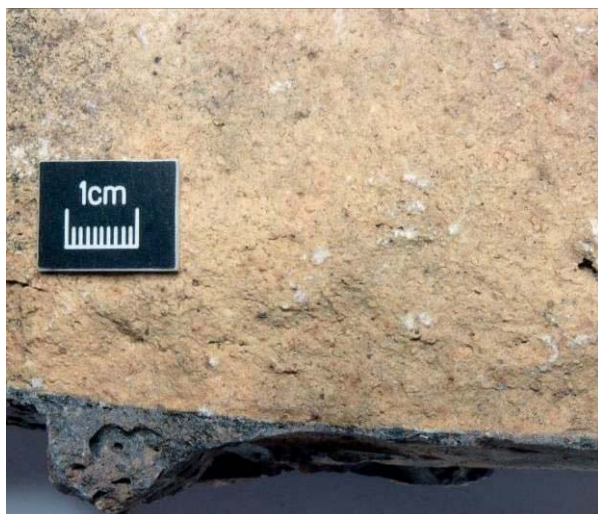


Plate 73: Close-up of crucible fabric from (143).



Plate 74: Close up of brick fabric from (128).

The crucibles have all been fired to a very high temperature (fractures tend to be hackly), and are all made from a refractory clay which is buff to grey in colour. This ceramic fabric has numerous but small (up to 1mm) grog inclusions (Plate 73). This contrasts with the ceramic fabric employed for bricks (Plate 74) which shares the same colour as the crucible fabric but which has much larger (up to 5mm) inclusions. Most of these appear to be grog, but flint and other inclusions may also be present. The same coarse fabric was also used to make other furnace components. Several fragments of refractory ceramic have forms that are similar to tiles (Plates 75 and 76), although these often have a tapered section. These tiles usually have at least one side with a clear 'glaze'; probably due to the corrosive effects of volatile alkalis from the glass, but some also have a black or maroon surface (suggesting exposure to a coal fire). It is possible that some or all of these ceramic tiles were used as lids for crucibles or doors or covers for the furnace openings. Some of the refractory ceramic materials have not been certainly identified as either crucible, brick, or other artefacts. These examples have the finely-grogged fabric of the crucibles but have a size and shape that does not appear to fit with known crucible forms. Some fragments of ceramic refractory material could derive from the furnace roof.



Plate 75: Refractory ceramic tile (lid/door?) from (047). Exterior surface glazed by coal ash/fumes.



Plate 76: Refractory ceramic (lid/door?) from (143). Interior surface glazed by volatile alkalis from glass.

Discussion

The North View assemblage includes a range of diagnostic glassworking debris with varying potential to provide detailed information on glassmaking practices in Manchester in the 1860s. Enough uncontaminated glass survives to show that a colourless glass (flint?) was produced. At least one other colour (pink) was produced, but the status of other colours (green and opaque white) as deliberate or accidental is not known at this stage. These samples have potential to provide detailed information on the chemical nature of the glass produced. The Portland Street glassworks operated in the 1860s — a generation after the repeal of the various Excise Acts which regulated the English glass industry (Dungworth 2019). Data from other 19th-century flint glass works (Holt *et al* 2014; Willmott *et al* 2012) suggests that this period saw considerable experimentation with glass recipes. Although this experimentation is demonstrated by the analysis of glassworking waste, contemporary historical documents provide almost no information on the motivations or means employed. The North View assemblage has great potential to improve our understanding of flint glass manufacture in the later 19th century. The refractory ceramic materials include fragments of furnace and crucible and these appear to have contrasting ceramic fabrics. It is likely that ceramic production was optimised depending on how the ceramic was to be used. These materials have potential to reveal choices in the raw materials employed and associated technologies.

6.8 *Historical Documentary Evidence*

Quantification: Census records from 1851 to 1911 and trades directories between 1850 and 1909, newspaper articles/adverts, contemporary industry journals, cartographic evidence.

Assessment: the documentary evidence consists of digital files and paper hard copy.

Potential: the analysis of historical records adds both a social historical element to the narrative which, when put together with physical information from the excavations and cartographic information, can be used to develop a picture of the development and nature of the area and its inhabitants; and may add vital information about the development of the glassworks and the processes being carried out on site. The analysis of the immediately available historical documentation has been carried out as part of the post-excavation assessment but requires more in depth study to refine further. The study of contemporary trade and industry journals has great potential to further understand the development and processes. There is also potential to cross reference this information with historical and archaeological data within a wider area, looking at the site in conjunction with the Manchester glass industry as a whole.

7. Curation and Conservation

7.1 Recipient Museum

The finds, the paper archive and the electronic archive will be deposited within Manchester Museum of Science and Industry, pending their agreement. Contact details are:

Museum of Science and Industry,
Liverpool Road,
Manchester,
M3 4FP

7.2 Conservation

There are no conservation requirements

7.3 Storage

The complete project archive, which will include digital plans, photographs, datasheets and artefacts, 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) prior to deposition.

For long-term storage of the digital data, DVDs will be used, the content including the reports, plans, scanned images and digital photographs. Each DVD will be fully indexed and accompanied by the relevant metadata for provenance.

All dry and stable finds will be packed according to the museum's specifications, in either acid-free cardboard boxes, or in airtight plastic boxes for unstable material. The artefactual assemblage is stable, but will be packed carefully with bubble wrap protecting the bags to minimise movement and abrasion in the boxes.

7.4 Packaging

The assemblage is currently well-packaged and will require no further packaging. Box lists derived from the site database have been compiled.

7.5 Discard Policy

A discard policy will be prepared, in consultation with the recipient museum. Material of no discernible long-term archaeological potential will be discarded, with the museum's agreement. It is recommended, however, that all the material with no further research value, such as the pottery, is discarded.

8. *Statement of Potential*

8.1 *Introduction*

The archaeological investigation undertaken at North View has provided a valuable opportunity to investigate the development of the glass-manufacturing industry in Manchester. The Manchester glass industry had a high reputation throughout Britain and developed somewhat apart from glass manufacturing elsewhere in the country. However, little study has been carried out on this important industry, and the North View excavation produced an interesting collection of 19th-century glass working waste and crucible fragments that merit scientific analysis.

Overall, the results of the 2019 excavation can be regarded as being of regional importance. Data pertinent to all of the original research themes was recovered. Assessment of the stratigraphic and artefactual data generated by the fieldwork is primarily concerned with the potential of the data to address these fieldwork aims and, if appropriate, formulate new questions and research aims that can be addressed by an analytical phase of the post-excavation programme.

8.2 *Principal Potential*

The present section reviews the success of the fieldwork and post-excavation assessment in providing data to address the original research aims. Assessment of the primary stratigraphic records has established activity on the site during the industrial period. The sequence is summarised in *Section 5*, above. Of particular importance is the collection of a significant assemblage of glassworking waste and the development of the intact glass furnace. Of equal importance is the body of historical data available for the glassworks. The development of the site, the physical evidence uncovered during the excavation and the accompanying historical information is discussed below.

8.3 *The Development of the Glass Manufacturing Industry*

The dataset obtained from the investigation at North View has the potential to add considerably to the small but currently increasing body of evidence relating to the development of glass manufacturing in Britain during the 19th century. Relatively few glassworks of this period have been examined through detailed archaeological excavation and so physical evidence is currently lacking. This lack of physical evidence is compounded by the fact that during this period much experimentation with glass recipes, furnaces and techniques was being carried out but very little was written down. This was partially due to a fear of industrial espionage in a very competitive industry and also partially to avoid certain industry regulations and infringements in technological patents by other companies.

The information that may be obtained from detailed analysis of the North View excavation evidence has the potential to produce regionally, possibly nationally, important information on this little understood industry.

Detailed below are the five main areas of potential arising from the data collected during the investigation.

Glass manufacturing waste: the greatest potential lies with the large quantity of glass manufacturing waste that was retrieved from secure contexts during the excavation. This material consisted of a broad range of waste types of sufficient quality to merit in depth scientific analysis. This has considerable potential to provide detailed information on the chemical nature of the glass produced, to improve the current understanding of flint glass manufacture in the later 19th century, and to reveal choices in the raw materials employed and associated technologies.

The glass furnace and associated working structures: detailed analysis of the furnace structure and the stratigraphic sequence of its development and modification has great potential to provide detailed information on the development of glass furnace technology. Although few glass furnaces have been excavated, those that have demonstrate great differences in technology due to the guarding of trade secrets. This is particularly important for the Manchester glass industry which developed separately from that in the rest of Britain and has distinct regional differences in the technology used and the qualities of the glass produced.

Historical research: although a general background history for the site area has been produced, more in-depth historical study needs to be undertaken to create a detailed historical narrative for the North View glassworks. In particular, a review of *The Pottery Gazette and Glass Trade Review* for the period that the glassworks was in operation may yield significant information. The resultant narrative would then be cross-referenced with the scientific and stratigraphic analysis to produce a definitive historical sequence for the glassworks and the development of the technology and processes.

Comparative study: once a detailed narrative is produced for the glassworks this should be compared to other investigated glassworks, both in Manchester and beyond. This comparative study has the potential to add greatly to the overall regional and national picture of the development of the glass industry and its place within the overall 19th-century British economy.

Publication: the results of the above four branches of analytical study have considerable potential to make an important contribution to an understanding of glass production in 19th-century Manchester and beyond, and will merit the production of an academic publication in an appropriate format, either as a detailed article in a relevant journal, or as an occasional paper that places the glassworks in context with other documented glass-manufacturing sites in Manchester.

8.6 *Regional Research Priorities*

The publication of the *Archaeological Research Framework for North West England* (NWARF; Brennand 2007) has provided a region-specific agenda that includes several research topics that are relevant to the study of the archaeological remains at North View. As a detailed national research agenda has been compiled, however, there is significant overlap between many of the research topics discussed in the regional and national research agendas, and the repetition of previously noted themes will be avoided.

The following key research themes for the industrial period are outlined by NWARF:

- ***Industrial period***
 - *Initiative 7.35* Industry specific studies are needed for those industries that have received little archaeological attention (Newman and McNeil 2007, 154)
 - *Initiative 7.41* The retention of all later period artefacts and their routine analysis as part of all archaeological excavation projects (Newman and McNeil 2007, 156)

9. Updated Project Design

9.1 Aims and Objectives of the Programme of Analysis

This section follows the guidance of Historic England regarding the formulation of updated research aims (English Heritage 1991a, 2–3). The original aims for the project remain valid (*Section 2.1 above*), but can be updated with new aims and objectives derived from the statement of potential set out in *Section 8*.

The updated research aims will consider the following:

- the development of glass-making processes through scientific analysis of the retrieved glass manufacturing waste;
- the development of the technology used in the glassworks through detailed analysis of the stratigraphic sequence;
- detailed historical narrative for the glassworks and subsequent re-use of the works;
- comparison of the evidence at North View with other excavated glassworks.

Updated Research Aim 1: what information can be gained from the scientific analysis of the glass manufacturing waste?

- *Objective 1:* can we determine what types of glass were being produced and how?
- *Objective 2:* is it possible to see the development of the glass-making processes in the chemical analysis of the waste?
- *Objective 3:* can the use of particular materials be assigned to different chemical processes?

Updated Research Aim 2: how did the furnace, and associated technologies, develop throughout the life of the glassworks?

- *Objective 1:* can we determine the exact stratigraphic/temporal sequence for the development of the furnace and associated technology?
- *Objective 2:* is it possible to assign the adoption of particular technological developments to different structures and modifications over time?
- *Objective 3:* can we assign difference modifications and developments to different processes seen in the chemical analysis?

Updated Research Aim 3: what is the full detailed history of the glassworks and subsequent occupiers?

- *Objective 1:* can we cross reference the results of the historical study with results of the chemical analysis and stratigraphic study of the development of the structures?
- *Objective 2:* can the historical information throw light onto the social aspect of industry as it relates to the glassworks and subsequent occupiers, and the rise and collapse of the industry itself?
- *Objective 3:* what can be inferred from the results of the various analyses on the contribution of the glassworks to the overall industry and economy?

Updated Research Aim 4: is it possible to compare the information from the North View glassworks with other examples of glassworks both in the region and nationally?

- *Objective 1:* how does the North View glassworks fit in with the overall picture of the 19th-century glass industry? How does it add to this picture and is it typical or atypical?
- *Objective 2:* can we determine if the glassworks has either influenced or been influenced by other glassworks and by the adoption of technologies within other industries?

9.2 Presentation of Results

In accordance with the guidelines provided in MAP2 and MoRPHE (English Heritage 1991a; Historic England 2015), it is proposed that the results of the project should be presented as follows:

Project archive: the completion of the project will result in an integrated project archive, which it is envisaged will be deposited with the receiving museum

Publication: appropriate dissemination of the results obtained from the analytical phase of the project will be required. As a minimum, a paper will be prepared for publication in an appropriate academic journal. However, the results of the different research aims may determine a further level of publication.

10. Method Statement

10.1 Programme Structure

The post-excavation programme, designed to fulfil the research aims outlined in *Section 9*, will be divided into the following stages:

- full cataloguing of any data representatively sampled;
- analysis;
- synthesis;
- preparation of draft text and illustrative material;
- publication;
- archive deposition.

10.2 Management, Monitoring and Review

Task 1: management and monitoring tasks have been built into the project. These tasks will include project monitoring, advice and co-ordination, problem solving, and conducting meetings with project staff and all interested external parties.

Reviews of the project will include both the specialists and the Salford Archaeology staff who are undertaking the analysis, and will provide an opportunity for all involved to present and receive information, to discuss the research aims, and permit an exchange of ideas. All specialists will be consulted following editing and prior to publication of their reports. In addition, there will be regular project review meetings at appropriate intervals throughout the preparation of the report.

10.3 Stratigraphy: Analysis and Synthesis

Task 2: the stratigraphic data will need to be studied in greater detail in order to refine the provisional phasing. More detailed structural analysis will be undertaken on complex structures and features. Existing matrices will require assimilation into one overall matrix for each investigation area, showing the amended periods and sub-phasing.

Once the data from all the areas have been analysed and a stratigraphic narrative completed, it will be possible to prepare phase plans. Such phase plans are a prerequisite for specialist analysis of the relevant artefact assemblages (in particular glass manufacturing waste). Analysis and synthesis of the results of specialist analysis of the glass waste will, however, contribute to the site phasing.

10.4 Processing and Transport of Artefact Assemblages

Task 3: at an early stage in the analytical programme, arrangements will be made to transport all relevant assemblages to the appropriate external specialist to facilitate analysis and reporting of the material. Conversely, on the completion of this work, material will need to be received from the specialist, sorted and checked against database records.

10.5 Digital Data in the Analysis Phase

Task 4: at the start of the fieldwork a CAD environment was set up, in which all plans and sections could be placed to produce an up-to-date composite view of the site.

Digital photographs: links to digital photographs will be embedded within the database where appropriate.

CAD Drawings: in order that a detailed analytical text of the stratigraphic information can be produced, phase drawings, sections and other relevant line illustrations, as required, will be drafted. These will provide detailed information on the periods and sub-phases of the site, and will indicate stratigraphically related groups. The draft text and phase drawings will form the basis both of the summary information to be supplied to specialists and of the stratigraphic section of the final published report.

10.6 Glass Manufacturing Waste

Task 5: the glass manufacturing waste will be analysed as follows:

1. Metrical recording of crucible fragments (thickness, diameter estimation, etc)
2. Replacement of cardboard storage boxes with rigid polypropylene boxes
3. Selection of samples and preparation for analysis
4. Chemical analysis of glass:
 - Colourless glass waste
 - Green glass waste
 - Clinker-glass waste
 - Pink glass waste
 - Opaque white glass waste
5. Chemical analysis of refractory ceramic:
 - Crucibles
 - Bricks
 - Tiles

6. Microstructure:
 - Crucible fabric (fine grog)
 - Brick/tile fabric (coarse grog)
7. Integrated chemical analysis and microstructure
 - Crucible-glass interaction
8. Publication report analysing all the above data and comparing it with other data from contemporary sites (Holt *et al* 2014; Willmott *et al* 2012).

All the work will be undertaken by the David Dungworth. Samples for microstructural and chemical analysis will be prepared by embedding in epoxy resin mounts which will be ground and polished to a mirror finish (1-micron). The examination and recording of microstructure will be undertaken using a scanning electron microscope (SEM). Images will be recorded digitally (TIFFs) using a back-scattered electron detector to show atomic number contrast. The determination of chemical composition will be carried out using an energy-dispersive spectrometer (EDS) attached to the SEM. The chemical data will be recorded as oxide weight percentages (stoichiometrically calculated) using a spreadsheet. The use of SEM-EDS allows the collection of spatially-coherent chemical data that can be related to microstructure (cf Dungworth 2008). Report writing will be undertaken by the author drawing on almost 20 years' experience .

10.7 Fragments of Muffle Kiln and Pipe Manufacturing Waste

Task 6: the small number of pieces of muffle kiln and pipe manufacturing waste retrieved during the excavation will be analysed by a clay pipe specialist (most likely Dr David Higgins).

10.8 Detailed Historical Research

Task 7: all relevant documentary, cartographic and photographic information will be studied including Census returns, rate books, trade directories, newspaper articles and contemporary trade journals, especially issues of *The Pottery Gazette and Glass Trade Review*. This information will allow a full historical narrative to be produced.

10.9 Integration of Datasets and Synthesis

Task 8: the information gathered from the analyses will be reviewed and integrated into the stratigraphic narrative. This will allow re-interpretation of the site using a thematic approach.

10.10 Illustrations

Task 9: during each part of the analytical programme, a selection will be made of appropriate material for illustration. This will include general plans and sections, phase plans, and illustrations of artefacts and structural elements.

10.11 *Production of Text and Publication*

Task 10: following the completion of the analysis of the stratigraphic and artefactual evidence, an archive report will be produced. The results of the programme of archaeological works will also be synthesised, and prepared for publication in a suitable academic vehicle (*Section 9.2*).

10.12 *Archive Deposition*

Task 11: Salford Archaeology undertakes to liaise throughout the project with the receiving museum to meet its deposition policies. On completion of the analysis, a discard policy will be implemented (*Section 7.5*). On submission of the completed text for publication, the archive will be updated as necessary and the receiving museum will be contacted to obtain the latest information on its deposition arrangements. Material in files and boxes will be checked, and indices and box lists will be compiled and appended.

The digital archive will be checked and indexed, and hard copies made of the data, if required by the recipient museum. The digital data will be accompanied by metadata, which will explain origin and accuracy.

11. *Presentation of Results*

11.1 *Introduction*

Following the analysis and interpretation of the data, the results should be placed in the public domain, as required by the planning condition. Given the importance of the material, it is anticipated that dissemination will consist of a full archive report.

Archive/Client Report: it is proposed that an archive report is produced, formatted for limited distribution in paper copy to local libraries, the County Record Office, and the HER, in addition to its deposition with the site archive. This will include details of structural and stratigraphic elements of the site and associated activity, and reports on the finds.

Archive Report Structure

A provisional breakdown of the contents of the proposed archive report is provided below. In advance of completion of the full post-excavation analysis, this synopsis can only be regarded as a draft, although it is anticipated that the archive report will work to the following general headings and content:

Summary and Acknowledgements

1 Introduction

Site location

Circumstances of project

2 Archaeological Background

Documentary evidence

Historical background

3 Results of the Archaeological Excavations

Outline of the archaeological works

Description of the development of the site

4 The artefacts

Reports on the artefacts by category, with a brief comment on the significance of the overall assemblage

5 General Discussion

Interpretation of the site, describing the results of the archaeological excavations and what they show about the conditions and changes through space and time within the study area

Bibliography.

12. Other Matters

12.1 Health and Safety

All Salford Archaeology post-excavation work will be carried out under relevant Health and Safety Legislation, including the Health and Safety at Work Act (1974). A copy of the Salford Archaeology *Health and Safety Policy* can be supplied on request. The nature of the work means that the requirements of the following legislation are particularly relevant:

- Workplace (Health, Safety and Welfare) Regulations (1992): offices and finds processing areas;
- Manual Handling Operations Regulations (1992): transport of bulk finds and samples;
- Health and Safety (Display Screen Equipment) Regulations (1992): use of computers for word-processing and database work;
- COSHH (1998): finds conservation and analysis.

12.2 Insurance

The insurance in respect of claims for personal injury to, or the death of, any person under a contract of service with the unit and arising out of the course of such person's employment shall comply with the employers' liability (Compulsory Insurance) Act 1969 and any statutory orders made there under.

12.3 Project Monitoring

Any proposed changes to the project design will be discussed with the client and relevant bodies.

Sources

Cartographic

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Web Resources

<https://www.combemill.co.uk/portfolio-item/portfolio-item-2/>

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Acknowledgements

Salford Archaeology would like to thank Leftfield Investment (Holdings) Limited for commissioning the archaeological works. In particular Salford Archaeology would like to thank Richard Kay for his support during the project. Salford Archaeology would also like to thank Dr Andrew Myers for providing monitoring support and advice through GMAAS.

The on-site excavations were conducted by Mandy Burns, assisted by Andy Coutts, Eleesha Davies and Richard Carter, with support from Graham Mottershead. The site survey was carried out by Sarah Mottershead and the photogrammetric survey carried out by Graham Mottershead. The report was written by Mandy Burns and Graham Mottershead, and illustrated by Sarah Mottershead. The finds section was written by Samantha Rowe. The analysis of the glass manufacturing waste, and assessment of the waste, was carried out and written by David Dungworth. The report was edited by Graham Mottershead, who was also responsible for project management.

Appendix 1: Context List

CfAA CONTEXT RECORD FORM				SHEET NO.
Site: North View		Site Code: NV19/155		Date: 31/10/2019
Context Number [cut]/(fill/layer)	Area no./ Trench/ Co-ords.	Date & Initials	Drawing Numbers	Context Description
(001)	South Corner	31/10/19 M.B		Demolition layer, below concrete surface.
(002)	"	"		Patch of plough soil, West of concrete block.
(003)	"	"		Mixed orange/brown clay below (001) + between (002+004).
(004)	"	"		Patch of plough soil North of (003).
(005)	"	"		Modern concrete raft and steel upright.
(006)	"	"		Black oily clay South of (003), along South edge of (003) linear?
[007]	"	"		Linear through (003) filled by (006).
(008)	"	"		Feature in south western quadrant of furnace.
(009)	"	"		Natural sand, Very orange.
(010)	"	"		Pinky brown natural clay overlaying (009) in places.
(011)	"	"		Foundation layer of wall, one course wide, made with handmade brick.
(012)	"	"		Ceramic drainpipe within cut [007], NE-SW.
(013)	"	"		Similar (011).
(014)	Square 2	"		Demolition rubble from outside furnace.
(015)	"	"		Black soot and brick rubble from inside furnace.
(016)	"	"		Furnace Wall foundations.
(017)	"	04/11/19		Furnace flue sample. Ash/black and red soot. (not retained).
(018)	"	"		Siege ash sample (black and red soot above eastern siege) (not retained).
(019)	"	"		Rubble fill of (008).
(020)	"	"		2" thick deposit on top of cobbles (023).
(021)	"	"		Debris between cobbles (023).

(023)	"	"		Cobbled floor between furnace and flues (removed)
(024)	"	"		Pair of brick, siege bases.
(025)	"	"		Pair of brick, grate supports attached to (024).
(026)	"	"		Brick arch in furnace wall (damaged).
(027)	"	"		Brick, stone and ceramic pipe drain on south side of furnace.
(028)	"	"		Brick feature on west side of (027).
(029)	"	"		Brick wall North of (028).
(030)	"	"		Brick wall on west side of furnace – goes under trench edge.
(031)	"	"		Brick wall outside furnace in-line with internal flue.
(032)	"	"		Stone – flag surface on east side of flue arch (026).
(033)	SE Corner	"		Grey clay pit with 19 th to 20 th Century pottery.
(034)	"	"		Handmade brick wall north of (033).
(035)	"	"		Handmade brick wall.
(036)	"	"		Handmade brick wall parallel to (035) on west side.
(037)	"	"		Large area of stone – flag floor. (removed).
(038)	Square 1	06/11/19		Small pocket of burnt, black material down west side of (031).
[039]	"	"		Foundation cut of (031).
(040)	Square 4	"		Black soot on south side of (013).
(041)	"	"		Mixed light brown rubble south of (040), also to the north.
(042)	"	08/11/19		Cobbles east of furnace (removed).
(043)	"	"		Plough soil patches (contained slipware).
(044)	"	11/11/19		Red silty sand fill of flue (082) above tunnel.
(045)	"	12/11/19		Re-deposited clay (see sq.4).
(046)	"	"		Sand below (045).
(047)	"	"		Cinder with waste glass, fill of cut [048].
[048]	"	"		Foundation cut for main flue seen in square 4.
(049)	"	"		Fill of flue with steps.
(050)	"	"		Fill of chimney, black cinder/clinker on top of (016).

(051)	Square 9	13/11/19		Black ash/ coal/ mixed fill of flue system NE corner.
[052]	Square 2	13/11/19		Brick feature on east side of furnace.
(053)	"	"		Fill of [052].
(054)	Square 7	14/11/19		Brick floor north of (035) + (036).
(055)	"	"		Fire brick laid floor located next to (054).
(056)	"	"		Flag stone floor.
(057)	"	"		Handmade brick wall aligned north – south.
(058)	"	"		Handmade brick wall aligned east – west.
(059)	"	15/11/19		Black cinder with glass waste, below brick floor (054).
(060)	"	"		Mixed light brown clay, below (059) + (054) glass waste.
(061)	Square 1	"		Black cinder on north side of wall (013).
(062)	Square 2	"		Compact grey clay, on top of (064). Rubble fill of squared brick feature.
(063)	"	19/11/19		Single course brick enclosure containing (064).
(064)	Square 2 + 5	"		Slate covered brick "drain", possible air flume.
(065)	Square 2	"		Ceramic drain.
(066)	Square 7	"		Concrete stanchion.
(067)	"	"		Concrete stanchion.
(068)	"	"		Evidence of floor level concrete within (036).
(069)	Square 3	"		Later phase wire cut brick flue. Brick base, NE aligned, sandy lime mortar.
(070)	"	"		Fire brick and wire cut brick wall extension / floor level.
(071)	"	"		Modern services piping.
(072)	"	"		Handmade brick platform bonded with sandy lime mortar.
(073)	"	"		Partial surviving handmade brick archway leading to furnace.
(074)	"	"		Handmade brick floor level, bricks stood on edge.
(075)	"	"		Plough soil / yellow clay.
(076)	"	"		Cobbles – layer above (074).
(077)	"	"		2 course handmade brick archway foundation NW-SE aligned.
(078)	"	"		Same as (077).

(079)	Square 3	19/11/19		Same as (075).
(080)	"	"		Platform foundation layer for (081).
(081)	"			Possible machine bed platform. Mixed brick types used for construction.
(082)	"	"		Flue with partial sloping to the NE of flue. Made with Handmade brick and sandy lime mortar.
(083)	"	"		Flue with stairs (stone) and handmade brick floor.
(084)	"	"		Walls and extended platform of flue (083). Mixed brick construction.
(085)	Square 4	"		3 course brick wall, handmade brick, bonded with sandy lime mortar. NE-SW aligned.
(086)	"	"		2 course handmade brick wall bonded with sandy lime mortar. Warped downwards.
(087)	"	"		Black cinder/ clinker fill next to (085).
(088)	"	"		Darker brown fill – building materials over clay foundation.
(089)	"	"		Black fill possibly old wall. No surviving wall there.
(090)	"	"		Black cinder/clinker fill same as (087).
(091)	"	"		Modern plastic services.
(092)	Square 6	"		Ceramic pipe.
(093)	"	"		2 course handmade brick wall. NW-SE aligned.
(094)	"	"		Modern services.
(095)	"	"		Machine made brick drainage enclosure.
(096)	"	"		Doglegged wall truncated by (094) handmade brick.
(097)	"	"		Stairs (stone) feature within flue (083).
(098)	"	"		Sloping bricks within flue (101) made from mostly firebrick.
(099)	"	"		Enclosed pit with gradual sloping sides.
(100)	"	"		Stone slab (flag).
(101)	"	"		Enclosed flue. Brick bottomed.
(102)	Square 8			Drainage/ air flume system? Brick built end enclosure.

(103)	"	"		2 course brick wall, handmade brick, NE- SE aligned.
(104)	Square 8	19/11/19		Stone flag step.
(105)	"	"		Brick extension wall abuts (103). Handmade brick.
(106)	"	"		Single course wall abuts (103). Handmade brick.
(107)	Square 9	"		Brick floor made from handmade brick.
(108)	"	"		Handmade brick wall, bonded with sandy lime mortar, aligned NE-SW. Abuts (110).
(109)	"	"		Modern services.
(110)	"	"		Mixed brick wall, red sandy mortar. Aligned NE-SW. Fills in (108).
(111)	"	"		2 course outer wall. Aligned NE-SW and NW-SE. Abuts (110) + (119).
(112)	"	"		Blocked flue brick floor.
(113)	"	"		3 course brick wall truncates (112) aligned NW-SE.
(114)	"	"		2 course brick wall truncates (118) NW – SE aligned.
(115)	"	"		3 Course brick wall NE-SW aligned. Abuts (112) and (108).
(116)	"	"		Possible flue feature. Brick bottomed.
(117)	"	"		Flue feature, brick bottomed.
(118)	"	"		Blocked flue – possible continuation of flue (112).
(119)	"	"		Original outer workshop wall. 3 courses, handmade brick.
(120)	"	"		Machine made brick wall – single course.
(121)	"	20/11/19		Layer below brick (116) contained glass waste light brown.
[122]	"	"		Wall cut for (112) flue curved wall.
(123)	"	"		Fill of [122].
(124)	"	"		Brick bottomed alcove.
[125]	Square 4	"		Cut within Sq.4. Black fill (089).
(126)	Square 6	21.11.19		Drainpipe
(127)	"	"		2 course wall abuts (101) + (098).
(128)	Square 2	25/11/19		Fill of original furnace, demolition rubble.
[129]	Square 9	"		Cut of wall (108).

(130)	"	"		Fill of cut [129]
(131)	Square 4	"		Archway from furnace.
(132)	Square 4	25/11/19		Handmade brick wall enclosure south of (131).
[133]	"	"		Wall cut of (132)
(134)	"	"		Fill of [133].
[135]	Square 2	26/11/19		Original cut of furnace outer wall.
(136)	"	"		Fill of [135].
(137)	"	"		Brick layer of inner circle. Right side.
(138)	"	27/11/19		Ceramic drainage feature.
(139)	"	"		Brick layer of inner circle. Left side.
(140)	"	"		Fill of inner circle under (139).
(141)	"	28/11/19		Rubble fill inside furnace, west side, north of (142+150).
(142)	"	"		Rubble fill inside furnace, west side, north of wall (151).
(143)	"	"		Rubble fill inside furnace, west side, north of wall (152).
(144)	"	"		Rubble fill inside furnace, east side, south of wall (147).
(145)	"	"		Rubble fill inside furnace, east side, north of wall (149).
(146)	"	"		Rubble fill inside furnace, east side, south of wall (149).
(147)	"	"		Handmade brick wall inside furnace. East side, south of (128).
(148)	"	"		Handmade brick wall inside furnace. East side, south of (147+144).
(149)	"	"		Handmade brick wall inside furnace. East side, North of (146).
(150)	"	"		Handmade brick wall inside furnace, west side, south of (141).
(151)	"	"		Handmade brick wall inside furnace. West side, south of (142).
(152)	"	"		Handmade brick wall inside furnace. West side, north of (140).
(153)	"	29/11/19		Right side wall of inner furnace.
(154)	"	"		Left side wall of inner furnace.

Appendix 2: Photographic Record

Number	Subdivision	Description	Looking	Initials
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Site Name: North View		Site Code: NV19/155		Sheet * of *: 1 of 10	
Media Type: Canon 1200D			Media Number: M.B		
9592	Square 1	Plough soil (004), linear drain [007]		NE	M.B
9593	“	Plough soil (004) and (002), drain [007]		SW	“
9594-9601	“	Square 1 overlapping shots		NE	“
9602	“	Aerial shot (002;003;004;005;006;007;009;010;013)		SE	“
9603	“	NW facing section		S	“
9604	“	NW facing section		S	“
9605	“	(004) removed and drain [007]		NE	“
9606	“	Drain [007] and fill (006)		S	“
9607	“	Drain [007] and sondage 1		NE	“
9608	“	Drain [007] and sondage 1		NE	“
9609	“	Drain [007] and sondage 1		NE	“
9610	Square 2	FURNACE (016) later phase		NW	“
9611	“	Drain (027;028) overlying feature (029)		N	“
9612	“	E. side of furnace (016) after partial collapse of (024)		E	“
9613	“	FURNACE (016;024) later phase		SE	“
9614	“	W. side of furnace (016) showing (008;024;025;019)		W	“
9615	“	(025) W. detail		W	“
9616	“	FURNACE (016); part of flag floor (037) (removed)		E	“
9617	“	FURNACE (016); part of flag floor (037) (removed)		E	“
9618	“	Drain (027;028) overlying feature (029) Aerial		NE	“
9619	“	FURNACE (016) from above		NE	“
9620	“	FURNACE (016); Flags (037); cobbles (023) (rem) and (042) (rem)		N	“

9621	“	Stone flagged floor (037) (removed)	SE	“
9622	“	Stone flagged floor (037) (removed)	N	“
9623	Square 2	Furnace (016); Flags (037) and cobbles (023)	N	M.B
9624	“	Cobbled Floor (023)	N	“
9625	“	Stone flags (037)	SW	“
9626	“	Stone flags (037)	SW	“
9627	“	Cobbles (023)	SW	“
9628	“	Cobbles (023)	S	“
9629	“	Cobbles (023)	W	“
9630	Square 3/6	Brick flue (081) machine bed?	NE	“
9631	“	Brick flue (081) machine bed?	NE	“
9632	“	Brick flue (081) machine bed?	SW	“
9633	“	Feature (081) and cobbles (023)	SW	A.C
9634	“	Feature (081) showing slumping	SE	“
9635	“	Feature (081) showing slumping	NW	“
9636	“	Feature (081) showing slumping detail	NW	“
9637	“	Feature (081) sloping brickwork	NE	“
9638	“	Feature (081) site of (077; 078)	SW	“
9639	Square 3/2	Flue (077;078) in line with (016)	SE	“
9640	“	Flue (077;078) in line with (016)	SE	“
9641	“	Flue (077;078) in line with (016)	SE	“
9642	“	Flue (077;078) in line with (016)	SE	“
9643	“	Flue (077;078) in line with (016)	SE	“
9644	“	Flue (077;078) in line with (016)	SE	“
9645	“	Flue (077;078) in line with (016)	SE	“
9646	Square 3/6	Feature (081) and (083)	NE	“

9647	“	Feature (081) and (083)	SW	M.B
9648	Square 6	Feature (083); part of (081)	NE	“
9649	Square 6	Feature (083); steps (097)	NE	M.B
9650	“	Feature (083); steps (097)	NE	“
9651	“	Steps (097)	NW	“
9652	Square 9	Machine beds (118)	NW	“
9653	Sq. 3,6,9	Machine beds	SW	“
9654	“	Machine beds	SW	“
9655	Square 9	Machine beds (118)	SE	“
9656	“	Machine beds	SE	“
9657	Square 6/9	Features (097) and (099)	SE	“
9658	“	Machine beds	E	“
9659	“	Machine beds	E	“
9660	“	Machine beds	NE	“
9661	“	Sondage south of (081)	E	“
9662	“	Sondage south of (081)	N	“
9663	Square 3	Brick feature (069)	N	“
9664	“	Brick feature (069)	N	“
9665	All	General shot including furnace (016)	SE	“
9666	Square 3	Furnace and extended features	NE	“
9667	Sq. 3,6,9	Machine beds	N	“
9668	“	Machine beds (from above)	N	“
9669	Square 2	FURNACE (016) (from above)	N	“
9670	Sq. 4,6,7,9	FURNACE (016) (from above)	NE	“
9671	Square 2	Brick feature (052) including (053;065)	W	“
9672	“	Brick feature (063) including (064) and (138)	W	“

9673	“	Furnace and (064;063;138)	W	“
9674	Square 3	Sondage south of machine beds	NW	“
9675	Square 3	Sondage showing flue (077;078)	W	M.B
9676	“	Flue (077;078) detail	W	“
9677	“	Flue (077;078) detail	S	“
9678	Square 7	Brick floor (054 and flags (056)	SW	“
9679	“	Brick floor (054) and flags (056)	SW	“
9680	“	Brick floor (054) detail	SW	“
9681	Sq. 3,6,9	Working shot of staff	NW	“
9682	Square 2	Drains (027;028)	W	“
9683	Square 9	Machine bed (118)	NW	“
9684	Square 2	Drains (027;028)	N	“
9685	“	Drains (027;028) (from above)	N	“
9686	“	Drains (027;028) (from above)	N	“
9687	“	Drains (027;028) (from above)	N	“
9688	Square 7	Brick features (035;036;057)	W	“
9689	“	Brick features (035;036;057) + (034)	S	“
9690	Sq. 4/7	Wall (013;034)	E	“
9691	“	Wall (013;034)	E	“
9692	Square 7	As 9689		“
9693	Sq. 3/6	Machine beds	N	“
9694	Square 8	Sondage section	S	“
9695	“	Sondage section detail	S	“
9696	“	Sondage section	S	“
9697	“	Sondage (Evaluation trench)	W	“
9698	“	Sondage (Evaluation trench)	W	“

9699	"	Sondage (Evaluation trench)	N	"
9700	"	Sondage (Evaluation trench) detail	N	"
9701	Square 2	Furnace detail (East)	E	M.B
9702	"	Furnace detail	E	"
9703	"	Hole in furnace wall (064)	W	"
9704	"	Furnace detail (West)	W	E.D
9705	"	Furnace detail (West)	NW	"
9706	"	Furnace detail (West)	SW	"
9707	"	Furnace brick detail	NW	"
9708	Square 3	Machine bed (083) Clean	W	M.B
9709	"	(083) detail at Western end	W	"
9710	"	(083)	W	"
9711	"	(084)	W	"
9712	"	Brickwork (084) machine beds	W	"
9713	"	Brickwork (084) machine beds	W	"
9714	"	Brickwork (081;083;084)	W	"
9715	"	Brickwork (081;083;084)	NW	"
9716	"	Brick feature (081)	W	"
9717	"	Brick feature (081) detail	W	"
9718	Sq. 6/9	Machine beds	W	"
9719	"	Machine beds	E	"
9720	Square 3	Steps (097) detail	E	"
9721	"	Steps (097) detail	SE	"
9722	"	Brick features (069;070;072)	W	"
9723	"	Brick features (069;070)	SW	"
9724	"	Brick features (069;070) detail	SW	"

9725	"	Brick features (069;070) detail	NE	"
9726	"	Slumped machine bed	N	"
9727	Square 3	Slumped machine bed detail	N	M.B
9728	Square 9	Machine bed (112)	NW	"
9729	"	Machine bed (112)	NW	"
9730	"	Machine bed (112) detail	NW	"
9731	"	Machine bed (112) detail	SE	"
9732	"	Flue detail (112)	W	"
9733	"	Flue detail (112)	W	"
9734	"	Brickwork detail (115;099)	W	"
9735	"	Brickwork detail (115;099)	W	"
9736	"	Brickwork detail (115;099)	E	"
9737	"	Brickwork detail (115;099)	S	"
9738	"	Brickwork detail (115;099)	S	"
9739	"	Brickwork detail (115;099)	S	"
9740	"	Brickwork detail (115;099)	N	"
9741	Square 9	Machine bed (118)	S	"
9742	"	Brickwork detail wall (108)	NW	"
9743	"	Brickwork detail wall (108)	NW	"
9744	"	Brickwork detail wall (112)	W	"
9745	"	Brickwork detail wall (112)	W	"
9746	"	Brickwork detail wall (111)	E	"
9747	"	Brickwork detail floor (116)	E	"
9748	"	Brickwork detail floor (116)	E	"
9749	Square 4	Linear feature [125] fill (089)	NW	"
9750	"	Linear feature [125] fill (089) detail	NW	"

9751	"	Linear feature [125] fill (089) slot	NW	"
9752	"	Linear feature [125] fill (089) slot	SW	"
9753	Square 4	Brick archway/ flue (131) in wall (085)	SE	M.B
9754	"	Brick archway/ flue (131) in wall (085)	SE	"
9755	"	Brick archway/ flue (131) in wall (085)	SE	"
9756	"	Brick archway/ flue (131) in wall (085)	SE	"
9757	"	Brick archway/ flue (131) in wall (085)	SW	"
9758	"	Re-deposited clay, NW of wall (085)	NW	"
9759	Square 3	Wall (078) flue, cut [048] fill (047)	SW	"
9760	"	Wall (078) flue, cut [048] fill (047)	SW	"
9761	"	Wall (078) flue, cut [048] fill (047)	SW	"
9762	"	Wall (078) flue, cut [048] fill (047)	NW	"
9763	"	Wall (078) flue, cut [048] fill (047)	NE	"
9764	Square 2	Brick features (052;053;065)	W	"
9765	"	Brick features (063) and drain (064)	SW	"
9766	Square 9	Brick detail wall (108)	NW	"
9767	Square 4	Flue/ archway detail (131)	SE	"
9768	"	Wall (085)	SW	"
9769	"	Flue entrance/ exit?	NW	"
9770	"	Flue entrance (132) [133] (134)	N	"
9771	"	Flue entrance detail	N	"
9772	"	Flue entrance/ exit	NW	"
9773	Square 2	Feature (008) further excavated	W	E.D
9774	"	Feature (008) further excavated	W	"
9775	"	Feature (008) further excavated	E	"
9776	"	Feature (008) detail	W	"

9777	“	Feature (008) detail	SW	“
9778	“	Feature (008) detail	WNW	“
9779	Square 2	Feature (008) detail	WNW	E.D
9780	Sq. 5/8	Man-hole (102) drain (138)	SW	M.B
9781	“	Man-hole (102) drain (138)	SW	“
9782	“	Man-hole (102) drain (138)	NE	“
9783	“	Man-hole (102) drain (138) detail	NE	“
9784	Sq. 2/5	Man-hole (102) drain (138) detail	NE	“
9785	“	Man-hole (102) drain (138) detail	NE	“
9786	Square 4	Flue/ arch entrance/ exit	NW	A.C
9787	“	Flue/ arch entrance/ exit	NW	“
9788	Square 2	Furnace cut [135]	NE	E.D
9789	“	Furnace cut [135] detail	NE	“
9790	-	Working (staff) shot of AC	-	“
9791	Square 2	Furnace cut [135] (from above)	NE	“
9792	“	Furnace (016)	N	“
9793	-	Furnace – working shot - staff	-	“
9794	Square 2	Furnace from above	NE	“
9795	“	Furnace under excavation	NE	“
9796	“	Furnace under excavation	NE	“
9797	“	Furnace under excavation	NE	“
9798	“	Working shot - staff	-	“
9799	“	Working shot – staff furnace	NE	“
9800	“	Working shot - staff	NE	“
9801	“	Western half of furnace – part excavated	NE	“
9802	“	Western half of furnace under excavation	NE	“

9803	"	Western half of furnace under excavation	NE	"
9804	"	Furnace foundation detail	NE	"
9805	Square 2	Furnace foundation detail	NE	E.D
9806	"	Feature (008)	W	"
9807	"	Feature (008)	N	"
9808	"	Feature (008) detail	N	"
9809	"	Furnace foundation detail	N	"
9810	"	Furnace foundation detail	N	"
9811	"	Furnace foundation detail	N	"
9812	"	Furnace foundation detail	N	"
9813	"	Furnace foundation detail	N	"
9814	"	Furnace foundation detail	NW	"
9815	"	Furnace foundation detail	N	"
9816	"	Furnace foundation detail	N	"
9817	"	Working shot	NW	"
9818	"	Furnace foundation detail	NW	"
9819	"	Furnace foundation detail	NW	"
9820	"	Furnace under excavation	NW	"
9821	"	Working shot - furnace	W	"
9822	"	Eastern half of furnace showing (064)	W	"
9823	"	Eastern half of furnace showing (064)	W	"
9824	"	Feature (138) in wall (016)	W	"
9825	"	Furnace brick detail of (008)	NW	"
9826	"	Furnace brick detail of (016) and (008)	N	"
9827	"	Furnace brick detail of (016) and (008)	N	"
9828	"	Feature (008) further excavated	NW	"

9829	"	Feature (008) further excavated	NW	"
9830	"	Feature (008) further excavated	NW	"
9831	Square 2	Western half of furnace – part excavated	NW	E.D
9832	"	Western half of furnace – part excavated	NW	"
9833	"	Western half of furnace – part excavated	NW	"
9834	"	Western half of furnace – part excavated	W	"
9835	"	Western half of furnace – part excavated	W	"
9836	"	Western half of furnace – part excavated	SE	"
9837	"	Western half of furnace – part excavated	SE	"
9838	"	Western half of furnace – part excavated	NW	"
9839	-	Oyster Shells	-	"
9840	-	Oyster Shells - blurred	-	"
9841	-	Oyster Shells	-	"
9842	Square 2	Furnace under excavation working shot	S	"
9843	"	Early phase furnace eastern half	E	"
9844	"	Early phase furnace eastern half	SE	"
9845	"	Early phase furnace eastern half detail	E	"
9846	"	Early phase furnace Western half	W	M.B
9847	"	Early phase furnace Western half (with A.C.)	W	"
9848	"	Early phase furnace Western half	W	"
9849	"	Furnace fully excavated (from above)	N	"
9850	"	Furnace fully excavated (from above)	N	"
9851	"	Furnace fully excavated (from above)	N	"
9852	"	Furnace fully excavated (from above)	N	"

Appendix 3: Figures

- Figure 1: Site location map
- Figure 2: Excavation trench location plan
- Figure 3: Site boundary superimposed onto Green's map of 1787-94
- Figure 4: Site boundary superimposed onto Bancks & Co's map of 1831
- Figure 5: Site boundary superimposed onto Ordnance Survey 1:1056 (60" to 1 mile) Town Plan 1851
- Figure 6: Site boundary superimposed onto Ordnance Survey 1:500 Town Plan 1891
- Figure 7: Site boundary superimposed onto Ordnance Survey 1:2500 County Series 1908
- Figure 8: Site boundary superimposed onto Ordnance Survey 1:2500 County Series 1922
- Figure 9: Site boundary superimposed onto Ordnance Survey 1:2500 National Grid Series 1949
- Figure 10: Site boundary superimposed onto Ordnance Survey 1:2500 National Grid Series 1966
- Figure 11: Site boundary superimposed onto modern Ordnance Survey digital mapping (2019)
- Figure 12: Outline plan of the excavation results
- Figure 13: Detailed plan of the earliest furnace
- Figure 14: Outline phased plan of the excavation results
- Figure 15: Outline excavation results plan superimposed onto Ordnance Survey 1:500 Town Plan 1891



Figure 1:
Site location



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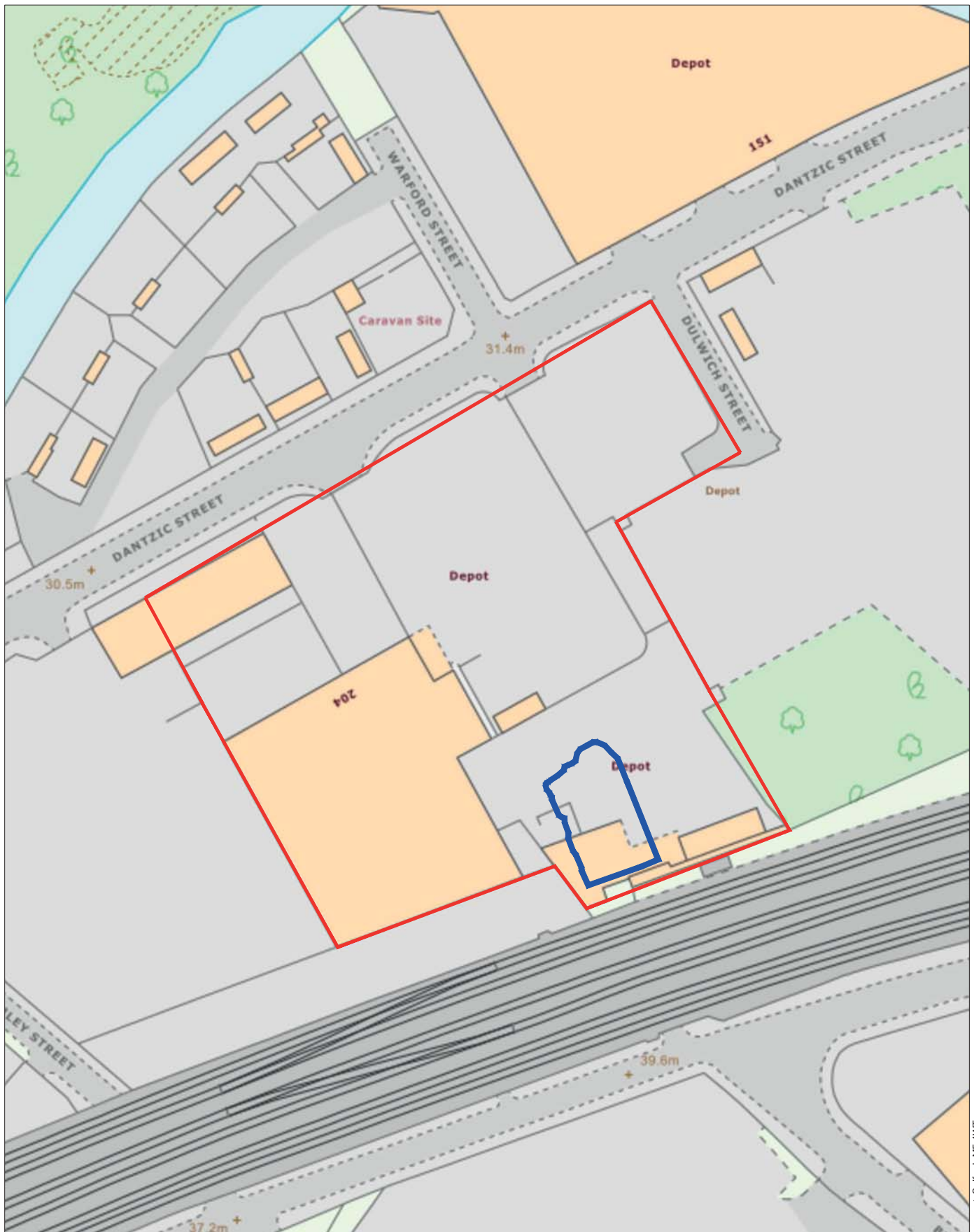


Figure 2:

Location of excavation trench



Key:

- Site boundary
- Archaeological excavation trench



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0 50 m

Scale at A4 1:1000

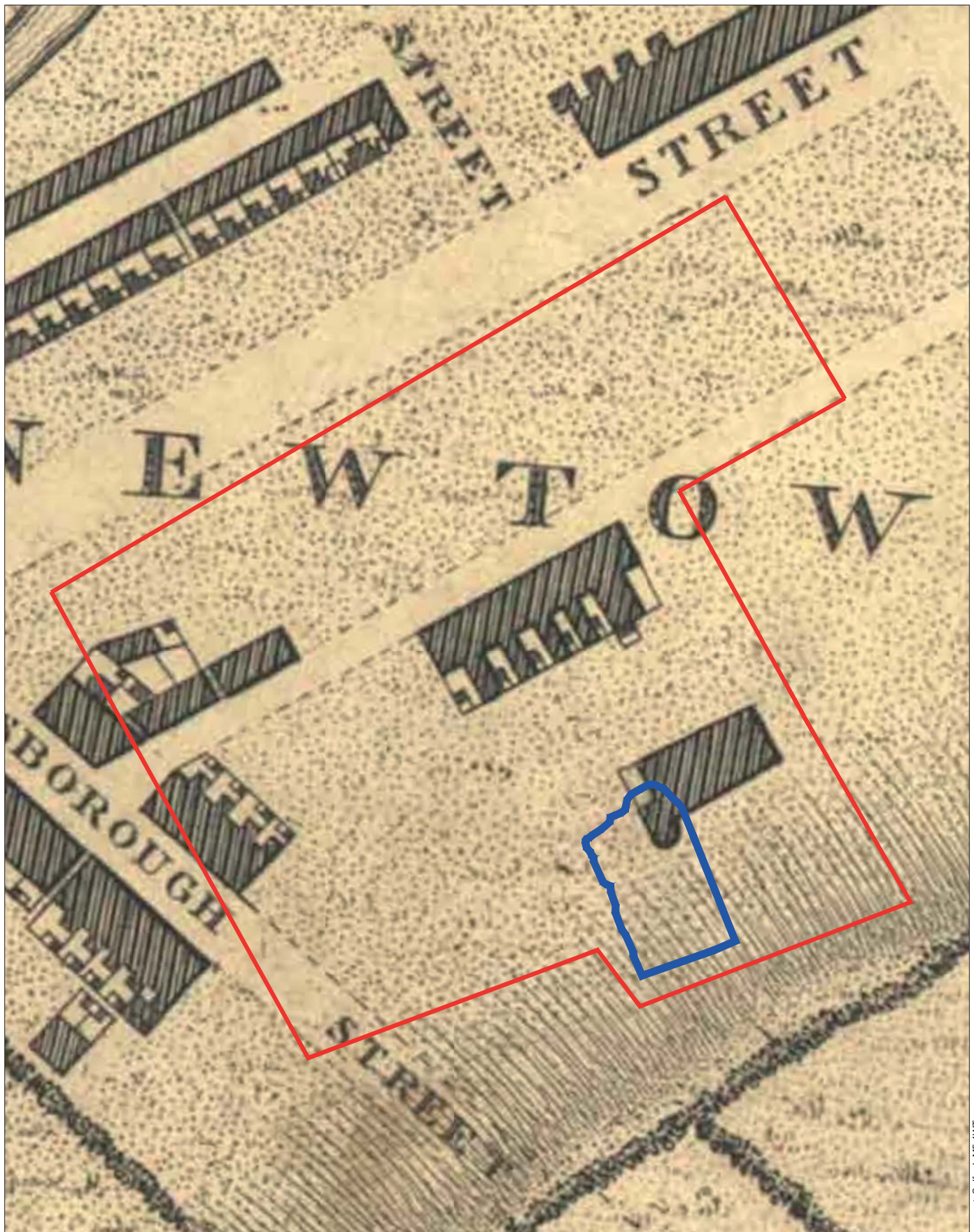


Figure 3:

Site boundary and trench outline superimposed onto Green's map of 1787-94



Key:

- Site boundary
- Trench



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0 50 m



Scale at A4 1:750

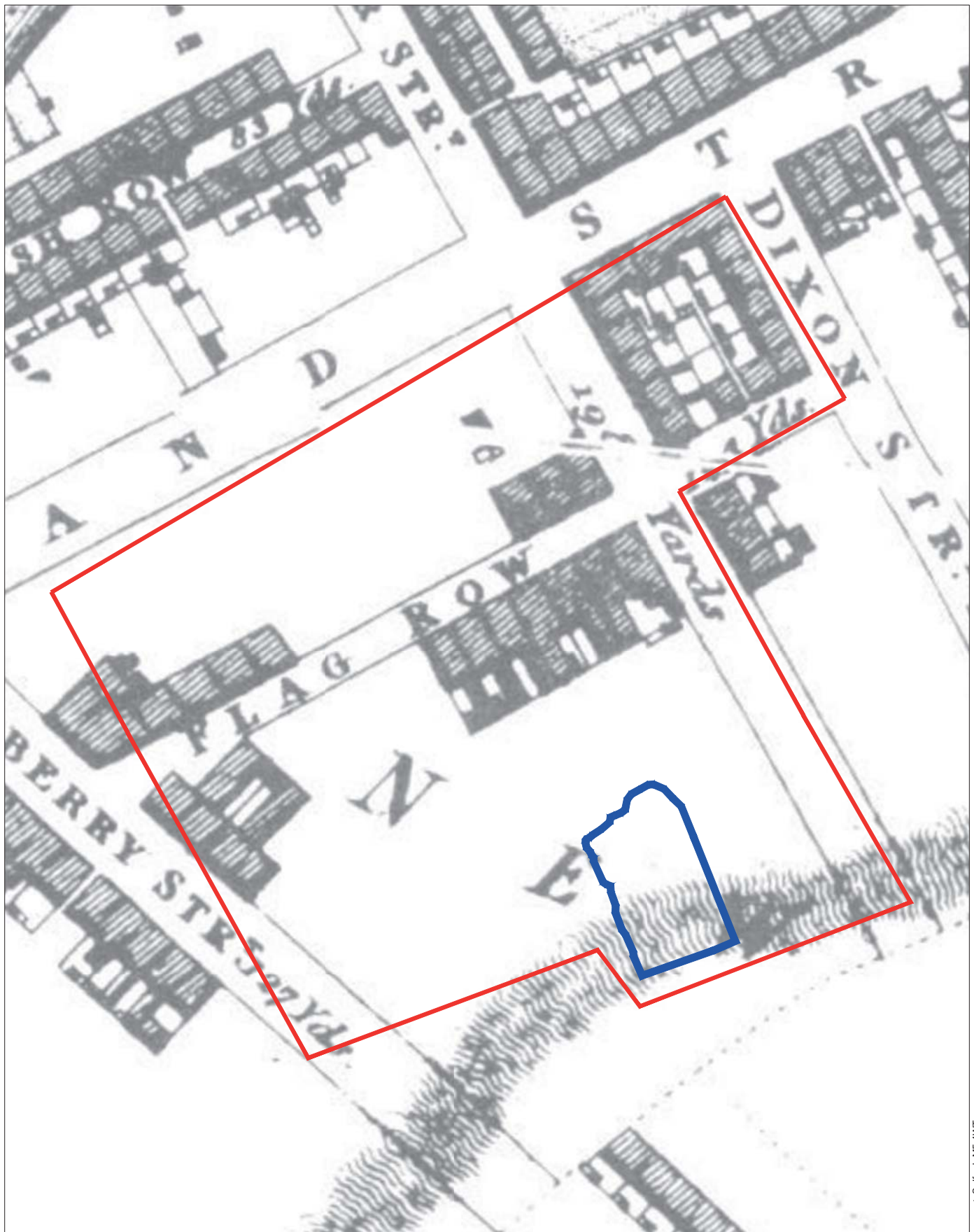


Figure 4:

Site boundary and trench outline superimposed onto Bancks & Co's map of 1831



Key:

- Site boundary
- Trench



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0



50 m

Scale at A4 1:750

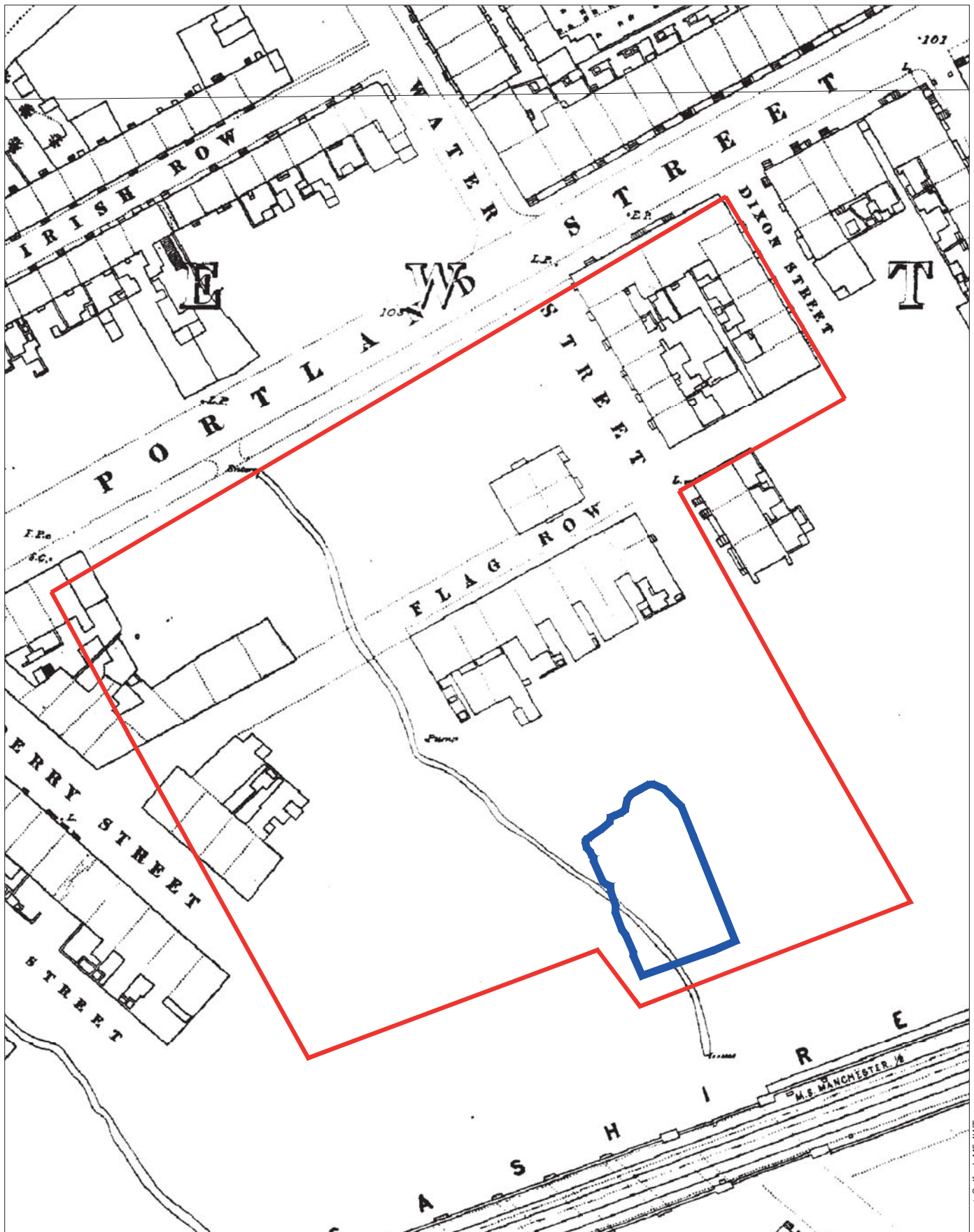


Figure 5:

Site boundary and trench outline superimposed onto Ordnance Survey 60" to 1 mile Town Plan of 1851



Key:

- Site boundary
- Trench



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0

50 m



Scale at A4 1:750

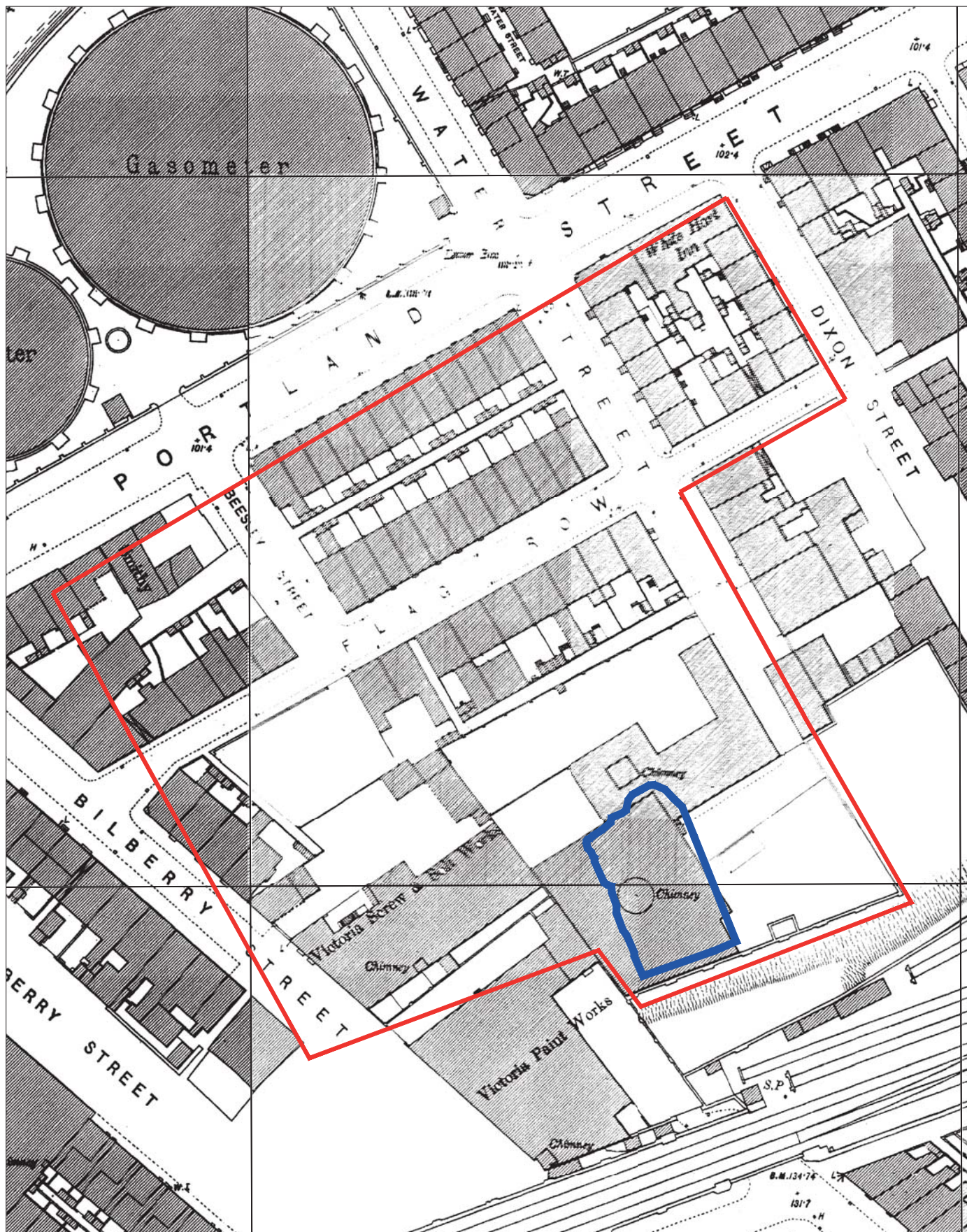


Figure 6:

Site boundary and trench outline superimposed onto Ordnance Survey 1:500 Town Plan of 1891



Key:

- Site boundary
- Trench



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0



50 m

Scale at A4 1:750

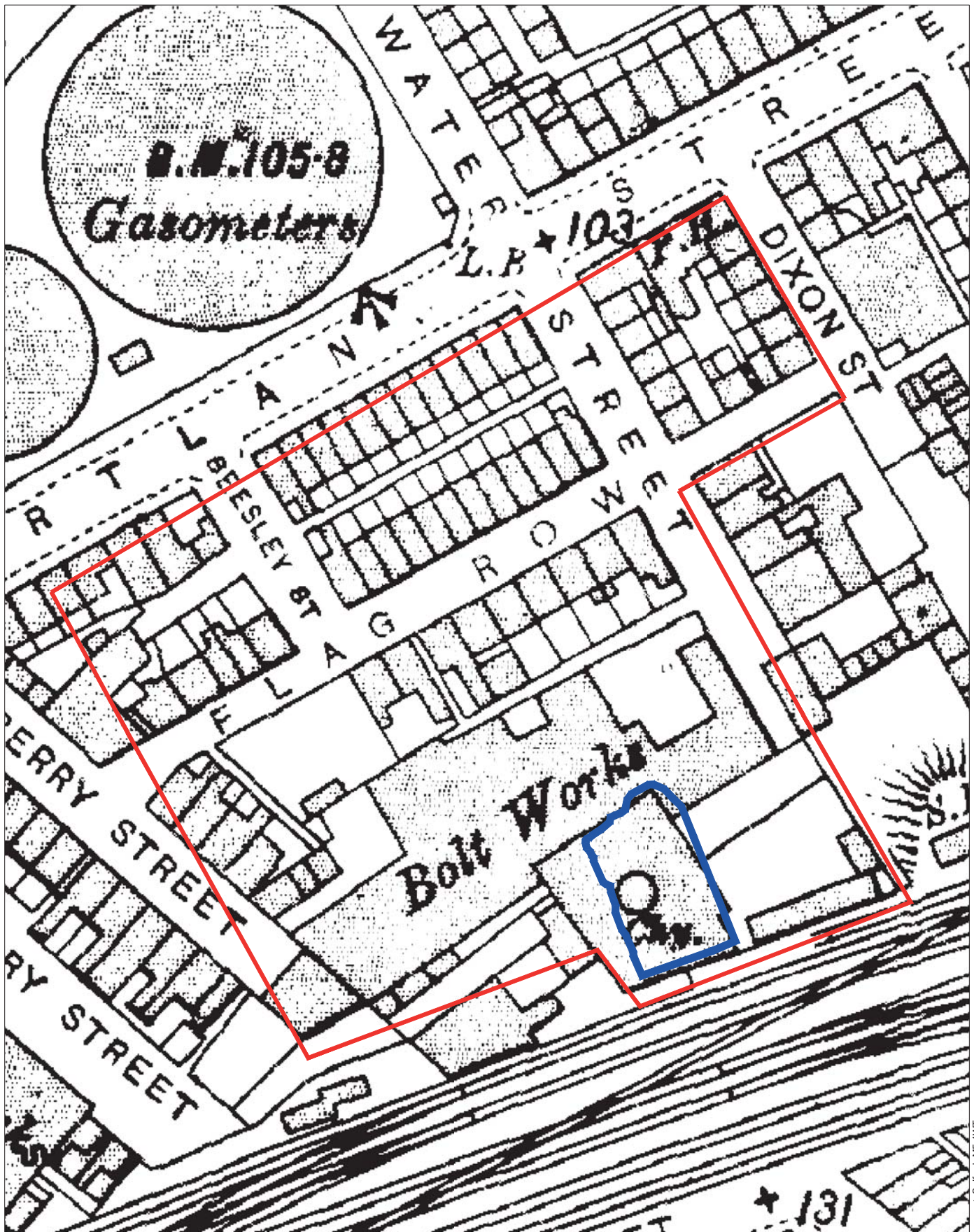


Figure 7:

Site boundary and trench outline superimposed onto Ordnance Survey 1:2500 County Series map of 1908



Key:

- Site boundary
- Trench



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0

50 m



Scale at A4 1:750

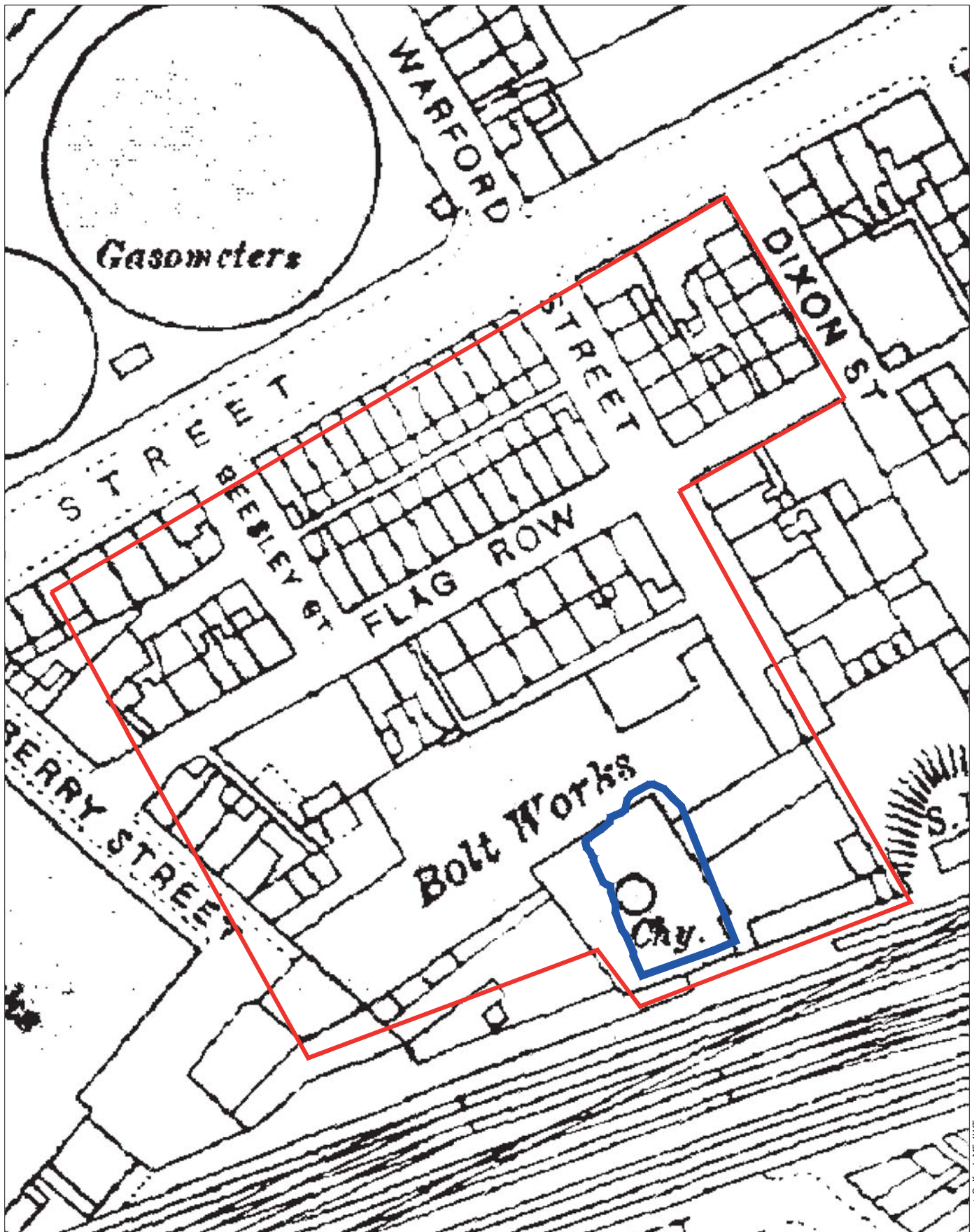


Figure 8:

Site boundary and trench outline superimposed onto Ordnance Survey 1:2500 County Series map of 1922

Key:

- Site boundary
- Trench



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0 50 m

Scale at A4 1:750

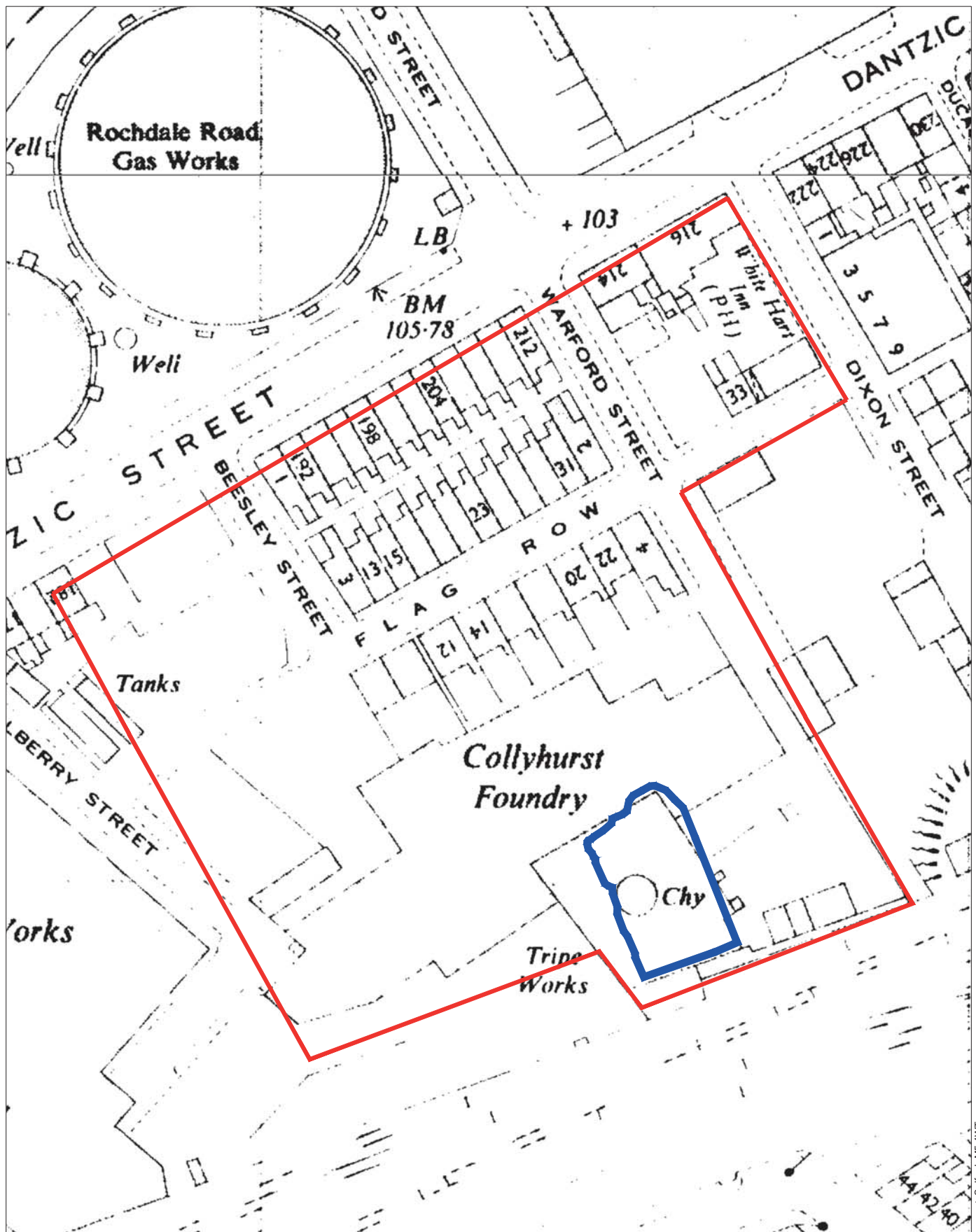


Figure 9:

Site boundary and trench outline superimposed onto Ordnance Survey 1:2500 National Grid Series map of 1949



Key:

- Site boundary
- Trench



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0 50 m

Scale at A4 1:750

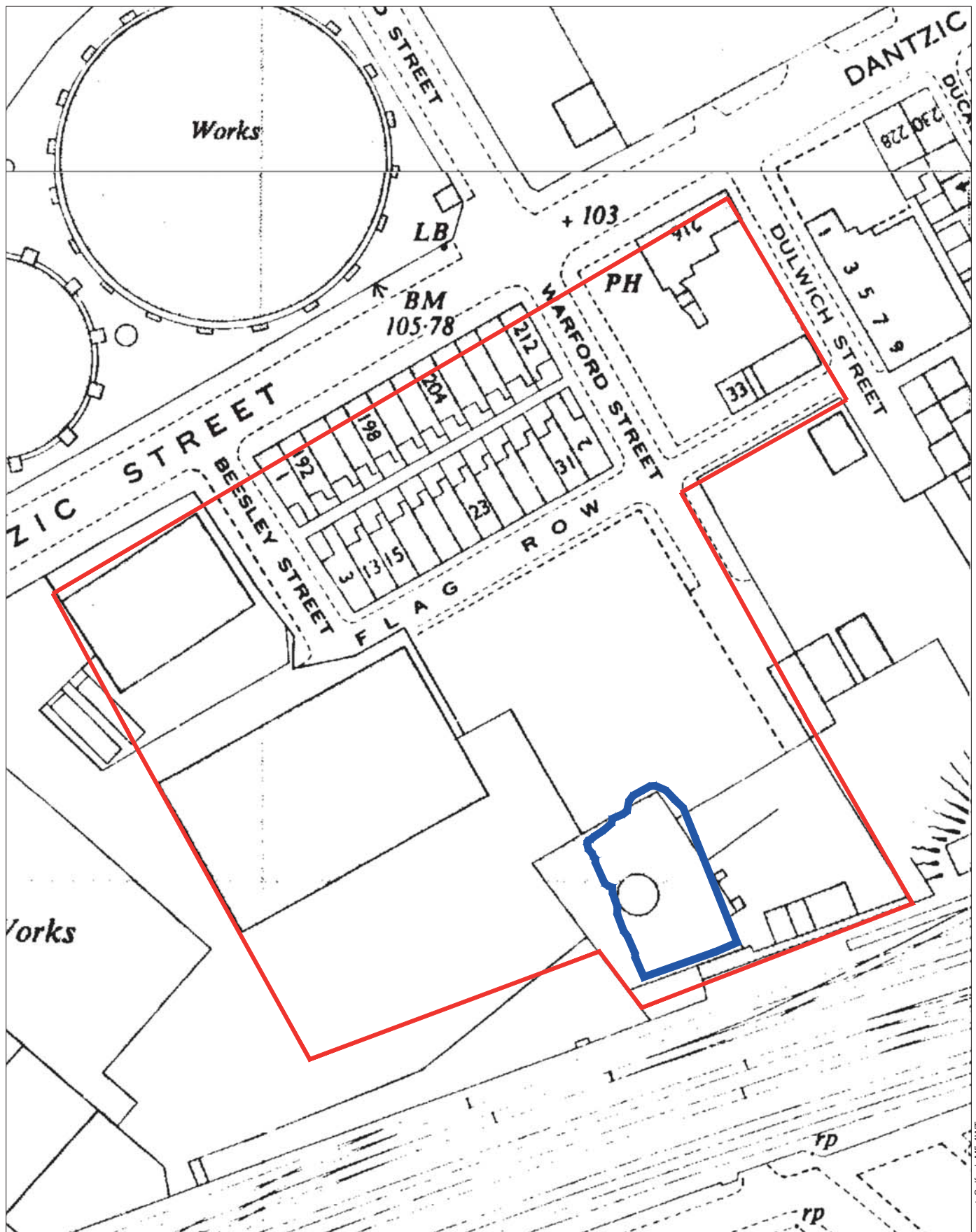


Figure 10:

Site boundary and trench outline superimposed onto Ordnance Survey 1:2500 National Grid Series map of 1966



Key:

- Site boundary
- Trench



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0



50 m

Scale at A4 1:750



Figure 11:

Site boundary and trench outline superimposed onto modern Ordnance Survey digital mapping (2019)



Key:

- Site boundary
- Trench



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0 50 m



Scale at A4 1:750

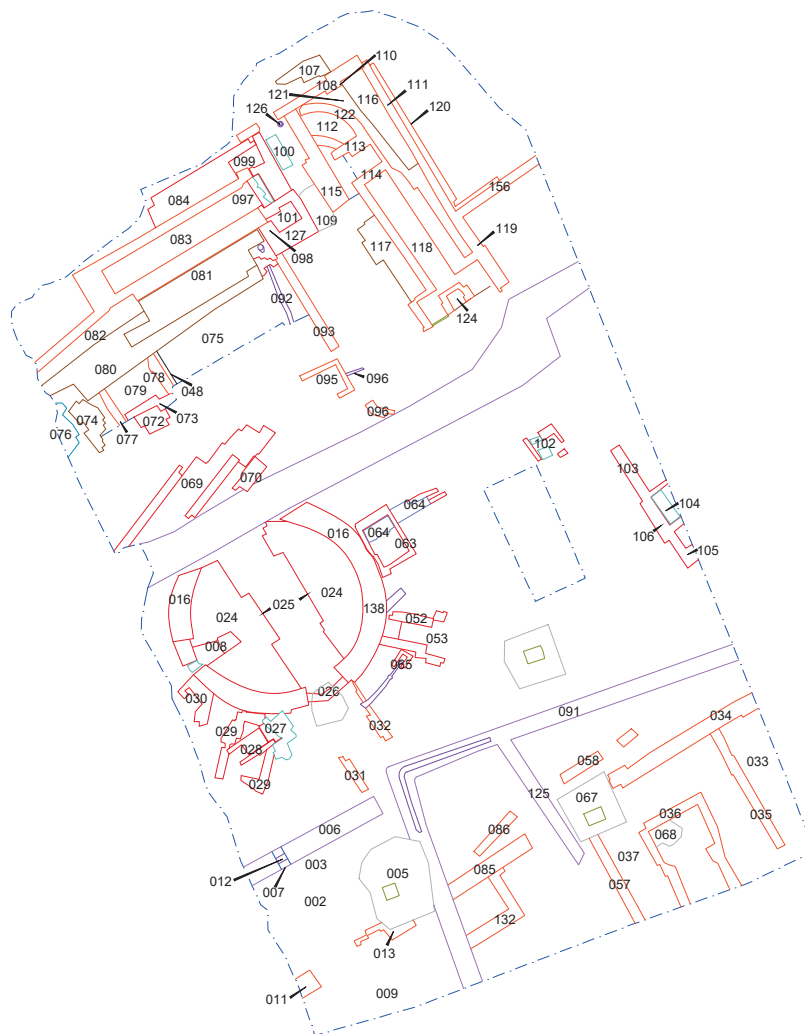


Figure 12:

Outline plan of excavation with contexts annotated



Key:

- | | |
|-----------------|----------------|
| — Brick | — Firebrick |
| — Brick surface | — Metal |
| — Brick wall | — Ceramic pipe |
| — Cobbles | — Slate |
| — Concrete | — Stone |
| — Disturbance | — Trench/LoE |



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0

10 m



Scale at A4 1:200

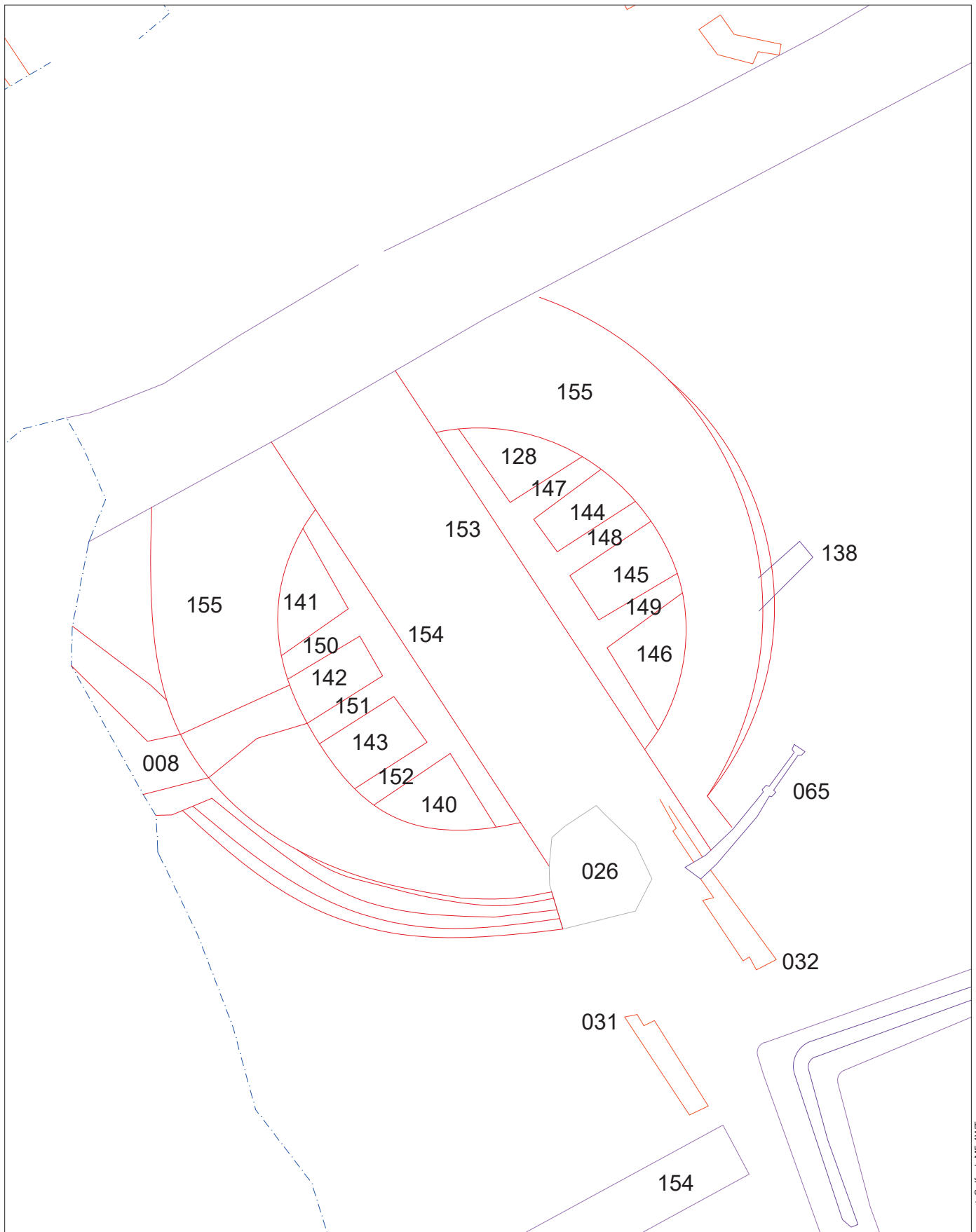


Figure 13:
Detail plan of phase 1 furnace

Key:

- Brick
- Brick wall
- Concrete
- Disturbance
- Pipe
- - - Trench



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0 2 m

Scale at A4 1:50

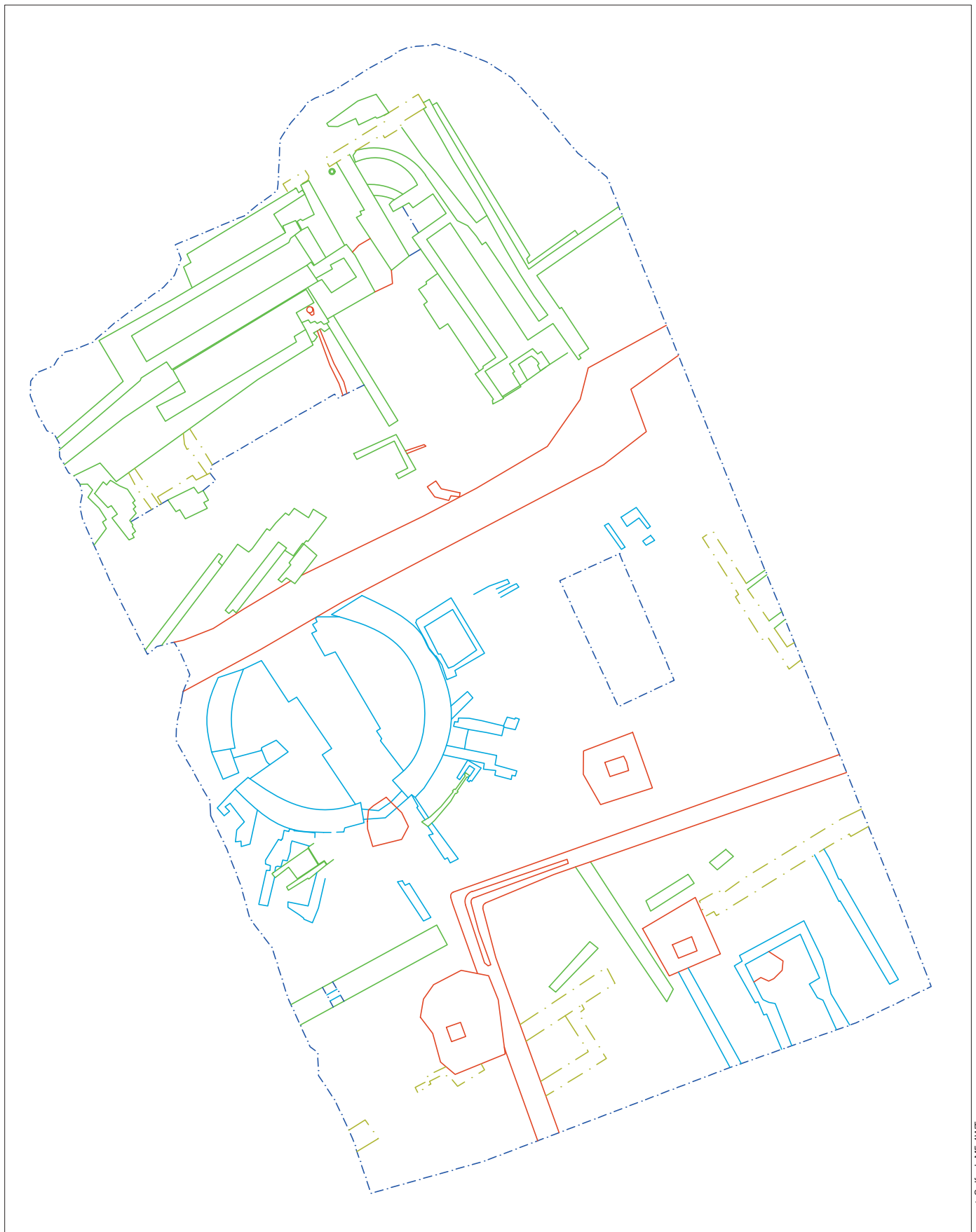


Figure 14:

Phased excavation plan (note - early phase 1 furnace not shown, lies below phase 2 furnace)



Key:

- Phase 1 - original furnace
- Phase 2 - remodelled furnace and works
- Phase 3 - Post glassworks industrial activity
- Phase 4 - Post demolition activity
- - - Trench



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0 50 m

Scale at A4 1:125

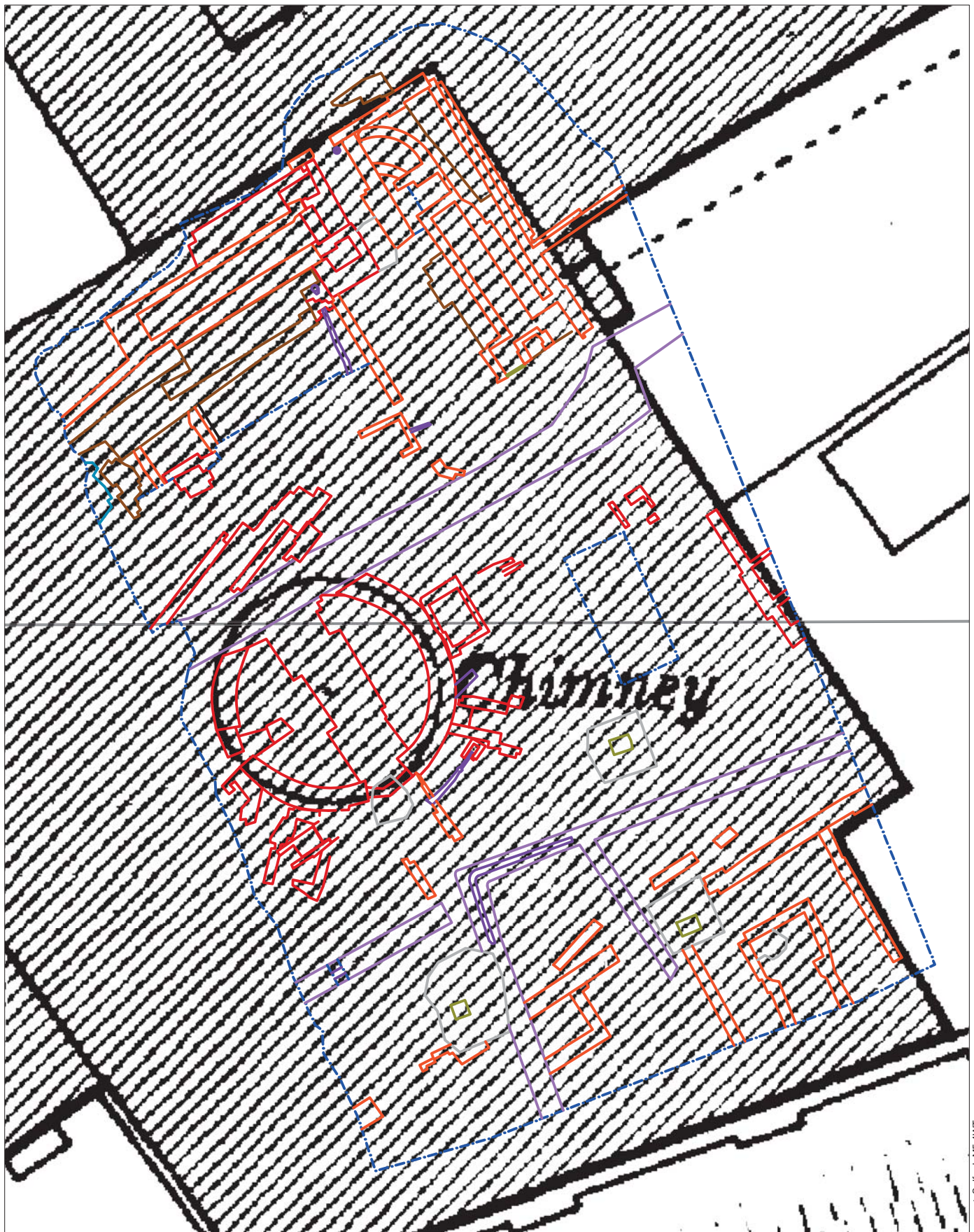


Figure 15:

Excavation plan superimposed onto Ordnance Survey 1:500 Town Plan of 1891



Key:

- | | |
|-----------------|----------------|
| — Brick | — Firebrick |
| — Brick surface | — Metal |
| — Brick wall | — Ceramic pipe |
| — Cobbles | — Slate |
| — Concrete | — Stone |
| — Disturbance | — Trench/LoE |



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0 50 m



Scale at A4 1:125