

**ENERGY RECOVERY FACILITY,
REDCAR,
REDCAR AND CLEVELAND**

**POST-EXCAVATION ASSESSMENT
REPORT**

August 2021

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PRE-CONSTRUCT ARCHAEOLOGY

Energy Recovery Facility, Redcar, Redcar and Cleveland

Post Excavation Assessment Report

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Site Code: ERF21

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ENERGY RECOVERY FACILITY, REDCAR, REDCAR AND CLEVELAND

POST-EXCAVATION ASSESSMENT REPORT

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1. NON-TECHNICAL SUMMARY

- 1.1 Pre-Construct Archaeology Ltd was commissioned by Prospect Archaeology, on behalf of South Tees Development Corporation, to undertake an archaeological investigation prior to development at the site. The development comprised the construction of an Energy Recovery Facility (planning ref. R/2019/0767/00M) at the Grangetown Prairie at National Grid Reference NZ 5438 2123. South Tees Development Corporation (STDC) was granted outline planning permission for development at the site, subject to a condition (no. 7), which required a programme of archaeological work in advance of remediation as the site was formerly home to both the Eston Ironworks and Cleveland Steel Works.
- 1.2 The site has been the subject of two desk-based assessments (Prospect Archaeology 2020 and Tees Archaeology 2019). These both document the long and complex history of use of the site for iron and steel production but came to differing conclusions on the potential for survival and significance of any remains of the 19th century works. Archaeological monitoring (watching brief) of site investigation test pits and a walkover survey has been undertaken by Northern Archaeological Associates (NAA 2020a & b). These schemes of work identified the presence of three surviving blast furnace bases of the Cleveland Steel Works. One is believed to be of 20th century date and the other two of possible 19th century date. The NAA report concluded that arched brick structural remains to the north of the later Cleveland Works furnaces may be furnace flues of the 1850s Eston Ironworks. An area of specific archaeological interest was therefore identified and a Written Scheme of Investigation for further archaeological work at the site was prepared by Prospect Archaeology (2021) and approved by North East Archaeological Research Ltd (NEAR), advisors to the local planning authority.
- 1.3 The scope of the further works was focussed primarily on the upstanding remains of the blast furnaces (Area B) and was to be subject to a scheme of Strip, Map and Record excavation. The area to the east had low archaeological potential and areas to the north, west and south subject to archaeological watching brief during any further SI works and remediation. Around the location of the Eston Ironworks, the watching brief was to be enhanced akin to a strip, map and record.
- 1.4 Prior to this scheme of works being undertaken, the ground level within Area B had been reduced as part of site clearance and as a result numerous structures were demolished and removed. The structures to the east of the rail line, which had been entirely removed, dated to the 20th century and were not of archaeological significance. The area around the blast furnaces to the west had also been reduced. At some point prior to Pre-Construct Archaeology (PCA) commencing the SMR, the blast furnaces were truncated further with the outer parts, including exterior iron bands, removed. The blast furnaces were demolished to only the core of the structures with outer layers of brick removed and were not deemed worthy of preservation. Considerable ground reduction had also taken places across the entirety of

- the watching brief areas, without archaeological supervision, destroying any remains of the Cleveland Steel Works and potentially any remains that may have survived of the Eston Iron Works to the north of Area B.
- 1.5 A single trench (Trench 1) was targeted over the site of the Eston Ironworks, established in 1853 by Henry Bolckow and John Vaughan. No remains survived of the early works which were replaced by the Cleveland Steel Works, established 1874-76, that occupied the majority of the Prairie Site. The heavily truncated remains of the Cleveland Steel Works, dating from the earliest phase c. 1874 up to the final use in the late 20th century were located within Area B.
- 1.6 A total of nine context were assigned within Trench 1 and 337 within Area B that have been split across five broad phases. These comprise Phase 1: Superficial Geology; Phase 2: Agricultural field drains; Phase 3.1 Cleveland Steel Works in the 19th century; Phase 3.2 Cleveland Steel Works in the 20th century and Phase 4: Demolition and modern remains. No remains of archaeological significance were uncovered within Trench 1 with only Phases 1, 2, 3.2 and 4 encountered, however Area B contained significant remains of the Cleveland Steel Works from both Phases 3.1 and 3.2. Structural remains exposed across Area B comprised numerous brick walls, three rail lines, three upstanding blast furnace (Blast Furnace 2, 3 and 4), two blast furnaces demolished to ground level (Blast Furnace 1 and 6), the base of a possible chimney stack and several floor surfaces of concrete, brick and firebrick. These features were all located within Area B to the west of the rail line.
- 1.7 The original three furnaces of the Cleveland Steel Works (Phase 3.1: Blast Furnace 1, 2 and 3) were replaced between 1911 and 1913 with two 'Yankee' furnaces (Phase 3.2: Blast Furnace 4 and 6). Blast Furnace 4 continued in use until 1993. Blast Furnace 5 was constructed in 1937 and continued in use until 1996 and survived to the south of Area B. Due to health and safety constraints only a photographic record was undertaken of BF5 due to concerns raised over a large Salamander perched precariously on top of the structure. It is unclear as to when Blast Furnace 6 was built because it is still extant on the Ordnance Survey map of 1953 so cannot be the Blast Furnace that was constructed between 1911 and 1913 and demolished after the First world War.
- 1.8 Historic accounts suggest that the blast furnaces produced haematite iron for use in Bessemer converters located in the main body of the steel works to the north of Area B. Molten pig-iron was brought by locomotive from the hematite blast furnaces in bogie ladles into the mixing plant within the Cleveland Steel Works before being taken to the Bessemer converters. In 1913, the Bessemer converters were replaced with a set of open-hearth steel making furnaces within the North Steel Plant.
- 1.9 Blast Furnace 1, 2, and 3 were abandoned in the early 20th century and replaced with Blast Furnaces 4 and 6 between 1911 and 1913 with Blast Furnace 5 constructed in 1937. Blast Furnace 4 continued in use until 1993 and BF5 continued in use until 1986. BF6 is recorded to

have been demolished after the First World War however historical mapping shows it was still extant in the mid-20th century.

- 1.10 This post-excavation assessment report has determined that the data is of local significance. Further work, in the form of a short publication about the site may be required. The scope of any such further analysis and publication, if required, would be agreed with North East Archaeological Research Ltd (NEAR) and the commissioning client before being undertaken.

2. INTRODUCTION

2.1 General Background

- 2.1.1 This report details the methodology and results of a programme of archaeological investigation undertaken by Pre-Construct Archaeology Limited (PCA) 11th January to 28th March 2021 at the former site of the Eston Iron Works and Cleveland Steel Works, Redcar. The central National Grid Reference for the site is NZ 5438 2123 (Figure 1 & 2). The work was commissioned by Prospect Archaeology on behalf of South Tees Development Corporation. Prior to the works commencing, a Written Scheme of Investigation (WSI) was prepared by Prospect Archaeology (2020b; updated 2021) and approved by North East Archaeological Research (NEAR), archaeological advisors to the local planning authority.
- 2.1.2 The aim of the archaeological excavation was to determine the extent, date, character, condition, significance and quality of the archaeological remains within the excavation area, in particular the industrial features identified in the previous phase of works.
- 2.1.3 The archaeological project herein described was designed according to the guidelines set out in Management of Research Projects in the Historic Environment (MoRPHE) (English Heritage 2006). In line with MoRPHE guidelines, this Assessment Report sets out a formal review of the data collected during the fieldwork. A range of appendices are included in this assessment which comprise the Figures (Appendix 1), the Context Index (Appendix 2), the Stratigraphic Matrix (Appendix 3), Photographic Plates (Appendix 4), and Brick Assessment (Appendix 5).
- 2.1.4 At the time of writing, the Site Archive, comprising written, drawn, and photographic records is housed at the Durham Office of PCA, The Rope Works, Broadwood View, Chester-le-Street DH3 3AF. When complete, the Site Archive will be deposited with Kirkleatham Museum, Redcar, under the site code ERF21. The Online Access to the Index of Archaeological Investigations (OASIS) reference number for the project is: preconst1-422160.

2.2 Site Location and Description

- 2.2.1 The site is located to the east of John Boyle Road and west of Tees Dock Road, in an area formerly occupied by the Cleveland Steel Works (NGR NZ 5438 2123; Figure 1). The proposed development site occupies an area covering c. 52ha with Area B measuring c. 10ha to the south of the Middlesbrough to Redcar main railway line (Figure 2). It forms part of the larger Grangetown Prairie site. The built elements of the former steelworks had been largely cleared from the site and prior to works commencing the site was a mixture of rubble, hard-standing and other rough ground.

2.3 Geology and Topography

- 2.3.1 Underlying geology at the site is comprised of Devensian Glaciolacustrine deposits of clay and silt overlying Mercia Mudstone bedrock (British Geology Survey website).

- 2.3.2 The site is largely level at c. 9-10m AOD and has been largely cleared of structures. A number of partial pipes and occasional buildings survive, most notably adjacent to the northern boundary where the subway to the north side of the Tees Valley Railway continues to carry pipework.

2.4 Planning Background

- 2.4.1 South Tees Development Corporation (STDC) has been granted outline planning permission (R/2019/0767/00M) for the development of an Energy Recovery Facility (ERF) at the Grangetown Prairie Land of the former Cleveland Steel Works. The permission was subject to a condition (No. 7) which required a programme of archaeological work to be undertaken in advance of remediation:

No phase of development shall take place until a written scheme of investigation (WSI) for archaeological work within that phase has been submitted to and approved in writing by the local planning authority. The WSI shall as a minimum make provision for:

(i) Before remediation or development commences, archaeological evaluation of borehole and trenching data;

(ii) Before remediation or development commences, initial archaeological survey (drawn and photographed) of the whole application site, with particular emphasis on the remains the subject of preservation in situ;

(iii) Where practical and before remediation or construction works takes place on site an archaeological strip, map and sample of remains of high significance suggested by the borehole/trenching data, or observed during the initial survey;

(iv) an archaeological watching brief of all ground disturbance during the remediation works and during construction ground works in areas identified as archaeologically sensitive;

(v) Protection during development, followed by consolidation and preservation of high value remains left in situ;

(vi) a general programme of works and monitoring arrangements, including reasonable notification to the local planning authority of commencement of works;

(vii) details of staff involvement in carrying out the work (including specialists), and their qualifications and responsibilities;

(viii) the timetable for completing post-excavation assessment.

(a) Provision for the analysis, archiving and publication of the results of the archaeological surveys and excavations shall be secured to the satisfaction of the local planning authority by the developer before the development is brought into use.

(b) The development shall not without the prior written approval of the local planning authority be carried out otherwise than in accordance with the approved WSI, and the consolidation and

preservation of on-site remains as provided for in the WSI (or as otherwise agreed at any time in writing by the local planning authority) shall be secured by the developer and/or landowner on an on-going basis.

REASON: The site contains remains of significant archaeological interest, some of which merit preservation in situ.

REASON FOR PRE-COMMENCEMENT: A pre-commencement condition is required to ensure that no remains are disturbed or otherwise compromised by site excavation of other ground works.

- 2.4.2 A Written Scheme of Investigation (WSI) was prepared by Prospect Archaeology Ltd (2020b; updated 2021) detailing the staffing, methodology and timetable of the programme of works for investigation and recording works. This report details the archaeological mitigation undertaken prior to development commencing at the site.

2.5 Archaeological and Historical Background

Much of this background is taken from the desk-based assessment prepared by Tees Archaeology (2019) and Prospect Archaeology Ltd (2020a), the research and writing of the authors is acknowledged.

Pre-Industrial Periods (10,000BC-1750AD)

- 2.5.1 There are no assets within the study area relating to the pre-industrial periods.

Industrial-Modern Periods (1750-present)

- 2.5.2 The first edition Ordnance Survey map of 1857 (Figure 3) shows clearly how the site was largely farmland called The Pastures, on the southern bank of the Tees Estuary. The edge of the dry land is delineated by the Middlesbrough and Redcar Railway with Eston Junction Station (HER 4358), Eston Junction and Lackenby Station (HER 4360) already present. Holme Beck and the Eston Branch head south-east along the western side of the Site, separated by a Bridle Road. Knitting Wife Beck is noted on the eastern side of the Site heading north into the Tees Estuary.
- 2.5.3 Eston Iron Works (HER 5631), located within the western part of the Site, was established by Henry Bolckow and John Vaughan in 1851, initially comprising three blast furnaces, 54 feet high (Rowe & Green 2007). The partnership already owned an iron and engineering works on the Tees at Middlesbrough, blast furnaces at Witton Park, and ironstone mines near Middlesbrough (https://www.gracesguide.co.uk/Bolckow_vaughan_and_Co). Worker's housing was provided in Furnace Row (HER 5627) to the west of the Site. To the south of Furnace Row was Clay Lane Farm representing an earlier economy of the area.
- 2.5.4 Over the course of the following forty years, reclamation of the Tees estuary and the expansion of industrial processing transformed the area. Bernhard Samuelson and John Vaughan built the South Bank Iron Works (HER 5652) just north of the Site in 1853, the works becoming operational the following year. By 1863, Samuelson had sold South Bank to

- Elwon, Malcolm & Co and opened a much larger ironworks at Newport (Prospect Archaeology 2020a). Elwon, Malcolm & Co had already built the Clay Lane Iron Works (HER 5619) in 1858, and Lackenby Iron Works (HER 5659) was constructed in 1871 (Rowe & Green 2007).
- 2.5.5 Bolckow and Vaughan were the leading firm on Teesside in developing steel production as opposed to iron. This took the initial form of the use of Bessemer conversion vessels, four of these were located on 3.7m high platforms in the north-western part of the development area but their precise location is unknown. These were served by a new set of three, 20m high, blast furnaces which were orientated north-south and replaced the original Eston Iron Works, which were demolished (Harrison 1978). The development area was the first location on Teesside at which steel was produced in bulk (Almond 1979, 171-172). Bolckow, Vaughan & Co. Ltd also acquired the South Bank Steelworks in 1879.
- 2.5.6 The massive change to the landscape imparted by the huge Cleveland Iron and Steel Works (HER 6619 & 5633) can be seen in the comparison of the 1857 and 1895 Ordnance Survey maps (Figure 3 and 4 respectively). From a largely agricultural landscape in the mid-19th century with just a small iron works, the landscape becomes entirely dominated by the industrial concerns of Bolckow, Vaughan & Co. The Cleveland Iron Works, which incorporated both the Clay Lane and Bessemer Blast Furnaces, covered a large area of often undifferentiated buildings on the early maps, with multiple internal railways concentrated on the north-western part of the Site, the railways feeding south and west to the mainlines. The Ordnance Survey map of 1895 (Figure 4) provides sufficient detail to identify a total of 11 blast furnaces present within or just outside the western side of the Site (eight belonging to Cleveland Iron Works and three later labelled Bessemer Blast Furnaces of the Cleveland Steel Works).
- 2.5.7 In the southern part of the Site, allotment gardens are shown, associated with the terrace housing of the newly established Grangetown settlement, a small section of which fell within the red line boundary. Station Road connected the settlement with Grangetown Station to the north-east. Further housing, including a terrace called Eston Grange, and allotment gardens were present adjacent to Station Road, within the Site. Eston Low Farm (later Low Grange Farm) was constructed in the later 19th century, indicating a continuing agricultural need locally (HER 6153).
- 2.5.8 To the north of the Site, reclamation of the mudflats is shown by 1895 with internal railways taking waste to create spoil grounds (HER 5632 & 5652). The South Bank Iron Works, and Antonien Works (Phosphate Manure) are shown on the Ordnance Survey map of 1895. The latter was later show as 'Basic Slag Works' (HER 5624). Slag from the various ironworks was processed here and at other locations (e.g. Clay Lane Slag Works HER 5618) to be used in the construction of reclamation walls and also for making 'Scoria Blocks' which were used in paving roads and alleyways (Rowe & Green 2007).

- 2.5.9 Jetties were constructed through the mud beyond the Site from the newly reclaimed land to carry rail lines to wharves on the Tees Bank. Eston Jett (HER 5612) and Clay Lane Jetty (HER 5608) terminated at their respective wharves. The jetties and wharves are no longer shown by 1915 when reclamation had extended the dry land to its current boundary although raised railways and conveyors continued to move materials to and from the riverside. Reclamation walls (HERs 5604 and 6046) are shown north and south along the riverbank from Eston and Clay Lane Wharves.
- 2.5.10 Bolckow, Vaughan & Co Ltd acquired the Clay Lane works in 1900, becoming the largest producers of steel in Great Britain. The original three furnaces of the Cleveland Works were replaced by two 'Bessemer' furnaces between 1911 and 1913 that can be seen on the Ordnance Survey map of 1915 (Figure 5; Tees Archaeology 2019). These were known as 'Yankee' furnaces in that they copied American practice. The name of these was taken from their proximity of the Bessemer converters. One of these (No 4) continued in use until 1993 and the other is recorded to have been demolished after the First World War. An additional furnace (No 5) was constructed in 1937 and continued in use until 1986. These furnaces were served by a 'Hi Line' where the charge was run straight to the top off an elevated rail line. The surviving embankment was part of this rail line, and it was carried to the blast furnaces on metal trestles.
- 2.5.11 The blast furnaces had blast stoves attached to them to provide the hot gases needed to achieve the blast; the location of these also lies within the development area as do the remains of late coke ovens (in the southwestern part of the site), part of a rolling mill, the laboratory and welfare facilities. To the immediate east of the furnaces were cooling towers.
- 2.5.12 In 1913 Bolckow & Vaughan replaced the Bessemer converters with a set of open-hearth steel making furnaces (North Steel Plant). South Steel Plant was constructed during the First World War. These plants lie to the east of the development area, but within the study area. In 1914, Bolckow, Vaughan & Co had a workforce of 18,000 and were specialising in 'Cleveland pig iron, hematite, ferro-manganese and spiegeleisen steel rails and plates, tramrails, ironstone, coal, coke, and by-products such as sulphate of ammonia, benzol, toluol, xylol, sol, naphtha and motor spirit; also fire brick and plate bricks, ground annealed slag and artificial stone. The manufacture of steel was carried on by the acid and basic processes of both Bessemer and Siemens' (https://www.gracesguide.co.uk/Bolckow,_Vaughan_and_Co). The difficult economic circumstances after the war meant that both the North and South Steel Plants were shut down by 1928 (Malcolm 1990; Cowburn 2016), however further industrial buildings were constructed across the site including No 5 Rolling Mill, the laboratories, an engineering works, cranes, railways, cooling ponds and pumping stations. Slight changes can also be seen to the blast furnaces between the Ordnance Survey of 1915 to 1929 (Figure 5 & 6 respectively).

- 2.5.13 In 1929, Bolckow, Vaughan & Co Ltd were effectively bankrupt, forcing them to accept a takeover by Dorman Long and as the economic situation improved prior to the Second World War changes were made. The works flourished following the takeover and the company was renowned for the construction of steel bridges across the world, including the Tyne Bridge and Sydney Harbour Bridge. During the 1930s the Bessemer furnaces were rebuilt and in the 1950s were converted for the production of ferro-manganese and spiegeleisen, used in refining steel from the open-hearth furnaces. The changes to the site can be seen on the Ordnance Survey map of 1953 (Figure 7) where Blast Furnaces 4, 5 and 6 can be seen on the map as square structures with hoists to the east.
- 2.5.14 With the nationalisation of the steel industry in 1967, Dorman Long was absorbed into the newly created British Steel Corporation. Privatisation in 1988 saw the company rebranded as British Steel plc. The last two surviving Bessemer blast furnaces at the works (now Teesside Steelworks HER 1831 formerly Cleveland Steel Works) were No. 5 constructed in 1937 and closed in 1986, and No. 4, built in 1911 and closed in 1993. Clearance of structures from the site took place from the late 1980s onwards and had been completed by the end of the 20th century.

Previous Archaeological Work

- 2.5.15 Archaeological monitoring (watching brief) of geotechnical test pits and a walkover survey has been undertaken by Northern Archaeological Associates (NAA 2020a & b). These identified the presence of three surviving blast furnace bases. One is believed to be of 20th century date and the other two of possibly 19th century date.

3. PROJECT AIMS AND RESEARCH OBJECTIVES

3.1 Project Aims

3.1.1 The aims of the archaeological excavation were set out in a Written Scheme of Investigation for archaeological excavation (Prospect Archaeology 2020; updated 2021). The investigation followed from two earlier phases of desk-based assessment (Tees Archaeology 2019; Prospect Archaeology 2020a), a watching brief (NAA 2020a) and a walkover survey (NAA 2020b).

3.1.2 An area of specific archaeological interest had been identified by the Tees Archaeology desk-based assessment and the programme of works detailed in the WSI focused primarily on that part of the site (Area B). The area to the east had low archaeological potential and areas to the north, west and south were planned to be monitored under archaeological watching brief during any further site investigation works and remediation.

3.1.3 The purpose of the archaeological excavation was to determine and understand the nature, function, and character of the site in its cultural setting. Moreover, the work was undertaken to ensure that all archaeological remains were identified, and, if required, a suitable strategy set in place to mitigate the impact of the development on the historic environment. The excavation area was stripped of modern overburden deposits, with hand cleaning of the archaeological horizons, and the measured survey of the structural elements present across the site.

3.1.4 The project aimed to fulfil the requirements of the local planning authority by undertaking an appropriately specified scheme of archaeological work. The primary aims of the current scheme for investigation were:

- to determine the extent, date, character, condition, significance and quality of archaeological remains within the excavation area, in particular the industrial features identified in the previous phase of work;
- to record in detail all archaeological remains encountered;
- to consider the site within its local, regional, and national context as appropriate;
- to disseminate the results of the archaeological investigation, and advance understanding of the site's archaeology as appropriate;

3.2 Research Objectives

3.2.1 The archaeological work at Cleveland Steel Works provides opportunities to address key research objectives as set out in *Shared visions: The North East Regional Research Framework for the Historic Environment* (NERRF) (Petts & Gerrard 2006). The NERRF highlights the importance of research as a vital element of development-led archaeological work. It sets out key priorities for all periods of the past so that all elements of commercial

archaeological work can be related to wider regional and national priorities for the study of archaeology and the historic environment.

- 3.2.2 The NERRF list the following key priority within the research agenda for the post-medieval period which is of direct relevance to the project: 'PMii- Industrialisation' which observes (Petts & Gerrard 2006, 184):

“Compared with the coal and lead industries, relatively little work has been undertaken on the region’s important iron and steel industry... As regards smelting, the 19th century furnaces of Northumberland, and the remaining evidence for the 19th/20th century Cleveland industry, are of particular value. The development of urban foundries in the 18th century, and forges, rolling mills and engineering works in the later 18th and 19th centuries is also of considerable interest.”

4. ARCHAEOLOGICAL METHODOLOGIES

4.1 Fieldwork

- 4.1.1 All fieldwork was undertaken in accordance with the relevant standard and guidance documents of the Chartered Institute for Archaeologists (CIfA) (CIfA 2014a & b). PCA is a CIfA-Registered Organisation. All fieldwork and post-excavation tasks were also carried out in accordance with the Yorkshire, the Humber & The North East: Regional Statement of Good Practice (SYAS 2011).
- 4.1.2 The specification for the archaeological excavation (Prospect Archaeology 2020b; updated 2021) sets out the research aims and objectives of the project and, in a series of detailed method statements for project execution, described the techniques and approaches to be employed to achieve those aims and objectives. This specification was agreed with North East Archaeological Research (NEAR), advisors to the local planning authority, prior to works commencing.
- 4.1.3 An area of archaeology interest was identified in earlier schemes of desk-based assessment (Tees Archaeology 2019 and Prospect Archaeology 2020a) and walkover survey (NAA 2020b). This area comprised the upstanding remains of three blast furnaces as well as surviving rail lines, surfaces and walls and measured c. 70m east/west by 120m north/south. The area to the east of Area B had low archaeological potential however, the areas to the north, west and south were to be subject to an archaeological watching brief to ascertain the level of truncation from the late 20th century phase of the Cleveland Steel Works. The watching brief was to be enhanced, in its initial stages akin to a strip, map and record, in the area containing the potential remains of the Eston Iron Works.
- 4.1.4 Prior to the archaeological investigation commencing, the ground level within the area had been reduced as part of site clearance and as a result numerous structures were demolished and grubbed out. The structures to the east of the rail line crossing through Area B, and an area to the west of the blast furnaces had been completely removed however they dated to the 20th century and were not of archaeological significance. Within Area B the blast furnaces had been partially demolished leaving only the core of the structures surviving. Considerable ground reduction had also taken place across the watching brief areas, without archaeological supervision destroying any remains of the Cleveland Steel Works and potentially any remains that may have survived of the Eston Iron Works. To mitigate the loss of the Eston Iron Works it was agreed to excavate a single trench (Trench 1: 20m x 2m at base) in an area left untouched by the ground remediation to ascertain whether it had been truncated by the 20th century Cleveland Steel Works. An updated WSI was produced by Prospect Archaeology (2021) that detailed the SMR in Area B and the excavation of Trench 1 to target the remains of the Eston Works that had not been destroyed during ground reduction during the initial stages of the development.

- 4.1.5 Blast Furnace 5 was noted to have survived to the south of Area B however due to the precarious position of a salamander at the top of the structure it was deemed too dangerous to hand clean and a photographic record was undertaken.
- 4.1.6 Ground level within the excavation areas was reduced using a tracked 360° 20-tonne mechanical excavator utilising a toothless ditching bucket. The machine carefully excavated through topsoil until either the first significant archaeological horizon or superficial geology was reached. All ground reduction was carried out under archaeological supervision.
- 4.1.7 Investigation of archaeological levels was undertaken by hand, with cleaning, examination and recording both in plan and section, where appropriate. Cleaning was restricted to portions of probable and certain archaeological features identified during machine removal of overburden. Investigations followed the normal principals of stratigraphic excavation and were conducted in accordance with the methodology set out in PCA's site manual (PCA 2009).
- 4.1.8 Deposits, masonry, timber and cut features were individually recorded on the *pro-forma Context Recording Sheet*. All site records were marked with the unique-number *Site Code* (ERF21). All archaeological features were excavated by hand tools and recorded in plan at 1:20 or in section at 1:10. An overall plan of all archaeological features was compiled using a mixture of GPS survey and hand-drawn plans.
- 4.1.9 A survey grade GPS was used to establish Temporary Bench Marks (TBMs) on the site. The height of all principal strata and features were calculated relative to Ordnance Datum using the TBM and indicated on the appropriate plans and sections in metres above Ordnance Datum (m AOD).
- 4.1.10 A detailed photographic record of the investigations was compiled using digital SLR cameras illustrating in both detail and general context the principal features and finds discovered. The photographic record also included 'working shots' to illustrate more generally the nature of the archaeological operation mounted. All record photographs included a legible graduated metric scale.

4.2 Post-excavation

- 4.2.1 The stratigraphic data generated by the project is represented by the written, drawn and photographic records. A total of nine contexts were assigned in Trench 1 and 337 within Area B (Appendix 2). The contents of the paper and photographic elements of the site archive are quantified in Section 6. Post-excavation work involved checking and collating site records, grouping contexts and phasing the stratigraphic data (Appendix 3).
- 4.2.2 The archaeological features recorded during the archaeological investigation have been placed within five phases of activity: Phase 1: Superficial geology; Phase 2: Field drains; Phase 3.1: Cleveland Steel Works (19th century); Phase 3.2: Cleveland Steel Works (20th century) and Phase 4: Modern remains and demolition (Appendix 3). A written summary of the archaeological sequence was then compiled, as described in Section 5.

- 4.2.3 Artefactual material from the investigations comprised an assemblage of brick samples. An assessment report has been produced including a basic quantification of the material, and a statement of its potential for further analysis. The report is contained in Appendix 5. No ecofactual material was recovered from the investigation.
- 4.2.4 The complete Site Archive, in this case comprising the written, drawn and photographic records (including all material generated electronically during post-excavation) and retained elements of the artefactual assemblage, will be packaged for long term curation.
- 4.2.5 In preparing the Site Archive for deposition, all relevant standards and guideline documents referenced in the Archaeological Archives Forum guidelines document (Brown 2007) will be adhered to, in particular a well-established United Kingdom Institute for Conservation (UKIC) document (Walker, UKIC 1990) and an ClfA publication (ClfA 2014c). The depositional requirements of the body to which the Site Archive will be ultimately transferred will be met in full.
- 4.2.6 At the time of writing the Site Archive is housed at the Durham Office of PCA, The Rope Works, Broadwood View, Chester-le-Street, County Durham, DH3 3AF. When complete, the Site Archive will be deposited with Kirkleatham Museum, Redcar, under the site code ERF21. The Online Access to the Index of Archaeological Investigations (OASIS) reference number for the project is: preconst1-422160.

5. RESULTS: THE ARCHAEOLOGICAL SEQUENCE

During the archaeological investigation, separate stratigraphic entities were assigned unique and individual context numbers, which are indicated in the following text as, for example [123]. The archaeological sequence is described by placing stratigraphic sequences within broad phases, assigned on a site-wide basis in this case. The findings within both Trench 1 and Area B have been grouped together within this section across the five archaeological phases (Contexts from Area B range from 1-338 and in Trench 1 from 1000-1008). An attempt has been made to add interpretation to the data and correlate these phases with recognised historical and geological periods.

5.1 Phase 1: Superficial Geology

- 5.1.1 Phase 1 represents geological material that was only exposed across the base of Trench 1. This comprised firm light greyish yellow silty clay [1007] at 6.40m AOD with patches of the deposit scorched red from industrial processes being undertaken either within the Eston Iron Works or Cleveland Steel Works. Natural deposits were not encountered within Area B.
- 5.1.2 The superficial geological deposits formed two million years ago in the Quaternary Period when the local environment was dominated by ice age conditions. They are glaciolacustrine in origin, formed of fine-grained detrital material from glacial meltwater.

5.2 Phase 2: Pre- 1853 agricultural field drains

- 5.2.1 An agricultural field drain G1 was encountered in Trench 1 and was exposed for 7.62m NW/SE (Figure 8; Plate 1). It was cut into geological deposit [1007] at 1.93m below ground level (6.16m AOD) and comprised a linear cut [1006] with a ceramic pipe that was backfilled with firm light greyish brown silty clay [1005]. The drain clearly predates the Eston Ironworks that was established c. 1853 as map regression shows the western range of the works occupying this area (Figure 3). The remains of the Eston works were truncated during the construction of the Cleveland Steel Works (Figure 4).

5.3 Phase 3.1: Cleveland Steel Works in the 19th century (c. 1874 onwards)

- 5.3.1 Phase 3.1 activity comprises the construction of the Cleveland Steel Works c. 1874-76 that replaced the Eston Iron Works (Figure 8 to 15). The change in the landscape can be seen when comparing the Ordnance Survey map of 1857 (Figure 3) with the Ordnance Survey of 1895 (Figure 4). The Eston works were demolished and replaced with four Bessemer conversion vessels in the north-western part of the development area. These converters were served by a set of three 20m high blast furnaces (Blast Furnaces 1, 2 and 3) that were uncovered on a north/south alignment in the centre of Area B. The map of 1895 (Figure 4) depicts this phase of the works as having three circular blast furnaces with four pairs of circular structures, perhaps blast stoves, to the east. The Hi-Line railway is noted to the east of these and a series of rail sidings to the west of the furnaces. A rail line is also depicted to the west of the blast furnace that continued into the Cleveland Steel Works to the north (Rail line G8).

5.3.2 Due to later phases of activity at the site, chiefly the numerous reconfigurations of the works in the 20th century, the majority of structural features from this phase were heavily truncated. Remnants of the three blast furnaces were uncovered (Blast Furnace 1, 2 and 3) along with a rail line to the west of the furnaces, a substantial pipe duct that ran across the site, a possible blast stove as well as numerous other structures.

Construction levelling and drainage

5.3.3 The initial phase of construction of the Cleveland Works comprised the levelling of the site and the laying down of levelling deposit [1004] in Trench 1 and G3 in Area B. In Trench 1 this comprised soft reddish pink sandy clay [1004] (the colour was derived from industrial processes scorching the ground a reddish hue) up to 0.90m thick at 80.04m AOD. Within Area B the levelling deposits were noted across the excavation area c. 120m NNW/SSE by 36m ENE/WSW and comprised several sandy clay deposits G3 (see table below).

Context	Type	Description	Interpretation
2	Layer	Soft light yellowish brown sandy clay encountered across Area B c. 120m NNW/SSE by 36m, ENE/WSW and >0.30m thick. Highest and lowest level 7.62m and 7.09m AOD respectively.	Construction levelling
111	Layer	Soft dark brownish grey sandy clay exposed to the east of BF4 for >1.40m ENE/WSW X >0.80m NNW/SSE and >0.65m thick. Highest level 7.34m AOD.	Construction levelling
275	Layer	Soft dark brownish grey sandy clay. Exposed at NW corner of Area B for 7.70m NNW/SSE X 16.48m ENE/WSW and >0.15m thick. Highest level and lowest level 7.47m and 6.80m AOD respectively.	Construction levelling

Group 3 Construction levelling for Cleveland Steel Works

5.3.4 Into these deposits were cut the initial structural phase of the Cleveland Steel Works, established c. 1874. In Trench 1 the only remains surviving associated with Phase 3.1 was drain G2 comprised of linear cut [1003], exposed for >3.6m ENE/WSW by 1.24m wide and 1.10m deep. It was backfilled with friable mid greyish brown clayey silt [1002] (Figure 8 and 9).

Context	Type	Description	Interpretation
1002	Fill	Friable mid greyish brown clayey silt with medium sized sub-angular stones and frequent brick fragments. Exposed for >3.6m ENE/WSW x 1.24m wide and >1.10m thick. Highest level 7.06m AOD.	Backfill of drain [1003]
1003	Cut	Linear cut with vertical sides, base unexcavated due to health and safety constraints. >3.6m ENE/WSW x 1.24m wide and >1.10m deep. Highest and lowest level 7.06m and 6.01m (not bottomed) AOD respectively.	Drain feature associated with Cleveland Steel Works.

Group 2 Drain Trench 1

- 5.3.5 No other features survived in Trench 1 relating to Phase 3.1, however, extensive remains survived in Area B.

Western Rail Line (Group 8)

- 5.3.6 Within Area B, a rail line was noted immediately to the west of the blast furnaces (Group 8) that crossed the site for c. 77m NNW/SSE with a track bed c. 2.9m wide (Figure 10; Plate 2 & 3). This rail line can be seen on the Ordnance Survey map of 1895 (Figure 4). It was comprised of western wall [44] (in cut [45]), eastern wall [40] (in cut [41]), four track bed deposits ([26], [316], [299] & [318]), several surviving rail sleepers with rail chairs ([298], [308], [309]), a small section of rail ([297]), small areas of brick surfaces ([36]/[37], [38]/[39], [311]/[315]), a probable buffer stop base ([313], [310], [75]/[76]), and three associated structures/features (walls [292]/[321], [293]/[320], [294]/[319], pipes [295] and [312] and timber [307]) . A section of rail line at the northern end of site had been truncated during the building of Phase 3.2 rail line G44 (Figure 11 & 12), the demolition/remediation works on Blast Furnace 1 (Figure 11) and during later building additions such as concrete structures G50 and G51 that completely removed the northernmost extent (Figure 11).
- 5.3.7 The first phase of construction would have comprised the building of walls [44] and [40] that survived in a fragmentary state along the track bed due to later phases of remediation at the site. Both appear to have stopped just past Blast Furnace 3, where a buffer stop would have likely been located (see below). Both walls ran relatively parallel to the rail line however an off-shoot was noted on the western side of wall [44] (opposite BF2; Figure 12 and 13) and at the northern extent of site with the return of wall [40] to the east (Figure 11). Wall [44] was truncated in this location by a modern concrete structure so it was unclear whether this represented a siding or a structural buttress to the wall. The northern extent of wall [40] does not appear to be a siding and perhaps demarcated the end of the working space around BF1.
- 5.3.8 The track bed of the rail line was comprised of four deposits. To the south of BF1 it was comprised of concrete foundation [316] with ballast/furnace waste [26] forming the upper levels. To the north the track bed was constructed with a foundation of strongly cemented ballast [318] with an upper layer of furnace waste/slag [299]. The change in construction is perhaps due to the materials available rather than a planned change in construction methods. The track bed was roughly level being encountered at 7.66m AOD at the northernmost extent and 7.56m at the southern. A change was also noted in the different materials used for the rail sleepers. In the north, on track bed [299]/[318] the sleepers [298] were a mix of iron (x3) and wood (x2) on which four rail chairs survived on the eastern side, three on the western side and a surviving steel rail line [297] imbedded in Phase 3.2 concrete structure G51 (Figure 14 and 10.6; Plate 4). On the southern half on the rail line only two timber sleepers were encountered ([308] and [309]) although ten timber impressions were noted within upper track bed deposit [26] (Plate 5). Interestingly an off-shoot of the rail line was noted adjacent to Blast Furnace 3 for 3.6m ENE/WSW (Plate 6). Two timber impressions were noted on the siding that would

have serviced the adjacent blast furnace. BF3 was built to accommodate this small section of rail line due to the straight edge of the masonry on the eastern terminus. Molten pig iron would have been taken from the blast furnaces by locomotive in bogie ladles to the Bessemer converters in the main part of the steel works to the north of Area B. This line would have also been used to transport furnace waste to the slag hills to the north of site. These waste materials were used extensively in land reclamation on the banks of the River Tees.

- 5.3.9 To the south of Blast Furnace 3's rail siding was a short section of track bed c. 7m NNW/SSE that terminated with concrete pad [75] in construction cut [76]. Immediately north of this was iron bar [313] and timber base plate (310) within track bed [26] (Figure 14). Four sub-rectangular recesses, showing signs of iron staining, were noted on the top of concrete pad [75] with a rectangular recess 0.57m by 0.08m containing an iron fitting 0.14m by 0.08m in timber [310]. Conceivably concrete pad [75], timber [310] and iron bar [313] formed the base of a buffer stop at the southern end of the rail line. The Ordnance Survey map of 1895 (Figure 4) depicts the line as continuing to the south so the construction of a buffer stop may have been a later addition to the line.
- 5.3.10 Three brick surfaces were noted along the course of the rail line: [311] adjacent to BF3's siding and [36]/[38] between BF2 and BF3. Their purpose is unclear as the track bed would have been firm under foot so there was surely no need to create small areas of brick surface. Other features of unclear purpose comprised timber sleeper [307] aligned NNW/SSE adjacent to BF2, pipe [312] at the southern extent of the line, structures [292], [293], [294] and pipe [295] at the northernmost extent of the line.

Context	Type	Description	Interpretation
26	Layer	Loose to indurated black ballast/furnace waste with occasional inclusions of iron sheeting (1.6m x 0.30m and 0.01m thick) and brick fragments. 12 sleeper impressions within track bed c. 2.20m ENE/WSW x 0.26m wide and 0.09m deep. Exposed for 74.94m NNW/SSE x 3.57m WNW/ESE (BF3 siding) x 2.94m wide and >0.30m thick. Truncated immediately west of BF1. Highest and lowest level 7.66m and 7.56m AOD respectively.	Track bed
36=38	Masonry	Brick surface (mixture of common and firebrick, and fireblock). Southern area 2.86m ENE/WSW x 1.32m NNW/SSE and 0.16m thick. Northern area 4.1m ENE/WSW x 0.95m NNW/SSE and 0.19m thick. Highest and lowest level 7.45m and 7.29m AOD respectively. Brick stamps noted within this surface include BV & Co., H & N and W2 (refer to Appendix 5).	Brick surface with rail line
37=39	Cut	Rectangular cut with vertical sides and flat base. 4.04m ENE/WSW x 2.99m NNW/SSE and 0.19m deep. Highest and lowest level 7.45m 7.19m AOD respectively.	Construction cut for surface [36]=[38]
40	Masonry	Firebrick and common brick wall running	Eastern wall of

		along eastern side of rail line G8. Ten courses visible. Most parts of this wall in the central and southern section truncated however it would have formerly been 72.57m NNW/SSE before returning 2.72m ENE/WSW by 0.64m wide and >0.4m high. Highest and lowest level 7.58m (south) and 7.21m (north) AOD respectively. Bricks stamps from this wall include BV.AP, BV & LC and W2 (refer to Appendix 5).	rail line G8
41	Cut	Vertical sides and presumably flat base (not bottomed). 72.57m NNW/SSE before returning 2.72m ENE/WSW by 0.64m wide and >0.4m high. Highest level 7.58m.	Construction cut for wall [40]
44	Masonry	Firebrick and common brick wall running along western side of rail line G8. Seven courses visible. Survived for 76.41m NNW/SSE x 0.64m wide and >0.40m high. Highest and lowest level 7.59m (south) and 7.29m (north) AOD respectively. Truncated to the west of BF1 by insertion of later railway G44 (Phase 3.2). Possible buttress or structure on western side of wall opposite BF2 for >1.14m WSW/ENE however this is difficult to ascertain due to later truncation during Phase 3.2 and remediation works for proposed development. One of the bricks was stamped W2 (refer to Appendix 5).	Western wall of rail line G8
45	Cut	Vertical sides and presumably flat base (not bottomed). 76.41m NNW/SSE x 0.64m wide and >0.40m deep. Highest level 7.59m AOD.	Construction cut for wall [44]
75	Structure	Concrete pad at southern end of rail line G8. 2.62m ENE/WSW x 1.82m NNW/SSE and >0.05m thick. Highest level 7.38m AOD. Four sub-rectangular recess in top of concrete base with associated iron staining suggest presence of iron buffer stop for rail line.	Concrete base for buffer stop on rail line G8
76	Cut	Rectangular with vertical sides and flat base. 2.62m ENE/WSW x 1.82m NNW/SSE and >0.05m deep. Highest level 7.38m AOD.	Construction cut for concrete buffer stop base [75]
292	Masonry	Firebrick structure adjacent to eastern side of track bed [299] at northern end of G8. 1.26m ENE/WSW x 0.37m NNW/SSE and 0.23m high. Highest level 7.53m AOD. One of the bricks was stamped PESCOD (refer to Appendix 5).	Structure adjacent to rail line G8
293	Masonry	Firebrick, fireblock and common brick structure adjacent to the eastern side of track bed [299] at northern end of G8. 0.87m ENE/WSW x 0.69m NNW/SSE and 0.18m high. Highest level 7.43m AOD. One of the bricks was stamped BV & LC for Bolckow, Vaughan and Leasingthorne Colliery (refer to Appendix 5).	Structure adjacent to rail line G8
294	Masonry	Firebrick and common brick structure adjacent to the eastern side of track bed [299] at northern end of G8. 0.83m ENE/WSW x 0.37m NNW/SSE and 0.11m high. Highest	Structure adjacent to rail line G8

		level 7.35m AOD. One of the bricks was stamped H & N and another HOWDEN (refer to Appendix 5).	
295	Pipe	Fe pipe running below rail line. Survived for 1.17m ENE/WSW and had a diameter of 0.18m. Highest level 7.49m AOD.	Water pipe associated with rail line G8
296	Cut	Linear pipe cut 1.17m ENE/WSW x 0.27m wide and 0.30m deep. Highest and lowest level 7.60m and 7.30m AOD respectively.	Cut for pipe [295]
297	Rail	Surviving metal rail on track bed [299] at northern end of rail line G8. I shaped iron/steel rail survived for 2.44m NNW/SSE x 0.06m wide and 0.14m high. Highest and lowest level 7.84m and 7.83m AOD respectively.	Surviving rail of rail line G8
298	Sleepers	Rail sleepers on track bed [299] comprised of three Fe sleepers and two wooden. Full sleepers 2.15m ENE/WSW x 0.29m wide and 0.09m high. Highest level 7.63m AOD. Six iron rail chairs also survived associated with the sleepers that found have formerly held the rail in place.	Rail sleepers
299	Layer	Indurated black ballast/furnace waste, survived for 6.64m NNW/SSE x 2.79m ENE/WSW and 0.50m thick. Highest and lowest level 7.68m and 7.66m AOD respectively.	Track bed
307	Sleeper	NNW/SSE aligned timber sleeper within track bed [26] (to the west of BF2). 779x231x82mm. Aligned incorrectly to support rail so may have had other function.	Timber sleeper within track bed [26]
308	Sleeper	Rail sleeper 1897 x 215 x 64mm to SW of BF2. Highest level 7.58m AOD.	Rail sleeper
309	Sleeper	Rail sleeper 2444 x 219 x 107mm to SW of BF3. Highest level 7.65m AOD.	Rail sleeper
310	Base plate	Timber base plate at southern extent of rail line adjacent to concrete foundation [75] for buffer stop. 1630 x 280 x 73mm. Fe fittings on top. Highest and lowest level 7.35m and 7.29m AOD respectively.	Timber base plate possibly associated with buffer stop.
311	Masonry	Redbrick and fireblock surface at southern end of rail line. 1.62m ENE/WSW x 0.93m NNW/SSE and 0.10m thick. Highest level 7.65m AOD.	Surface within rail line
312	Pipe	Fe pipe running along western side of wall [40]. Survived for 4.36m NNW/SSE and had a diameter of 0.12m. Highest level 7.61m AOD.	Pipe
313	Metal beam	Fe beam at southern extent of rail line associated with timber baseplate [310]. 2.04m ENE/WSW x 0.1m wide and >0.17m high. Highest level 7.42m AOD. May be associated with buffer stop to the south?	Metal beam at southern extent of rail line G8
315	Cut	Rectangular cut 1.62m ENE/WSW x 0.92m NNW/SSE and 0.10m deep. Highest level 7.65m AOD.	Construction cut for surface [311]
316	Layer	Indurated light grey concrete exposed for 6.8m NNW/SSE x 2.46m ENE/WSW and 0.42m thick. Highest level 7.12m AOD.	Concrete base for rail track

318	Layer	Strongly cemented dark brownish grey ballast at northern end of site below [299]. Survived for 6.85m NNW/SSE x 2.76m ENE/WSW and 0.30m thick. Highest level 7.16m AOD.	Ballast forming base of northern part of rail line
319	Cut	Linear cut with vertical sides and flat base. 0.83m ENE/WSW x 0.37m NNW/SSE and 0.11m deep. Highest level 7.35m AOD.	Construction cut for wall [294]
320	Cut	Linear cut with vertical sides and flat base. 0.87m ENE/WSW x 0.69m NNW/SSE and 0.18m high. Highest level 7.43m AOD.	Construction cut for wall [293]
321	Cut	Linear cut with vertical sides and flat base. 1.26m ENE/WSW x 0.37m NNW/SSE and 0.23m high. Highest level 7.53m AOD.	Construction cut for wall [292]

Group 8 Western Rail Line for Blast Furnace 1 to 3

Blast Furnace 1 (Group 4)

5.3.11 The heavily truncated remains of Blast Furnace 1 were located at the northern end of site and comprised construction cut [252] containing concrete foundation [254] and masonry [254] (Figure 10 & 11; Plate 7). The concrete foundations [254] survived for 18.10m NNW/SSE by 14.5m ENE/WSW however they were truncated in the central and western areas. The demolition of Blast Furnace 1 occurred during the construction of Phase 3.2 Blast Furnace 4. Only a small area of Blast Furnace 1's masonry [254] survived in the south-west corner of the concrete foundations c. 1.17m N/S by 2.69m E/W and 0.25m high at 7.58m AOD (Plate 8). The surviving elements of the furnace were built of firebrick and fireblocks and show that it was formerly circular in shape. No industrial residues were noted within BF1.

Context	Type	Description	Interpretation
252	Cut	Circular cut for Blast Furnace 1. Heavily truncated during construction of Phase 3.2 BF4 and remediation works during the proposed development. Presumably vertical sides and flat base (not excavated). 18.10m NNW/SSE x 14.5m ENE/WSW. Depth unknown (not excavated). Highest level 7.44m AOD.	Construction cut for Blast Furnace 1
253	Structure	Indurated mid grey concrete 18.10m NNW/SSE x 14.5m ENE/WSW. Highest and lowest level 7.44m and 7.34m AOD respectively.	Concrete foundation for BF1
254	Masonry	Remnant of upstanding masonry on SW corner of BF1. Comprised of firebricks and blocks. Only two courses survived for 1.17m N/S x 2.69m E/W and 0.25m high. Highest level 7.58m AOD.	Blast Furnace 1 masonry

Group 4 BF1

Blast Furnace 1 Blast stove base (Group 9) and alteration (Group 10)

5.3.12 To the north of BF1 was a possible blast stove base that comprised a semi-circular construction cut [276] containing concrete foundation [332], brick base [277] and backfill of construction cut [333] (Group 9; Figure 10 & 11; Plate 9). The masonry element was built of a

mixture of firebrick and common brick surviving for seven courses for 10.77m ENE/WSW by 2.56m NNW/SSE and 0.50m high at 7.59m AOD. Structure G10 was added to the northern edge of the blast stove base that comprised a firebrick, fireblock and common brick structure that survived for 1.70m NNW/SSE by 8.18m ENE/WSW and 0.24m high at 7.55m AOD.

5.3.13 Hot-blast was needed for the effective operation of the blast furnaces, so air (blast) was brought from blowing engines to the stoves via pipelines into blast stoves to create a hot-blast. This was then blown into the lower section of the furnace through a series of tuyeres. No elements of the blast stove survived with structures G9 and G10 representing the base of the structure. Historical accounts suggest that eight Cowper stoves (*c. 60 feet high and 25 feet diameter*) were used for the three haematite furnaces on the site (Institution of Mechanical Engineers 1893, 355). These are depicted as four pairs of circular structures to the east of the blast furnaces on the Ordnance Survey map of 1895 (Figure 4). Blast stove base G9 may predate these later stoves as it is not depicted on the 1895 map. Blast would have been taken from a mains line (refer to G11 pipe duct; G12 subsidiary pipe duct for BF1 and G13 subsidiary air supply to BF1 blast stove G9/10) supplied by eight non-condensing beam engines (located to the north of Area B; see Section 7 discussion). Conceivably blast was delivered to blast stove base G9 by air supply G13 immediately to the south. The two stoves shown on the 1895 map (Figure 4) would have received blast from pipe duct G12.

Context	Type	Description	Interpretation
Group 9			
276	Cut	Semi-circular cut with vertical sides and flat base. 10.77m ENE/WSW x 2.56m NNW/SSE and 0.50m deep. Highest and lowest level 7.34m and 6.78m AOD respectively.	Construction cut for blast stove G9
277	Masonry	Firebrick and common brick blast stove surviving for 7 courses. 10.77m ENE/WSW x 2.56m NNW/SSE and 0.50m high. Highest and lowest level 7.59m and 7.26m AOD respectively.	Blast stove
332	Structure	Indurated light grey concrete exposed for >1.22m NNW/SSE x >0.86m ENE/WSW and >0.06m thick. Highest level 6.84m AOD.	Concrete foundation for [277]
333	Fill	Loose mid reddish-brown sand, clinker and slag. >1.22m NNW/SSE x >0.86m ENE/WSW and 0.56m thick. Highest level 7.34m AOD.	Backfill of construction cut [276]
Group 10			
278	Masonry	Firebrick, fireblock and common brick semi-circular wall. Two courses survived to 1.70m NNW/SSE x 8.18m ENE/WSW and 0.24m high. Highest level 7.55m AOD.	Alteration to blast stove by addition of outer wall
334	Cut	Curvilinear construction cut 1.7m NNW/SSE x 8.18m ENE/WSW and 0.24m deep. Highest and lowest level 7.55m and 7.31m AOD respectively.	Construction cut for masonry [278]

Group 9 BF1 blast stove base and G10 alteration

Blast Furnace 2 (Group 5)

- 5.3.14 Blast Furnace 2 was located within the centre of the site and comprised construction cut [23], concrete foundation [22], furnace walls [21] and salamander [20] (Figure 10 & 12; Plate 10 & 11). The concrete foundations survived for 14.71m ENE/WSW by 14.74m NNW/SSE however they were truncated to the north by the construction of Blast Furnace 4 c. 1911 (Phase 3.2).
- 5.3.15 The upstanding structural remains [21] of BF2 survived for 8.02m NNW/SSE by 6.71m ENE/WSW and >3m high however it was clear that much of the furnace had been demolished as in plan it survived for 12.66m NNW/SSW by 9.29m ENE/WSW. The upstanding remains only represented the core of the blast furnace with no external features surviving. The hole furnace was built using firebricks (what were first thought to be scoria or carbon bricks were in fact heat affected firebricks). The top of the furnace was surmounted with a 'salamander'; a deposit of iron and slag that was the result of the remnants of the final use of the furnace which was left in situ once the furnace fell out of use. This waste material appeared to have escaped the core of the furnace as it was noted protruding between the firebricks on the south-western side suggesting a catastrophic failure of the inner structure.
- 5.3.16 No blast stoves survived to the east of the furnace however subsidiary pipe duct G15 did survive that would have carried air from the mains pipe G11 to the Cowper blast stoves of Blast Furnace 2.

Context	Type	Description	Interpretation
20	Metal	Indurated dark orange, brown iron/iron slag. 5.77m NNW/SSE x 5.22m ENE/WSW and >0.70m thick. Highest level 10.89m AOD.	Salamander
21	Masonry	Firebrick and fireblock masonry forming remains of core of BF2. Upstanding remains survived for 8.02m NNW/SSE x 6.71m ENE/WSW and >3m high however remains in plan survived for 12.66m NNW/SSE x 9.29m ENE/WSW. Highest level 10.13m AOD. One of the bricks was stamped BV & Co. for Bolckow, Vaughan & Co (refer to Appendix 5).	Furnace walls
22	Structure	Indurated mid grey concrete, 14.71m ENE/WSW x 14.74m NNW/SSE and >0.20m thick. Highest and lowest level 7.41m and 7.27m AOD.	Concrete foundation
23	Cut	Circular cut with vertical side and presumably flat base (not bottomed). 14.71m ENE/WSW x 14.74m NNW/SSE and >0.20m deep. Highest level 7.41m AOD.	Construction cut for BF2

Group 5 BF2

Blast Furnace 3 (Group 6)

- 5.3.17 Blast Furnace 3 was located in the southern central part of the site and comprised construction cut [35], concrete foundations [34], furnace walls [33] and salamander [32] (Figure 10 & 13; Plate 12 & 13). The concrete foundations [34] survived for 14.06m NNW/SSE by 15.49m ENE/WSW showing the original size of the furnace prior to remediation works

undertaken prior to the proposed development. The upstanding remains of the furnace within Area B survived for 8m NW/SE by 6.47m NE/SW and c. 1.59m high however remains in plan survived for 13.70m NNW/SSE by 14.22m ENE/WSW showing how much of the structure was lost during the remediation works. The walls of the furnace [33] were constructed with firebricks, much like BF2, however unlike BF2, radial bands of iron were noted from the centre of the furnace that were perhaps added to provide much needed structural support (Plate 14).

- 5.3.18 The top of the structure was also surmounted with a 'salamander' [32]; a deposit of iron and slag that was left within the core of the furnace once BF3 was abandoned.
- 5.3.19 Interestingly, BF3 is the only furnace with a dedicated rail siding (see G8 above) with the south-west corner of the structure seemingly built to accommodate bogie ladles awaiting molten iron or wagons for waste slag.
- 5.3.20 No blast stoves survived to the east of the furnace however subsidiary pipe duct G16 was uncovered that would have carried air from the mains pipe G11 to the Cowper blast stoves of Blast Furnace 3.

Context	Type	Description	Interpretation
32	Metal	Indurated dark orange, brown iron/iron slag. 5.30m NNW/SSE x 5.70m ENE/WSW and 1.93m high. Highest level 9.86m AOD.	Salamander
33	Masonry	Firebrick and fireblock masonry forming core of BF3. Upstanding remains survived for 8m NW/SE x 6.47m NE/SW and c. 1.59m high however remains in plan survived for 13.70m NNW/SSE x 14.22m ENE/WSW. Highest level 8.59m AOD. Four Fe bands running from the centre of the blast furnace to the outer perimeter were noted on the western side. Presumably these continued all around the furnace and added structural strength.	Furnace walls
34	Structure	Indurated mid grey concrete, 14.06m NNW/SSE x 15.49m ENE/WSW and >0.05m thick. Highest and lowest level 7.46m and 7.37m AOD respectively.	Concrete foundation
35	Cut	Circular cut with vertical sides and presumably flat base (not bottomed). 14.06m NNW/SSE x 15.49m ENE/WSW and >0.05m deep (not bottomed). Highest level 7.46m AOD.	Construction cut for BF3

Group 6 BF3

Concrete between BF2 and BF3 (Group 7)

- 5.3.21 Between BF2 and BF3 was concrete surface [42] within construction cut [43] that measured 15.86m NNW/SSE by 11.42m ENE/WSW and represented the working area for the steelworkers (Figure 13). It was truncated by Phase 3.2 ENE/WSW pipe trench [9].

Context	Type	Description	Interpretation
42	Surface	Indurated mid grey concrete between BF2	Concrete

		and BF3. 15.86m NNW/SSE x 11.42m ENE/WSW and >0.05m thick. Highest and lowest level 7.43m and 7.36m AOD respectively.	surface between BF2 and BF3
43	Cut	Sub rectangular construction cut with vertical sides and presumably flat base (not bottomed). 15.86m NNW/SSE x 11.42m ENE/WSW and >0.05m deep. Highest level 7.43m AOD.	Construction cut for concrete [42]

Group 7 Concrete surface between BF2 and BF3

Main pipe duct (Group 11) with subsidiary ducts for BF1 (Group 12 & 13), BF2 (Group 15) and BF3 (Group 16)

5.3.22 Main pipe duct G11 was located c. 7.4m to the east of the blast furnaces across Area B. It was exposed for c. 94m NNW/SSE before changing direction to the north-west for >16.7m continuing past the limits of excavation (Figure 10-15). The structure can be split into two elements: the main north/south alignment (Figure 11-15; Plate 15) and the curvilinear element at the northern extent of Area B (Figure 11; Plate 16 & 14). The north/south branch was comprised of brick duct walls [60] within construction cut [61], wall [112], brick arch [249] and mains blast pipe [59]. Brick wall [60] was the main element surviving for a maximum distance of 70m NNW/SSE and to a depth of >1.28m. The structure formed a duct c. 1.36m wide that housed blast pipe [59]; a c. 0.50m diameter pipe that carried air from the blowing engines to the blast stoves of the furnaces. Only the southern 9.38m survived of this pipe as it was likely removed for scrap in the late 20th century when the works were decommissioned. At the base of the structure was a concrete surface (this was not fully exposed due to localised flooding on the site).

5.3.23 At the southern end of the duct, a change in construction materials was noted, with firebrick arch [249] exposed for 20.58m NNW/SSE at the southernmost extent of the structure. This arch would have formerly covered blast pipe [59] for the southern third of the duct although it is unclear where the arch stopped as it was truncated by Phase 3.2 hoist area G38 and structures G54 and G42. A wall [112] was exposed running along the western side of this arch for its entire length however due to the scale of truncation it is unclear what function it served.

5.3.24 The curvilinear element of pipe duct G11 comprised walls [180] and [181] with iron cross beams [183], [184] and [185]. It contained pipes [232] and [233] at the eastern end and pipes [176], [177] and [177] at the western. These pipes presumably once connected to the main pipe [59] in the north/south element of the duct. Walls [180] and [181] were both bonded into wall [60] showing that they were contemporary structures, however unlike the larger duct, the curvilinear section was backfilled with deposit [179] to bury the pipes while they were still in operation.

5.3.25 Along southern wall [181] of the curvilinear section, pipe [300] had been installed within construction cut [330] and bonded into the wall perhaps once connecting to one of the pipes within the duct. An L-shaped wall [182] within construction cut [206] was built alongside this

pipe that was then sealed with surface [287] within cut [286] (Plate 18). This projection of pipe perhaps connected to pipe duct G13 that connected the mains blast duct to blast stove base G9. One of the bricks from [182] was stamped BV & Co. for Bolckow, Vaughan & Co (refer to Appendix 5).

- 5.3.26 Subsidiary air supply G13 was located along the southern extent of blast stove base G9 and comprised rectangular construction cut [288] c. 8.87m ENE/WSW by 1.51m NNW/SSE that housed iron pipes [289] and [290] (Plate 19). This new pipe duct was supported with cross beam [304] and, like the curvilinear section to the north, was immediately backfilled with [291] burying the pipes soon after installation.
- 5.3.27 An additional three subsidiary pipe ducts were noted within Area B connecting the main blast pipeline G11 to the former blast stoves of each of the three furnaces. These comprised G12 for BF1 (Plate 20), G15 for BF2 (Plate 21) and G16 for BF3 (Plate 22). The ducts were all built of brick with concrete floors and an internal channel c. 5.6m ENE/WSW by 0.70m wide that contained an iron pipe. Within the subsidiary duct of BF 2 and 3 (G15 and G167 respectively) the pipes were truncated at either end however in BF1's duct the pipe continued into main blast pipe duct G11. Here the pipe dropped down to the base of the structure perhaps formerly connecting to the now removed blast pipe [59]. The western end of the pipe was also noted to rise out the subsidiary duct and was then likely split between a pair of blast stoves for each respective furnace. No remains survived of these stoves however they are shown on the Ordnance Survey map of 1895 (Figure 4) that likely corresponds to the areas where later Phase 3.2 surfaces [40], [238], [18], [13], [11] and [30] were uncovered.
- 5.3.28 Blast for the stoves was produced at a pressure of 5¼ lbs. per square inch from eight non-condensing beam engines to the north of the Area B. This blast was then heated to c. 1450°F in eight Cowper stoves 60 feet high by 25 feet diameter to create the hot blast for the three furnaces.

Context	Type	Description	Interpretation
Group 11			
59	Pipe	Fe pipe at southern extent of site. Survived for 9.38m NNW/SSE and had a diameter of 0.50m. Highest and lowest level 7.39m and 7.48m AOD respectively.	Main iron pipe in pipe duct
60	Masonry	Brick pipe duct running a total length of 93.92m NNW/SSE although southern 20.6m are formed by walls [112] and [249]. Walls between 0.61m and 0.50m wide and at least 1.28m high. Internally the structure is 1.36m wide and externally 2.37m wide. Fe cross bars noted to be bonded across both sides of walls adding strength to the structure. At northern end the duct stopped with a shallower duct running off to the NW formed by walls [180] and [181]. Highest and lowest level on top of the structure 7.41m and 7.21m AOD respectively. Lowest level on base of	Brick pipe duct

		structure 5.98m AOD at northern end of duct. One of the bricks was stamped BOV... or BOW... (refer to Appendix 5).	
61	Cut	Linear cut running >73.28m NNW/SSE x 2.37m wide and >1.28m deep. Highest and lowest level 7.41m and 5.98m AOD respectively.	Construction cut for pipe duct walls [60]
112	Masonry	Common brick wall at southern extent of pipe duct only noted along western side. 15.94m NNW/SSE x 0.37m wide. At least 1 course high (not excavated). Highest and lowest level 7.40m and 7.36m AOD respectively.	Pipe duct wall at southern extent
176	Pipe	Fe pipe exposed for 2.71m NNW/SSE. Truncated at southern end with a diameter of 0.33m. Highest level 7.40m AOD.	Pipe at end of NNW/SSE alignment of pipe duct between walls [180] and [181]
177	Pipe	Fe pipe 0.80m NNW/SSE with a diameter of 0.27m. Possible junction box at southern end with down pipe 0.17m internal diameter and 0.50m deep. Highest level 7.43m AOD.	Pipe at end of NNW/SSE alignment of pipe duct between walls [180] and [181]
178	Pipe	Fe pipe exposed for 5.03m NW/SE with an external diameter of 0.35m. Highest and lowest level 7.07m and 7.05m AOD respectively.	Pipe at end of NNW/SSE alignment of pipe duct between walls [180] and [181]
179	Fill	Loose black clayey silt backfill of duct between walls [180] and [181]. Exposed for 5.03m NW/SE x 1.05m NE/SE and >0.55m thick. Highest and lowest level 7.49m and 7.27m AOD respectively.	Backfill of north-western pipe duct in [205]
180	Masonry	Common brick curvilinear wall bonded into northern extent of pipe duct wall [60]. At eastern end it was exposed for c. 2m NNW/SSE and was 0.51m wide and >0.55m high. It continued out of the LOE but returned to the west for an additional 5.06m NW/SE (total length c. 14.69m). Highest and lowest level 7.49m and 7.06m AOD respectively. One of the bricks was stamped H & N (refer to Appendix 5).	NE wall of curvilinear pipe duct within [205]
181	Masonry	Common brick curvilinear wall bonded into northern extent of pipe duct wall [60]. Exposed for c. 15.64m NW/SE x 0.36m wide and >0.55m high. From pipe duct wall [60] the wall was on a NW/SE alignment, before changing to WSW/ENE and then curving back towards the north and continuing passed the LOE. Highest and lowest level 7.49m and 7.29m AOD respectively. Brick stamps noted from this wall comprised BV & LC, C & M, N.HOGG, NEWFIELD and PESCOD (refer to Appendix 5).	SW wall of curvilinear channel within [205]
182	Masonry	L-shaped wall built on top of wall [181] c. 2.61m NNW/SSE x 1.43m WSW/ENE x	L-shaped wall within

		0.37m wide and >0.36m high. Highest level 7.31m AOD. One of the bricks was stamped C & N (refer to Appendix 5).	construction cut [205] built on top of curvilinear wall [181]
183	Metal	Iron cross bar between walls [180] and [181] c. 1m NE/SW x 0.15m wide and 0.07m thick. Highest level 7.10m AOD.	Fe crossbar between walls [180] and [181]
184	Metal	Iron cross bar between walls [180] and [181] c. 1.08m NE/SW x 0.12m wide and 0.07m thick. Highest level 7.13m AOD	Fe crossbar between walls [180] and [181]
185	Metal	Iron cross bar between walls [180] and [181] c. 1.04m NNE/SSW x 0.13m wide and 0.05m thick. Highest level 7.14m AOD.	Fe crossbar between walls [180] and [181]
205	Cut	Construction cut for curvilinear pipe duct walls [180] and [181]. Exposed for >15.64m NW/SE x 1.85m wide and >0.55m deep (not bottomed). Highest level 7.49m AOD.	Construction cut for pipe duct walls [180] and [181]
206	Cut	L-shaped cut for wall [182] c. 2.61m NNW/SSE x 1.43m WSW/ENE x 0.37m wide and >0.36m high (not bottomed). Highest level 7.31m AOD.	Construction cut for wall [182]
232	Pipe	Iron pipe >4.9m NW/SE and 0.27m diameter between walls [180] and [181]. Truncated at SE end but thought to connect with pipe [59] in main pipe duct. Highest level 7.04m AOD.	Fe pipe in duct [180]/[181]
233	Pipe	Iron pipe >6.45m NW/SE and 0.17m diameter between walls [180] and [181]. Truncated at SE end but thought to connect with pipe [59] in main pipe duct. Highest level 7.07m AOD.	Fe pipe in duct [180]/[181]
249	Masonry	Firebrick arch at southern end of pipe duct. Four courses visible above ground water level that would have once covered pipe [59]. The wall on the western side of the duct survived for 20.58m NNW/SSE x 0.24m wide at 7.34m AOD and the eastern side survived for 11.91m NNW/SSE x 0.24m wide at 7.40m AOD. The arch survived to over >>0.40m before disappearing below water line of the flooded duct. One of the bricks was stamped BV & Co. (refer to Appendix 5).	N-S duct walls forming arch over pipe [59] at southern extent of main pipe duct
286	Cut	Construction cut c. 0.50m NNW/SSE x 0.58m ENE/WSW and 0.12m deep. Highest level 7.27m AOD.	Construction cut for surface [287]
287	Masonry	Brick surface in corner of wall [182] above pipe [300]. 0.50m NNW/SSE x 0.58m ENE/WSW and 0.12m thick. Highest level 7.27m AOD. One of the bricks was stamped H & N (refer to Appendix 5).	surface in [286]
300	Pipe	Iron pipe exposed for 2.53m NNW/SSE with a diameter of 0.30m. Built into walls [181] and [182] and likely connected with pipe [289] in G13. Highest and lowest level 7.22m at southern end and 7.10m AOD at northern.	Fe pipe through wall [181] on southern side of curvilinear pipe duct
330	Cut	Linear cut for pipe [300], c. 2.53m NNW/SSE x 0.30m wide and 0.30m deep. Highest and lowest level 7.22m and 6.92m AOD respectively.	Cut for pipe [300]

Group 12			
242	Pipe	Iron pipe within brick duct [243]. Survived for 6.49m WSW/ENE with a diameter of 0.30m. The eastern end turned down into main pipe duct G11 but the western end turned upwards before being truncated. Highest and lowest level 7.36m (west) and 7.10m (east).	Fe pipe in subsidiary duct [243]
243	Masonry	Common brick duct with concrete base c. 5.93m WSW/ENE x 1.76m NNW/SSE x 0.61m wide and >0.40m high. Internal area measured 0.67m NNW/SSE x 5.59m WSW/ENE. Highest and lowest level 7.34m and 7.32m AOD.	Subsidiary pipe duct from main duct G11 towards BF1
244	Cut	Rectangular construction cut c. 5.93m WSW/ENE x 1.76m NNW/SSE and >0.40m deep. Highest level 7.34m AOD.	Construction cut for pipe duct [243]
Group 13			
288	Cut	Linear construction cuts for pipes c. 8.87m ENE/WSW x 1.51m NNW/SSE and >0.45m deep (not bottomed). Highest level 7.34m AOD.	Cut for Fe pipes [289] and [290]
289	Pipe	Iron pipe c. 5.97m ENE/WSW and 0.18m diameter. Highest level 7.34m AOD.	Fe pipe in [288]
290	Pipe	Iron pipe exposed for 2.30m ENE/WSW with a diameter of 0.20m. Highest level 7.10m.	Fe pipe in [288]
291	Fill	Soft mid greyish brown silty sand c.8.87m ENE/WSW x 1.51m NNW/SSE and >0.45m deep. Highest level 7.34m AOD.	Backfill of [288]
304	Metal	Iron cross beam fitted in wall [277] to the north to support pipe trench [288] 0.85m NNW/SSE x 0.17m wide and 0.13m thick. Highest level 7.31m AOD.	Cross beam in [288]
Group 15			
15	Pipe	Iron pipe within brick duct [16] survived for 5.18m ENE/WSW with a diameter of 0.38m. Both eastern and western ends truncated however there is a slight rise from 7.30m AOD in the east to 7.41m AOD in the west.	Fe pipe in subsidiary duct [16]
16	Masonry	Common brick duct with concrete base c. 6.29m WSW/ENE x 1.97m NNW/SSE x 0.68m wide and 0.38m high. Internally 5.66m WSW/ENE x 0.56m NNW/SSE. Highest and lowest level 7.48m and 7.33m AOD respectively. Abuts wall [60] to east.	Subsidiary pipe duct from main duct G11 towards BF2
17	Cut	Rectangular construction cut c. 6.29m WSW/ENE x 1.97m NNW/SSE and >0.38m deep (not bottomed). Highest level 7.48m AOD.	Construction cut for pipe duct [16]
Group 16			
27	Pipe	Iron pipe within brick duct [28], survived for 4.56m WSW/ENE with a diameter of 0.22m. Both eastern and western ends truncated however there is a slight rise from 7.19m AOD in the east to 7.31m AOD in the west.	Fe pipe in subsidiary duct [28]
28	Masonry	Common brick duct with concrete base c. 6.32m WSW/ENE x 2.13m NNW/SSE x 0.61m wide and 0.43m high. Internally 5.77m WSW/ENE x 0.63m NNW/SSE. Highest and	Subsidiary pipe duct from main duct G11 towards BF3

		lowest level 7.54m and 7.39m AOD respectively.	
29	Cut	Rectangular construction cut c. 6.32m WSW/ENE x 2.13m NNW/SSE and >0.43m deep (not bottomed). Highest level 7.54m AOD.	Construction cut for pipe duct [28]

Group 11 main pipe duct with Group 12 subsidiary duct for BF1, Group 13 subsidiary duct for BF1 blast stove G9, Group 15 subsidiary duct for BF2 and Group 16 subsidiary duct for BF3

Structures at northern end of pipe duct G11 (Group 17)

5.3.29 At the northern end of pipe duct G11 were four structures: wall [281], base [282] and surface [282] within construction cut [284] and wall [285] in construction cut [284]. These structures all appeared to relate to the blast pipeline as they were located where the curvilinear element of pipe duct G11 joined with the linear section. Surface [283] likely continued around wall [285] but had been truncated during demolition works in the late 20th century. This truncation was likely the result of scrap removal as an iron fixing point was noted on base [282] suggesting that a piece of machinery or structural metalwork was formerly located there. The removal of this structure also damaged the other G17 structures.

Context	Type	Description	Interpretation
280	Cut	Irregular shaped cut c. 5.05m ENE/WSW x 1.89m NNW/SSE and >0.28m deep (not bottomed). Highest level 7.37m AOD.	Construction cut for [281], [282] and [283]
281	Masonry	L-shaped common brick wall c. 4.14m ENE/WSW x 1.71m NNW/SSE x 0.73m wide and 0.28m high. Highest and lowest level 7.38m and 7.34m AOD respectively. One of the bricks was stamped W2 (refer to Appendix 5).	Wall
282	Masonry	Rectangular wall/base c. 2.11m ENE/WSW x 1.22m NNW/SSE and >0.22m high (not bottomed), Highest and lowest level 7.37m and 7.21m AOD respectively. Fe bar upright c. 30mm diameter on eastern side of structure. One of the bricks was stamped W2 (refer to Appendix 5).	Wall/base
283	Masonry	Firebrick surface c. 1.44m ENE/WSW x 1.43m NNW/SSE and 0.11m high. Bricks set on edge. Highest level 7.24m AOD. One of the bricks was stamped W2 (refer to Appendix 5).	Surface
284	Cut	Rectangular cut c. 1.38m NNW/SSE x 1m ENE/WSW and >0.38m deep (not bottomed). Highest level 7.21m AOD.	Construction cut for wall/base [285]
285	Masonry	Brick structure c. 1.38m NNW/SSE x 1.21m ENE/WSW and >0.38m high (not bottomed). Highest level 7.21m AOD.	Wall

Group 17 Structures at northern end of main pipe duct G11

Structures at southern end of pipe duct G11 (Group 18)

5.3.30 At the southern end of the pipe duct G11 were several structures attached to its eastern side (Figure 10 and 14). Running parallel to firebrick arch [249] was structure [25] that measured c. 11.97m NNW/SSE x 1.2m wide. The purpose of this structure is unclear as it has no fixing points to act as a machine base or any other features to identify its original purpose. To the south was surface [24] that was exposed for 5.40m NNW/SSE x 1.62m ENE/WSW. This surface originally continued to the edge of the duct with the firebrick arch stopping at the southern end of wall [25]. Attached to the eastern side of wall [25] was a semi-circular structure comprising concrete foundation [114] and truncated brick wall [115] in construction cut [113]. Again, it is unclear as to the original purpose of this structure.

Context	Type	Description	Interpretation
24	Masonry	Firebrick and fireblock surface c. 1.62m ENE/WSW x 5.40m NNW/SSE and >0.80m thick (not bottomed). Highest level 7.41m AOD. One of the bricks was stamped B (refer to Appendix 5).	Surface
25	Masonry	Wall running parallel to pipe duct c. 11.97m NNW/SSE x 1.3m wide and >0.40m high (not bottomed). Highest and lowest level 7.49m and 7.40m AOD. One of the bricks was stamped BV & Co. (refer to Appendix 5).	Structure
113	Cut	Semi-circular cut c. 3m NNW/SSE x 1.28m ENE/WSW and 0.38m deep. Highest and lowest level 7.49m and 7.11m AOD respectively.	Construction cut for wall [115] and concrete [114]
114	Structure	Indurated light grey concrete c. 0.90m to 0.42m wide x 3m NNW/SSE x 1.28m ENE/WSW and 0.30m thick. Highest level 7.40m AOD.	Concrete foundation for wall [115]
115	Masonry	Firebrick structure on top of [114] c. 0.48m ENE/WSW x 0.47m NNW/SSE and 0.11m high. Highest level 7.51m AOD. One of the bricks was stamped BV & Co. (refer to Appendix 5).	Wall

Group 18 Structures at southern end of main pipe duct G11

Possible Chimney (Group 14)

5.3.31 At the northern end of site was a circular structure G14 comprising wall [102] within construction cut [101] c. 3.48m in diameter (2.46m internally) (Figure 10 and 11; Plate 23). The structure was thought to be a chimney however two pipes [104] and [105] were noted entering the structure from the south and three pipes [108] entered the structure from the east. It is possible that the structure may be a cooling tower with either unused cold blast from the blast pipeline or unneeded hot blast from nearby stoves being vented into the structure for release. Unusually pipe [104] dropped down into the structure heading towards its base. This seems to be counter intuitive of how cooling towers work so the structures may represent a completely different function like a tank or water sump for the Lancashire boilers to the north (the structure was not bottomed due to the water table being reached).

Context	Type	Description	Interpretation
101	Cut	Circular cut c. 3.48m diameter and >0.58m deep (not bottomed). Highest level 7.34m AOD.	Construction cut for [102]
102	Masonry	Brick circular structure possible chimney, tank or cooling tower. External diameter 3.48m, internal diameter 2.46m, 0.5m wide wall and >0.58m high (not bottomed). Highest level 7.39m AOD. Pipes [104] and [105] enter the structure from the south and pipes (3xno.) [108] from the east. One of the bricks was stamped H & N and another LC & Co (refer to Appendix 5).	Structure
104	Pipe	Iron pipe entering structure [102] from the south. Survived for 5.85m NNW/SSE with a diameter of 0.16m. Highest level 7.23m AOD. Southern end truncated.	Pipe feeding into [102]
105	Pipe	Iron pipe entering structure [102] from the south. Survived for 2.08m NNW/SSE with a diameter of 0.12m. Highest and lowest level 7.31m and 78.19m AOD respectively.	Pipe feeding into [102]
106	Cut	Linear cut with vertical sides and flat base. Survived for 2.08m NNW/SSE x 0.16m wide and 0.16m deep. Highest and lowest level 7.31m and 7.03m AOD respectively.	Cut for pipe [105]
107	Cut	Linear cut with vertical sides and flat base. Survived for 5.85m NNW/SSE x 0.12m wide and 0.12m deep. Highest and lowest level 7.23m and 7.11m AOD respectively.	Cut for pipe [104]
108	Pipes	Three pipes entered the eastern side of structure [102] however they were not visible in plan as they were too deep. Diameters ranged from 0.15m, 0.16m and 0.27m.	Three pipes entering into side wall of [102] from east side
279	Masonry	Fireblock and firebrick channel for pipes [104] and [105]. 1.24m NNW/SSE x 0.54m WSW/ENE and 0.10m high. Highest level 7.31m AOD. One of the bricks was stamped BV (refer to Appendix 5).	Brick structure associated with pipes [104] and [105]

Group 14 Possible cooling tower or tank

Other structures and features (Group 19, Group 20, Group 21, Group 22 and Group 23)

5.3.32 Several other structures were uncovered across Area B, however, their original function was unclear due to the scale of truncation. These structures comprised: G19 walls and concrete to the south-east of BF2; G20 firebrick bases to the south-east of BF2; G21 pipe running between G19 and G20 to the south-east of BF2; G22 fire brick walls to the north-east of BF3 (Plate 24) and G23 two pipes at the northern extent of site that do not appear to connect with any structures.

Context	Type	Description	Interpretation
Group 19			
219	Cut	Rectangular cut for walls [221], [222] and concrete [220] to SE of BF2. 2.75m ENE/WSW x 1.41m NNW/SSE and >0.45m	Construction cut for walls [221], [222] and [220]

		deep (not bottomed). Highest level 7.56m AOD.	
220	Structure	Concrete between walls [221] and [222], c. 2.21m ENE/WSW x 0.77m NNW/SSE and 0.11m thick. Highest level 7.56m AOD.	Concrete between walls [221] and [222]
221	Masonry	Brick wall c. 2.75m ENE/WSW x 0.88m NNW/SSE x 0.62m wide and >0.45m high (not bottomed). Highest level 7.56m AOD. One of the bricks was stamped W2 (refer to Appendix 5).	Firebrick wall (northern) in [219]
222	Masonry	Brick wall c. 1.53m ENE/WSW x 0.46m NNW/SSE and 0.35m high. Highest level 7.55m AOD. One of the bricks was stamped W2 (refer to Appendix 5).	Firebrick wall (southern) in [219]
Group 20			
10	Masonry	Firebrick surface or base. Four courses visible. 5.36m ENE/WSW x 1.56m NNW/SSE and >0.38m high (not bottomed). Highest and lowest level 7.47m and 7.21m AOD respectively. Three brick stamps were noted within [10] comprising BV & Co., HOWDEN and N.CAP (refer to Appendix 5).	Firebrick surface/base
142	Cut	Construction cut for firebrick surface/base c. 1.4m ENE/WSW x 1.8m NNW/SSE and >0.15m deep (not bottomed). Highest level 7.17m AOD.	Construction cut for [143]
143	Masonry	Firebrick surface or base. 1.4m ENE/WSW x 1.8m NNW/SSE and >0.15m high (not bottomed). Highest level 7.17m AOD. Brick stamps noted from this surface/base include HOWDEN, NEWFIELD and STOBART (refer to Appendix 5).	Firebrick surface/base
317	Cut	Construction cut for firebrick surface/base with vertical sides and presumed flat base c. 5.36m ENE/WSW x 1.56m NNW/SSE and >0.38m deep (not bottomed). Highest level 7.47m AOD.	Construction cut for [10]
Group 21			
4	Pipe	Iron pipe c. 11.60m ENE/WSW with a diameter of 0.21m. Highest level 7.35m AOD.	Fe pipe in [7]
6	Masonry	Masonry duct for pipe [4] c. 4.92m ENE/WSW x 0.11m wide and c. 0.25m high. Highest level 7.34m AOD.	Masonry to south of pipe [7]
7	Cut	Linear cut with vertical sides and flat base c. 12.20m ENE/WSW x 0.47m NNW/SSE and 0.44m. Highest and lowest level 7.35m and 6.91m AOD.	Cut for pipe [4] and masonry [6]
Group 22			
216	Masonry	Firebrick wall, visible for two courses, c. 4.58m ENE/WSW x 0.84m NNW/SSE and >0.17m high (not bottomed). Highest level 7.45m AOD. One of the bricks was stamped W2 (refer to Appendix 5).	Firebrick wall in construction cut [217]
217	Cut	Cut for walls [216] and [218]. For wall [218] cut measured 2.34m WSW/ENE x 2.8m NNW/SSE x between 0.47-0.66m wide and >0.08m high (not bottomed). The cut for wall [216] was 4.58m ENE/WSW x 0.84m	Construction cut for wall [216] [218]

		NNW/SSE and >0.17m high (not bottomed). Highest level 7.45m AOD.	
218	Masonry	Firebrick wall, two courses visible c. 2.34m WSW/ENE x 2.8m NNW/SSE x between 0.47-0.66m wide and >0.08m high (not bottomed). Highest and lowest level 7.58m and 7.45m AOD respectively. One of the bricks was stamped W2 (refer to Appendix 5).	Firebrick wall in construction cut [217]
Group 23			
172	Cut	Linear cut for pipe [173] c. 5.03m NE/SW x 0.26m wide and 0.26m deep. Highest and lowest level 7.40m and 7.14m AOD respectively.	Cut for Fe pipe [173]
173	Pipe	Iron pipe survived for c. 5.03m NE/SW with a 0.26m diameter. Highest level 7.40m AOD. Truncated at southern end.	Fe pipe in [172]
174	Cut	Linear cut for pipe [175] c. 5.80m ENE/WSW x 0.20m wide and 0.20m deep. Highest and lowest level 7.47m and 7.27m AOD respectively.	Cut for Fe pipe [175]
175	Pipe	Iron pipe survived for 5.8m ENE/WSW with a diameter of 0.20m. Highest level 7.45m AOD. Truncated at both eastern and western ends.	Fe pipe in [174]

Group 19 structure, Group 20 structure, Group 21 pipe, Group 22 structure, and Group 23 pipes

5.4 Phase 3.2: Cleveland Works in the 20th century

5.4.1 Phase 3.2 represents the Cleveland Steel Works in the 20th century (Figure 10 to 16). Blast Furnaces 1-3 were still being used by the Ordnance Survey map of 1895 (Figure 4), however by the map of 1915 (Figure 5) the works within Area B had been remodelled and Furnaces 1 to 3 decommissioned and replaced with two furnaces between 1911 and 1913 and a third in 1937 (Blast Furnaces 4, 6 and 5 respectively). The blast furnace built in 1913 is recorded to have been demolished after the First World War however map regression shows that BF6 was still present on the Ordnance Survey maps of 1915, 1929 and 1953 (Figures 5-7 respectively). The desk-based assessment also notes that the blast furnaces were rebuilt in the 1930s and again in the 1950s with nothing of the original 19th century furnaces believed to have survived (Prospect Archaeology 2020a, 8). The site walkover report notes that in 1947 the furnaces were modernised and rebuilt with 18' 6" hearths and it was in this form that they lasted until the later stages of the works. During the decommissioning of the original three furnaces, BF1 was demolished to ground level however BF 2 and 3 survived although heavily truncated.

5.4.2 As with the earlier phase of the works, Phase 3.2 was heavily truncated but numerous structures were encountered across the site. In Trench 1 the remains of a concrete structure relating to the later phase of works was uncovered. In Area B, two blast furnaces (BF4 & 6), two rail lines, the hoist areas for BF4 and BF6, structures, walls and surfaces were encountered. Western rail line G8 was replaced by rail lines G43 and G44 and the main blast duct was altered around the new BF4 as two brick partitions were constructed across the width of the duct (G30). The remains of Blast Furnace 5 survived to the south of Area B

however due to an unsupported salamander balanced precariously on top of the structure we were unable to hand clean the furnace due to health and safety constraints. A photographic record and GPS plan of the structure was therefore undertaken. The remains of this phase can be seen across the historic map regression from 1915 to 1953 (Figure 5, 6 & 7).

Trench 1 structure (Group 24)

5.4.3 Within Trench 1 a brick and concrete structure was noted along the northern and eastern edge of the trench that was exposed for >21m NNW/SSE by >4.53m ENE/WSW and 1.44m high at 8.04m AOD (Figure 8 & 9; Plate 25). The building represented a long rectangular structure that first appeared on the Ordnance Survey map of 1915 (Figure 5).

Context	Type	Description	Interpretation
1001	Masonry	Brick and concrete structure in eastern and northern section of Trench 1. 21m NNW/SSE x 4.53m ENE/WSW and 1.44m high. Highest level 8.04m AOD.	Cleveland Steel Works building
1008	Cut	Rectangular cut with flat base and vertical sides. 21m NNW/SSE x 4.43m ENE/WSW and 1.44m high. Highest and lowest level 8.04m and 6.48m AOD respectively.	Construction cut for [1001]

Group 24 structure

Area B

Concrete resurfacing prior to construction of 20th century blast furnaces (Group 27, Group 46, Group 47)

5.4.4 In the early 20th century, the areas to the east of the now decommissioned blast furnaces (1 to 3) were resurfaced comprising G27 to the east of BF1, G46 to the east of BF2 and G47 to the east of BF3. They have been grouped together in this section as they all followed the same stratigraphic sequence and are comprised of the same material. They are conceivably later than 1911 as surface G46 cuts early hoist structure G28/G29 for BF4. Furthermore, the construction cut for BF4 (likely the rebuild of the 1930s or 1950s) truncates G27 surface. The three surface groups were perhaps constructed when the blast stoves were replaced adding suitable foundations for the large structures. If this is the case, the blast stoves were rebuilt in the same location as the 19th century structures as they do not appear to have moved on the Ordnance Survey maps of 1915 (Figure 5) and 1929 (Figure 6).

Context	Type	Description	Interpretation
Group 27			
238	Structure	Indurated grey concrete c. 6.19m NNW/SSE x 9.85m ENE/WSW and >0.20m thick. Highest level 7.40m AOD.	Concrete surface to east of BF1
239	Cut	Square cut for concrete with vertical sides and flat base. 6.19m NNW/SSE x 9.85m ENE/WSW. Highest level 7.40m AOD.	Construction cut for [238]
240	Structure	Indurated grey concrete c. 8.05m ENE/WSW x 7.48m NNW/SSE and >0.20m thick (not	Concrete surface to east

		excavated. Highest and lowest level 7.39m and 7.34m AOD respectively.	of BF1
241	Cut	Square cut for concrete [238] 8.05m ENE/WSW x 7.48m NNW/SSE and >0.20m deep. Highest level 7.39m AOD.	Construction cut for [240]
Group 46			
13	Structure	Indurated grey concrete c. 5.49m NNW/SSE x 5.85m ENE/WSW. Highest level 7.45m AOD.	Concrete surface to east of BF2
14	Cut	Square cut for concrete [13], c. 6.79m NNW/SSE x 5.85m ENE/WSW. Highest level 7.45m AOD.	Construction cut for [13]
18	Structure	Indurated grey concrete c. 6.65m NNW/SSE x 5.84m ENE/WSW. Highest level 7.45m AOD.	Concrete surface to east of BF2
19	Cut	Square cut for concrete [18] 6.65m NNW/SSE x 5.84m ENE/WSW. Highest level 7.45m AOD.	Construction cut for [18]
Group 47			
11	Structure	Indurated grey concrete c. 5.70m ENE/WSW x 6.72m NNW/SSE and >0.34m thick. Highest level 7.44m AOD.	Concrete surface to east of BF3
12	Cut	Square cut for concrete [11] 5.70m ENE/WSW x 6.72m NNW/SSE and >0.34m deep (not bottomed). Highest level 7.44m AOD.	Construction cut for [11]
30	Structure	Indurated grey concrete c. 5.7m ENE/WSW x 4.60m NNW/SSE and >0.48m thick (not bottomed). Highest level 7.46m AOD.	Concrete surface to east of BF3
31	Cut	Square cut for concrete [30] 5.7m ENE/WSW x 4.60m NNW/SSE and >0.34m deep (not bottomed). Highest level 7.46m AOD.	Construction cut

Concrete resurfacing prior to construction of 20th century blast furnaces (G27, G46 & G47)

Blast Furnace 4 (Group 25)

5.4.5 Blast Furnace 4 was located at the northern end of Area B and comprised a circular structure c. 15.32m ENE/WSW by 12.55m NNW/SSE and 3.50m high (Figure 12; Plate 26 & 27). The original Blast Furnace 4 was built in c. 1911 however the remains present on site likely represent a later rebuilding of the furnace in the 1930s, 1940s or 1950s as the structure truncates an earlier hoist room for the 1911 furnace (G28) (Prospect Archaeology 2020a, 8; NAA 2020b, 5). Blast Furnace 4 was perhaps the best surviving example of a 'Yankee' furnace on site however, it was still heavily truncated. The furnace comprised construction cut [74] with concrete foundation [73] on to which was build external masonry [72], metal uprights [71] and [301], metal casing [69], concrete deposits [70] and [302], inner core [68] and [67]. Outer external wall [72] survived in a fragmentary state with only short sections surviving at the north-east, south-east and western sides. Internally metal uprights [301] were placed on top of concrete foundation [73] then encased in concrete [70]. Into this deposit of concrete were set steel bars that supported a secondary set of metal uprights [71] which were then encased in concrete [302]. The core of the furnace was sealed with iron sheeting/band [69] that housed firebrick/fireblock lining [68] with a core of carbon blocks [67] (Plate 28 & 29). To

the east of the furnace was a small section of flooring [110] that perhaps represented the working area prior to it being truncated by reconfigurations of the hoist room to the east (Figure 17). Still in situ on top of the furnace was a salamander 4.65m N/S by 4.87m E/W and >1.32m thick comprising industrial waste and ferromanganese from the last firing (Plate 30).

5.4.6 All the elements appeared to be contemporary suggesting that nothing survived of the 1911 furnace. No remains survived of the structure that represented tuyeres from the blast stoves, tapping holes for the removal of slag or the furnace hearth. A possible entrance for a pipe was noted on the eastern side of the furnace formed by channel G34 however the pipe had been removed and the hole below the metal casing [69] could not be investigated due to heavily concreted deposits (Plate 31).

Context	Type	Description	Interpretation
66	Metal	Indurated dark orange brown solidified iron and slag with inclusion of possible silver manganese (ferromanganese). 4.65m N/S x 4.87m E/W and >1.32m thick. Highest level 10.80m AOD.	Salamander
67	Masonry	Carbon block lining of BF4, only one course survived. 2.39m E/W x 1.4m N/S and 0.51m high. Highest level 10.60m AOD.	Internal lining of BF4
68	Masonry	Fireblock lining of BF4 c. 8.16m ENE/WSW x 8.21m NNW/SSE and >2m high. Highest and lowest level 9.79m and 8.80m AOD respectively.	Firebricks/blocks within BF4
69	Metal	Fe plating around exterior of BF 4 c. 8.32m diameter x 0.04m-0.08m thick and 1.95m high. Consists of 12 curved iron plates. Highest level 9.23m AOD.	Outer metal shell of BF4
70	Structure	Indurated grey concrete c. 12.55m NNW/SSE x 12.50m ENE/WSW and >0.59m thick. Highest and lowest level 7.96m and 7.94m AOD respectively.	Concrete base for metal uprights [71] in BF4
71	Metal	Fe uprights x3 around perimeter of BF4 formed by outer casing of iron with two upright I beams internally and then filled with concrete. Imbedded in concrete level [302]. Each measured c. 0.58m x 0.98m and a maximum height of 1.63m.	Metal uprights around BF4
72	Masonry	Fireblock, firebrick and common brick exterior masonry of BF4. Six courses visible. Survive in three parts: north-east c. 5.9m ENE/WSW x 1m wide and >0.16m high; south-east c. 5.6m ENE/WSW x 0.76m wide and >0.34m high and western 8.7m NNW/SSE x 1.16m wide and >0.16m high. Highest and lowest level 7.95m and 7.54m AOD respectively.	External masonry of BF4
73	Structure	Indurated grey concrete, exposed for c. >2.71m NNW/SSE x 5.83m ENE/WSW and >0.16m thick. Highest level 7.37m AOD.	Concrete foundation for BF4
74	Cut	Construction cut for BF4 c. 15.32m ENE/WSW x 12.55m NNW/SSE. Not excavated. Highest level 7.53m AOD.	Construction cut for BF4

110	Masonry	Fireblock surface on eastern side of BF4 c. 0.92m ENE/WSW x 0.62m NNW/SSE and 0.10m thick. Highest level 7.34m AOD.	BF4 external floor surface?
301	Metal	Fe uprights x3 around perimeter of BF4 formed by outer casing of iron with two upright I beams internally and then filled with concrete. Imbedded in concrete levels [70] and [302]. Each measured c. 1.39m x 0.79m and 2.88m high.	Metal uprights around BF4
302	Structure	Indurated grey concrete surrounding the inner furnace structure and uprights [71] and [301]. Survived in two areas: northern 3.70m E/W x 2m N/S and 0.2m thick; southern 9.20m E/W x 1.80m N/S and 0.20m thick.	Concrete overlying [70] and [71]

Group 25 Blast Furnace 4

Blast Furnace 4 hoist areas with later additions and remodelling ([96], Group 28, Group 29, Group 30, Group 31, Group 32, Group 33, Group 34, Group 35, Group 36)

- 5.4.7 To the east of BF4 was a series of hoist areas that had been reconfigured throughout the 20th century (Figure 10, 12 & 17; Plate 32 & 33). The position of this hoist, and the hoists for BF5 and BF6 are shown on the Ordnance Survey map of 1953 (Figure 7). The hoist would have carried the raw materials up to the top of the blast furnace from the screening room G37. Within the screening room were two metal screens built within rail line G43 that would have been used to prepare the charge for the furnace. This charge comprised ore, fuel (coke) and flux (limestone) that when mixed to the required composition transported to the top of the furnace for smelting.
- 5.4.8 The earliest remaining hoist was G28 that conceivably corresponded to the 1911 incarnation of BF4 before it was rebuilt in the 1930s and again in the 1950s. Group 28 hoist room was c. 10.54m NNW/SSE by 6.01m ENE/WSW with an internal area of 8.29m NNW/SSE by 4.10m ENE/WSW and was formed by wall [258] in the north, wall [109] in the south and wall [207]/[208] in the east (the western wall was truncated by later reconfigurations of the hoist room). Both north wall [258] and south wall [109] housed a rectangular recess c. 1.07m NNW/SSE by 0.62m ENE/WSW and over >0.32m deep (not bottomed due to ground water). These recesses perhaps represented the support bases for the overhead hoist taking the charge to the top of the blast furnace. The western wall [208] replaced part of the main blast pipe duct wall and contained a brick arch [208] perhaps for a pipe to feed into the structure. Running parallel to northern wall [258] was an iron pipe [260] (possibly towards a blast stove) that headed towards BF4 before turning upwards at the western extent of the structure. Metal sheeting [81] was also uncovered in the southern part of the room that may have functioned as a floor surface lying over levelling deposit [86]. Also overlying the levelling deposit was a potential pipe duct in the centre of the structure formed by timbers [77], [78], [79], and [85] that led to a gap in wall [208] with a curved profile. An additional timber [80] was observed to the south however it is unclear how this related to the possible pipe duct. The pipe within this duct

- was likely removed during later reconfigurations of the room however it may have connected to pipe G36 to the south-east.
- 5.4.9 Structure G31 was built within the southern interior of G28 and comprised sub-base deposit [88] that was laid down over G28 metal plates [81]. On top of levelling sub-base [88] was built a firebrick duct [89] that housed a vertical iron pipe [158] before being backfilled with clinker/industrial waste [157]. It is unclear what the purpose of this pipe was for, but it may have connected to a pipe that was housed in arch [208] that carried blast from the main pipe duct towards BF4 to the west. One of the bricks from duct [89] was stamped BVN for Bolckow, Vaughan Newfield Colliery (refer to Appendix 5).
- 5.4.10 If the remains of BF4 corresponded to the rebuild of the 1930s then G28/G31 were in use between 1911 and the 1930s. They were then backfilled with detritus G29 up to a maximum thickness of 0.76m, with infilling G30 bricking up arch [208] and partitioning the main blast duct with the construction of wall [210] and [274] across the width of the Phase 3.1 structure (the blast may then have been brought in from G35 as discussed below). One of the bricks from wall [274] was stamped BONNYBRIDGE BRAND possibly referring to Bonnybridge Silica & Fireclay works 1874-1971, Bonnymuir Brickworks c. 1869-1960s, or Broomhill Brickworks 1924-1979 (refer to Appendix 5). Once room G28 had been backfilled then concrete structure G32 was built. G31 was retained in this phase as it appeared to be integrated to G34 structure.
- 5.4.11 G32 comprised a rectangular concrete structure c. 4.15m ENE/WSW by 5.39m NNW/SSE and 0.47m high with concrete surface [93] surrounded by concrete walls [94] to the north, east and south (to the west the structure was built up against concrete [70] of BF4). Internally the room was 3.5m ENE/WSW by 4.44m NNW/SSE and featured an entrance for a possible pipe along the northern wall c. 0.82m wide. This entrance was short lived however as it was infilled with brick wall [96] and then the whole structure backfilled with industrial waste, rubble and clinker G33 up to a maximum depth of 0.47m thick in preparation of concrete channel G35.
- 5.4.12 Concrete channel G34 was comprised of concrete walls and surface [99] and surface [92] within construction cuts [98] and [90] (respectively). The channel survived for 4.7m NW/SE with the internal space c. 0.6m wide and 0.27m high. It appeared to incorporate earlier pipe duct G31 with concrete surface [92] to the west. The western end of this channel ended at the base of BF4 where a backfilled void was present below the metal casing of the interior of the furnace. This may have housed a pipe carrying the blast from nearby stoves into the furnaces but was removed during later stages of demolition.
- 5.4.13 Structure G35 was perhaps the latest addition to the hoist room that comprised construction cut [235] that housed a substantial pipe [230] c. 1.2m in diameter and concrete backfill [236]. It was exposed on the eastern side of the main blast pipe duct G11 before heading towards BF4. It is unclear where the pipe terminated as only the access hatch/upright pipe connection was visible, however the concrete fill continued along the southern boundary of G28 wall [258]

stopping at the westernmost extent of the structure. It is possible that the pipe may have continued below the furnace.

Context	Type	Description	Interpretation
96	Masonry	Firebrick and common brick infill c. 0.82m ENE/WSW x 0.32m NNW/SSE and 0.44m high. Highest level 7.77m AOD.	Later infilled section of structure G32
Group 28			
77	Timber	Horizontal timber beam 2.76m ENE/WSW x 0.34m NNW/SSE and 0.10m thick. Highest level 7.00m AOD.	Timber within hoist room for BF4. Possible pipe duct?
78	Timber	Horizontal timber beam set on edge c. 1.38m ENE/WSW x 0.40m wide and 0.10m thick. Highest level 7.10m AOD.	Timber within hoist room for BF4. Side wall of pipe duct?
79	Timber	Horizontal timber beam set on edge c. 0.75m ENE/WSW x 0.10m wide and 0.10m thick. Highest level 7.12m AOD.	Timber within hoist room for BF4. Side wall of pipe duct?
80	Timber	Horizontal timber beam set on edge c. 2.75m NNW/SSE x 0.31m wide and >0.10m thick. Highest and lowest level 7.19m and 7.15m AOD respectively.	Timber within hoist room for BF4. Butts up against timber [79]
81	Metal	Fe plate in southern side of room c. 2.14m WSW/ENE x >1.08m NNW/SSE and 10mm 5mm thick. Highest level 7.10m AOD. Small series of grided holes within sheeting c. 20mm diameter.	Fe plates within hoist room
82	Masonry	Firebrick wall along western edge of sandstone wall [207]. Same as [83] and [84]. 2.42m NNW/SSE x 0.21m wide (max) and 0.14m high. Highest level 7.11m AOD. One of the bricks was stamped BV & Co. (refer to Appendix 5).	Firebrick wall (northern section)
83	Masonry	Firebrick and block wall along western edge of sandstone wall [207]. Same as [82] and [84]. 1.28m NNW/SSE x 0.22m wide and 0.17m high. Highest level 7.17m AOD.	Firebrick wall (central section)
84	Masonry	Firebrick and block wall along western edge of sandstone wall [207]. Same as [82] and [83]. >0.63m NNW/SSE x 0.22m wide and 0.17m high. Highest level 7.17m AOD.	Firebrick wall (southern section)
85	Timber	Horizontal timber beam set on edge c. 0.80m WNW/ESE x 0.14m wide and 0.10m thick. Highest level 7.05m AOD.	Timber within hoist room for BF4. Side wall of pipe duct?
86	Deposit	Compact black sand clinker and rubble c. 4.30m NNW/SSE x 2.18m ENE/WSW and >0.05m thick (not bottomed due to ground water level reached). Highest and lowest level 7.03m and 6.97m AOD respectively. One of the bricks was stamped HBC SB (refer to Appendix 5).	Levelling deposit for [77] to [81] and [85]
109	Masonry	Brick structure on southern side of hoist room, paired with [258] on the northern side.	Footing for hoist system. Paired

		5.79m ESE/WNW x 2.33m NNW/SSE x 1.20m wide and >0.54m high. Highest level 7.66m AOD. Rectangular recess in wall for hoist/conveyor support c. 0.59m ENE/WSW x 1.06m NNW/SSE and >0.30m high (matches recess in northern wall [258]).	with [258]
159	Cut	Linear cut with vertical sides and presumably flat base (not bottomed). 5.79m ESE/WNW x 2.33m NNW/SSE x 1.20m wide and >0.20m deep. Highest level 7.43m AOD.	Construction cut for [109]
207	Masonry	Sandstone wall at eastern side of hoist room replacing main duct wall for G11. 5.86m NNW/SSE x 1.10m wide and >0.5m high. Highest level 7.40m AOD.	Sandstone wall within hoist room
208	Masonry	Firebrick arch within wall [207]. 1.07m ENE/WSW x 0.75m NNW/SSE and >0.50m high. Internal space 1.07m ENE/WSW x 0.45m NNW/SSE and >0.20m high. Highest level 7.40m AOD.	Firebrick arch in wall [207]
257	Cut	Linear cut with vertical sides and presumably flat base (not bottomed). 5.74m ENE/WSW x 2.43m NNW/SSE x 0.69m wide and >0.10m deep (not bottomed). Highest level 7.40m AOD.	Construction cut for [258] and pipe [260]
258	Masonry	Brick structure on northern side of hoist room, paired with [109] on the southern side. 5.74m ENE/WSW x 2.43m NNW/SSE x 0.69m wide and >0.54m high. Highest level 7.62m AOD. Rectangular recess in wall for hoist/conveyor support c. 0.59m ENE/WNW x 1.06m NNW/SSE and >0.30m high (matched recess in southern wall [109]). One of the bricks was stamped C & M (refer to Appendix 5).	Footing for hoist system. Paired with [109]
260	Pipe	Fe pipe adjacent to wall [258]. Exposed for >2.40m ENE/WSW x c. 30m diameter. Highest level 7.53m AOD.	Pipe adjacent to brick footing [258]
Group 29			
245=259	Deposit	Loose dark grey demolition rubble comprising fragments of brick and sandstone found in footing recesses within wall [109] ([245]) and [258] ([259]) Footing areas c. 0.59m ENE/WNW x 1.06m NNW/SSE.	Backfill of structure G28
87	Deposit	Loose dark grey silt, clinker and industrial waste. Main part of hoist room 2.91m ENE/WSW x 5.53m NNW/SSE. Highest level 7.29m AOD.	Backfill of structure G28
Group 30			
209	Masonry	Brick infill of arch [208]. Three courses visible 1.07m ENE/WSW x 0.45m NNW/SSE and >0.20m high.	Infill of arch [208] in wall [207] structure G28
210	Masonry	Brick partition across Phase 3.1 main pipe duct G11. 1.44m ENE/WSW x 0.46m wide and >0.73m high. Highest level 7.4m AOD.	Wall across pipe duct [60] (southern)
274	Masonry	Brick partition across Phase 3.1 main pipe duct G11. 1.39m ENE/WSW x 1.33m NNW/SSE and >0.70m high. Built over by	Wall across pipe duct [60] (northern)

		later modification to hoist area G35.	
Group 31			
88	Deposit	Indurated black clinker/industrial waste c. >2.19m ENE/WSW x >1.1m NNW/SSE and >0.03m thick. Highest level 7.11m AOD. Directly over lied metal plates [81] of structure G28.	Sub-base for brick structure [89]
89	Masonry	Vertical brick pipe duct c. 1.58m NNW/SSE x 1.56m ENE/WSW and 0.57m high. Contained metal pipe [158] c. 0.34m in diameter. Highest level 7.42m AOD.	Firebrick pipe duct
157	Deposit	Indurated black slag and silt c. 0.90m NNW/SSE x 0.90m ENE/WSW and >0.10m deep. Backfilled up to ground level.	Backfill of [89]
158	Metal	Vertical Fe pipe c. 0.34m in diameter and exposed for >0.35m high.	Upright metal pipe
Group 32			
91	Cut	Rectangular cut for concrete building with vertical sides and flat base. 4.15m ENE/WSW x 5.39m NNW/SSE and 0.20m deep. Highest level 7.29m AOD.	Construction cut for concrete surface [93] and structure [94]
93	Surface	Indurated grey concrete c. 4.15m ENE/WSW x 5.39m NNW/SSE and 0.20m thick. Highest level 7.30m AOD.	Concrete surface within construction cut [91]
94	Structure	Concrete walls c. 4.10m x 5.22m NNW/SSE x 0.35m wide and 0.47m high. Highest level 7.77m AOD.	Concrete walls within [91]
95	Structure	Concrete structure c. 0.43m NNW/SSE x 0.32m WSW/ENE and 0.16m high. Highest level 7.45m AOD.	Concrete structure. Part of [94]
186	Fill	Compact black silt, slag and clinker c. 1.90m x 0.90m and >0.29m deep.	Backfill of construction cut [91]
Group 33			
97	Fill	Loose dark grey clinker, ash, silt and other industrial residues c. 4.15m ENE/WSW x 5.39m NNW/SSE and >0.43m thick. Highest level 7.77m AOD.	Backfill of structure G32
100	Fill	Compact dark grey demolition rubble with frequent sandstone and brick fragments c. 1.3m NNW/SSE x 1.01m ENE/WSW and >0.54m thick. Highest level 7.63m AOD.	Backfill of structure G32
261	Fill	Compact black clinker, ash and demolition rubble c. 1.74m ENE/WSW x 0.99m NNW/SSE and 0.44m thick. Highest level 7.8m AOD.	Backfill of structure G32
Group 34			
90	Cut	Linear cut with vertical sides and flat base c. 3.05m ENE/WSW x 1.10m wide and 0.23m deep. Highest level 7.32m AOD.	Construction cut for concrete surface [92]
92	Surface	Indurated concrete surface c. 3.05m ENE/WSW x 1.10m wide and 0.23m thick. Highest level 7.32m AOD.	Concrete surface
98	Cut	Linear cut with vertical sides and flat base. >4.7m ENE/WSW x 1.22m E/W x 1.26m wide and c. 0.44m deep. Highest level 7.72m AOD.	Construction cut for concrete structure [99]

99	Structure	Indurated grey concrete forming walls and floor of channel to the east of BF4 c. >4.7m NW/SE x 1.22m E/W x 0.63m wide internally x 1.26m wide externally and 0.27m high (internally) and 0.44m high (externally). Highest level 7.72m AOD.	Concrete channel from BF4
Group 35			
235	Cut	Construction cut for pipe [237] c. 11m ENE/WSW x 7.32m NNW/SSE and >0.60m deep (not bottomed). Highest level 7.64m AOD.	Construction cut for [236] and [237]
236	Deposit	Indurated grey concrete with rebar c.11m ENE/WSW x 7.32m NNW/SSE x 3.2m wide and c. 0.85m thick. Highest and lowest level 7.80m and 7.43m AOD respectively.	Concrete encasing Fe pipe [237]
237	Pipe	Substantial FE pipe c. 1.2m in diameter. Highest level 8.00m AOD.	Fe pipe
Group 36			
229	Cut	Linear pipe cut c. 5.7m NW/SE x 0.5m wide and 0.4m deep. Highest level 7.37m.	Construction cut for pipe [230]
230	Pipe	Fe pipe c. 5.7m NW/SE with a diameter of 0.25m. Highest level 7.21m AOD.	Fe pipe in [229]
231	Fill	Loose dark grey gravel with inclusions of brick rubble. Highest level 7.37m AOD.	Backfill of pipe cut [229]

Black Furnace 4 hoist areas with later additions and remodelling G28, G29, G30, G31, G32, G33, G34, G35 and G36

Blast furnace 4 screening area (Group 37)

5.4.14 Blast Furnace 4's screening area was located to the east of Phase 3.1 main blast pipe duct G11 and comprised construction cut [223] housing concrete and brick western walls [224] and [225] (respectively), southern brick wall [226], structure [336] and [337] as well as iron beams [227] (Figure 10 & 12; Plate 32 & 34). The room measured c. 3.18m ENE/WSW by 7.14m NNW/SSE and > 1.22m deep (not bottomed due to reaching ground water). Two metal screens [326] within rail line G43 (see below) processed the raw materials into the charge for the blast furnace. This charge would have been comprised of a mixture of ore, flux and fuel which would have been carried up to the top of the blast furnace on the hoist. Part of the hoist system survived in this room in the form of metal beams [227]. Concrete structure [224] was a repair to the south-west corner of the room as the northern element was comprised of brick. Immediately to the west of iron beams [227] was structure [337] that was fitted with a wooden ladder for access to the base of the screening room.

Context	Type	Description	Interpretation
223	Cut	Rectangular cut with vertical sides and flat base c. 7.84m NNW/SSE x 3.75m ENE/WSW and >1m deep (not bottomed due to groundwater). Highest level 7.39m AOD.	Construction cut for screening area G37
224	Structure	Indurated grey concrete c. 2.6m WNW/WSW x 3.7m NNW/SSE and >0.6m deep. Highest level 7.17m AOD.	Concrete structure
225	Masonry	Common brick structure c. 3.55m NNW/SSE x 3.40m ENE/WSW x 1.16m wide and >1m	Brick and concrete

		high. Highest level 7.17m AOD.	structure
226	Masonry	Brick wall c. 1.39m ENE/WSW x 0.51m wide and >0.8m high. Highest level 7.51m.	Brick wall in construction cut [223]
227	Metal	Fe beams (x7) spaced along c.4m NNW/SSE. Horizontal beam c. 4m NNW/SSE x 0.16m x 0.13m supporting 7 uprights at 7.22m AOD. The vertical beams survived for a height of 1.3m with each beam being 0.11m x 0.06m.	Fe uprights for conveyor system
336	Masonry	Brick structure associated with BF4's screens in rail line G43. 0.82m ENE/WSW x 0.64m NNW/SSE and >0.49m high. Highest level 7.16m AOD.	Brick structure
337	Structure	Indurated grey concrete c. 0.22m ENE/WSW x 0.71m NNW/SSE and >0.61m high. Highest level 7.15m AOD.	Concrete structure

Group 37 Blast furnace 4 screening area

Eastern rail line (Group 43)

5.4.15 The eastern rail line survived for >101.68m NNW/SSE and comprised a construction cut [322] that contained concrete foundation for rails [323] and rail line [324] (Figure 10 to 15; Plate 35 & 36). The rail line [324] contained two pairs of metal screens within the track: [326] for BF4's screening room G37 (Plate 34) and [327] for BF6's screening room G42 (Plate 37). The line does not appear on the historic Ordnance Survey maps as it was situated below the Hi-line rails that brought coke from the ovens to the south. The line would have also carried other raw materials such as iron ore and the flux.

Context	Type	Description	Interpretation
322	Cut	Linear cut with vertical sides and flat base c. >101.68m NNW/SSE x between 1.57m-5.20m wide and 0.67 deep (max). respectively. Highest level 7.76m AOD.	Construction cut for rail line [324]
323	Structure	Indurated grey concrete c. >101.68m NNW/SSE x between 1.57m (south) to 5.20m (north) wide and 0.67m thick. Highest and lowest level 7.76m and 7.47m AOD.	Concrete base for rails [324]
324	Metal	Two Fe rails and supports. Rail line survived for >101.68m NNW/SSE. Each rail was 0.12m wide and 0.13m high. The gauge was 1270mm (4 foot 2 inches).	Rail lines
326	Metal	Two iron screens built into track for preparing charge into blast furnace. Northern and southern screens 1.73m NNW/SSE x 1.17m ENE/WSW and >0.79m high (not bottomed due to ground water). Highest level 7.54m AOD.	Northern metal screens in rail line [324] associated with BF4
327	Metal	Two iron screens built into track for preparing charge into blast furnace. Northern and southern screens 1.60m NNW/SSE x 1.17m ENE/WSW and >0.51m deep (not bottomed). Highest level 7.60m AOD.	Southern metal screens in rail line [324] associated with BF6

Group 43 Eastern rail line

North-western rail line and associated structures (Group 44)

5.4.16 A short section of rail line survived to the north-west of Blast Furnace 4 for c. 12.3m NW/SE that replaced earlier Phase 3.1 rail line G8 (Figure 10, 11 & 12; Plate 38). The rail line comprised a layer of sand bedding [270] for metal sleepers [65] that carried rails [64]. Two concrete structures were also associated with G44 that comprised structure [263] at the south-eastern extent that perhaps functioned as a buffer stop for the line and structure [269] that was located to the east of the line. The purpose of structure [269] is unknown but would have likely functioned as a base for something such as signage. Due to its location to the west of the blast furnaces the rail line would have conceivably transported slag or molten iron as both the slag beds and Bessemer converters were located in the main part of the steel works to the north.

Context	Type	Description	Interpretation
64	Metal	Fe rails comprising rail line to the NW of BF4. Survived for 12.33m NW/SE with each rail 0.14m wide and 0.16m high. Gauge of the rail line standard gauge 1435mm (4ft 8.5 inches). Highest and lowest level 7.46m 7.21m AOD respectively.	Metal rail tracks to NW of BF4
65	Metal	Fe sleepers c. 2.3m NE/SW x 0.28m wide and 0.06m thick. Highest and lowest level 7.22m and 7.03m AOD respectively.	Metal sleepers for rails [64]
262	Cut	L-shaped cut c. 4.7m NE/SW x 5.2m NW/SE x 1.36m wide and >0.42m deep. Highest level 7.55m AOD.	Construction cut for concrete structure [263]
263	Structure	Indurated grey concrete c. 4.7m NE/SW x 5.2m NW/SE x 1.36m wide and >0.56m thick. Highest level 7.82m AOD.	Concrete structure in [262]. Support for buffer stop
268	Cut	Rectangular cut for concrete and Fe structure [269]. Vertical sides and flat base c. 2.55m ENE/WSW x 0.52m wide and >0.05m (not bottomed). Highest level 7.08m AOD.	Construction cut for concrete structure [269]
269	Structure	Two upright Fe I beams encased in concrete c. 2.55m ENE/WSW x 0.52m wide and 1.02m high. Highest level 7.36m AOD.	Concrete structure in [268]
270	Deposit	Loose mid yellowish grey sand bedding for rails. 12.40m NW/SE x 2.15m NE/SW and >0.05m thick. Highest and lowest level 7.19m and 6.93m AOD respectively.	Sand track bedding for rails [64] and sleepers [65]

Group 44 North-western rail line

Blast Furnace 5

5.4.17 Blast Furnace 5 was located to the south of Area B and was already exposed prior to archaeological monitoring that commenced in January 2021 (Figure 10 & 16; Plate 39 & 40). The furnace was built in 1937 and can be seen on the Ordnance Survey of 1953 (Figure 7) to the south of Area B (the structure to the west of the southernmost hoist area). Due to the presence of a substantial salamander on top of the structure that was balanced on top of a small spoil heap, the furnace could not be hand cleaned and recorded due to health and

safety constraints. Structurally the furnace was similar to BF4 as it was comprised of metal uprights around the exterior of the furnace set into concrete with metal sheeting encasing a core of fireblocks.

Blast Furnace 6 (Group 26)

5.4.18 Blast Furnace 6 was located between BF 4 and 5 (immediately south of Phase 3.1 furnace BF3) at the southern end of Area B (Figure 10 & 14; Plate 41 & 42). The structure was 15.86m NNW/SSE by 11.42m ENE/WSW and had been demolished to ground level. The structure comprised a rectangular construction cut [160] with concrete foundations [161] supporting firebrick furnace [163] c. 11m in diameter with a core of heat affected fireblocks [164]. Metal straps [162] were noted on the south-west exterior of the furnace however these had been removed from the remainder of the structure (Plate 43).

Context	Type	Description	Interpretation
160	Cut	Rectangular cut with vertical side and presumably flat base (not bottomed) c. 11.42m ENE/WSW x 15.86m NNW/SSE. Highest level 7.43m AOD.	Construction cut for BF6
161	Structure	Indurated grey concrete c. 11.42m ENE/WSW x 15.86m NNW/SSE. Highest level 7.43m AOD.	Concrete foundation for BF6
162	Metal	Fe strap at SW corner of exterior wall [163] of blast furnace. 4.2m x 45mm wide and 0.18m high. At bond ends of the iron band were two ovoid loops c. 200mm x 35mm. These loops were fitted onto iron lugs that projected from the end of the blast furnace. This context constitutes two of these bands directly atop one another in situ. Highest level 7.55m AOD.	Fe strap around exterior of BF6 in SW corner
163	Masonry	Fire brick masonry of blast furnace c. 11m diameter and >0.20m high (not bottomed). Highest and lowest level 7.62m and 7.46m AOD respectively. One of the bricks was stamped F & L (refer to Appendix 5).	Firebrick furnace
164	Masonry	Fireblock core of BF6 c. 1.86m NE/SW x 1.6m NW/SE and 0.12m high (not bottomed), Highest level 7.47m AOD.	Fireblock core of BF6

Group 26 Blast Furnace 6

Blast Furnace 6 hoist area with later additions and remodelling (Group 38, Group 39, Group 40, Group 41, Group 58)

5.4.19 The hoist area was located to the east of BF6 and can be seen on the Ordnance Survey map of 1953 (Figure 7; Plate 44) as a rectangular structure labelled hoist. As was seen with the northern hoist area for BF4, the room associated with BF6 also comprised several later additions and remodelling however it was placed slightly offset from screening room G42 to the east (Figure 14; Plate 44). The earliest element of the structure was G38 that comprised sandstone and brick walls [188] within construction cut [187] with an internal space of c. 6.16m NNW/SSE by 3.24m ENE/WSW. This internal room was then separated by brick

partition [194] creating a northern and southern area c. 2.7m NNW/SSE by 3.24m ENE/WSW. It is unknown what the two internal divisions of this room were like as they were resurfaced in concrete [314] during the construction of G40. Part of a structure [195] did survive in the north-west internal corner of the room however it was too truncated to ascertain its function. Also noted were some modifications to the western wall of [188] comprising [331] and [335] but again they were too truncated to elucidate their function.

- 5.4.20 Structure G39 was added shortly after the construction of G38 with the earlier room being retained. Structure G39 was similar in plan to BF4's hoist room G28 as they both featured two rectangular recesses for structural supports of the overhead hoist system. The structure survived for 10.2m NNW/SSE by 4.96m ENE/WSW and comprised walls [190] and [191] in the north, walls [192] and [193] in the west and brick support [202] in the south.
- 5.4.21 Structure G40 modified the interior of the hoist room with the addition of concrete structure [196] and [197] at the western side of the room and resurfaced the internal areas of G38 with concrete floor [314]. The purpose of concrete structure [196] and [197] is unknown but they formed three small tanks c. 0.80m by 0.80m (Figure 14).
- 5.4.22 Structure G41 was added to the western face of G39 wall [193]. The structure was heavily truncated by a later intrusion to the west and north but likely functioned as an additional support for the overhead hoist.

Context	Type	Description	Interpretation
Group 38			
187	Cut	Rectangular cut for BF6 hoist room with vertical sides and presumably flat base (not bottomed). 7.9m NNW/SSE x 5.07m ENE/WSW and >0.45m deep (not bottomed). Highest level 7.40m AOD.	Construction cut for [188]
188	Masonry	Sandstone and brick rectangular room 7.9m NNW/SSE x 5.07m ENE/WSW x 1.06m wide and >0.45m high. Internally c. 6.16m NNW/SSE x 3.24m ENE/WSW however separated by ENE/WSW wall [194] creating two areas c. 2.7m NNW/SSE x 3.24m ENE/WSW. Highest level 7.54m AOD.	Sandstone wall in [187]
194	Masonry	Internal brick partition in wall [188] c. 2.35 ENE/WSW x 0.68m wide and 0.22m high. Highest level 7.43m AOD.	Brick partition wall in structure [188]
195	Structure	Concrete structure in northern partition of G38 c. 1.21m NNW/SSE x 1.06m ENE/WSW and 0.12m high. Highest level 7.31m AOD.	Concrete structure abutting wall [188]
331	Masonry	Brick structure within wall [188] c. 0.60m NNW/SSE x 1.10m and 0.48m high. Highest level 7.42m AOD.	Brick structure in wall [188]
335	Masonry	Brick structure on eastern edge of wall [188], 0.45m NNW/SSE x 0.56m ENE/WSW and 0.48m high. Highest level 7.42m AOD.	Brick structure
201	Cut	Square cut with vertical sides and presumably flat base (not bottomed) c. 1.32m	Construction cut for structure

		ENE/WSW x 1.45m NNW/SSE and >0.40m deep. Highest level 7.36m AOD.	[202]
202	Structure	Firebrick hoist support mirrored by recess in wall [190] G39 to the north c. 1.45m NNW/SSE x 1.32m ENE/WSW x 0.36m wide and >0.40m deep. Recess 0.59m ENE/WSW x 0.89m NNW/SSE. Highest level 7.38m AOD. One of the bricks was stamped BV & Co. (refer to Appendix 5).	Structure in cut [201]
Group 39			
189	Cut	Rectangular construction cut with vertical sides and presumably flat base c. 7.9m NNW/SSE x 5.07m ENE/WSW. Highest level 7.40m AOD.	Construction cut for walls [190], [191], [192] and [193]
190	Masonry	Brick wall for hoist support, c. 3.2m ENE/WSW x 1.06m NNW/SSE and >0.36m high. Similar to G28 for BF4 to the north. Recess for support for hoist conveyor c. 0.57m ENE/WSW x 1.1m NNW/SSE and >0.36m high. Highest level 7.40m AOD.	Brick wall in construction cut [189]
191	Masonry	Firebrick, common brick and sandstone wall to the west of [190] forming hoist room for BF6. 1.94m ENE/WSW x 1.92m NNW/SSE and >0.10m high (not bottomed). Highest level 7.43m AOD.	Sandstone and firebrick wall in construction cut [189]
192	Masonry	Firebrick wall (only a single brick wide) parallel to sandstone wall [188]. Truncated by G40 in the centre. 0.30m wide x 7.9m NNW/SSE (not excavated so height unknown). Highest level 7.54m AOD.	Brick wall in construction cut
193	Masonry	Firebrick wall c. 0.5m ENE/WSW x 5.7m NNW/SSE. Highest level 7.54m. One of the bricks was stamped W2 (refer to Appendix 5).	Brick wall in construction cut [189]
Group 40			
196	Structure	Indurated concrete structure c. 1.95m ENE/WSW x 1.11m NNW/SSE and 0.50m high. Highest and lowest level 7.46m and 6.96m AOD respectively. Two chambers within structure: western 0.83m ENE/WSW x 0.77m NNW/SSE and eastern 0.47m ENE/WSW x 0.74m NNW/SSE.	Concrete structure within BF6 hoist area
197	Masonry	Fire brick structure on southern side of [196] c. 1.1m ENE/WSW x 0.83m NNW/SSE and >0.5m deep. Highest and lowest level 7.44m and 7.05m AOD respectively. Internal area of structure 0.90m x 0.46m.	Brick structure addition to wall [188]
314	Structure	Indurated grey concrete surface in concrete structure [196] c. 6.16m NNW/SSE x 3.24m ENE/WSW. Highest level 7.23m AOD.	Concrete surface in structure [196]
338	Cut	Cut with vertical sides and flat base c. 1.95m ENE/WSW x 1.11m NNW/SSE and 0.50m deep. Highest and lowest level 7.43m and 6.93m AOD respectively.	Cut for concrete structure [196]
Group 41			
203	Cut	Construction cut with vertical sides and flat base c. 1.4m NNW/SSE x 0.95m ENE/WSW. Highest level 7.46m AOD.	Construction cut for brick structure [204]
204	Masonry	Firebrick structure c. 1.4m NNW/SSE x	Firebrick

		0.95m ENE/WSW and >0.08m high (not bottomed). One of the bricks was stamped W2 (refer to Appendix 5).	structure in [203]
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Blast furnace 6 hoist area with later additions and remodelling (G38, G39, G40, & G41)

Blast Furnace 6 screening area (Group 42)

5.4.23 The screening area for BF6 was located to the east of the hoist room (Figure 10 & 14; Plate 45). It comprised a square brick structure [124] within construction cut [123] c. 6.50m NNW/SSE by 5.20m ENE/WSW and >0.46m deep (not bottomed due to groundwater). Internally the room was 4.4m NNW/SSE by 3.55m ENE/WSW. Unlike screening room G37 for BF4, no remains survived of the hoist system however two screening hoppers [327] were exposed within rail line G43. Unfortunately, due to localised flooding on the site, the room could not be bottomed although it was noted that concrete [251] on the western internal wall of the room sloped down to the east.

Context	Type	Description	Interpretation
123	Cut	Square construction cut with vertical sides and presumably flat base c. 6.50m NNW/SSE x 5.20m ENE/WSW and >0.46m deep (not bottomed due to groundwater). Highest level 7.41m AOD.	Construction cut for structure [124]
124	Masonry	Common brick and fire brick structure forming outer walls of BF6's screening room c. 5.20m ENE/WSW x 6.50m NNW/SSE x 1.19m wide and >0.46m high. Internally room 4.4m NNW/SSE x 3.55m ENE/WSW. Highest level 7.41m AOD.	Brick/concrete structure in [123]
127	Fill	Loose dark brown sand with occasional fragments of brick and rubble. 1.15m NNW/SSE x 5.59m ENE/WSW. Highest level 7.40m AOD.	Backfill of construction cut [123]
251	Structure	Indurated grey concrete, internal to room formed by walls [124]. Slopes down to the east at approx. 80°. 4.4m NNW/SSE x 0.52m ENE/WSW and >0.46m high (not bottomed). Highest level 7.41m AOD.	Concrete structure adjacent to wall [124]

Group 42 Blast Furnace 6 screening area

Room at south-east corner of Area B (Group 45)

5.4.24 At the south-east extent of the site (to the west of Phase 3.1 duct G11) was room G45 that survived for 18.4m NNW/SSE by 8.73m ENE/WSW (Figure 10 & 14; Plate 46 & 47). It comprised L-shaped wall [51] forming the western and southern walls, internal concrete surfaces [54] (north) and [53] (south) and a possible base/platform formed by firebrick walls [56], [57] and concrete [58]. External to the room was firebrick floor [50] to the south with wall [52] and apsidal structure [55] built up against the external western face of wall [51]. Due to the level of later truncation the purpose of these structures are unknown as although firebricks were used in their construction, they do not appear to have had an obvious industrial function.

Context	Type	Description	Interpretation
50	Masonry	Firebrick surface c. 9.07m ENE/WSW x 8.91m NNW/SSE and >0.42m high. Several courses of firebrick. Highest and lowest level 7.60m and 7.30m AOD respectively.	Firebrick surface
51	Masonry	L-shaped common brick and fire brick wall c. 15.25m NNW/SSE x 5.94m ENE/WSW x between 1.22-2.09m wide and >0.32m high (not bottomed). Highest level 7.54m AOD. One of the bricks was stamped BV & Co. (refer to Appendix 5).	Firebrick wall
52	Masonry	Firebrick structure exposed for c. 10.82m NNW/SSE x 2.19m ENE/WSW and >0.57m high. Highest level 7.99m AOD. One	Firebrick structure
53	Surface	Indurated grey concrete surface c. 4.62m ENE/WSW x 6.10m NNW/SSE and >0.25m thick (not bottomed). Highest level 7.35m AOD.	Concrete surface adjacent to structure [51] (southern)
54	Surface	Indurated grey concrete surface c. 7.14m NNW/SSE x 5.16m ENE/WSW and >0.15m thick (not bottomed). Highest level 7.43m AOD.	Concrete surface adjacent to structure [51] (northern)
55	Masonry	Apsidal structure on western side of wall [51] c. 2.48m NNW/SSE x 1.31m ENE/WSW and >0.16m high (not bottomed). Highest level 7.64m AOD. One of the bricks was stamped W2 (refer to Appendix 5).	Apsidal structure on west side of [51]
56	Masonry	Common brick structure on eastern side of [51] c. 3.46m ENE/WSW x 0.84m wide and >0.18m high (not bottomed). Highest level 7.42m AOD. One of the bricks was stamped BV & Co. (refer to Appendix 5).	Structure on east side of [51] (northern)
57	Masonry	Common brick and fire brick structure on east side of [51] c. 3.46m ENE/WSW x 0.84m NNW/SSE and > 0.16m high. Highest level 7.51m AOD.	Structure on east side of [51] (southern)
58	Structure	Indurated grey concrete c. 3.46m ENE/WSW x 0.89m NNW/SSE and > 0.3m thick (not bottomed). Highest level 7.49m AOD.	Concrete between [56] and [57] to the east of [51]
306	Cut	Semi-circular construction cut with vertical sides and presumably flat base (not bottomed) c. 2.48m NNW/SSE x 1.31m ENE/WSW and >0.16m deep. Highest level 7.64m AOD.	Construction cut for structure [55]

Group 45 room

Other structures and features around Area B ([305], Group 48, Group 49, Group 50, Group 51, Group 52, Group 56, Group 57, Group 59)

5.4.25 Nine additional features were located within Area B between the western limits of the excavation area and Phase 3.1 pipe duct G11 (Figures 10 to 15). Due to the scale of truncation, it is difficult to assign a function to any of these remains with even the pipes heading towards no obvious industrial stoves/furnaces. These remains are comprised of brick

wall [305] (Figure 13); G48 pipe running ENE/WSW between BF2 and BF3 (Figure 13); G49 concrete structure to the west of BF4 (Figure 12); concrete structure G50 and G51 at the northwest corner of site (Figure 11); G52 pit with timber uprights to the east of BF6 (Figure 14); G56 partially uncovered firebrick structure to the southeast of BF6 (Figure 14); G57 late 20th century concrete surface at the southern extent of Area B (Figure 14 & 15) and G59 concrete surfaces/structures (Figure 13).

Context	Type	Description	Interpretation
305	Masonry	Brick wall c. 2.66m NNW/SSE x 0.57m wide and >0.10m high. Highest level 7.55m AOD.	Brick wall abutting brick duct G16
Group 48			
5	Pipe	Fe pipe survived for 15.73m ENE/WSW with a diameter of 0.35m. Highest level 7.51m AOD.	Fe pipe in [9]
8	Fill	Loose grey silt sand with inclusions of brick rubble c. 27.95m ENE/WSW x 1.21m wide and >0.12m thick (not bottomed). Highest level 7.47m AOD.	Backfill of pipe cut [9]
9	Cut	Linear cut for pipe [5] c. 27.95m ENE/WSW x 1.21m wide and >0.12m deep. Highest level 7.47m AOD.	Construction cut for pipe [5]
139	Cut	Rectangular cut c. 1.15m ENE/WSW x 1.08m NNW/SSE and 1m deep. Highest and lowest level 7.35m and 6.35m AOD respectively.	Construction cut for concrete structure [140]
140	Structure	Indurated concrete structure c. 1.15m ENE/WSW x 1.08m NNW/SSE and 1m deep. Internal space 0.88m x 0.77m. Highest level 7.35m AOD.	Concrete manhole structure in [139]
Group 49			
266	Cut	Sub-rectangular construction cut for concrete c. 3.64m ENE/WSW x 1.70m NNW/SSE and >0.05m deep (not bottomed). Highest level 7.87m AOD.	Construction cut for concrete structure [267] to the west of BF4
267	Structure	Indurated light grey concrete structure c. 3.64m ENE/WSW x 1.70m NNW/SSE and >0.05m deep. Highest level 7.87m AOD.	Concrete structure
Group 50			
271	Cut	Irregular cut with vertical sides at northern end of site c. 3.59m ENE/WSW x 2.83m NNW/SSE and >1.05m high. Highest level 7.80m AOD.	Construction cut for concrete [272] and Fe base [273]
272	Structure	Indurated light grey concrete c. 3.59m ENE/WSW x 2.83m NNW/SSE and >1.05m high. Highest level 7.80m AOD.	Concrete foundation for [273]
273	Metal	Truncated metal upright set in concrete [272]. Diameter 1.52m and >0.30m high.	Fe base
Group 51			
264	Cut	Irregular cut with vertical sides and flat base c. 10.5m x 5.3m and >0.05m deep. Highest level 7.08m AOD.	Construction cut for concrete structure [265]
265	Structure	Concrete structure at northern end of site. Indurated light grey concrete c. 10.5m x 5.3m and >0.05m deep. Highest level 7.08m AOD.	Concrete structure

Group 52			
211	Cut	Square cut with vertical sides 1.13m NNW/SSE x 0.90m ENE/WSW and >0.04m deep. Not excavated.	Cut for timber upright/structure [212]
212	Fill and Timber	Soft silty clay backfill around upright timber. Fill 1.13m NNW/SSE x 0.90m ENE/WSW. Timber upright c. 230mm x >300mm x 40mm.	Timber upright
Group 56			
328	Cut	Cut for masonry [329] c. >1.03m ENE/WSW x 0.25m NNW/SSE and 0.30m deep. Highest and lowest level 7.87m and 7.57m AOD respectively.	Construction cut for fireblock structure [329]
329	Masonry	Fire block structure partially uncovered for c. >1.03m ENE/WSW x 0.25m NNW/SSE and 0.30m high. Highest level 7.87m AOD.	Partially uncovered firebrick structure
Group 57			
46	Surface	Indurated grey concrete surface to the south of BF6 c. 12.54m ENE/WSW x 6.52m NNW/SSE and >0.20m thick. Highest level 7.97m AOD.	Concrete surface at southern end of site
47	Cut	Irregular cut with vertical sides and flat base c. 12.54m ENE/WSW x 6.52m NNW/SSE and >0.20m deep. Highest level 7.97m AOD.	Construction cut for [46]
48	Surface	Indurated grey concrete c. 17.47m NNW/SSE x 13.84m ENE/WSW and >0.20m thick. Highest level 7.87m AOD.	Concrete surface and supports at southern end of site
49	Cut	Rectangular cut for concrete with vertical sides and flat base concrete c. 17.47m NNW/SSE x 13.84m ENE/WSW and >0.20m deep. Highest level 7.87m AOD.	Construction cut for [48]
Group 59			
213	Cut	Rectangular cut for concrete on north and south side of wall G22. 2.14m NNW/SSE x 4.55m ENE/WSW and >0.30m deep. Highest level 7.45m AOD.	Construction cut for concrete [214]/[215]
214	Structure	Indurated grey concrete c. 0.56m NNW/SSE x 4.55m ENE/WSW and >0.30m thick. Highest level 7.45m AOD.	Concrete south of wall [216] in [213]
215	Structure	Indurated grey concrete c. 0.70m NNW/SSE x 4.55m ENE/WSW and >0.30m thick. Highest level 7.52m AOD.	Concrete north of wall [216] in [213]

Other structures within Area B ([305], G48, G49, G50, G51, G52, G56, G57, G59)

Other structures between rail line G43 and main pipe duct G11 (Group 53, Group 54, Group 55, Group 60, Group 61, Group 62, Group 63, Group 64, Group 65, Group 66, Group 67, Group 68, Group 69, Group 70, Group 72, Group 73)

5.4.26 Sixteen structures were uncovered between rail line G43 and pipe duct G11 along the eastern limits of Area B. The majority of these features were concrete pads/bases that may have related to the rail line however, like all the structural remains within this section, they were all too truncated to ascertain their function. The sixteen structures comprised: G53 concrete pad to the south of screening room G53 (Figure 14); G54 concrete and brick structure in south-

west corner of Area B (Figure 14); G55 Fe base plate to the east of wall [25] in the south-east corner of Area B (Figure 14); G60 concrete surface (Figure 12); G61 concrete surface (Figure 13); G62 concrete and brick structure (Figure 13); G63 sandstone pad (Figure 13); G64 concrete pad (Figure 13); G65 concrete pad (Figure 13); G66 concrete pad (Figure 12); G67 concrete pad (Figure 12); G68 concrete pad (Figure 12); G69 concrete pad (Figure 12); G70 structure (Figure 12 & 13); G72 concrete structure (Figure 12) and G73 concrete structure at the north-east of Area B (Figure 11).

Context	Type	Description	Interpretation
Group 53			
122	Structure	Indurated grey concrete to south of BF6 screen room G42 c. 1.43m ENE/WSW x 1.76m NNW/SSE and > 0.10m deep. Highest level 7.43m AOD.	Concrete/Fe structure
126	Cut	Square cut with vertical sides and flat base c. 1.43m ENE/WSW x 1.76m NNW/SSE and > 0.10m deep. Highest level 7.43m AOD.	Construction cut for [122]
Group 54			
119	Cut	Linear cut at SE corner of site c. 17.93m NNW/SSE x 4.52m ENE/WSW and >0.12m deep (not bottomed). Highest level 7.36m AOD.	Construction cut for brick shuttering [120] and concrete [234]
120	Masonry	Brick shuttering for concrete [234] c. 9.95m NNW/SSE x 0.22m wide. Highest level 7.27m AOD.	Brick shuttering for concrete [234] within [119]
234	Structure	Indurated grey concrete with rebar c. 17.93m NNW/SSE x 4.52m ENE/WSW and >0.12m thick. Highest level 7.36m AOD.	Concrete structure in [119]
Group 55			
116	Cut	Semi-circular cut on eastern side of wall [25] c. 1.42m NNW/SSE x 0.78m ENE/WSW and 0.24m deep. Highest level and lowest level 7.40m and 7.16m AOD respectively.	Construction cut for Fe base [117]
117	Metal	Metal base plate with five rivets on top. A short section of wire protruded from underneath so could therefore have represented overhead light for furnaces? Highest level 7.16m AOD.	Fe column base
Group 60			
155	Cut	Linear cut with presumably flat base (not bottomed) on eastern side of pipe duct G11 c. 14.35m NNW/SSE x 1.86m ENE/WSW. Highest level 7.39m AOD.	Construction cut for concrete surface [156]
156	Structure	Indurated light grey concrete c. 14.35m NNW/SSE x 1.86m ENE/WSW. Highest level 7.39m	Concrete surface
Group 61			
130	Cut	Linear cut with presumably flat base (not bottomed) on eastern side of pipe duct G11 c. 15.73m NNW/SSSE x 2.38m ENE/WSW. Highest level 7.51m AOD.	Construction cut for concrete surface [131]
131	Surface	Indurated light grey concrete c. 15.73m NNW/SSSE x 2.38m ENE/WSW. Highest	Concrete surface

		level 7.51m AOD.	
Group 62			
165	Cut	Construction cut with vertical sides and presumably flat base (not bottomed) c. 3.38m ENE/WSW x 2.48m NNW/SSE. Highest level 7.41m AOD.	Construction cut for concrete surface [166]
166	Surface	Indurated light grey concrete 1.6m NNW/SSE x 2.10m ENE/WSW. Highest 7.31m AOD.	Concrete surface in [165]
167	Masonry	Brick structure c. 1.4m ENE/WSW x 2.48m NNW/SSE and 0.07m high (only one course survived). Highest level 7.36m AOD. One of the bricks was stamped No.22 (refer to Appendix 5).	Firebrick wall in [165]
168	Structure	Indurated light grey concrete 1.02m NNW/SSE x 0.90m WSW/ESE (not bottomed). Highest level 7.45m AOD.	Concrete structure in [165]
169	Masonry	Fire brick structure c. 1.10m ENE/WSW x 1.10m NNW/SSE and 0.10m high/ Highest level 7.41m AOD.	Brick wall in [165]
Group 63			
128	Cut	Rectangular cut with vertical sides and flat base c. 1.24m ENE/WSW x 0.76m NNW/SSE and 0.40m deep. Highest level 7.41m AOD.	Construction cut for [129]
129	Masonry	Sandstone pad c. .24m ENE/WSW x 0.76m NNW/SSE and 0.40m high. Highest level 7.41m AOD.	Sandstone pad
Group 64			
132	Cut	Square cut with vertical sides and flat base c. 0.85m ENE/WSW x 0.95m NNW/SSE. Highest level 7.43m AOD.	Construction cut for concrete pad [133]
133	Structure	Indurated light grey concrete c.0.85m ENE/WSW x 0.95m NNW/SSE. Highest level 7.43m AOD.	Concrete pad
Group 65			
137	Cut	Square cut with vertical sides and flat base c. 0.7m ENE/WSW x 0.9m NNW/SSE. Highest level 7.40m AOD.	Construction cut for [138]
138	Structure	Indurated light grey concrete c. 0.7m ENE/WSW x 0.9m NNW/SSE. Highest level 7.40m AOD.	Concrete pad
Group 66			
144	Cut	Square cut with vertical sides and flat base c. 0.7m ENE/WSW x 0.9m NNW/SSE and >0.3m deep. Highest level 7.36m AOD.	Construction cut for concrete pad [145]
145	Structure	Indurated light grey concrete c. 0.7m ENE/WSW x 0.9m NNW/SSE and >0.3m deep. Highest level 7.36m AOD.	Concrete pad
Group 67			
149	Cut	Square cut with vertical sides and flat base c. 0.9m ENE/WSW x 0.95m NNW/SSE. Highest level 7.36m AOD.	Construction cut for concrete pad [150]
150	Structure	Indurated light grey concrete c. 0.9m ENE/WSW x 0.95m NNW/SSE. Highest level 7.36m AOD.	Concrete pad
Group 68			
151	Cut	Square cut with vertical sides and flat base c. 0.9m ENE/WSW x 0.9m NNW/SSE. Highest level 7.36m AOD.	Construction cut for concrete pad [152]

152	Structure	Indurated light grey concrete c. 0.9m ENE/WSW x 0.9m NNW/SSE. Highest level 7.36m AOD.	Concrete pad
Group 69			
153	Cut	Square cut with vertical sides and flat base c. 0.95m NNW/SSE x 0.95m ENE/WSW. Highest level 7.39m AOD.	Construction cut for concrete pad [154]
154	Structure	Indurated light grey concrete c. 0.95m NNW/SSE x 0.95m ENE/WSW. Highest level 7.39m AOD.	Concrete pad
Group 70			
134	Cut	Rectangular cut with vertical sides and flat base c. 1.5m ENE/WSW x 0.76m NNW/SSE and > 0.4m deep (not bottomed). Highest level 7.47m AOD.	Construction cut for [135]
135	Masonry	Firebrick structure 1.5m ENE/WSW x 0.76m NNW/SSE and >0.4m deep. Highest level 7.47m AOD. Brick enclosed Fe fixing point for machinery. One of the bricks was stamped ...R CROWN (refer to Appendix 5).	Firebrick and Fe structure in [134]
136	Metal	Metal fitting set into masonry [135]. Possible anchor/fixing point.	Metal fitting
Group 72			
146	Cut	Square cut with vertical sides and flat base c. 1m ENE/WSW x 1.06m NNW/SSE and >0.26m deep. Highest level 7.30m	Construction cut for concrete structure [147]
147	Structure	Indurated light grey concrete c. 1m ENE/WSW x 1.06m NNW/SSE and >0.26m deep. Highest level 7.30m	Concrete structure
Group 73			
246	Cut	Square cut with vertical sides and flat base c. 2.25m NNW/SSE x 1.8m ENE/WSW and >0.90m deep. Highest level 7.94m AOD.	Construction cut for concrete structure [247]
247	Structure	Indurated light grey concrete with iron supports c. 2.25m NNW/SSE x 1.80m1.8m ENE/WSW and 0.90m thick. Highest level 7.94m AOD.	Concrete structure

Other structures between rail line G43 and main pipe duct G11 (G53, G54, G55, G60, G61, G62, G63, G64, G65, G66, G67, G68, G69, G70, G72, G73)

5.5 Phase 4: Demolition and Modern Remains

5.5.1 With the decline of the British steel industry in the late 20th century came the closure of the works. Clearance of the structure from the site took place from the late 1980s onwards and had been completed by the end of the 20th century. Deposits attributed to this phase are therefore related to the demolition of the Works, the backfilling of structures and the levelling of the site. The demolition deposits from both Trench 1 and Area B have been grouped together in G75 and comprised a mixture of demolition debris. Within Trench 1 these deposits were >4.61m ENE/WSW by 20.26m NNW/SSE and in Area B >71.76m ENE/WSW by >119.06m NNW/SSE. Group 75 ranged from 1.10m thick in Trench 1 to between 1.35m at the northern end of Area B to 0.43m at the southern. The highest and lowest level of G75 within Trench 1 was 8.10m in the south and 7.92m AOD in the north and within Area B, 8.69m in the north and 8.26m AOD in the south.

Context	Type	Description	Interpretation
Trench 1			
1000	Layer	Friable dark grey clayey silt c. >4.61m ENE/WSW x >20.26m NNW/SSE and up to 1.10m thick. Highest and lowest level 8.10m and 7.92m AOD respectively.	Modern overburden
Area B			
1	Layer	Loose dark brownish grey coarse sand and demolition rubble c. >71.76m ENE/WSW x >119.06m NNW/SSE and 1.35m thick. Highest and lowest level 8.69m and 8.26m AOD respectively.	Modern overburden
103	Fill	Compact dark grey coarse gravel c. 3.48m in diameter and >0.58m thick. Highest level 7.39m AOD.	Backfill of possible chimney G25
118	Fill	Friable mid brownish grey silt c. 1.42m NNW/SSE x 0.78m ENE/WSW and >0.24m thick. Highest level 7.51m AOD.	Backfill of G55
121	Fill	Soft dark brownish grey coarse gravel 17.93m NNW/SSE x 4.32m ENE/WSW and >0.17m thick. Highest and lowest level 7.37m and 7.27m AOD respectively.	Backfill of G54
125	Fill	Loose dark brownish grey sand with frequent inclusions of demolition rubble c. 4.56m NNW/SSE x 3.65m ENE/WSW and >0.38m thick. Highest level 7.41m AOD.	Backfill of structure G42
141	Fill	Loose dark grey gravel c. 0.92m ENE/WSW x 0.77m NNW/SSE and 1m thick. Highest level 7.38m AOD.	Backfill of structure G48
148	Fill	Soft mid yellowish brown silty clay. 0.75m ENE/WSW x 0.75m NNW/SSE and >0.30m thick. Highest level 7.30m AOD.	Backfill of structure G72
170	Fill	Compact dark reddish brown silty sand c. 1.3m ENE/WSW x 0.19m NNW/SSE and 0.10m thick. Highest level 7.41m AOD.	Backfill of G62
171	Fill	Friable dark brownish grey sandy silt c. 1.44m NNW/SSE x 1.52m ENE/WSW and >0.1m thick. Highest level 7.45m AOD.	Backfill of G62
198	Fill	Friable mid grey clayey silt c. 1.11m NNW/SSE x 1.95m ENE/WSW and >0.50m thick. Highest level 7.46m AOD.	Backfill of structure G40
199	Fill	Friable mid grey clayey silt c. 0.9m ENE/WSW x 0.6m NNW/SSE and >0.50m thick. Highest level 7.44m AOD.	Backfill of structure G40
200	Fill	Friable dark grey sandy silt with ash and clinker c. 6.10m NNW/SSE x 3.40m ENE/WSW and 0.15m thick. Highest level 7.46m AOD.	Backfill of G38
228	Fill	Soft dark brownish grey demolition rubble with a matrix of silt c. 1.8m ENE/WSW x 4.6m NNW/SSE and 0.1m thick. Highest level 7.17m AOD.	Backfill of G37
248	Fill	Friable mid grey clayey silt c. 0.58m ENE/WSW x 0.9m NNW/SSE and >0.40m thick. Highest level 7.38m AOD.	Backfill of G39
250	Fill	Loose light greyish brown demolition rubble c. 8.88m NNW/SSE x 1.21m ENE/WSW and >0.79m thick. Highest level 7.45m AOD.	Backfill of G11

303	Fill	Friable mid grey clayey silt c. 0.6m ENE/WSW x 1.1m NNW.SSE and >0.36m thick. Highest level 7.43m AOD.	Backfill of G39
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Group 75 demolition material and overburden

6. CONTENTS OF THE ARCHIVE

6.1 Paper Records

6.1.1 The paper element of the Site Archive is as follows:

Item	No.	Sheets
Context register	1	9
Context sheets	350	350
Section register	1	1
Section drawings	3	7
Plans	7	24

Contents of the paper archive

6.2 Photographic Records

6.2.1 The photographic element of the Site Archive is as follows:

Item	No.	Sheets
Digital photograph registers	1	8
Digital photographs	367	N/A

Contents of the photographic archive

6.3 Site Archive

6.3.1 The complete Site Archive, including the paper and photographic records and artefactual archive, is currently housed at the PCA Durham Regional Office.

6.3.2 The Site Archive will eventually be deposited with Kirkleatham Museum, Redcar, Redcar & Cleveland, under the Site Code ERF21, for permanent storage and the detailed requirements of the repository will be met prior to deposition. Digital photography has been archived online with Archaeological Data Service under the OASIS ID preconst1-422160.

7. SUMMARY DISCUSSION OF THE ARCHAEOLOGICAL FINDINGS

7.1 Phase 1: Superficial Geology

7.1.1 Phase 1 represents the superficial geology of this part of Redcar comprising Devensian Glaciolacustrine deposits of clay and silt overlying Mercia Mudstone bedrock (British Geological Survey website). The geological material was only observed in Trench 1 at a height of 6.40m AOD and was formed two million years ago in the Quaternary Period when the local environment was dominated by ice age conditions. They are glaciolacustrine in origin, formed of fine-grained detrital material from glacial meltwater.

7.1.2 Agricultural use of the land throughout the medieval and post-medieval periods likely resulted in horizontal truncation of the upper surface of the geological substratum through plough truncation.

7.2 Phase 2: Pre-1853 Agricultural Field Drain

7.2.1 Phase 2 comprises a single ceramic field drain noted in the base of Trench 1 that likely dates from the early 19th century. Prior to industry taking hold within Redcar, the area was known as *The Pastures* and comprised large, enclosed fields on the banks of the Tees. This field drain predates both the early Eston Iron Works built c. 1853 (Figure 3) and the later Cleveland Steel Works that occupied the site from c. 1874 (Figure 4).

7.3 Phase 3: Cleveland Steel Works

Phase 3.1

7.3.1 From 1850 the iron industry around Redcar and Cleveland rapidly expanded, propelling the area (albeit briefly) to one of the world's largest iron-producing centres and brought about the formation of a major industrial hub in a previously unindustrialised area (James 2013, 1). The Eston Iron Works were the first industrial property to be built within the redline boundary of the proposed development, however, no remains of the 1853 works were uncovered as they were truncated by the construction of the Cleveland Steel Works in c. 1874. The works continued producing iron and steel up to the late 20th century which saw the closure of the works due to the decline of the steel industry and its subsequent demolition (Phase 4).

7.3.2 The remains of the Cleveland Steel Works have been split into two sub-phases: Phase 3.1 19th century activity and Phase 3.2 20th century activity. The Phase 3.1 works can be seen on the Ordnance Survey map of 1895 (Figure 4) that shows the sprawling industrial complex comprising three large rectangular structures, numerous rail lines and several other buildings dotted across the site. A simplified plan of these works was produced in the *Institution of Mechanical Engineers Proceedings* for the year 1893 that labelled the functions of each of the buildings (reproduced in Historic Plate A & B). The large structures that occupied the northern part of the proposed development area contained the Bessemer converters, mills (Mills, Bloom Mills and Plate Mills) and the Rail Finishing Machinery with smaller structures

- containing boilers, blowing engines and gas producers. To the south of the main steel works were labelled three 'Bessemer' furnaces (BF1, BF2 and BF3). These were not true Bessemer furnaces that converted iron to steel but rather haematite blast furnaces that produced iron for the Bessemer converters located to the north (discussed in more detail below).
- 7.3.3 The Phase 3.1 structural remains on the site were heavily truncated by 20th century additions and remodelling of the Cleveland Steel Works (Phase 3.2), the demolition of the works in the late 20th century (Phase 4) and in the 21st century during remediation works for the Energy Recovery Facility. No remains survived of the steel works to the north of Area B as the ground was reduced by c. 2m prior to archaeological works commencing.
- 7.3.4 The earliest activity on the site initially involved ground preparation work, namely the deposition of levelling deposits G3 for the construction of the steel works. Into these made ground deposits were cut all the structures noted across the site. Within Trench 1, a single drain survived from Phase 3.1, that may have connected to the boiler or engines that occupied the small square structure to the east of the trench (Figure 4). Phase 3.1 remains within Area B comprised three circular blast furnaces (BF1, BF2 and BF3), the base of a possible blast stove (G9/G10), a rail line (G8), a substantial pipe duct (G11) with four subsidiary ducts (G12, G13, G15 & G16) as well as several other structures such as concrete surfaces or a possible chimney (G14).
- 7.3.5 The three blast furnaces were heavily truncated during Phase 3.2 as they were replaced with newer 'Yankee' furnaces BF4, 5 and 6. Blast Furnace 1 was in the poorest state as only a small section of firebrick masonry on a concrete foundation survived in the south-west corner. Blast Furnace 2 and 3 fared slightly better with substantial upstanding masonry surviving. The construction of these two furnaces were similar as they comprised a concrete foundation onto which a circular firebrick structure was built. Both were also capped with an in-situ salamander (a deposit of all liquid and solidified materials in the hearth of a blast furnace below the tap hole) however, when they went out of use during the early 20th century, they were partially demolished with only the base of the structures surviving. It appears that BF2 suffered a catastrophic failure as part of the salamander had escaped the confines of the furnace with the detrital material escaping through weak points in the masonry core. BF3 varied from BF2 as bands of metal radiated out from the centre of the furnace, likely added to aid in structural support. Unlike the other two furnaces there was a small rail siding built into the western side of the furnace. Rail line G8 would have taken both the molten iron to the Bessemer converters to the north and the waste slag to either be dumped on the banks of the Tees or reused to create slag by-products such as scoria bricks in nearby adjacent works.
- 7.3.6 To the east of each of the three Phase 3.1 blast furnaces were rectangular brick ducts containing iron pipes that fed into a main pipe duct G11. This main pipe duct housed a substantial pipe that only survived at the southernmost extent of the site but the masonry element crossed the entirety of Area B continuing out of the limit of excavation to the north. An

- additional smaller pipe duct was also noted to the north of BF1 that connected the main pipe duct to the remains of blast stove G9/G10. These pipes would have carried air from the blowing engine depicted on the 1893 Plan of the Cleveland Steel works that was located to the north-east of BF1 (Historic Plate A & B). The air would have been carried from the engines towards the furnaces in main duct G11 before being diverted to Cowper Blast Stoves to create a hot blast for the furnaces. This was then blown into the lower section of the furnace through a series of tuyeres. No remains survived of the tuyeres and the only possible blast stove to survive was that of G9/G10 to the north of BF1 however the Ordnance Survey map of 1895 depicts three pairs of stoves immediately east of each of the blast furnaces with a fourth pair noted to the south-east of BF3 (Figure 4). Blast stove G8/G9 perhaps predates this new arrangement of stoves as it does not appear on the historic mapping sequence. No evidence of the blast-stoves to the east of the furnaces were uncovered as these would have been located above ground. It appears that some of the blast stoves were demolished during the construction of the Welfare Block, which is shown on the 1978 demolition plan (not reproduced in the figures; refer to Prospect Archaeology 2020a, 24).
- 7.3.7 The 'Proceedings of the Institution of Mechanical Engineers' (1983, 354-358) offers a first-hand account of the works in the late 19th century. The Cleveland steel works were erected in 1876 (possibly started in 1874 and completed in 1876) to the designs and under the supervision of Mr. E Windsor Richards, for the manufacture of steel rails by the Bessemer process. By 1893 the works had been extended with construction of plant for the basic and open-hearth smelting processes. The works occupied an area of sixty acres of which twenty were covered with roofing. When in full operation the works were capable of producing 5,500 tons of finished steel per week and employed 2,500 men. The hematite blast furnaces (Area B: BF1, BF2 & BF3) produced hematite pig-iron for use in the acid lined converters (Bessemer) to the north in the steel works. The bulk of the ore that was used in the furnaces was known as Rubio and was obtained from mines in the north of Spain, namely Luchana Co.'s mines at Bilbao. The three blast furnaces were 72 feet high, 23 to 24 feet diameter at the bosh and 10 feet in the hearth with blast provided at a pressure of 5 ¼ lbs per square inch taken from the mains blast line (G11) that also supplied the nearby Cleveland Iron Works c. 450m to the west. Eight non-condensing beam engines supplied blast to the furnaces which had cylinders 40 inches in diameter and a 96-inch stroke. The blast was then heated to a temperature of about 1,450° Fahrenheit (787.77° C) in eight Cowper blast stoves, 60 feet high by 25 feet in diameter. The blowing engines were located at the southern end of the Bessemer shop. There were four double blowing engines with 40-inch steam and 50-inch air cylinders by 60-inch stroke, of which three were by Messers. D. Adamson and Co. and one by Messers. Bolckow, Vaughan and Co.
- 7.3.8 Adjacent to the furnaces were a row of 32 mineral bunkers surmounted by a gantry which was approached by an incline. The furnaces were loaded by two hoists, one water-balance and the

other actuated by a winding engine. The output of these furnaces was about 1,000 tons of hematite pig-iron per furnace per week.

- 7.3.9 Located near the western entrance to the steel works, to the north-west of Area B (Historic Plate A & B), were the mixing plant for the de-sulphurization and homogenization of pig-iron by the Massenez process; it comprised two mixers each capable of holding 140 tons of molten pig-iron. The molten metal was brought from the hematite blast furnaces to the south (BF1-3) by locomotives in bogie ladles and raised by an incline to the level of the gantry on which the mixers were placed (Institution of Mechanical Engineers 1893). The metal would have been poured in at one end of the mixer and run out at the other end as required by the converters (*ibid.*, 355). At the west end of the main building were the Bessemer and basic shops. The Bessemer shop contained four 8-ton acid-lined converters, served by two centre cranes and six ingot cranes. On the converter gantry were four small Spiegel cupolas, served by a hydraulic lift with another lift used to raise the molten metal to the gantry. Cupolas for melting pig-iron were also located in this building.
- 7.3.10 The basic shop contained six 15-ton basic lined converters, served by four centre cranes and eight ingot cranes, all worked by hydraulic power. To the west of these were the 'plug' shops where linings were prepared. They contained sixteen drying stoves, five pug-mills, one stone breaker, five cupolas for shrinking dolomite for basic linings, and one steam-hammer for consolidating the perforated plugs. A special underground railway with frequent openings was also noted in this period that afforded a ready exit for slag and refuse of all kinds. This may have been the continuation of rail line G8 that was uncovered to the west of Blast Furnaces 1 to 3.
- 7.3.11 To the east of the basic and Bessemer shops was the mill building (Historic Plate A & B). This building contained seven horizontal and six vertical ingot-heating furnaces. All used the regenerative principle and heated by producer gas. The cogging mills consisted of a stand of 48-inch rolls and the plate mill consisted of two stands of rolls. No. 1 mill was capable of producing 500 tons of rails of heavy section per shift with No. 2 mill used for the production of sleepers, angles and rails. No. 3 mill is listed as being capable to have produced 1500 tons of angles or light rails per week and No. 4 mill capable of producing 250 tons of fish plates or merchant bars per week. All the mills were provided with suitable shears and saws and there were re-heating furnaces provided for the plate mill and for the various rail and bar mills (*ibid.* 358).
- 7.3.12 Seven steel-melting furnaces were located at the eastern end of the works (to the north-east of Area B). These were all acid lined. Two were of the original Siemens type having a capacity of 12 tons each with five having iron-cased regenerators with the capacity of between 20 and 30 tons. In front of the 30-ton capacity regenerators was a casting pit, in which ingots up to 5 tons in weight were cast. At the eastern end of the range of melting furnaces was the steel foundry that had a 25-ton overhead crane and two drying stoves.

- 7.3.13 Interestingly the *Proceedings* document refers to the stagnation in technological advancement of blast furnaces since 1871 as no great change had been made in the size, form or performance (Institution of Mechanical Engineers 1893, 231). A weekly output per furnace of 500 tons of Cleveland or of 800 tons of hematite pig iron was no longer considered remarkable with these figures having been considerably exceeded. Members of the Iron and Steel Institute visited America in 1890 and were impressed by the enormous outputs obtained per furnace at some of the American smelting works. This was found to be due partly to the use of exceedingly rich ores however that did not account for the overall observed results. The performance of the Edgar Thomson furnace 'I' during January 1892 reported a 90 feet high furnace that was 21 feet wide at bosh and 12 feet wide at the hearth with a capacity of about 23,000 cubic feet. Within that month the furnace produced 12,706 tons of iron with the best week's work 3,005 tons and the best days work 511 tons. The volume of air delivered by the blowing engine was 27,000 cubic feet per minute, which was 1,175 cubic feet per 1,000 cubic feet capacity or from 3 to 4.5 times what was usual in Cleveland. The advantage obtained in richer ores could not be obtained in Cleveland if only local ores were being used. With regards to the difference in practice, the most noteworthy aspect was the enormously greater quantity of air passing through the American furnace than what was being used in Cleveland and the higher pressure of blast which has to be maintained for enabling it to penetrate the charge. The maximum American output exceeded the Cleveland maximum in about the same proportion as the air passed through per 1,000 cubic feet of capacity and goes some measure to explain the higher yield of the American furnaces.
- 7.3.14 The American method did have its problems as the practice of forcing furnaces, with the consequent rapid destruction of linings, did not find favour generally in Cleveland (Institution of Mechanical Engineers 1893, 237). The lining of a Cleveland furnace lasted any time from six years if on hematite ore, up to eighteen and even twenty years on Cleveland Ore. The American highly forced furnaces required re-lining every two to three years which paled in comparison to one example at Cleveland that lasted nearly 18 years and served for 500,000 tons of pig iron. The American process did however raise much discussion and indicated various lines of progress for the future of Cleveland Steel. The American system laid emphasis upon blowing power with each furnace having a separate engine or engines independently of any others. Cleveland engineers in 1893 were unconvinced that separate blowing was better than blowing into and drawing out of one common main (such as the main blast pipeline G11) however they conceded the point and, in some cases, shifted to separate blowing as practiced in American. At one works in Cleveland a special furnace was built to use Spanish hematite on the line of the most recent practice, but insufficient data had been collected when the 1893 *Proceedings* document was published (Institution of Mechanical Engineers 1893, 237). It was likely that the higher output of the American furnaces prompted the replacement of Blast Furnace 1-3 with 'Yankee' furnaces in the early 20th century (Phase 3.2).

Phase 3.2

- 7.3.15 Phase 3.2 represents 20th century changes at the Cleveland Steel Works reflecting technological improvements within the British steel industry, specifically the adoption of Yankee furnaces from around 1911. As with Phase 3.1 of the Cleveland Steel Works, Phase 3.2 was heavily truncated however numerous structures did partially survive. In Trench 1 this comprised the remains of a long rectangular structure first observed on the Ordnance Survey map of 1915 (Figure 5). In Area B, two blast furnaces (BF4 & 6) were uncovered as well as a third to the south outside the excavation area (BF5). Also uncovered within Area B were two rail lines, hoist areas for BF4 and BF6 and numerous other structures, walls and surfaces.
- 7.3.16 The original three blast furnaces were still in use up until 1911 as they are shown on the Ordnance Survey map of 1895 (Figure 4), however by the map of 1915 (Figure 5) the works had been remodelled with the construction of BF4 and 5 and Blast Furnace 1, 2 and 3 decommissioned. The works can be clearly seen in aerial photographs taken in 1924 that show the Hi-line rail line to the east of Blast Furnace 4 and 6 and several blast stoves (Historic Plate C-E). During the decommissioning of the original three furnaces, BF1 was demolished to ground level however BF2 and BF3 survived above ground albeit heavily truncated. Blast Furnace 4 was built c. 1911 with BF6 constructed shortly after in 1913, and BF5 built in 1937. The remains uncovered on site likely do not represent their original form as Yankee furnaces are known to require frequent relining after 2-3 years (Institution of Mechanical Engineers 1893, 237). Previous phases of works at the site note that these furnaces were rebuilt in the 1930s and 1950s (Prospect Archaeology 2020a, 8). In 1947 the furnaces were modernised and rebuilt with 18' 6" heaths and in this form two of them are recorded to have lasted until the 1990s (NAA 2020b, 5). Conceivably, it is in this form that the remains of the later blast furnaces uncovered on site originated.
- 7.3.17 Blast Furnace 6, that was built in 1913, is recorded to have been demolished after the First World War (Tees Archaeology 2019, 7) however map regression shows that it was still present on the Ordnance Survey maps of 1915, 1929 and 1953 (Figure 5-7 respectively). This reference may refer to relining or modernising the furnace rather than its total demolition.
- 7.3.18 Blast Furnace 4 and 5 were the better-preserved structures as BF6 had been demolished to ground level. BF4 and 5 were also very similar regarding the methods used in their construction. Both featured a concrete base with brick elements surrounded with metal uprights. The exterior of the central fireblock cores were both also lined with metal sheeting and in situ salamanders were also present. Blast Furnace 6 differed as there was no evidence of metal uprights around the perimeter of the core of the furnace and iron bands were noted around part of the exterior of BF6 that were not present in BF4 and BF5. The changes noted in construction may be explained by varying construction dates with BF4 and 5 being rebuilt and modernised whilst BF6 remained in its original form.

- 7.3.19 The main blast pipeline from the blowing engines to the blast stoves of the furnaces was retained during Phase 3.2. This illustrates that although the Cleveland Steel industry was keen to adopt the Yankee furnaces, they remained sceptical of the need for separate blowing engines for each furnace rather than a centralised system. The structure that contained the blowing engine (Historic Plate A & B) appears to have survived in the Ordnance Survey map of 1915 (Figure 6) with modifications made to the pipeline system in 1953 (Figure 7).
- 7.3.20 To the east of BF4 and BF6 were their respective hoist and screening areas (depicted on the Ordnance Survey map of 1953; Figure 7). The hoist areas saw several phases of rebuild with seven alterations noted at BF4 and four at BF6. Due to the scale of truncation, no mechanical elements survived in either of the hoist rooms. The screening room for BF4 was slightly better preserved with metal rails surviving from the hoist mechanism however these had been removed from the screening area associated with BF6. Rail line G43 provided ore and fuel to the furnaces that were processed by a pair of purpose-built screens built into the track for BF4 and BF6. These screens are thought to have been used when preparing the charge for the blast furnace. Raw materials comprising ore, fuel (coke) and flux (limestone) would have been screened through the hoppers to the desired mixture then transported to the top of the blast furnace via a conveyor system (Historic Plate F). The charge is then stored in bells until the timing is right for the charge to be dropped into the furnace. From here hot air is blown into the furnace via tuyeres to fire the mixture. The coke would burn to increase the temperature in the furnace and the limestone flux would attract the impurities in the metal ore to form slag.
- 7.3.21 Slag was likely removed from the furnaces from rail lines to the west of the furnaces (see Figure 5, 6 and 7). Only one short section of these rail lines survived (G44) from BF4 that replaced Phase 3.1 rail line G8. This rail line was built after 1929 as it does not appear on the Ordnance Survey map of 1929 (Figure 6) but does appear on the map of 1953 (Figure 7).
- 7.3.22 Historic Plate G depicts a cross section of a contemporary blast furnace from Clay Lane, c. 790m to the west of the site, that bears a remarkable resemblance to BF4 and 5. Coke and ore are fed through an elevated rail line (such as the Hi-line) through bins to the control house to be screened into waiting skips then carried up to the top of the furnace via a hoist. The skip hoists were powered by machinery adjacent to the furnace (in the image it is shown elevated above ground level however within Area B it would have been within the respective hoist rooms). The blast furnace is shown to have a large base, possibly comprised of concrete with a masonry core above. Metal uprights can also be observed around the perimeter of the core with the main elements of the furnace located well above ground level.
- 7.3.23 Several other structures were noted across the site however due to the scale of truncation their purpose/function could not be elucidated.

7.4 Phase 4: Demolition of Cleveland Steel Works and Modern Activity

- 7.4.1 Phase 4 represented the demolition of the steel works, the backfilling of structures and the levelling of the site comprising ground raising dumps and demolition deposits. The last two surviving blast furnaces at the works were BF5, constructed in 1937 and closed in 1986, and BF4, constructed 1911, undergoing several rebuilds throughout the 20th century, and closing in 1993. Clearance of the structures from the site took place from the late 1980s onwards and had been completed by the end of the 20th century.

8. SIGNIFICANCE OF DATA AND POTENTIAL FOR FURTHER ANALYSIS

8.1 The investigation has demonstrated that the heavily truncated remains of the Cleveland Steel Works survived within Area B however no remains survived of the earlier Eston Iron Works to the north in Trench 1.

8.2 In 1874, Eston Iron Works were demolished and replaced by the Cleveland Works (1874-1876). Bolckow and Vaughan was the leading firm on Teesside in developing steel production, as opposed to iron, which initially used Bessemer conversion vessels, to convert pig iron to steel. They were served by a set of three 20m high blast furnaces (BF1, BF2 and BF3). Although there are numerous earlier examples of hematite blast furnaces within the region, the development area was the first location on Teesside at which steel was produced in bulk (Tees Archaeology 2019, 7).

8.3 The archaeological investigation at the Energy Recovery Facility site has made a significant contribution to knowledge of industrial steelmaking in Teesside. In terms of NERRF, the research priorities for the post-medieval period (PM) it can be concluded that the excavation has contributed to 'PMii- Industrialisation' which observed (Petts & Gerrard 2006, 184):

"Compared with the coal and lead industries, relatively little work has been undertaken on the region's important iron and steel industry... As regards smelting, the 19th century furnaces of Northumberland, and the remaining evidence for the 19th/20th century Cleveland industry, are of particular value. The development of urban foundries in the 18th century, and forges, rolling mills and engineering works in the later 18th and 19th centuries is also of considerable interest."

8.4 One hundred and seven samples of were taken during the excavations that comprised a mixture of firebricks, fireblocks and common bricks (106 in total) along with another sample from a carbon block. All the brick samples appear to date from the second half of the 19th into the 20th centuries with no identifiably earlier types. There is potential for further research into the unidentified (or not positively identified) stamped bricks, and it is recommended that the following brick stamps are photographed for the archive: W2 <22> [282]; ...R CROWN <39> [135]; N.HOGG <17> [181]; C & N <19> [182]; BOV...(or BOW...) <29> [60]; HBC SB <40> [86] and (unreadable) <12> [180]. There is no potential for further work or retention of the rest of the brick assemblage.

8.5 Historic England had previously considered BF4 for scheduling and concluded it was of National Importance. Tees Archaeology had also classed the remains High for Historical Value, Low for Aesthetic value and Medium for communal value (Daniels 2019). Conversely, however, the desk-based assessment undertaken in 2020 concluded that heritage assets dating to the 19th and 20th centuries, relating to industrial uses of the site would be of up to local importance if they were found to have survived. Were the archaeological remains of the blast furnaces in good condition with the hearth surviving as well features such as arches and

tuyeres, then they would be considered to be of Regional significance. Unfortunately, due to demolition works at the closure of the site and later remediation works, the archaeological remains on site are only of Local significance. The continued use for heavy industry into the 21st century, with the expansion, replacement and rebuilding of all elements coupled with the site-wide clearance of buildings and structures, limited the significance of the archaeological remains.

- 8.6 This assessment of the data recovered has concluded that the remains of the Cleveland Steel works are of local significance as only the core of the earlier blast furnaces survived with no evidence remaining of the hearts or external features. These blast furnaces once served the Bessemer converters to the north however, remediation works removed any trace of these more significant remains. Further analysis leading to publication may be required as detailed in the Written Scheme of Investigation (Prospect Archaeology 2021). If required, the results of the investigation will be published in a regional journal or within a popular publication or pamphlet aimed at a broader more non-specialist audience. The scope of any such further analysis and publication should be agreed with North East Archaeological Research and the commissioning client before being undertaken.

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steel-making-on-teeside/](https://www.rmweb.co.uk/community/index.php?/topic/28937-steel-making-on-teeside/)

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PCA Credits

Project management: Jennifer Proctor/Aaron Goode

Post-excavation management: Jennifer Proctor

Fieldwork: Aaron Goode (Project Manager), Scott Vance (Project Officer), James Hopper (Supervisor), Andy Abson, John Jack Brannon, Gavin Cuthbertson, John Kemp, Lucy McLay, Daniel Percy, and Mathew Stirke.

Survey: Scott Vance

Archive consolidation: Scott Vance

Report: Scott Vance

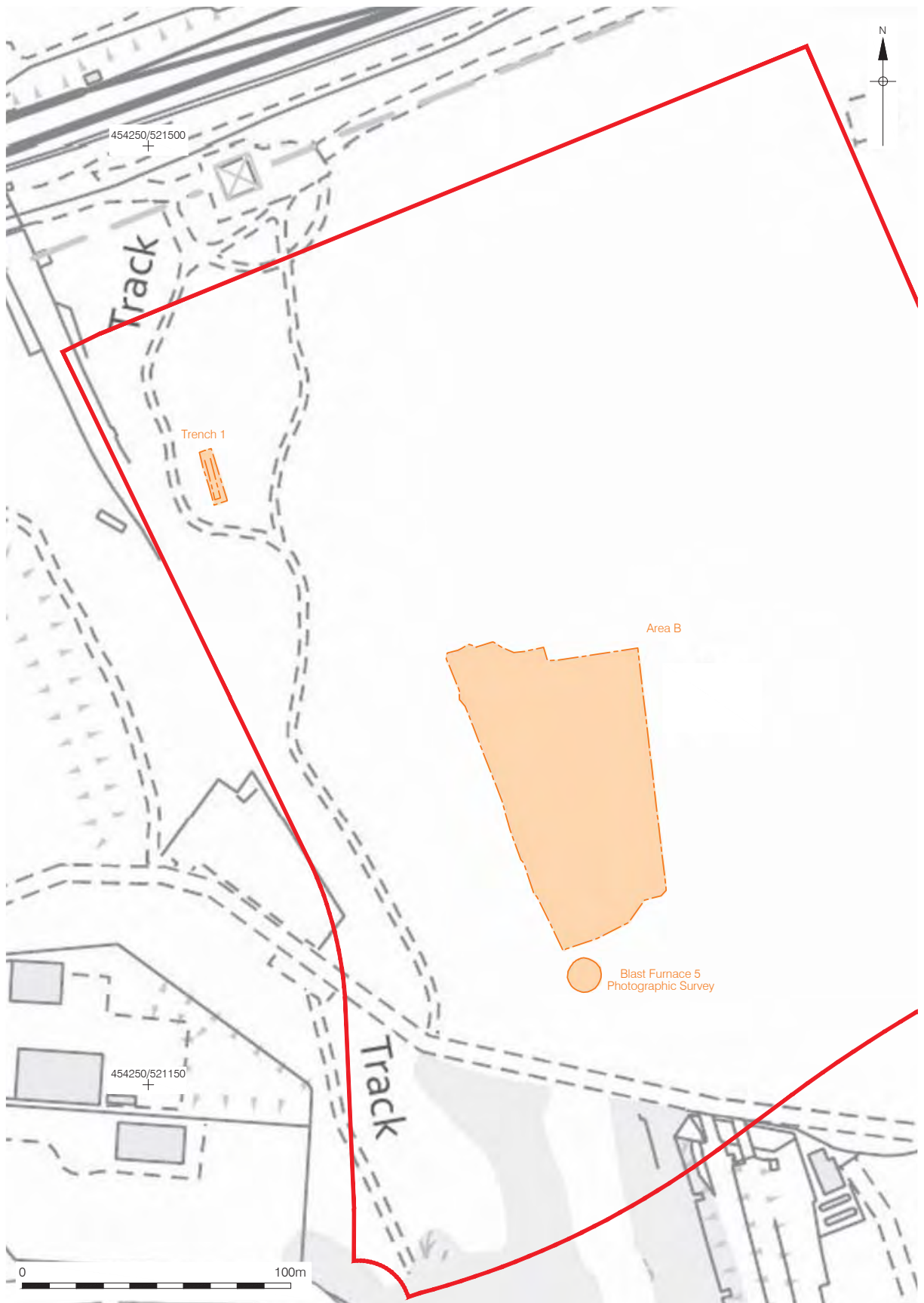
Illustrations: Diana Valk

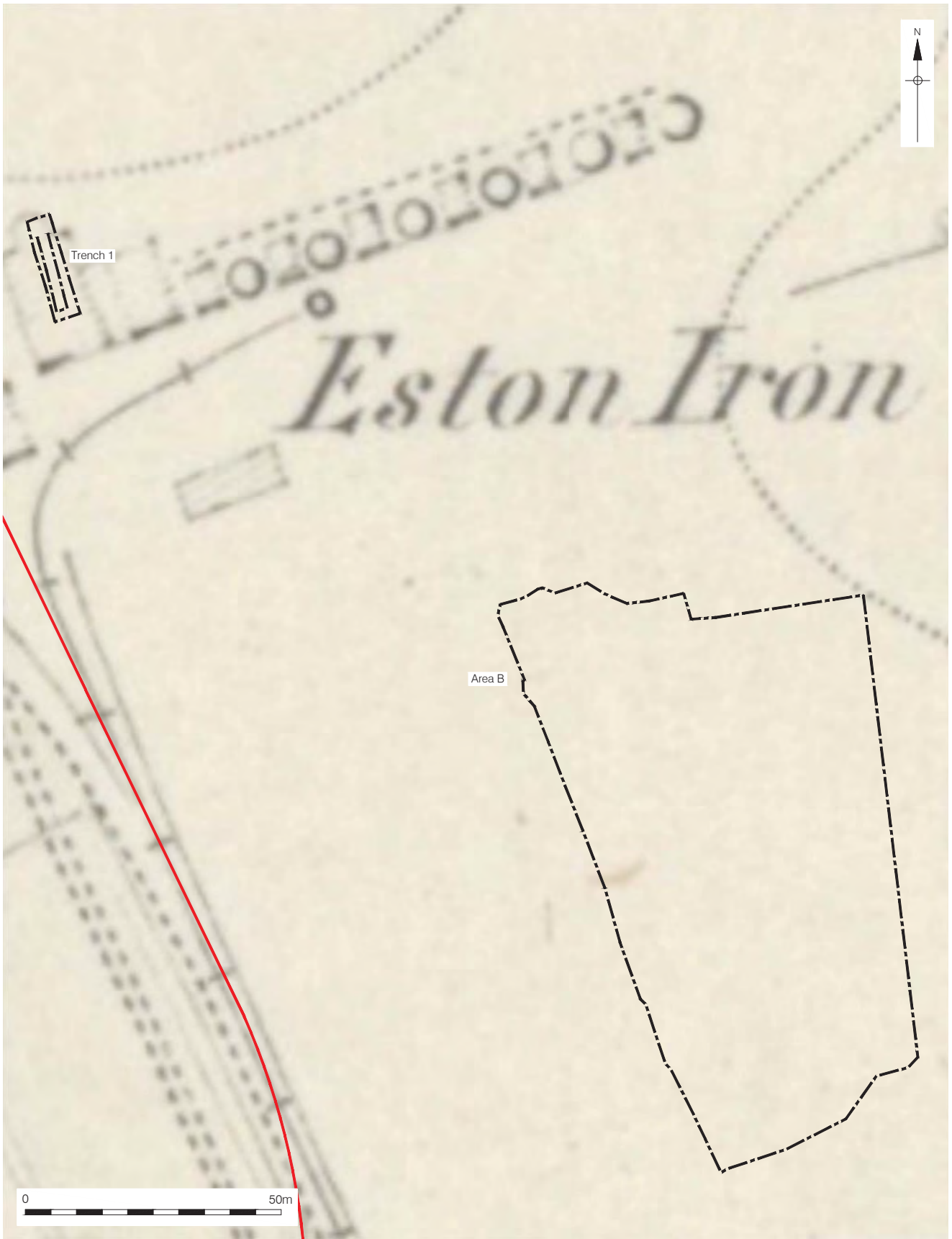
Other Credits

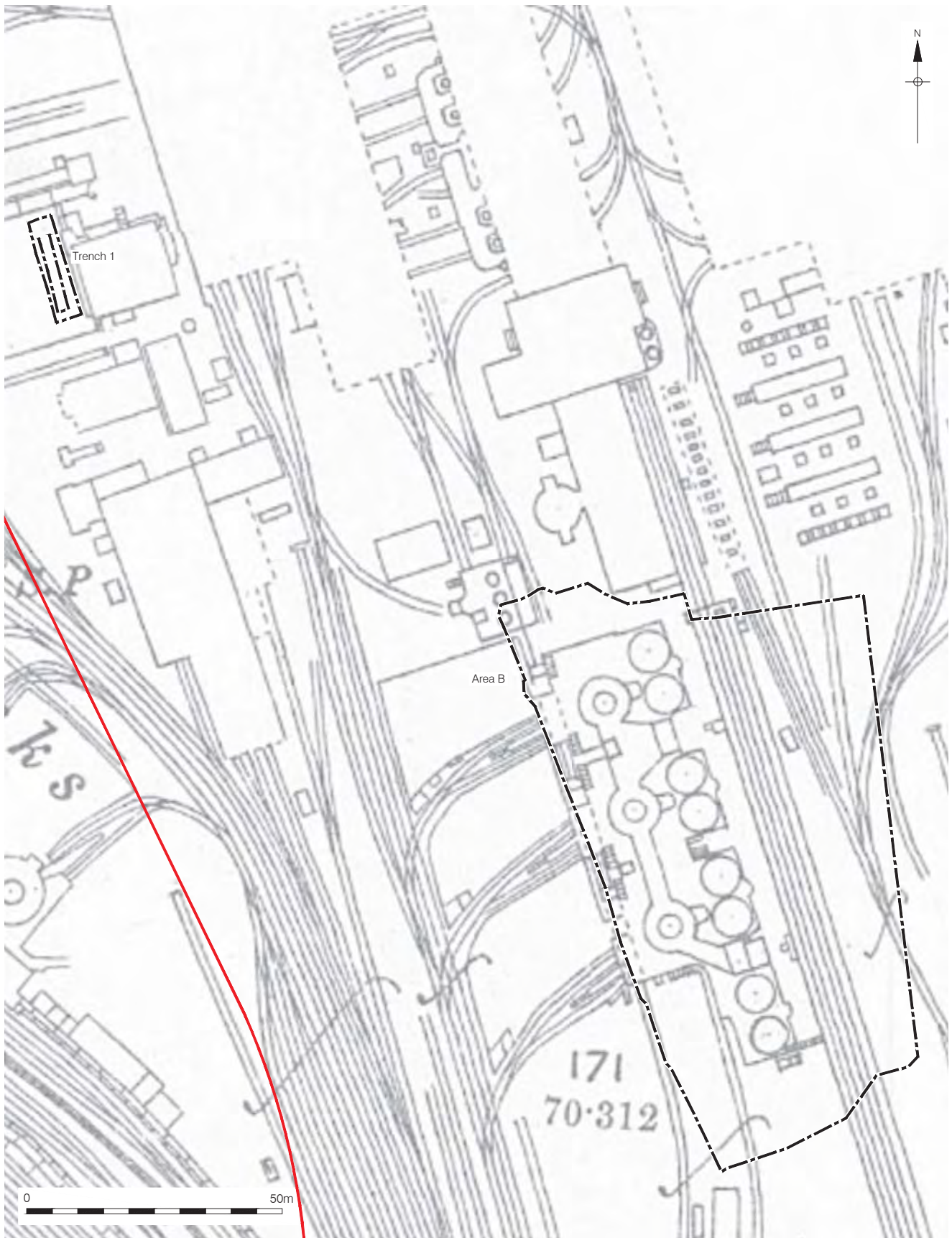
Bricks: John Nolan (NCAS)

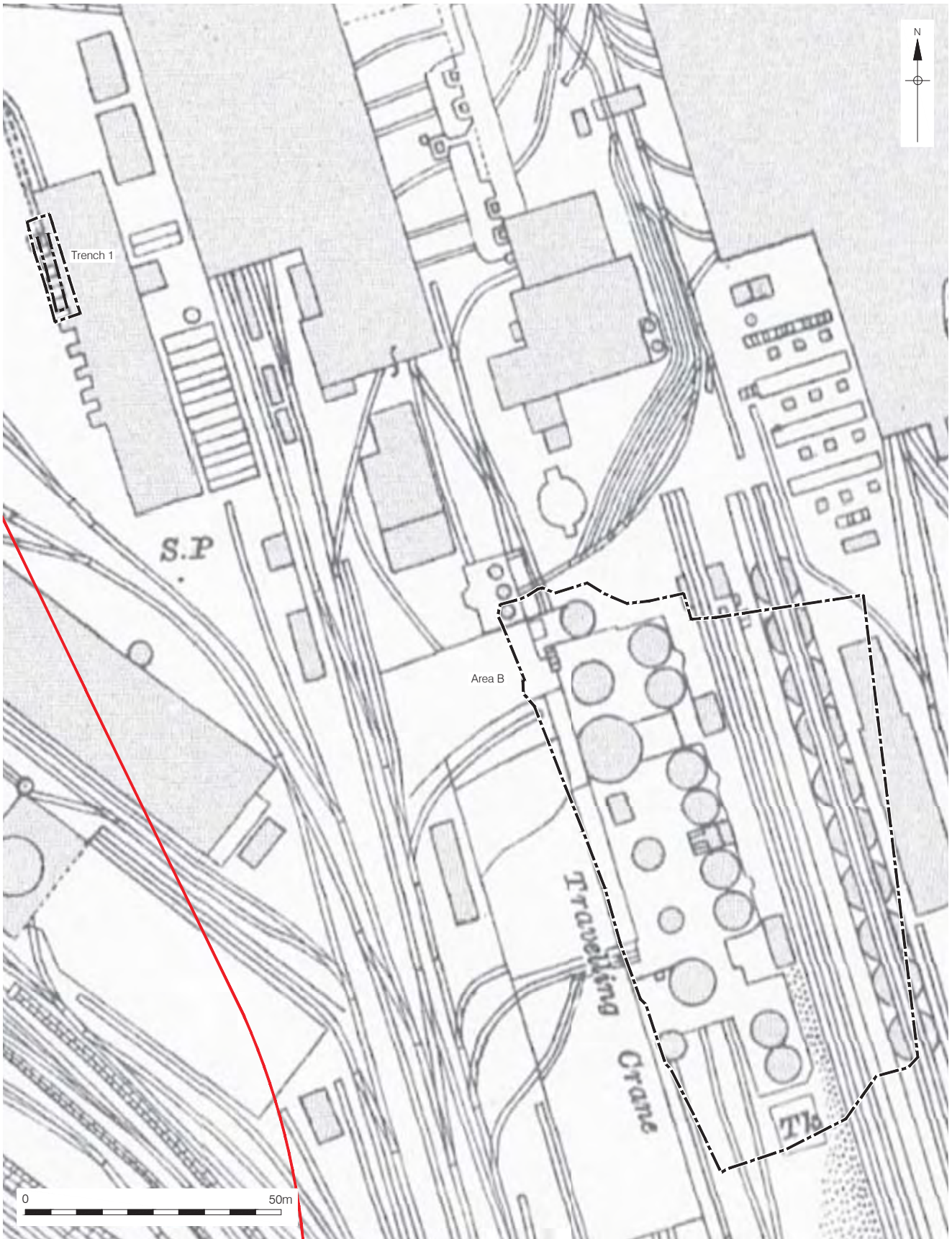
APPENDIX 1: FIGURES

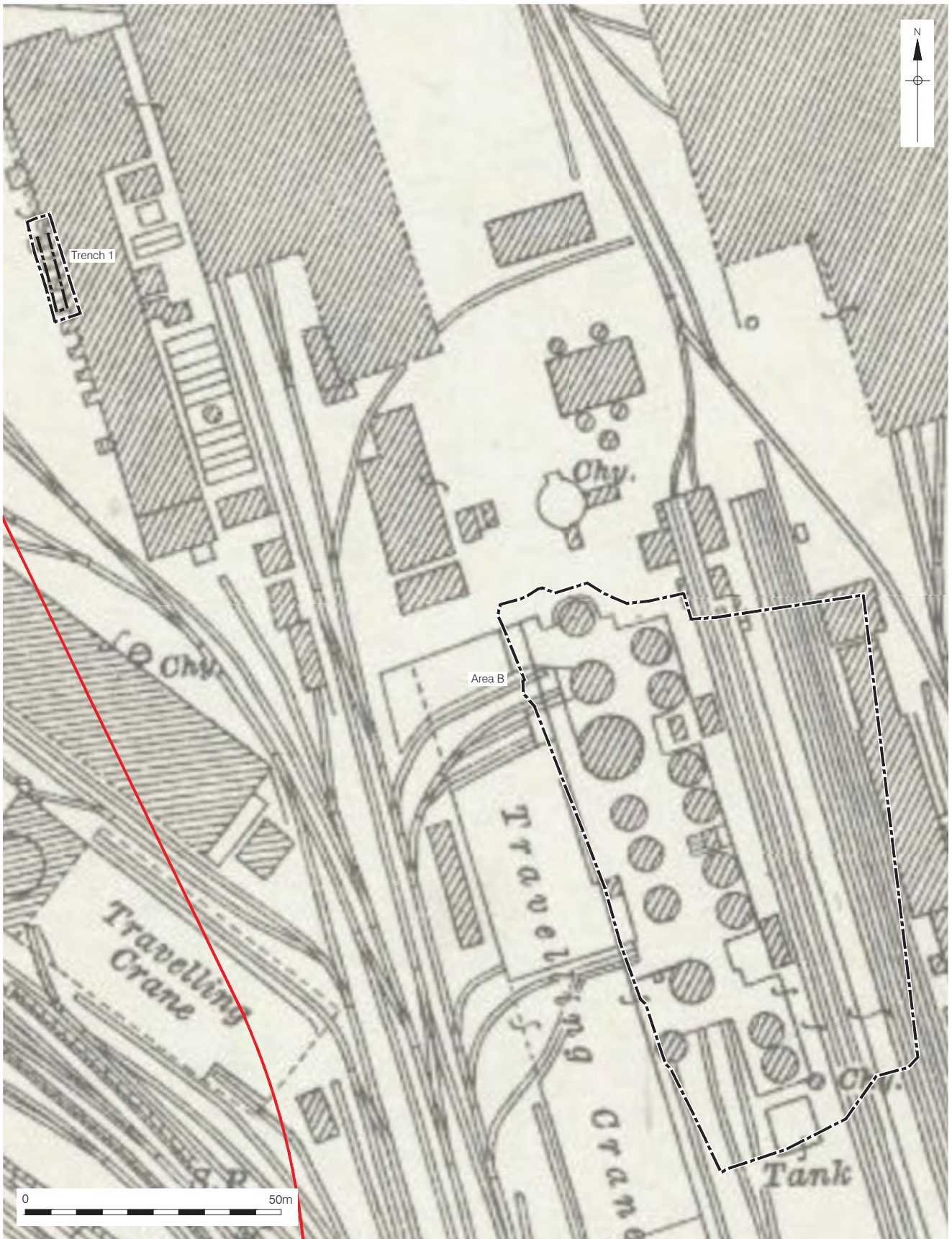












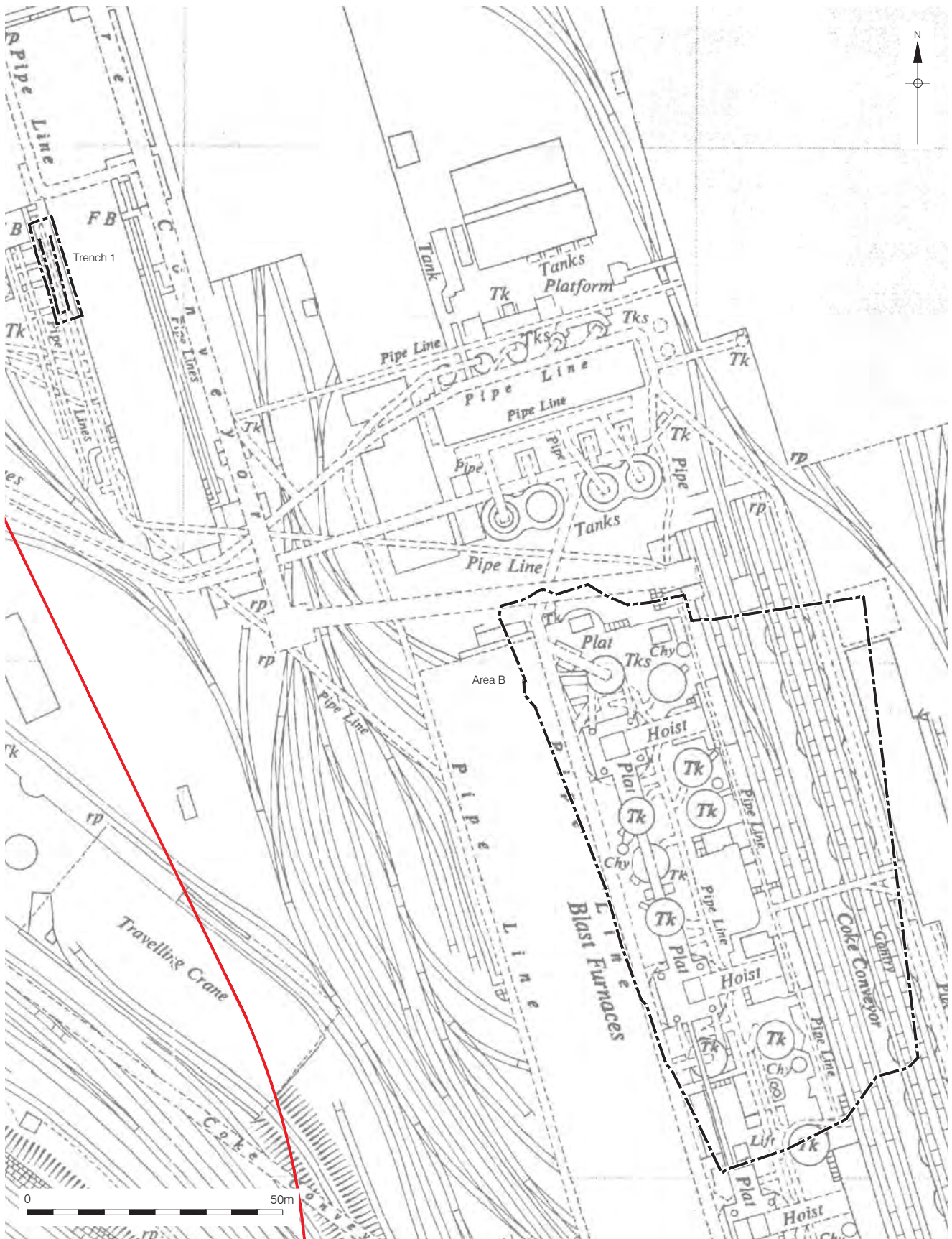
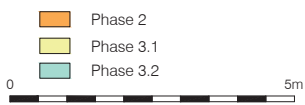
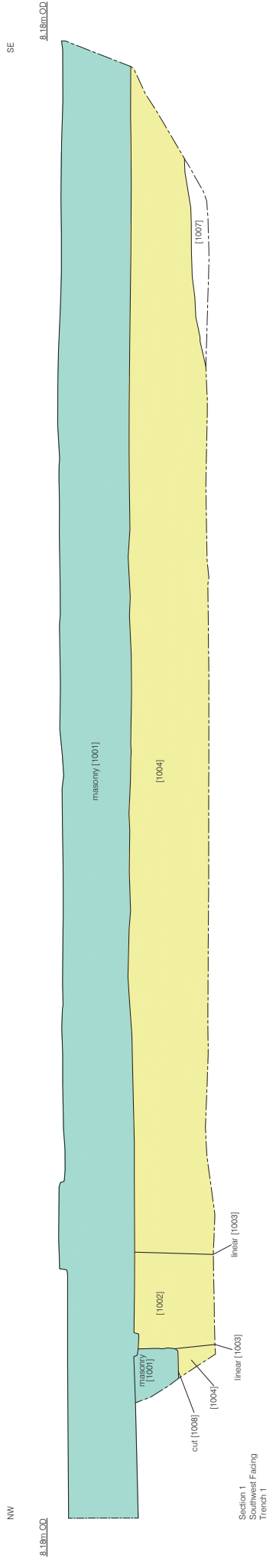


Figure 7

Trench Locations overlain on 1953 Ordnance Survey map
1:1,000 at A4





Section 1
Southwest Facing
Trench 1



Figure 9
Section 1
1:50 at A3

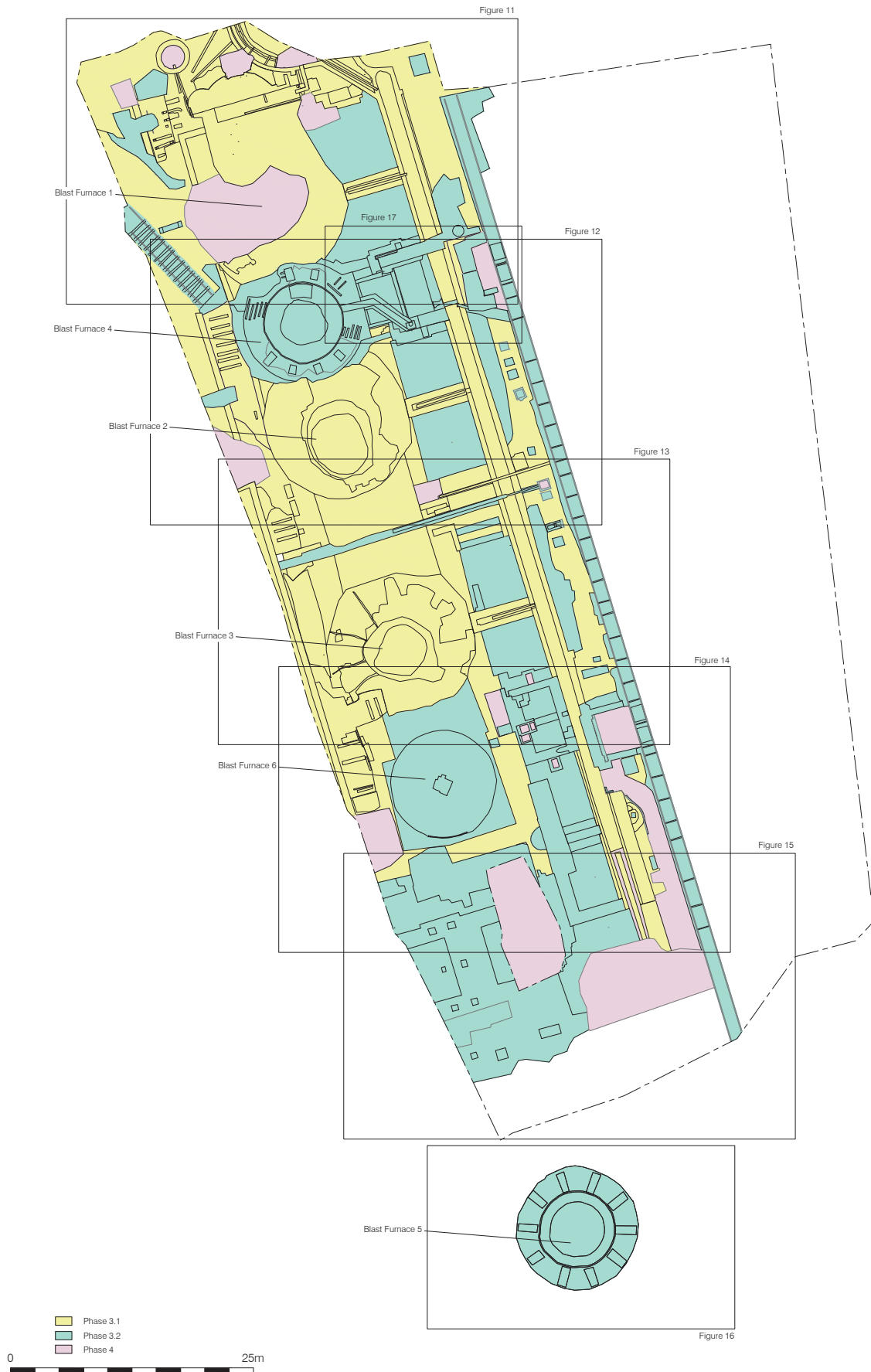




Figure 11
Area B Detailed Plan 1
1:125 at A3

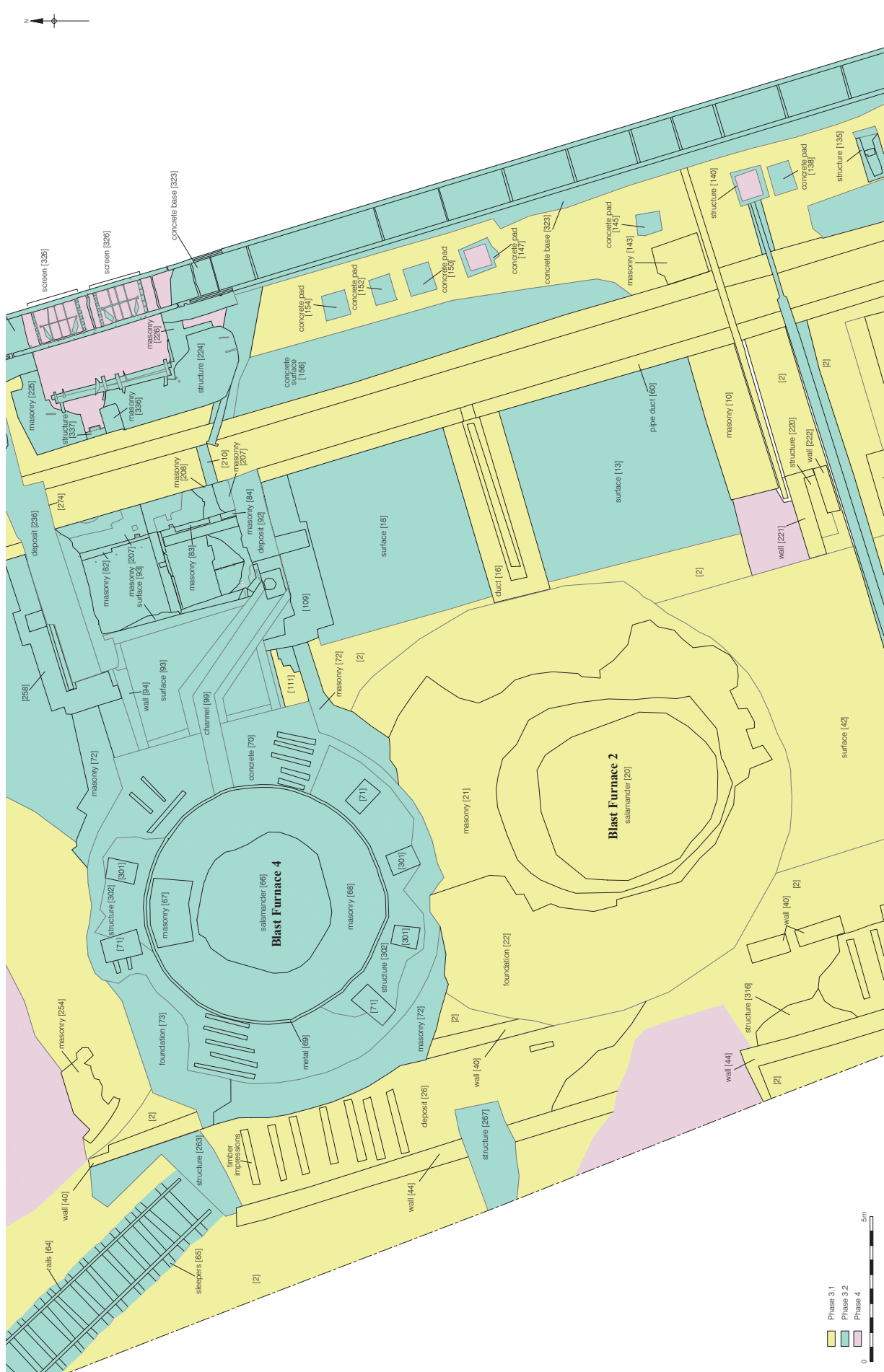


Figure 12
Area B Detailed Plan 2
1:125 at A3

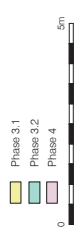
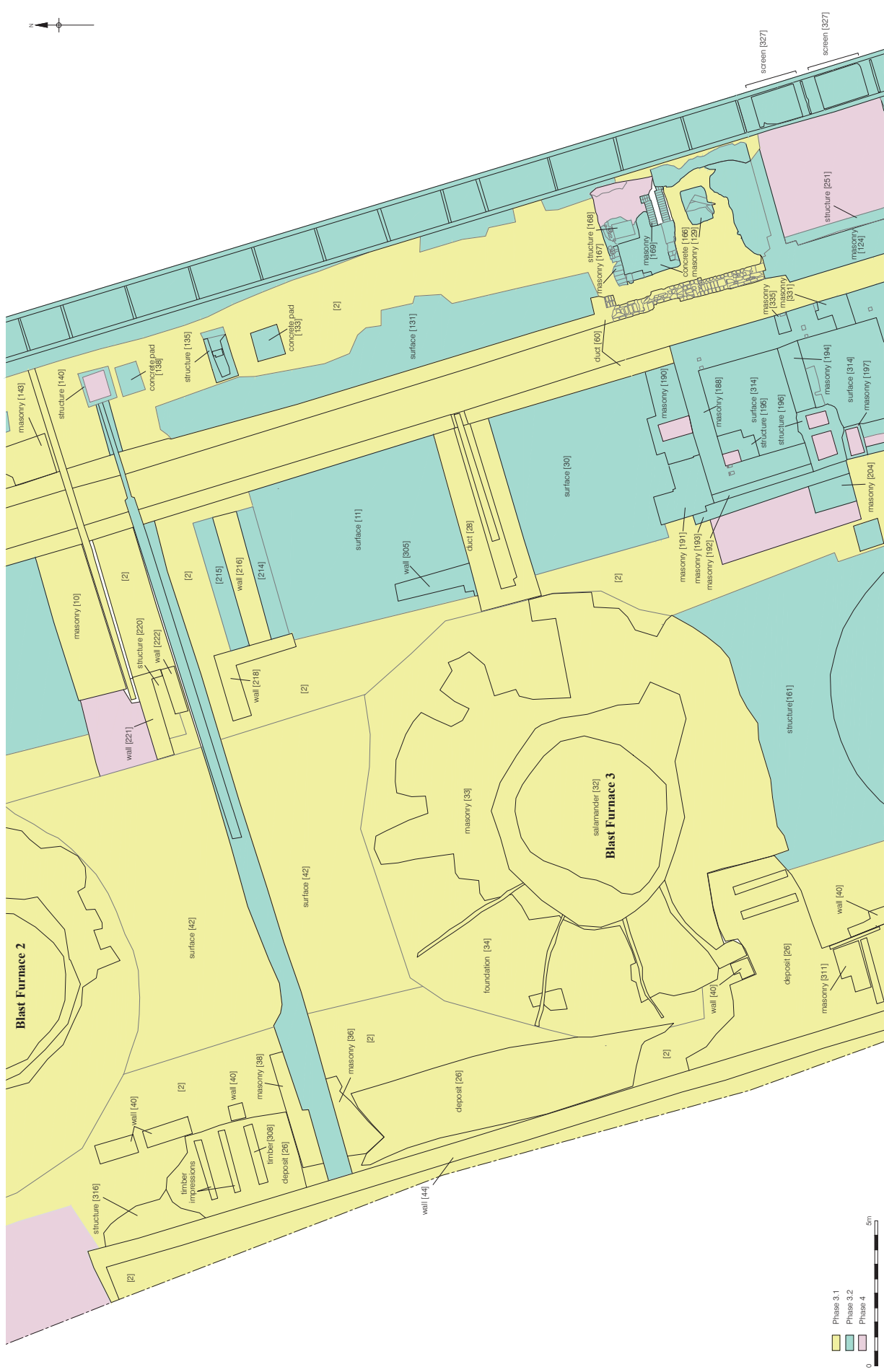


Figure 13
Area B Detailed Plan 3
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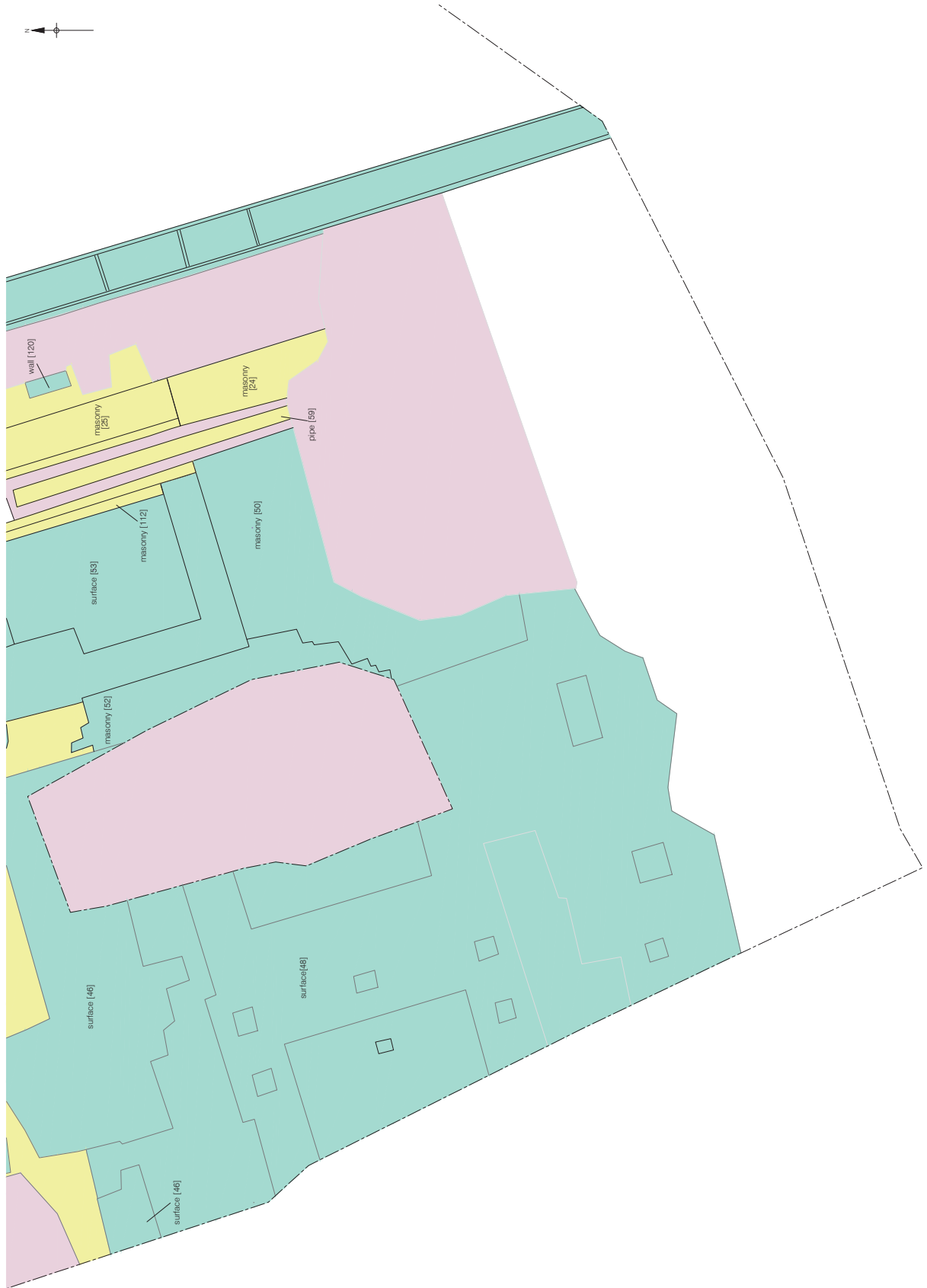


Figure 15
Area B Detailed Plan 5
1:125 at A3



Blast Furnace 5

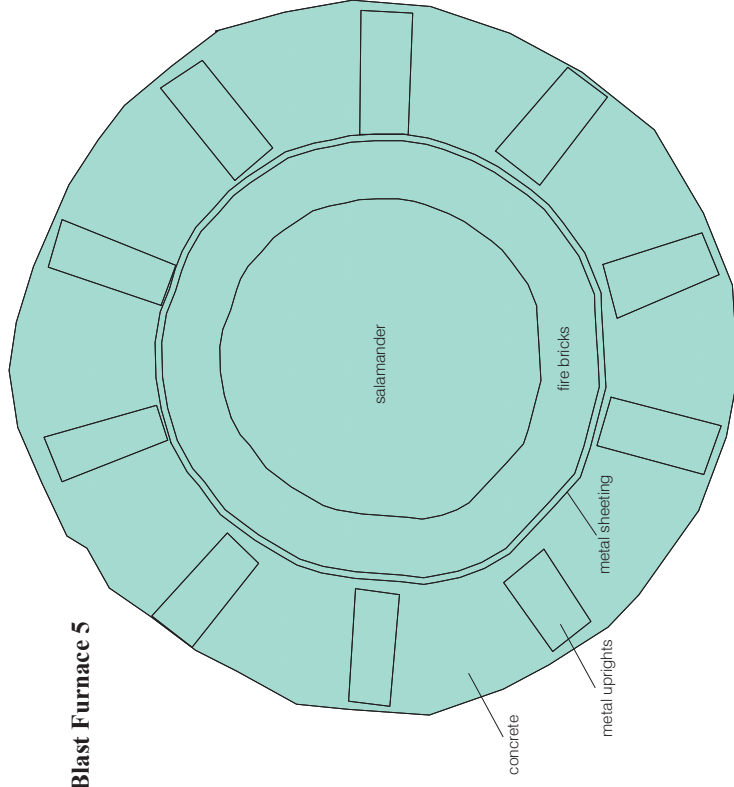


Figure 16
Detailed Plan of Blast Furnace 5
1:125 at A4

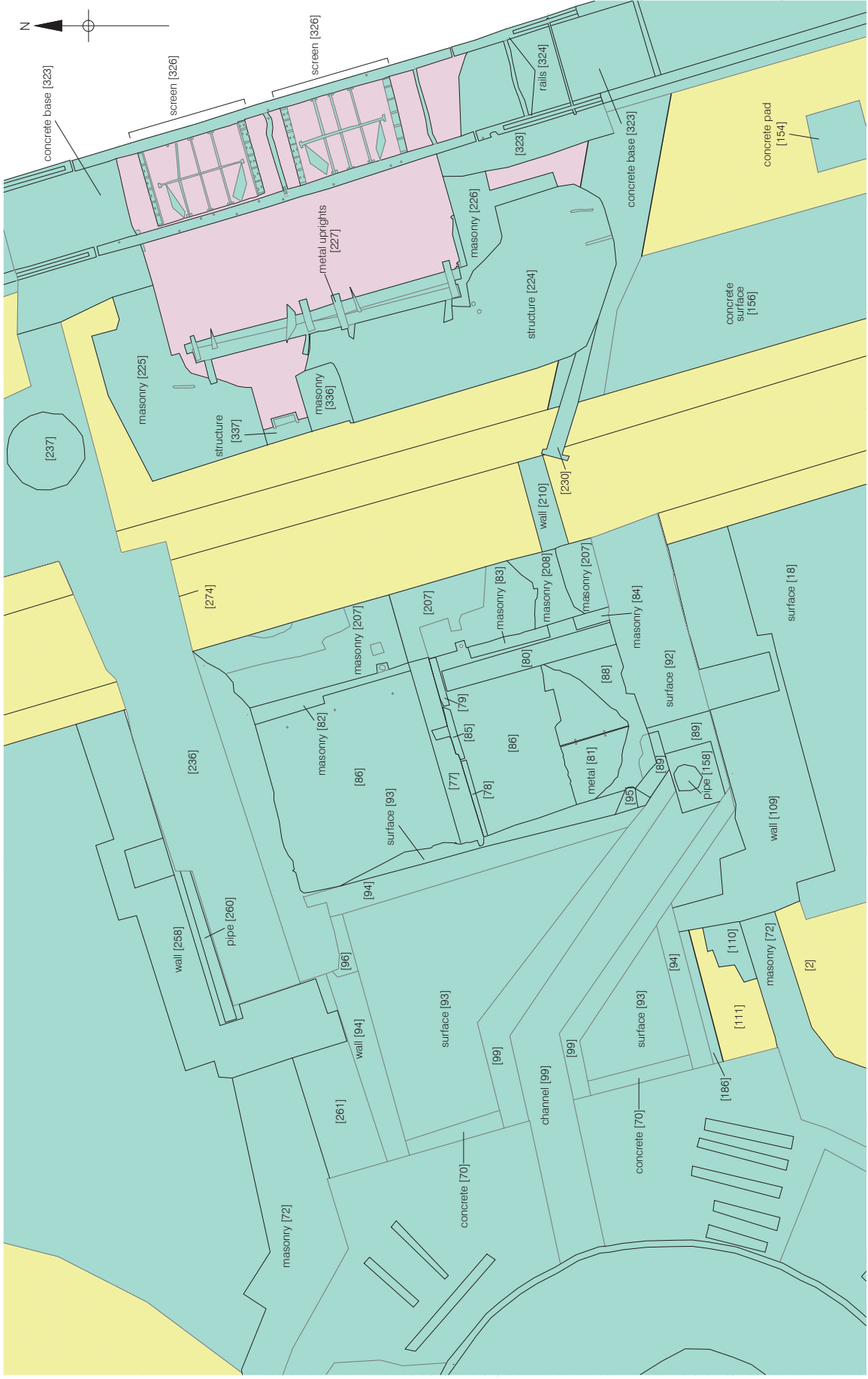


Figure 17
Detail of Blast Furnace 4 Hoist Area
1:80 at A4



APPENDIX 2: CONTEXT INDEX

Context	Phase	Group	Type 1	Type 2	Interpretation
Trench 1					
1000	4	G75	Deposit	Layer	Modern overburden
1001	3.2	G24	Masonry	Structure	Twentieth century steel works in construction cut [1008]
1002	3.1	G2	Deposit	Fill	Fill of drainage feature [1003]
1003	3.1	G2	Cut	Linear	Drainage feature filled by [1002]
1004	3.1		Deposit	Layer	Levelling/consolidation
1005	2	G1	Deposit	Fill	Fill of field drain [1006]
1006	2	G1	Cut	Linear	Field drain filled by [1005]
1007	1		Deposit	Layer	Superficial geology
1008	3.2	G24	Cut	Linear	Construction cut for [1001]
Area B					
1	4	G75	Deposit	Layer	Modern overburden
2	3.1	G3	Deposit	Layer	Construction ground raising dump
3	-	-	-	-	VOID
4	3.1	G21	Other	Pipe	Metal pipe in cut [7]
5	3.2	G48	Other	Pipe	Metal pipe in cut [9]
6	3.1	G21	Masonry	Structure	Masonry to south of pipe [7]
7	3.1	G21	Cut	Linear	Construction cut for pipe [7]
8	3.2	G48	Deposit	Fill	Backfill of pipe cut [9]
9	3.2	G48	Cut	Linear	Construction cut for pipe [5]
10	3.1	G20	Masonry	Surface?	Firebrick surface/base
11	3.2	G47	Deposit	Surface	Concrete surface in [12]
12	3.2	G47	Cut	Discrete	Construction cut for concrete surface [11]
13	3.2	G46	Deposit	Surface	Concrete surface in [14]
14	3.2	G46	Cut	Discrete	Construction cut for concrete surface [13]
15	3.1	G15	Other	Pipe	Pipe within brick duct [16] from main pipe duct to blast-stoves for BF2
16	3.1	G15	Masonry	Structure	Brick duct for pipe [15] for BF2's blast stoves
17	3.1	G15	Cut	Linear	Construction cut for pipe duct [16]
18	3.2	G46	Deposit	Surface	Concrete surface in [19]
19	3.2	G46	Cut	Discrete	Construction cut for concrete surface [18]
20	3.1	G5	Deposit	Metal	In situ salamander within Blast Furnace 2
21	3.1	G5	Masonry	Structure	Blast Furnace 2
22	3.1	G5	Deposit	Structure	Concrete foundation for BF2
23	3.1	G5	Cut	Circular	Construction cut for BF2
24	3.1	G18	Masonry	Surface	Firebrick surface at SE corner of site
25	3.1	G18	Masonry	Structure	Firebrick structure at SE corner of site
26	3.1	G8	Deposit	Layer	Rail line embankment along western side of blast furnaces
27	3.1	G16	Other	Pipe	Pipe within brick duct [28] from main pipe duct to blast-stoves for BF3
28	3.1	G16	Masonry	Structure	Brick duct for pipe [27] within construction cut [29] for BF3
29	3.1	G16	Cut	Linear	Construction cut for brick duct [28] and pipe [27]

30	3.2	G47	Deposit	Surface	Concrete surface in [31]
31	3.2	G47	Cut	Discrete	Construction cut for concrete surface [30]
32	3.1	G6	Deposit	Metal	In situ salamander within Blast Furnace 3
33	3.1	G6	Masonry	Structure	Blast Furnace 3
34	3.1	G6	Deposit	Structure	Concrete foundation for BF3
35	3.1	G6	Cut	Circular	Construction cut for BF3
36	3.1	G8	Masonry	Surface	Surface at western end of pipe [9]
37	3.1	G8	Cut	Linear	Construction cut for surface [36]
38	3.1	G8	Masonry	Surface	Surface at western end of pipe [9]
39	3.1	G8	Cut	Linear	Construction cut for surface [38]
40	3.1	G8	Masonry	Structure	Eastern wall of rail embankment [26]
41	3.1	G8	Cut	Linear	Construction cut for wall [40]
42	3.1	G7	Deposit	Surface	Concrete surface between BF2 and BF3
43	3.1	G7	Cut	Discrete	Construction cut for surface [42]
44	3.1	G8	Masonry	Structure	Western wall of rail embankment [26]
45	3.1	G8	Cut	Linear	Construction cut for wall [44]
46	3.2	G57	Deposit	Surface	Concrete surface at southern end of site
47	3.2	G57	Cut	Discrete	Construction cut for concrete surface [46]
48	3.2	G57	Masonry	Surface	Concrete surface and supports at southern end of site
49	3.2	G57	Cut	Discrete	Construction cut for concrete surfaces and supports [48]
50	3.2	G45	Masonry	Surface	Firebrick surface at SE corner of site
51	3.2	G45	Masonry	Structure	Structure at SE corner of site
52	3.2	G45	Masonry	Structure	Firebrick structure at southern end of site
53	3.2	G45	Deposit	Surface	Concrete surface adjacent to structure [51]
54	3.2	G45	Deposit	Surface	Concrete surface adjacent to structure [51]
55	3.2	G45	Masonry	Structure	Apsidal structure on W side of [51]
56	3.2	G45	Masonry	Structure	Structure to the E of structure [51] (northern)
57	3.2	G45	Masonry	Structure	Structure to the E of structure [51] (southern)
58	3.2	G45	Deposit	Structure	Concrete between [56] and [57] to the E of [51]
59	3.1	G11	Other	Pipe	Pipe within pipe duct [60] carrying air from blowing engine to blast-stoves adjacent to furnaces
60	3.1	G11	Masonry	Structure	Pipe duct running N/S across site for pipe [59]. Located to the east of the furnaces
61	3.1	G11	Cut	Linear	Construction cut for pipe duct [60]
62	-	-	-	-	VOID
63	-	-	-	-	VOID
64	3.2	G44	Other	Metal	Metal rail tracks to NW of BF4
65	3.2	G44	Other	Metal	Metal sleepers for rail tracks [64]
66	3.2	G25	Deposit	Metal	In situ salamander in BF4
67	3.2	G25	Masonry	Structure	Large firebrick/carbon blocks internal to BF4
68	3.2	G25	Masonry	Structure	Firebricks/blocks lining BF4
69	3.2	G25	Other	Metal	Metal ring around BF4
70	3.2	G25	Deposit	Structure	Concrete base for metal uprights [71] in BF4
71	3.2	G25	Other	Metal	Metal uprights around BF4
72	3.2	G25	Masonry	Structure	External masonry of BF4
73	3.2	G25	Deposit	Structure	Concrete foundation of BF4

74	3.2	G25	Cut	Circular	Construction cut for BF4
75	3.1	G8	Deposit	Structure	Concrete foundation for buffer stop at SE end of embankment [26]
76	3.1	G8	Cut	Discrete	Construction cut for buffer stop foundation [75]
77	3.2	G28	Timber	Horizontal	Timber within possible plant room immediately east of BF4
78	3.2	G28	Timber	Horizontal	Timber within possible plant room immediately east of BF4
79	3.2	G28	Timber	Horizontal	Timber within plant room immediately east of BF4
80	3.2	G28	Timber	Horizontal	Timber within plant room immediately east of BF4
81	3.2	G28	Other	Metal	Iron plates within plant room to east of BF4
82	3.2	G28	Masonry	Structure	Firebrick wall within NE corner of plant room to the east of BF4 (northern section)
83	3.2	G28	Masonry	Structure	Firebrick wall within SE corner of plant room to the east of BF4 (central section)
84	3.2	G28	Masonry	Structure	Firebrick wall within SE corner of plant room to the east of BF4 (southern section)
85	3.2	G28	Timber	Horizontal	Timber within plant room to east of BF4
86	3.2	G28	Deposit	Layer	Dump/levelling deposit within room to east of BF4
87	3.2	G29	Deposit	Fill	Backfill of plant room to the east of BF4 prior to construction cut [90] for concrete structure [93]/[94]
88	3.2	G31	Deposit	Layer	Sub-base for brick structure [89]
89	3.2	G31	Masonry	Structure	Firebrick vertical pipe duct associated with concrete flue [99]
90	3.2	G34	Cut	Linear	Construction cut for concrete surface [92]
91	3.2		Cut	Discrete	Construction cut for concrete surface [93] and structure [94]
92	3.2	G34	Deposit	Surface	Concrete surface within [92]. Adjacent to plant room east of BF4
93	3.2	G32	Deposit	Surface	Concrete surface within construction cut [91]
94	3.2	G32	Deposit	Structure	Concrete walls within [91] to the east of BF4
95	3.2	G32	Deposit	Structure	Fragmented concrete floor or part of [94]
96	3.2		Masonry	Structure	Brick infill within concrete wall [94] to east of BF4
97	3.2	G32	Deposit	Fill	Backfill deposit of room [93]/[94] prior to construction of concrete structure [99] in construction cut [99]
98	3.2	G34	Cut	Linear	Construction cut for concrete structure [99] forming a channel/flue to the east of BF4
99	3.2	G34	Deposit	Structure	Concrete channel within [98] to the east of BF4
100	3.2	G33	Deposit	Fill	Backfill of concrete structure [94]/[93].
101	3.1	G14	Cut	Discrete	Construction cut for chimney [102]
102	3.1	G25	Masonry	Structure	Chimney at northern extent of Area B
103	4		Deposit	Fill	Backfill of chimney [102]
104	3.1	G14	Other	Pipe	Iron pipe within [107] feeding into chimney [102]
105	3.1	G14	Other	Pipe	Iron pipe within [106] feeding into chimney [102]
106	3.1	G14	Cut	Linear	Cut for Fe pipe [105]

107	3.1	G14	Cut	Linear	Cut for Fe pipe [104]
108	3.1	G14	Other	Pipes	Three iron pipes entering structure [102] from east side
109	3.2	G28	Masonry	Structure	Footing for hoist for BF4
110	3.1	G25	Masonry	Surface	Fireblock surface adjacent to BF4
111	3.1	G3	Deposit	Layer	Construction levelling deposit. Same as [2]
112	3.1	G11	Masonry	Structure	Wall running adjacent to main brick duct [249] at SE corner of site
113	3.1	G18	Cut	Linear	Construction cut for wall [115] and concrete foundation [114]
114	3.1	G18	Deposit	Structure	Concrete foundation for wall [112]
115	3.1	G18	Masonry	Structure	Brick wall within [113]
116	3.2	G55	Cut	Discrete	Construction cut for Fe column base
117	3.2	G55	Other	Metal	Fe column base in [116]
118	4	G75	Deposit	Fill	Backfill of [116]
119	3.2	G54	Cut	Discrete	Modern feature at SE corner of Area B
120	3.2	G54	Masonry	Structure	Brick wall forming ad hoc shuttering in [119]
121	4	G75	Deposit	Fill	Backfill of [119]
122	3.2	G53	Deposit	Structure	Concrete/Fe structure
123	3.2	G42	Cut	Discrete	Construction cut for structure [124]
124	3.2	G42	Masonry	Structure	Brick/concrete structure in [123]
125	4	G75	Deposit	Fill	Backfill of structure [124]
126	3.2	G53	Cut	Discrete	Construction cut for structure [122]
127	3.2	G42	Deposit	Fill	Fill of construction cut [123] structure [124]
128	3.2	G63	Cut	Discrete	Construction cut for [129]
129	3.2	G63	Masonry	Structure	Sandstone block
130	3.2	G61	Cut	Discrete	Construction cut for concrete surface [131]
131	3.2	G61	Deposit	Surface	Concrete surface in [130]
132	3.2	G64	Cut	Discrete	Construction cut for concrete pad [133]
133	3.2	G64	Deposit	Structure	Concrete pad in [132]
134	3.2	G70	Cut	Discrete	Construction cut fir structure [135]
135	3.2	G70	Masonry	Structure	Firebrick, sandstone and Fe structure in [134]
136	4	G70	Deposit	Fill	Metal fitting in structure G70
137	3.2	G65	Cut	Discrete	Construction cut for [138]
138	3.2	G54	Deposit	Structure	Concrete pad in [137]
139	3.2	G48	Cut	Discrete	Construction cut for concrete structure [140]
140	3.2	G48	Deposit	Structure	Concrete structure in [139]
141	4	G75	Deposit	Fill	Backfill of [140]
142	3.1	G20	Cut	Discrete	Construction cut for surface [143]
143	3.1	G20	Masonry	Surface	Firebrick surface in [142]
144	3.2	G66	Cut	Discrete	Construction cut for concrete pad [145]
145	3.2	G66	Deposit	Structure	Concrete pad in [144]
146	3.2	G72	Cut	Discrete	Construction cut for concrete structure [147]
147	3.2	G72	Deposit	Structure	Concrete structure in [146]
148	4	G75	Deposit	Fill	Backfill of [147]
149	3.2	G67	Cut	Discrete	Construction cut for concrete pad [150]
150	3.2	G67	Deposit	Structure	Concrete pad in [149]
151	3.2	G68	Cut	Discrete	Construction cut for concrete pad [152]
152	3.2	G68	Deposit	Structure	Concrete pad in [151]

153	3.2	G69	Cut	Discrete	Construction cut for concrete pad [154]
154	3.2	G69	Deposit	Structure	Concrete pad in [153]
155	3.2	G60	Cut	Discrete	Construction cut for concrete pad [156]
156	3.2	G60	Deposit	Structure	Concrete pad in [155]
157	3.2	G31	Deposit	Fill	Backfill of [89]
158	3.2	G31	Other	Metal	Upright metal pipe adjacent to concrete channel [99] to east of BF4
159	3.2	G28	Cut	Linear	Construction cut for wall [109]
160	3.2	G26	Cut	Discrete	Construction cut for Blast Furnace 6
161	3.2	G26	Deposit	Structure	Concrete structure in construction cut [160] BF6
162	3.2	G26	Other	Metal	Fe strap around exterior of BF6
163	3.2	G26	Masonry	Structure	Firebrick structure forming BF6
164	3.2	G26	Masonry	Structure	Fireblock core of BF6
165	3.2	G62	Cut	Discrete	Construction cut for concrete surface [166] to the east of brick duct opposite BF6
166	3.2	G62	Deposit	Surface	Concrete surface in [165]
167	3.2	G62	Masonry	Structure	Firebrick wall in cut [165]
168	3.2	G62	Deposit	Structure	Concrete structure in [165]
169	3.2	G62	Masonry	Structure	Brick walls in [165]
170	4	G75	Deposit	Fill	Fill between walls [169]
171	4	G75	Deposit	Fill	Backfill of [167] and [166]
172	3.1	G23	Cut	Linear	Construction cut for Fe pipe [173]
173	3.1	G23	Other	Pipe	Fe pipe in cut [172]
174	3.1	G23	Cut	Linear	Construction cut for Fe pipe [175]
175	3.1	G23	Other	Pipe	Fe pipe in cut [175]
176	3.1	G11	Other	Pipe	Fe pipe in curvilinear channel formed by walls [180] and [181] within construction cut [205]
177	3.1	G11	Other	Pipe	Fe pipe in curvilinear channel formed by walls [180] and [181] within construction cut [205]
178	3.1	G11	Other	Pipe	Fe pipe in curvilinear channel formed by walls [180] and [181] within construction cut [205]
179	3.1	G11	Deposit	Fill	Backfill of curvilinear channel formed by walls [180] and [181] within construction cut [205]
180	3.1	G11	Masonry	Structure	NE wall of curvilinear channel within construction cut [205]
181	3.1	G11	Masonry	Structure	SW wall of curvilinear channel within construction cut [205]
182	3.1	G11	Masonry	Structure	L-shaped wall within construction cut [206] built on top of channel wall [181]
183	3.1	G11	Other	Metal	Fe crossbar between walls [180] and [181]
184	3.1	G11	Other	Metal	Fe crossbar between walls [180] and [181]
185	3.1	G11	Other	Metal	Fe crossbar between walls [180] and [181]
186	3.2	G32	Deposit	Fill	Backfill of [91] wall [94]
187	3.2	G38	Cut	Discrete	Construction cut for hoist base/room adjacent to BF6
188	3.2	G38	Masonry	Structure	Sandstone block wall in [187]. Part of hoist base/room adjacent to BF6
189	3.2	G39	Cut	Linear	Construction cut for later walls [190], [191], [192] and [195]
190	3.2	G39	Masonry	Structure	Red brick wall in construction cut [189]

191	3.2	G39	Masonry	Structure	Sandstone and firebrick wall in construction cut [189]
192	3.2	G39	Masonry	Structure	Red brick wall in construction cut [189]
193	3.2	G39	Masonry	Structure	Brick wall in construction cut [189]
194	3.2	G38	Masonry	Structure	Brick partition wall in structure [188]
195	3.2	G38	Deposit	Structure	Concrete structure abutting wall [188]
196	3.2	G40	Deposit	Structure	Concrete structure in wall [188]
197	3.2	G40	Masonry	Structure	Brick structure in wall [188]
198	4	75	Deposit	Fill	Backfill of structure [196]
199	4	75	Deposit	Fill	Backfill of structure [197]
200	4	75	Deposit	Fill	Backfill of structure [188] and [194]
201	3.2	G39	Cut	Discrete	Construction cut for concrete structure [202]
202	3.2	G39	Deposit	Structure	Concrete structure in [201]
203	3.2	G41	Cut	Discrete	Construction cut for brick structure [204]
204	3.2	G41	Masonry	Structure	Firebrick structure in [203]
205	3.2	G11	Cut	Linear	Construction cut for duct wall [180] and [181] at northern end of site
206	3.1	G11	Cut	Linear	Construction cut for wall [182]
207	3.2	G28	Masonry	Structure	Sandstone block wall in hoist/plant room to the east of BF4
208	3.2	G28	Masonry	Structure	Firebrick arch in wall [207]
209	3.2	G30	Masonry	Structure	Infill of arch [208]
210	3.2	G30	Masonry	Structure	Sandstone wall across main pipe duct [60] to east of furnaces
211	3.2	G52	Cut	Structure	Cut for timber upright/structure [212]
212	3.2	G52	Timber	Vertical	Timber upright in cut [211]
213	3.2	G59	Cut	Discrete	Construction cut for concrete [214]/[215] and firebrick wall [216]
214	3.2	G59	Deposit	Structure	Concrete south of wall [216] in construction cut [213]
215	3.2	G59	Deposit	Structure	Concrete north of wall [216] in construction cut [213]
216	3.1	G22	Masonry	Structure	Firebrick wall in construction cut [217]
217	3.1	G22	Cut	Linear	Construction cut for wall [218]
218	3.1	G22	Masonry	Structure	Firebrick wall in construction cut [217]
219	3.1	G19	Cut	Discrete	Construction cut for walls [221], [222] and concrete [220]
220	3.1	G19	Deposit	Structure	Concrete between walls [221] and [222]
221	3.1	G19	Masonry	Structure	Firebrick wall (northern) in construction cut [219]. To SE of BF2
222	3.1	G19	Masonry	Structure	Firebrick wall (southern) in construction cut [219]. To SE of BF2
223	3.2	G37	Cut	Discrete	Construction cut for structure [224], [225], [226] and Fe [227]. Adjacent to the rail track screens for BF4
224	3.2	G37	Deposit	Structure	Concrete structure in [223]
225	3.2	G37	Masonry	Structure	Brick and concrete structure in construction cut [223]
226	3.2	G37	Masonry	Structure	Brick wall within construction cut [223]
227	3.2	G37	Other	Metal	Fe uprights
228	4	G75	Deposit	Fill	Backfill of structures [225], [224] and [226]

229	3.2	G36	Cut	Linear	Cut for Fe pipe [230]
230	3.2	G36	Other	Pipe	Fe pipe in [230]
231	3.2	G36	Deposit	Fill	Backfill of pipe cut [229]
232	3.1	G11	Other	Pipe	Fe pipe in duct [180]/[181] (northern extent of Area B)
233	3.1	G11	Other	Pipe	Fe pipe in duct [180]/[181] (northern extent of Area B)
234	3.2	G54	Deposit	Structure	Concrete in [119]
235	3.2	G35	Cut	Linear	Construction cut for [236] and [237]
236	3.2	G35	Deposit	Structure	Concrete encasing Fe pipe [237]
237	3.2	G35	Other	Pipe	Fe pipe in cut [235]
238	3.2	G27	Deposit	Surface	Concrete surface in [239]. To the E of BF 1
239	3.2	G27	Cut	Discrete	Construction cut for concrete surface [238]
240	3.2	G27	Deposit	Surface	Concrete surface in [241]. To the E of BF 1
241	3.2	G27	Cut	Discrete	Construction cut for concrete surface [240]
242	3.1	G12	Other	Pipe	Fe pipe in duct [243] for BF1
243	3.1	G12	Masonry	Structure	Brick pipe duct containing [242] for blast stoves associated with BF1
244	3.1	G12	Cut	Linear	Construction cut for pipe [242] and brick duct [243]. Associated with BF1
245	3.2	G29	Deposit	Fill	Backfill of structure [109]
246	3.2	G73	Cut	Discrete	Construction cut for concrete structure [247]
247	3.2	G73	Deposit	Structure	Concrete structure likely related with pipe [237] to the south
248	4	G75	Deposit	Fill	Backfill of [202]
249	3.1	G11	Masonry	Structure	N-S duct walls forming arch (part of duct [60])
250	4	G75	Deposit	Fill	Backfill of duct [249]
251	3.2	G42	Deposit	Structure	Concrete structure adjacent to wall [124]
252	3.1	G4	Cut	Discrete	Construction cut for Blast Furnace 1
253	3.1	G4	Deposit	Structure	Concrete foundation for BF1 in [251]
254	3.1	G4	Masonry	Structure	Remnant of Blast Furnace 1 masonry
255	-	-	-	-	VOID
256	-	-	-	-	VOID
257	3.2	G28	Cut	Linear	Construction cut for brick pipe duct [258] containing Fe pipe [260]. BF4
258	3.2	G28	Masonry	Structure	Brick duct in construction cut [257]. BF4
259	3.2	G29	Deposit	Fill	Backfill of [258] and [257]
260	3.2	G28	Other	Pipe	Fe pipe in brick duct [258]. BF4
261	3.2	G33	Deposit	Fill	Backfill between [94] and [72]
262	3.2	G44	Cut	Discrete	Construction cut for concrete structure [263]
263	3.2	G44	Deposit	Structure	Concrete structure in [262]. Buffer stop support for rails {64} associated with BF4
264	3.2	G51	Cut	Discrete	Construction cut for concrete structure [265]
265	3.2	G51	Deposit	Structure	Concrete structure in [265]
266	3.2	G49	Cut	Discrete	Construction cut for concrete structure [267]
267	3.2	G49	Deposit	Structure	Concrete structure in [266]
268	3.2	G44	Cut	Discrete	Construction cut for concrete structure [269]
269	3.2	G44	Deposit	Structure	Concrete structure in [268]
270	3.2	G44	Deposit	Layer	Sand ballast associated with rail [64] and sleepers [65]

271	3.2	G50	Cut	Discrete	Construction cut for concrete [272] and Fe [273]
272	3.2	G50	Deposit	Structure	Concrete foundation for [273] in [271]
273	3.2	G50	Other	Metal	Fe base
274	3.2	G30	Masonry	Structure	Brick wall below concrete [236]
275	3.1	G3	Deposit	Layer	Levelling/ consolidation layer
276	3.1	G9	Cut	Discrete	Construction cut for structure [277]
277	3.1	G9	Masonry	Structure	Wall to north of BF1. Stove base?
278	3.1	G10	Masonry	Structure	Structure in construction cut [334]. Possible outer wall of stove to north of BF1
279	3.1	G14	Masonry	Structure	Brick structure associated with Fe pipes [104] and [105]
280	3.1	G17	Cut	Discrete	Construction cut containing masonry [281], [282] and [283]
281	3.1	G17	Masonry	Structure	Firebrick wall in construction cut [280]
282	3.1	G17	Masonry	Structure	Firebrick wall in construction cut [280]
283	3.1	G17	Masonry	Structure	Firebrick surface in construction cut [280]
284	3.1	G17	Cut	Discrete	Construction cut for wall [285]
285	3.1	G17	Masonry	Structure	Firebrick wall in cut [284]
286	3.1	G11	Cut	Discrete	Construction cut for wall [287]
287	3.1	G11	Masonry	Structure	Wall in [286]
288	3.1	G13	Cut	Linear	Cut for Fe pipes [289] and [290]
289	3.1	G13	Other	Pipe	Fe pipe in [288]
290	3.1	G13	Other	Pipe	Fe pipe in [288]
291	3.1	G13	Deposit	Fill	Backfill of [288]
292	3.1	G8	Masonry	Structure	Firebrick structure in [321]
293	3.1	G8	Masonry	Structure	Firebrick structure in [320]
294	3.1	G8	Masonry	Structure	Brick structure in [319]
295	3.1	G8	Other	Pipe	Fe pipe in [296]
296	3.1	G8	Cut	Linear	Cut for pipe [295]
297	3.1	G8	Other	Metal	Rail on Fe sleepers [298] on top of ballast track bed [299]. Continuation of rail line to the south to the west of blast furnaces
298	3.1	G8	Other	Metal	Fe sleepers for rails [297] on ballast track bed [299]
299	3.1	G8	Deposit	Layer	Upper level of rail track for [297] and [298]
300	3.1	G11	Other	Pipe	Fe pipe
301	3.2	G25	Other	Metal	Metal uprights around BF4
302	3.2	G25	Deposit	Structure	Concrete layer overlying [70] and [71] BF4
303	4	G75	Deposit	Fill	Backfill of recess [190]
304	3.1	G13	Other	Metal	Fe cross beam in [288]
305	3.2		Masonry	Structure	Brick wall abutting brick duct [28] to east of BF3
306	3.2	G45	Cut	Discrete	Construction cut for [55]
307	3.1	G8	Timber	Horizontal	Timber sleeper in ballast [26]
308	3.1	G8	Timber	Horizontal	Timber sleeper in ballast [26]
309	3.1	G8	Timber	Horizontal	Timber sleeper in ballast [26]
310	3.1	G8	Timber	Horizontal	Timber sleeper in ballast [26]
311	3.1	G8	Masonry	Surface	Brick surface in construction cut [315] within ballast track bed [26]. South-west of BF3.

312	3.1	G8	Other	Pipe	Fe pipe in ballast [26]
313	3.1	G8	Other	Metal	Fe beam at southern extent of ballast track bed [26]. Perhaps associated with buffer stop on [75]/[76]
314	3.2	G40	Deposit	Structure	Concrete surface in structure [196]
315	3.1	G8	Cut	Discrete	Construction cut for brick surface [311]
316	3.1	G8	Deposit	Structure	Concrete base for rail track along western extent of site. Below ballast track bed [26]
317	3.1	G20	Cut	Discrete	Construction cut for wall [10]
318	3.1	G8	Deposit	Layer	Ballast below ballast [299]. Northern extent of site
319	3.1	G8	Cut	Linear	Construction cut for wall [294]
320	3.1	G8	Cut	Linear	Construction cut for wall [293]
321	3.1	G8	Cut	Linear	Construction cut for wall [292]
322	3.2	G43	Cut	Linear	Construction cut for rail line [324]
323	3.2	G43	Deposit	Structure	Concrete base for rails [324]
324	3.2	G43	Other	Metal	Rail lines
325	-	-	-	-	VOID
326	3.2	G43	Other	Metal	Northern screens in rail line [324] associated with BF4
327	3.2	G43	Other	Metal	Southern screens in rail line [324] associated with BF6
328	3.2	G56	Cut	Discrete	Construction cut for fireblock structure [329]
329	3.2	G56	Masonry	Structure	Partially uncovered firebrick structure to south of BF6 in [328]
330	3.1	G11	Cut	Linear	Cut for pipe [300]
331	3.2	G38	Masonry	Structure	Brick structure in wall [188]
332	3.1	G9	Deposit	Structure	Concrete foundation for structure [277]
333	3.1	G9	Deposit	Fill	Backfill of construction cut [276]
334	3.1	G10	Cut	Linear	Construction cut for structure [278]
335	3.2	G38	Masonry	Structure	Brick structure
336	3.2	G37	Masonry	Structure	Brick structure
337	3.2	G37	Deposit	Structure	Concrete structure to the west of northern screens for BF4
338	3.2	G40	Cut	Discrete	Cut for concrete structure (196)

APPENDIX 3: STRATIGRAPHIC MATRIX

APPENDIX 4: PHOTOGRAPHIC & HISTORIC PLATES

Photographic Plates

Plate 1: Trench 1 field drain G1 Culvert [495]: view north-east 2m scale (Archive Photo Ref. D191)



Plate 2: Rail Line G8 (left of photo) with BF3 in foreground: view west-northwest. 2m scale (Archive Photo Ref. D.358)

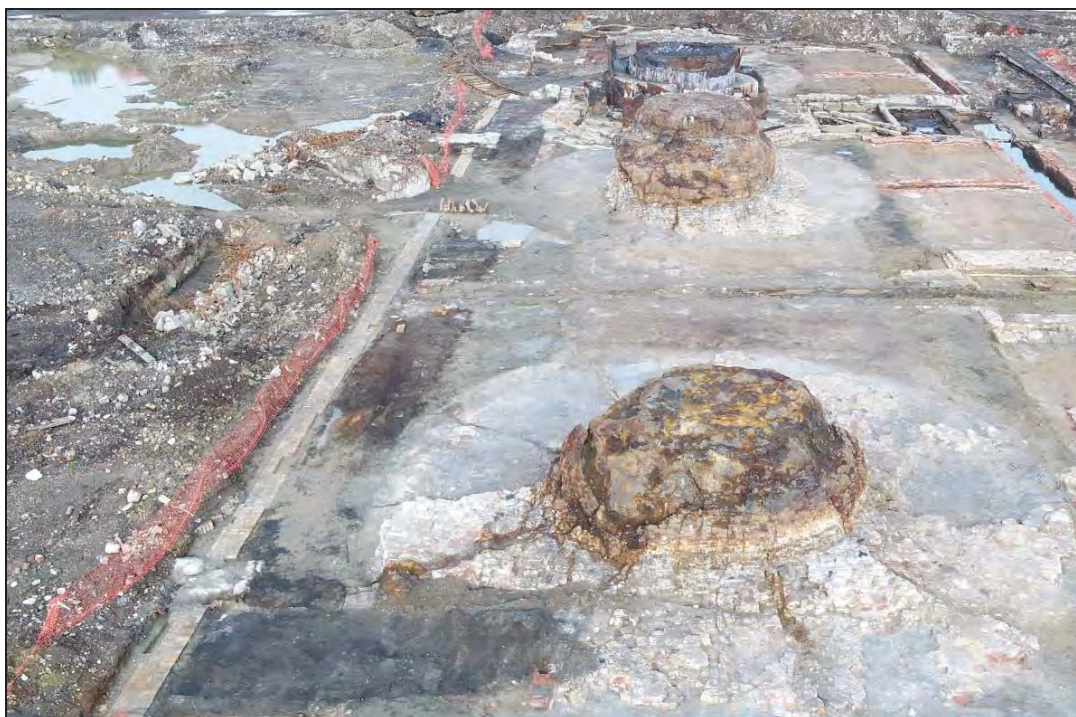


Plate 3: Overview of rail line G8: view north-northwest. 2m scale (Archive Photo Ref. D168)



Plate 4: Northern part of rail line G8: view north-northwest. 1m scale (Archive Photo Ref. D246)



Plate 5: Timber impressions within track bed [26] G8: view south-southeast. 2m scale (Archive Photo Ref. D135)



Plate 6: Rail line G8 showing BF2 (left) and BF3 with siding (right) (Archive Photo Ref. D364)



Plate 7: Truncated remains of BF1 (centre) to the north BF4 (right): view east (Archive Photo Ref. D345)



Plate 8: Surviving masonry [254] of BF1 (right): view north-west. 2m scale (Archive Photo Ref, D231)



Plate 9: BF1 Blast Stove Base G9/G10: view east-northeast. 2m scale (Archive Photo Ref. D250)



Plate 10: BF2 (right) with later BF4 (left): view east (Archive Photo Ref. D344).



Plate 11: BF2: view north-east. 2m scale (Archive Photo Ref. D35)



Plate 12: BF3 G6: view east-northeast (Archive Photo Ref. D342)



Plate 13: BF 3 G6: view northeast, 2m scale (Archive Photo Ref. D166)



Plate 14: BF3 radial bands of metal from centre of furnace outwards (Archive Photo Ref. D353)



Plate 15: Main blast pipe duct G11 north-south: view north-northwest. 2m scale (Archive Photo Ref. 15)



Plate 16: NW section of main blast pipe G11: view northwest. 2m scale (Archive Photo Ref. D201)



Plate 17: Curvilinear section of main blast pipe duct G11: view west. 2m scale (Archive Photo Ref. D210)



Plate 18: L-shaped wall [182] with pipe [300] and surface [287] attached to southern wall [181] of curvilinear section of duct G11: view north-northwest. 0.2m scale (Archive Photo Ref. D261)



Plate 19: Subsidiary air supply G13 for Blast Stove G9: view west-southwest. 2m scale (Archive Photo Ref. D242)



Plate 20: Subsidiary duct G12 for BF1: view west-southwest. 2m scale (Archive Photo Ref. D202)



Plate 21: Subsidiary duct G15 for BF2: view west-southwest. 2m scale (Archive Photo Ref. D29)



Plate 22: Subsidiary duct G16 for BF3: view west-southwest. 2m scale (Archive Photo Ref. D108)



Plate 23: Structure G14 chimney/cooling tower or vent: view south. 2x1m scales (Archive Photo Ref. D331)



Plate 24: Structure G19, G20, G21, G22 and G23: view west-southwest, 1m scale (Archive Photo Ref. D20)



Plate 25: Trench 1: Structure G24: view south-east. 2m scale (Archive Photo Ref. D190)



Plate 26: BF4 G25]: view southwest (Archive Photo Ref. D361)



Plate 27: BF4: view north-northwest. 2m scale (Archive Photo Ref. D164)



Plate 28: BF4 fireblocks [68]: view south-southwest. 1m scale (Archive Photo Ref. D154)



Plate 29: BF4 carbon blocks [67]: view north-northwest. 1m scale (Archive Photo Ref. D153)



Plate 30: In situ salamander [66], BF4: view south-west. 1m scale (Archive Photo Ref. D156)



Plate 31: Hole below BF4 (where photo scale is located): view west-southwest. 2m scale (Archive Photo Ref. D39)



Plate 32: Hoist Room for BF 4 comprising [96], G28, G29, G30, G31, G32, G33, G34, G35, G36: view north-northeast. 2m scale (Archive Photo Ref. D361)



Plate 33: Hoist room for BF4: view north-northwest (Archive Photo Ref. D360)



Plate 34: Screening room G37 for BF4: view south-southwest. 1m scale (Archive Photo Ref. D340)



Plate 35: Eastern rail line G43 (right of photo adjacent to orange fencing): view northwest (Archive Photo Ref. D188)



Plate 36: Rail line G43 (left) with Hi-line rail embankment in the distance: view south-southeast. 2m scale (Archive Photo Ref. D303)



Plate 37: Eastern rail line G43 southern screens [327] for BF6: view north-northwest. 0.5m scale
(Archive Photo Ref. D281)



Plate 38: NW rail line and associated structures G44: view north-west. 2m scale (Archive Photo Ref. D227)



Plate 39: BF5 (Archive Photo Ref. D366)



Plate 40: BF5: view south-west. 2m scale (Archive Photo Ref. D14)



Plate 41: BF6 (G26): view east-northeast (Archive Photo Ref. D341)



Plate 42: BF6: view north-west. 2m scale (Archive Photo Ref. D178)



Plate 43: BF6 metal straps [162] (Archive Photo Ref. D176)



Plate 44: BF6 screening area (G38, G39, G40, G41 & G58) (Archive Photo Ref. D341)



Plate 45: BF6 screening area G42 (Archive Photo Ref. D336)



Plate 46: Room G45. (Archive Photo Ref. D349)

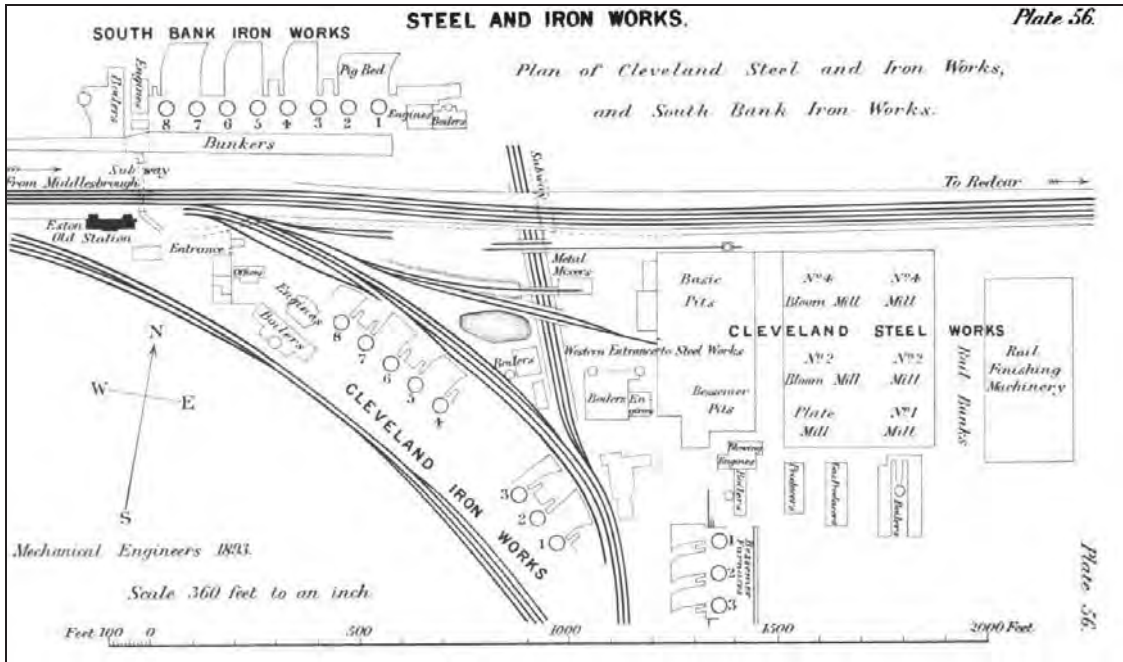


Plate 47: Room G45 (Archive Photo Ref. D101)

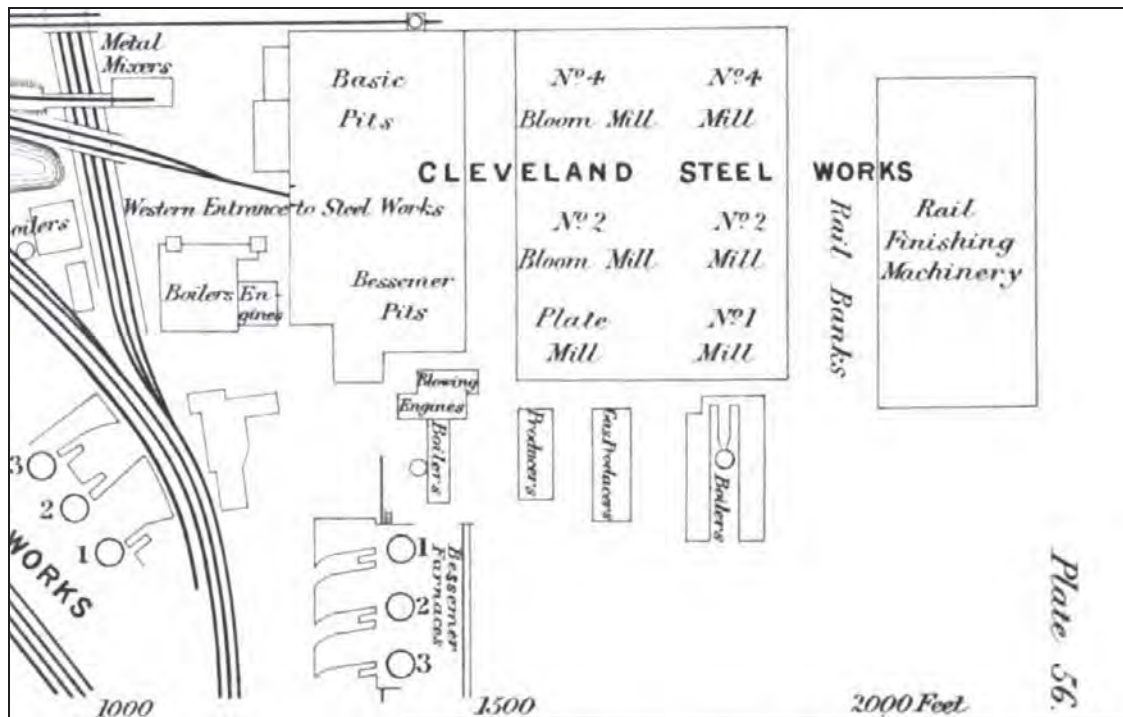


Historic Plates

Historic Plate A: Plan of Cleveland Steel and Iron Works 1893, taken from *Proceedings Institution of Mechanical Engineers*, 1893



Historic Plate B: Plan of Cleveland Steel and Iron Works 1893, taken from *Proceedings Institution of Mechanical Engineers*, 1893



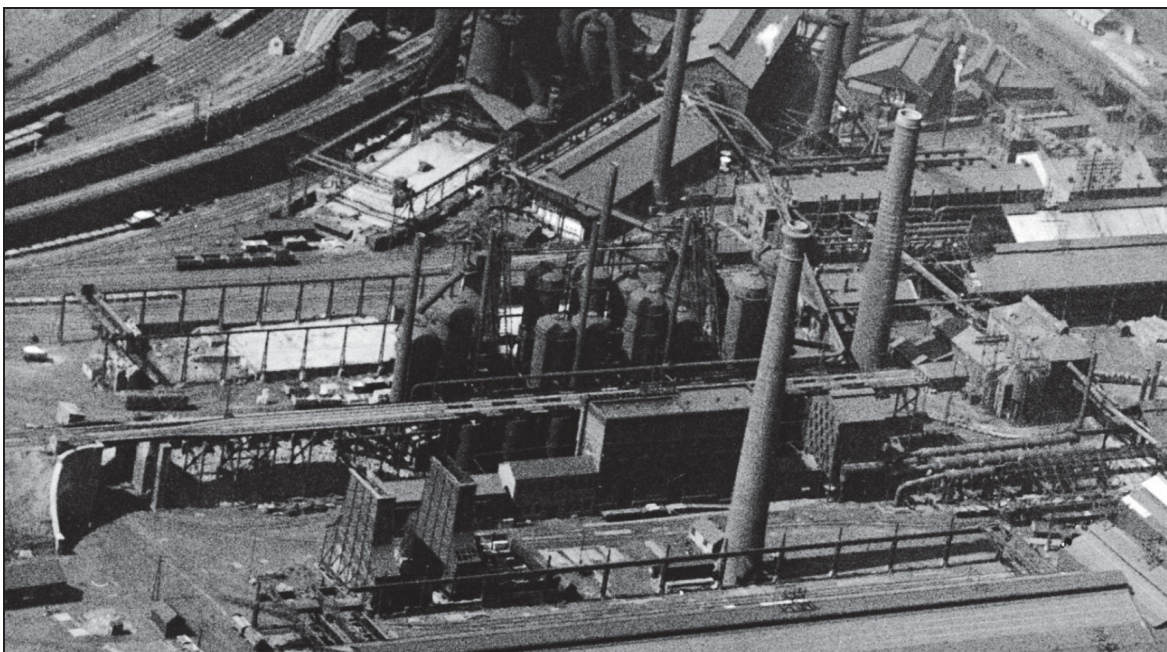
Historic Plate C: Cleveland Steel Works, Grangetown, 1924. Hi-line bottom left with Bessemer furnaces to west of line (Source: Britain from Above website Ref. EPW010144)



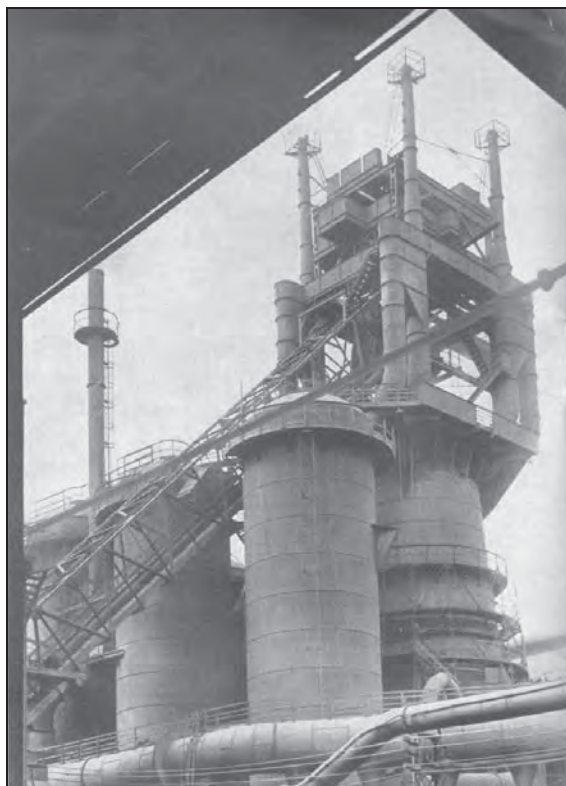
Historic Plate D: Cleveland Steel Works, Grangetown, 1924. Bessemer furnaces in centre of photograph (Source: Britain from Above website Ref. EPW010142)



Historic Plate E: Cleveland Steel Works, Grangetown, 1924. Bessemer furnaces in centre of photograph showing BF 4 and BF6 (BF5 had yet to be built) (Source: Britain from Above website Ref. EPW010143)



Historic Plate F: One of the Cleveland Steel Bessemer Furnaces c. 1947 after rebuild (Source: RMWeb)



APPENDIX 5: BRICK ASSESSMENT

John Nolan NCAS 14th July 2021

Introduction

One hundred and seven samples were taken during excavations between January and March 2021 site code (ERF21) on the site of the former Eston Iron Works and Cleveland Steel Works, established by Henry Bolckow and John Vaughan in 1853 (Phase 3.1 of site use) and fully redeveloped as the Cleveland Steel Works 1874-6 which remained operational until the late 20th century (Phase 3.2 of site use).

One insecurely stratified firebrick (Sample no. 83 context 256) was omitted from the assessment, while another sample (Sample no. 104, context 67) was a fragment from a carbon block used in steelmaking. The remaining 105 samples were firebricks, firebrick shapes, and common bricks.

All the brick samples appear to date from the second half of the 19th into the 20th centuries, with no identifiably earlier types.

Methodology

All samples were labelled with context and find number. A site summary, context list, and brick register, were made available for this assessment.

All samples were visually examined, measurable dimensions taken (in millimetres) where possible, and their appearance, maker's marks, and evidence for method of manufacture, use, or reuse, was noted. Dimensions, - length (L), width (W), and thickness (T)) – are averages, as there were minor variations caused by distortion during moulding, firing, or damage during use.

The bricks were described using the terms *bed face* (the largest upper and lower surfaces), *stretcher* face (the long sides), and *header face* (the narrow ends). The metric and descriptive data was then entered into an Excel spreadsheet catalogue.

In this assessment report the context numbers are given in [] brackets and brick sample numbers in < > brackets.

Firebricks

Ninety firebricks formed the bulk of the assemblage. These included 17 other refractory shapes including quarls, wedges/tapered blocks, possible vousssoirs, and one shaped like the letter 'T'. Sixty-eight were stamped, though the mark was not always legible. Those that were more or less readable are listed below. All fabrics were fine-grained pale yellow-white in colour, most with surface discolouration, sooting, or ferrous staining, from use. The Phase 3.1 types were probably all hand moulded. Mortar was generally off-white or grey. Some incomplete samples had mortar adhering to the broken faces, indicating reuse. Dimensions of the actual firebricks ranged from (L) 225mm - 245mm, (W) between 105 - 116mm, and (T) 55 – 67mm, though most were remarkably consistent at (L) 230mm x (W)110mm x (T) 70-75mm.

Legible marks (on firebricks unless otherwise stated):-

B Unidentified, on a quarl. *Phase 3.1* <85> [24].

BF F Unidentified, on a quarl. Possibly Bradford Fire Clay Co. (Kitching) *Phase 3.2* <41> [86].

BONNYBRIDGE BRAND *Phase 3.2* <100> [274] Scottish (Stirlingshire), possibly Bonnybridge Silica & Fireclay works 1874-1971, Bonnymuir Brickworks, c.1869-1960s, or Broomhill Brickworks 1924-1979 (Douglas and Oglethorpe, 61-2).

BOV...(or ?BOW...) Unidentified, on a quarl. *Phase 3.1* <29> [60].

BV and **B.V** Bolckow, Vaughan. Not identifiable to any specific colliery. *Phase 3.1* <9> and <103> [279]; *Phase 3.2* <101> [225].

B & V Bolckow and Vaughan. Not identifiable to any specific colliery. *Phase 3.1* <11> [180].

BV & Co. Bolckow, Vaughan & Co. Not identifiable to any specific colliery. *Phase 3.1* <69> [10,], <55> [21], <86> [25], <48> [38]; <90> [115], <18> [182], <82> [249]. *Phase 3.2* <79> [51], <81> [56], <98> [82], <78> [202].

BV.AP Bolckow, Vaughan Auckland Park. Auckland Park colliery opened in 1864 and was owned by Bolckow Vaughan and Co. between 1872-1929. Fireclay was listed as an output from 1896. (Durham Mining Museum). *Phase 3.1* <2> and <44> [40].

BV.LC Bolckow Vaughan Leasingthorne Colliery. Leasingthorne Colliery, which was owned by Bolckow Vaughan in the 1870s – 1929, and had a brickyard working by 1894 (Davison, 232). *Phase 3.1* <56> [40], [181].

BV & LC Bolckow, Vaughan and Leasingthorne Colliery. *Phase 3.1* <1> [40], <6> [293], <13> [181].

BVN Probably Bolckow, Vaughan Newfield Colliery. The Low Yard at Newfield Colliery, was making common red bricks for the High Yard Kiln with this stamp in 1901 (Davison, 231), and the stamp has been seen on firebricks at the Byers Green kilns, working between 1879-1921 (Davison, 227). *Phase 3.2* <99> [89].

C & M Chapman & Morson, Crook Colliery 1864-79 (Davison, 211). *Phase 3.1* <16> [181] x 1; *Phase 3.2* possibly <38> [258].

C & N Unidentified, but possibly a fudged 'C & M'. *Phase 3.1* <19> [182].

F & L Ferens and Love, Cornsay Colliery c.1879-1975, and Lanchester Colliery 1897 (Davison, 196, 199). *Phase 3.2* <28> [163].

HBC SB Possibly the Hartburn Brick & Tile Co. operating between 1906-20 (Davison,, 242). *Phase 3.2* <40> [86].

H & N Hunwick and Newfield Collieries. Hunwick Colliery near Bishop Auckland was acquired by Bolckow, Vaughan & Co. Ltd. In the 1870s and closed in 1921 (Durham Mining Museum). *Phase 3.1* <49> [36] , <34> [102] , <10> [180] , <20> [287], and possibly <5> [294].

HOWDEN Howden Colliery, G. Hutchinson and Co. Firebrick Works 1879-1897 (Davison, 209, 211); Chapman, Morson & Co were owners in the 1880s, and fireclay noted as an output from 1896 (Durham Mining Museum). *Phase 3.1* <60> [10] , <66> [143], <4> [294].

LC & Co Leasingthorne Colliery. *Phase 3.1* <35> [102].

N.CAP Newton Cap firebrick works established in the early 1880s (1884?) by Henry Stobart and Partners (Davison, 211). *Phase 3.1* <58> [10].

N.HOGG Unidentified, though the mark of John Hogg, firebrick maker at Butterknowle in partnership with John Hymer and Joseph Teasdale is known (Kitching). *Phase 3.1* <17> [181].

NEWFIELD Bolckow & Vaughan's brickworks at Newfield near Bishop Auckland, operating between 1855-1985 (Davison, 225). *Phase 3.1* <67> [143], <16> [181].

No.22 Unidentified, on a quarl. *Phase 3.2* <92> [167].

NOR...WORTL.. LEEDS On a quarl. The 'NOR...' has not been precisely identified, but otherwise this is a product on the Leeds Fireclay Co. at Wortley near Leeds. *Phase 3.2* <27> [52].

PESCOD Probably John Pescod, making bricks at Wackerfield nr. Cockfield (Hilton Tarn Brick & Tile Works?) 1856. Managed the Victoria Brick & Tile Works at Howden in 1865, and died 1876 (Kitching; Davison, 211, 228). *Phase 3.1* <14> [181], <7> [292].

...R CROWN On a quarl. Not positively identified but possibly a 'Foster Crown' from Henry Foster's Hotspur brickworks, Backworth, opened in 1877 (Davison, 51). *Phase 3.2* <39> [135].

STOBART Probably Henry Stobart who was making firebricks at Old Etherly Colliery from the 1850s and established the Newton Cap firebrick works in the early 1880s (Davison, 221). *Phase 3.1* <65> [143].

W2 Unidentified but an example has been recorded from 'south-west Durham' (Kitching). *Phase 3.1* <47> [38], <43> [40], <45> [44], <61> [216], <62> [218], <64> [222], <23> [281], <22> [282], possibly <24> [283]; *Phase 3.2* <80> [55], <74> [193], <75> [204], <63> [221].

Common bricks

There were seven common facing bricks from Phase 3.1 and four from Phase 3.2, distinguished from the refractory material by their mid-dark red fabric. All were of broadly similar type: probably hand-moulded, red or purple-red, ranging between 225-240mm in length, 105-115mm in width, and 65-82mm thick, though the most frequent dimensions were 230mm x 110mm x 75mm.

Three were stamped: two in Phase 3.1, one with 'BV.& LC' for Bolckow Vaughan and Leasingthorne Colliery (<13> [181]), the other 'BV.AP' for Bolckow Vaughan Aukland Park <21> [285]. and one in Phase 3.2 with 'C & (?)' <38> [258] which was probably made by Chapman and Morson at Crook Colliery. Among other uses, red facing bricks were used externally on furnaces and on chimneys.

Discussion

Despite the number of maker's marks the assemblage itself is not very helpful as a dating tool as most of the identifiable brick marks and brick types are of makers whose operating dates span both phases of the site, some continuing into the second half of the 20th century. Some with maker's marks common to both phases may have been re-used. The bricks themselves are not intrinsically datable but their form and characteristics are compatible with a date-range spanning the third quarter of the 19th century to the first half 20th century.

Perhaps unsurprisingly, half the stamps (or probable stamps) on the firebrick and common brick were of Bolckow Vaughan and their collieries. Other makers are largely from south Durham, within a radius of some 25 miles from the site. These 'local' stamps are generally represented in both phases: the unidentified W2 (ten examples in Phase 3.1 and two in Phase 3.2); BV & C^o (six in Phase 3.1 and two in Phase 3.2); BV (two in Phase 3.1 and one in Phase 3.2. That these stamps predominantly occur in Phase 3.1 suggests they date to the period c.1874-1911, appearing residually thereafter. Some 'local' stamps are exclusively to Phase 3.2: BVN, F&L, HBC SB, and ...R CROWN, but again the known dates when these manufactories were in operation span both phases and so could be residual.

The few non-local or suspected non-local firebrick samples originated from Scotland and Yorkshire - 'BF F', 'BONNYBRIDGE BRAND' (Stirlingshire), 'NOR...Wortl...LEEDS', and possibly 'No.22'. Another Stirlingshire firebrick, stamped 'NETTLE ED' <83> [256] was unstratified and omitted from the assessment.

Potential for further work and archiving (Retention/disposal)

There is potential for further research into the unidentified (or not positively identified) stamped bricks, and it is recommended that the following samples are retained, or at least their stamps clearly photographed:-

W2 <22> [282].

...R CROWN <39> [135]

N.HOGG <17> [181]

C & N <19> [182]

BOV...(or BOW...) <29> [60]

HBC SB <40> [86]

(unreadable) <12> [180] This should be cleaned to elucidate the stamp.

It is not considered that there is any potential for further work on, or retention of, the rest of this assemblage.

Sources

Davison, P.J. 1986. Brickworks of the North-East, Gateshead Public Library.

Douglas G and Oglethorpe M. Brick, Tile and Fireclay Industries in Scotland. RCHMS 1993, 56.

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