



3, Glass Wharf,
Temple Quay,
Bristol,
Avon

**Summary Report of
Archaeological Works**



Oxford Archaeology North

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**Salmon Harvester Properties
Ltd**

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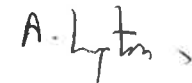
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SUMMARY

Salmon Harvester Properties Ltd is preparing a planning application for the redevelopment of land at Temple Quay in Bristol (centred at NGR 359855 172655). The Temple Quay area of the city is a predominantly modern commercial area, but has a rich industrial heritage as a focus for Bristol's former glass-manufacturing industry. The application area, referred to as Area ND5, lies within the boundary of an earlier development proposal by Castlemore Securities Ltd, the groundworks for which were progressed in 2007-08.

In order to secure archaeological interests, Bristol City Council recommended that a condition was attached to the 2007 planning permission that required an appropriate programme of archaeological excavation to be carried out in advance of development. Oxford Archaeology North (OA North) was commissioned subsequently to undertake a major programme of archaeological investigation of the site, which commenced in April 2007. This allowed for the full excavation of the application site, including Area ND5, coupled with an archaeological watching brief that was maintained during groundworks associated with the development.

The excavation exposed considerable remains of historic glassworks of regional importance, and enabled a comprehensive record to be made of the buried remains in advance of their ultimate destruction. The physical remains of the eighteenth-century glass furnaces were fragmentary, although well-preserved remains of four regenerative glass furnaces, together with a bank of associated gas producers, a probable annealing house, and ancillary structures were exposed. Excavation provided some evidence for the application of design improvements to the furnaces and the results offer a valuable opportunity to elucidate details of the evolution of glass furnace technology during the later nineteenth century. The record of the physical remains is enhanced considerably by a large assemblage of glass-manufacturing debris, which has some potential to furnish important details of the manufacturing processes carried out at the works. Other remains exposed during the excavation included a nineteenth-century dock and associated railway lines, which had been constructed across the site of earlier stone buildings.

Following the completion of the site investigation works, a programme of post-excavation assessment was implemented, in accordance with professional guidelines. This was intended to produce an updated project design and method statement for the analysis and ultimate publication of the hugely significant dataset recovered from the excavation, in accordance with the archaeological condition attached to planning consent. However, during the course of the post-excavation assessment process, Castlemore Securities Ltd went into liquidation and the archaeological analytical process stalled.

This report presents a summary of the archaeological works carried out at Temple Quay in 2007-08, and sets out a synopsis of the analytical tasks that are required to satisfy the archaeological conditions. As all the fieldwork requirements for the entire site, including Area ND5, have been fulfilled, the remaining tasks relate solely to the analysis and publication of the archaeological dataset.

1. INTRODUCTION

1.1 CIRCUMSTANCES OF THE PROJECT

- 1.1.1 Salmon Harvester Properties Ltd is preparing a planning application for the redevelopment of land at Temple Quay in Bristol. The Temple Quay area of the city is a predominantly modern commercial area, but has a rich industrial heritage as a focus for Bristol's former glass-manufacturing industry. The significance of the archaeological resource of the site has been established via several desk-based studies and intrusive investigation carried out since 1988.
- 1.1.2 The application area lies within the boundary of an earlier development proposal by Castlemore Securities Ltd, which was partially progressed in 2007-08. This earlier scheme involved the construction of properties for business, residential and leisure uses, and necessitated enabling works that would have a negative impact on the known sub-surface archaeological resource. In particular, the area between the River Avon and Avon Street was to be disturbed extensively by the creation of semi-basement parking, beneath the proposed office developments to the west of Area ND5.
- 1.1.3 In order to secure archaeological interests, the City Archaeologist, who provides archaeological planning advice to Bristol City Council, recommended that an appropriate programme of archaeological excavation was carried out in advance of development in order to mitigate the ultimate loss of significant buried remains. Acting on this recommendation, Bristol City Council attached an archaeological condition to planning consent for the proposed redevelopment. In order to satisfy this condition, Oxford Archaeology North (OA North) was commissioned to undertake a major programme of archaeological investigation of the site, which commenced in April 2007. This allowed for the full excavation of the whole application site, including Area ND5, coupled with an archaeological watching brief that was maintained during groundworks associated with the subsequent development. The archaeological investigation of the site was completed, and essentially 'sterilised' the area of all buried archaeological remains, including those in Area ND5; there is no merit in carrying out any further intrusive archaeological investigation of the site as part of the present planning application.
- 1.1.4 Following the completion of the site investigation works, a programme of post-excavation assessment was implemented, in accordance with professional guidelines. This was intended to produce an updated project design and method statement for the analysis and ultimate publication of the hugely significant dataset recovered from the excavation, in accordance with the archaeological condition attached to planning consent. However, during the course of the post-excavation assessment process, Castlemore Securities Ltd went into liquidation and the archaeological analytical process stalled.

1.1.5 This report presents a summary of the archaeological works carried out at Temple Quay in 2007-08, and provides a synopsis of the analytical tasks that are required to satisfy the archaeological conditions. These remaining tasks relate solely to the analysis and publication of the archaeological dataset.

1.2 SITE LOCATION

1.2.1 The present application area is situated within the historic parish of St Philips and St Jacobs, in the commercial centre of Bristol (centred at NGR 359855 172655). The main site lay to the south of Avon Street, north of the Floating Harbour, and was bordered by a railway viaduct and Trinity Quay to the east and the west respectively (Fig 1, Plate 1).



Plate 1: Aerial view of the site prior to development



Plate 2: *Painting of Soap Boilers' and Hoopers' glasshouses (Hugh O'Neill 1821)*

2. SUMMARY OF EXCAVATION RESULTS

2.1 INTRODUCTION

- 2.1.1 In total, an area equivalent to approximately 10,436m² was subject to detailed archaeological excavation in 2007, with a further 3910m² recorded under watching brief conditions. The excavation area was located on the southern side of Avon Street, whilst the watching brief monitored earth-moving works to the north.
- 2.1.2 The current application concerns Area ND5, which was subject to archaeological investigation in 2007. In total, an area measuring 56 x 45m was subject to excavation, which enabled a sequence of archaeological activity to be identified. The earliest anthropogenic deposits comprised a series of tip layers that had seemingly been intended to level the ground in advance of development. Excavation of these layers yielded an important assemblage of glass-manufacturing waste, together with abundant fragments of Red Ware pottery. A sequence of pits also derived from the primary phase of activity in this part of the site, and these similarly contained large groups of Red Ware pottery. Significantly, these including fragments of 'wasters', indicative of a pottery production site in the immediate vicinity. Numerous stone walls, representing the foundations for a large building(s) and associated wells, were also revealed during the excavation. Excavated remains pertaining to later stages in the development of ND5 included considerable elements of a nineteenth-century dock, together with parts of the associated railway infrastructure. These included *in-situ* sections of railway line, and the brick-built foundations that are likely to represent small turntables for railway wagons.
- 2.1.3 The stratigraphic and material assemblages recovered from Area ND5 are closely linked to the data recovered from the other excavations areas. In particular, an understanding the glass-manufacturing waste recovered from the various deposits in ND5 is dependent to some degree upon clarification of the sequence of glass-melting furnaces excavated elsewhere on the wider site.

2.2 THE STRATIGRAPHIC SEQUENCE

- 2.2.1 The stratigraphic sequence captured by the site archive contains a total of 1160 contexts that can be ordered and summarised according to the provisional chronological phasing and developmental sequence outlined below.
- 2.2.2 **Phase 1 activity:** Pre-glassworks activity; post-medieval - early eighteenth century.

This phase is mainly represented by a series of occupation layers, identified and dated by a wide array of material finds, which probably represent early encroachment on the area associated with the urban development and expansion of Bristol.

2.2.3 **Phase 2 activity:** Early industrial activity; early eighteenth century – mid-nineteenth century (1715 – 1853).

This phase is represented by an array of structures and deposits which can be identified as follows:

- Heavily truncated structural remains and deposits relating to the establishment and early development of the **Soap Boilers' glasshouse** (Furnace A) (Plate 3);
- Structural remains and deposits relating to the establishment and early development of the **Hoopers' glasshouse** (Furnace B) (Plate 4);
- A range of structures and deposits identified with ancillary buildings, *ie* an **annealing house**, outbuildings and land divisions;
- Structural remains and deposits (characterised by the presence of brass slag blocks) probably associated with **William Lund's copper and brass works of 1749-55** (Plate 5);
- Tip deposits and made ground relating to waste disposal from the industries and land reclamation along the river bank;
- Expansion of clay extraction pits to provide clay for construction;
- A series of independent buildings, equipped with cellars (Plates 6 and 7), and walls of unknown function.

2.2.4 **Phase 3 activity:** Later industrial activity; late nineteenth to early twentieth centuries (1853 – 1925).

This phase is represented by structural remains, mainly identified by the use of red brick and fire brick, as well as concrete, as opposed to the earlier use of sandstone. These remains relate to the amalgamation and expansion of the glass works under the new company of Powell & Ricketts during the 1860s.

They primarily consist of:

- the large-scale modification and modernisation of the original furnaces (A and B) to incorporate the new Siemens design for a regenerative furnace. (Plates 8-10);
- the provision of two further regenerative furnaces (C and D) (Plates 11-15);
- Additional ancillary buildings, including several gas producers, providing a modern energy source for the new furnaces (Plate 16) and a further annealing house (Plate 17);
- Construction of the river side dock and slightly later railway infrastructure (Plate 18);

2.2.5 **Phase 4 activity:** Post-glassworks activity; 1925 – present.

This phase of activity primarily relates to the decommissioning of the glass works and a change in the use of the site during the early twentieth century.

It is represented by:

- extensive demolition deposits from the glass works;
- concrete foundation deposits for the establishment of a Yeast factory;
- various service trenches and further rail infrastructure;
- a late timber building of unknown use (Plate 19);
- a circular brick structure (Plate 20).

2.3 **THE MATERIAL ARCHIVE**

2.3.1 The artefactual assemblage recovered during the course of the investigation was substantial in size and varied in composition, comprising finds from various material categories, summarised below.

- **Glass:** a substantial, varied and regionally significant assemblage of glass objects, fragments and waste, as one might expect from the scale of glass works investigated at the site. The assemblage holds considerable potential to provide detailed information about the operation of the glassworks on this site, particularly in relation to the nineteenth-century glass-working waste and contemporary embossed bottles.
- **Post-medieval pottery:** the assemblage comprises a total of 6304 sherds (including kiln waste). For the most part, this is fairly ubiquitous and well represented elsewhere by more complete examples. However, given the good chronological framework already developed for the material, the assemblage holds considerable potential to aid in the dating of features. It also holds considerable potential for further informative research relating to specific sub-sections of the assemblage, namely the body of Red Ware.
- **Clay tobacco pipe:** the assemblage comprises 1046 fragments that, while fairly well represented elsewhere, hold good potential for the dating of features.
- **Ferrous and other Metalwork:** the assemblage includes 211 iron or steel objects, 21 copper alloy objects and three of lead.
- **Stone:** the assemblage includes 16 objects of various kinds.
- **Animal bone and Marine Molluscs:** a small assemblage indicative of the deposition of food waste.
- **Organic material:** the assemblage includes 27 wooden and five leather items recovered from waterlogged conditions.

-
- 2.3.2 The digital and paper archive generated from the excavation, together with the majority of the material archive, is currently stored in OA North's offices in Lancaster. The principal exception is the assemblage of glass, which is presently held by the appointed external specialist.
- 2.3.3 It is recommended that, after the analysis phase has been completed, the material assemblage, including the glass and glass-working materials, is prepared for archive deposition by retaining some material and disposing of the remainder. In making initial recommendations for retention and discard, it is intended to strike a balance between the need to retain as much as material as would allow an independent review of the evidence for glass manufacturing (and potentially new avenues of research) and the need to avoid straining the archive and storage facilities of Bristol City Museum. The recommendations made will be based on discussions between Oxford Archaeology North staff and Bristol City Museum.

3. POTENTIAL AND SUGGESTED FURTHER REQUIREMENTS

3.1 INTRODUCTION

- 3.1.1 Post-excavation assessment work completed to date has indicated conclusively that the archaeological dataset generated from the 2007 excavations at Temple Quay has considerable potential to contribute to research agendas at local and regional levels. Regional research has highlighted the apparent dearth of knowledge relating to urban centres of glass-making which developed from the seventeenth century onwards (Crossley 1993, 30). A functional understanding of many industrial processes in particular is required, which is one of the principal ways that industrial archaeology can contribute to the study of the past (Cranstone 2003). This site therefore presents ample opportunity to make a considerable contribution to our understanding of such sites and their developmental context.
- 3.1.2 The precise potential of the various classes of data recovered from the excavation has still to be assessed fully. Whilst considerable progress with this process was achieved in 2008, the resultant post-excavation report still needs to be finalised and updated in the light of more recent legislation and research objectives. The completion of the post-excavation assessment report should form the first stage in the archaeological programme of works.

3.2 STRATIGRAPHIC ARCHIVE

- 3.2.1 The excavation enabled a detailed record to be compiled of the archaeological remains across the site, to mitigate their ultimate loss during the development. The stratigraphic and structural data embodied within the archive will provide the framework within which all other analyses will take place.
- 3.2.2 The key to understanding the chronology of the different types of activity, and the development of the wider urban and commercial landscape, resides within this record and the spatial organisation of the site, which can be interpreted through a study of the artefactual and phased stratigraphic records. Individual contexts, moreover, offer a potential for understanding the manufacturing processes that were undertaken on the site. The longevity of the glassworks on this site allow them to be of greater potential than others in the city.
- 3.2.3 Further analysis of the stratigraphic data will be required to refine the provisional phasing and chronological development of the key structures. The spatial nature of the site, its location, the variety of feature types, and the relatively narrow timeframe for the urban changes, mean that the site is significant not only to the development of Bristol, but to the wider region. The phases as they stand have been simplified, and the complex nature of the stratigraphy over a large area, both spatially and temporally will require further sub-divisions and refinement. In particular, further work will be required to refine the phasing of the furnaces and their internal details and alterations, which occupy relatively tight timeframes.

3.3 MATERIAL ARCHIVE

- 3.3.1 The material archive, particularly the glass, ceramic and clay pipe assemblages, offers the potential to significantly aid in the dating and subsequent chronological phasing of the site as a whole and will, consequently, inform the interpretation of specific structural remains relating to the functional development of the site and the industrial processes carried out there.
- 3.3.2 Analysis of the glass fragments recovered during the course of the archaeological investigation will undoubtedly provide significant details of the glass-making processes and practices, and the precise chemicals and elements used as colourants, decolourisers and opacifiers.

3.4 RECOMMENDATIONS FOR FURTHER REPORTING

- 3.4.1 Preparations for the production of a comprehensive assessment report were in the early stages of development prior to the collapse of funding sources and consequent suspension of work. Such a programme can easily be re-initiated in order to provide a comprehensive synthesis of the results of the excavations that would contribute towards satisfying the current archaeological conditions associated with the site.
- 3.4.2 It is recommended that, given the regional significance of the site, following such analysis, a full archive report is produced, and a summary of the results warrant publication in an appropriate manner.

4. TASKS REQUIRING COMPLETION

4.1 COMPLETION OF THE POST-EXCAVATION ASSESSMENT

4.1.1 The post-excavation assessment report that was progressed following the completion of the excavations carried out in 2007 was on-going when the programme of works stalled due to the collapse of Castlemore Securities Ltd. Since that date, planning guidance has been revised, and archaeological research objectives have been refined. In order to progress the programme of outstanding analytical works, the post-excavation assessment report will need to be revised and finalised, which will enable an updated programme of analysis and publication to be formulated. It is probable, however, that the results obtained from the assessment programme that was largely completed will remain valid. These are summarised below.

4.2 STRATIGRAPHIC ANALYSIS

4.2.1 The stratigraphic data recovered from the excavations will need to be analysed in greater detail in order to refine the provisional phasing and iron out problems. A broad stratigraphic framework has been produced but it is clear from this work that there are several discrepancies to be resolved, and that there are many areas where considerable further detailed work is required. This broad stratigraphic framework will require review and refinement, and it will also be essential to compile detailed sub-phasing, which will require careful analysis of the primary records, all contexts, and site plans and sections.

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

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

4.2.4 All contexts need to be attributed to these sub-phases once they have been established, and the site database will then require updating and amending. In the course of this analysis, the site matrices will require redrawing to conform to the amended periods and sub-phasing, and to include those contexts which could not be resolved at the assessment stage.

4.2.5 A detailed analytical text of the stratigraphic information, accompanied by phase drawings, sections and other relevant line illustrations, as required, will be drafted. This will provide detailed information on the periods and sub-phases of the site, and will indicate stratigraphically related groups.

- 4.2.6 The draft text and phase drawings will form the basis both of the summary information to be supplied to specialists and of the stratigraphic section of the final published report.
- 4.2.7 The revised databases will result in all the context data being collated in a readily accessible digitised form, and this will be made available to all specialists. All specialists' reports will also need to accommodate any new stratigraphic information, phasing and sub-phasing. As required, all necessary material will be sent to the specialists.

4.3 ANALYSIS OF THE GLASS

- 4.3.1 A catalogue will be made of all bottles and other containers, with typological analysis to indicate when and for whom they were produced. Given the potential for relatively tight dating of the bottles, this will include all unstratified examples. The analytical report will include a list of the bottles and other glass, which should be illustrated for the publication report.
- 4.3.2 Scanning electron microscopy with x-ray microanalysis (SEM-EDS) will be undertaken, to determine the major and minor elements present in the glass and other related materials (crucible, slag, refractory brick, clinker). This should be related to microstructure where this is present, and line scans should be taken across significant material boundaries (*eg* glass-crucible interaction) where these are present. The results of the SEM-EDS analyses will be calibrated against suitable reference materials. The chemical analysis of closely dated bottles will add considerably to an understanding of chronological changes in raw materials and/or batch.
- 4.3.3 Energy dispersive X-ray fluorescence (EDXRF) will be undertaken to determine trace elements present in the glass and other related materials. The results of the EDXRF analyses will be calibrated against suitable reference materials.
- 4.3.4 A SEM back-scatter detector will be used to illustrate the microstructure of selected materials, where appropriate. This should be supplemented with chemical analysis to aid the identification of euhedral phases in multiphase samples. Sieving will be carried out to determine the particle size range of the sand samples to determine whether they were used in glassmaking.

4.4 THE POTTERY

- 4.4.1 An archive report on the pottery will be prepared, which will conform to the requirements of a publication text for the Red Ware kiln waste. This should describe and illustrate the main vessel forms present in the assemblage, describe the production methods which can be determined from the vessels and kiln furniture, and detail the history of the Hill/Yabbicom Pottery. The report should include brief notes on the other types of kiln waste from the site in order to record their presence.

4.5 DOCUMENTARY RESEARCH

- 4.5.1 Further documentary research will be undertaken to enhance the fieldwork results. This may include, for instance, a study of the available rate assessments for the site, with a view to elucidating a precise date for the erection of the third furnace, as this addition to the works will have increased its annual value. Research will also be undertaken to identify comparable structures elsewhere, from either historical or archaeological sources.
- 4.5.2 A key component of the documentary research will be to consult in detail the results obtained from the previous archaeological work carried out on the site by BaRAS in 1988, the analysed results of which await publication.

4.6 ILLUSTRATION

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

4.7 PRODUCTION OF TEXT

- 4.7.1 Following completion of the full analysis of all the stratigraphic and artefactual evidence, an archive report will be drawn up. This will form the basis for the synthesised publication text, which will incorporate as necessary any information from comparable excavations. The report will be subject to internal revision, and will be submitted to all specialists after editing for their comments. A draft text and illustrative material for publication in an academic monograph and as an easily accessible popular publication should then be produced and edited.

4.8 ARCHIVE DEPOSITION

- 4.8.1 On submission of the completed text for publication, the archive will be updated as necessary, particularly the database information. This will all be checked and then submitted to Bristol Museums Service. Material in boxes will be checked and box lists compiled and appended. The entire paper and material archive will be indexed, ordered and checked, and all parts delivered to the receiving museum in good order.

4.9 CONCLUSION

4.9.1 In order to complete an appropriate programme of recording and analysis of the information uncovered to date, the post-excavation assessment report requires finalising. This will enable an updated project design to be formulated, which will map out a methodology for the analysis and publication of the archaeological dataset, which will focus on the material recovered from Area ND5. :

- Analysis of the stratigraphic sequence;
- Chemical analysis of the glass-manufacturing waste;
- Analysis of the Red Ware pottery, with emphasis on the kiln waste;
- Production of final archive report;
- Appropriate level of publication;
- Deposition of the digital, paper and material archive with the Bristol Museum.

4.9.2 It is accepted that the current planning application for Area ND5 constitutes only a part of the whole area that subject to archaeological investigation in 2007-08. It is thus anticipated that the financial contribution to the costs of full analysis and publication of the entire dataset furnished by the current applicant will be commensurate with the size of the area that is subject to the renewed planning application.

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Plate 6: Wall **1149** in the north-western corner of ND5, with later brick steps, looking north-west

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Plate 17: Area of the possible annealing house on the north side of the site, looking west

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Plate 19: Later timber structure **1090**, looking south

Plate 20: Late circular brick structures, looking north-east



Plate 3: Furnace A earlier phase, looking west



Plate 4: General view of Furnace B, with the Phase 2 sandstone walls visible, looking west



Plate 5: Sandstone-built wall 3390, looking south, thought to be part of William Lunds' brass and copper works



Plate 6: Wall 1149 in the north-western corner of ND5, with later brick steps, looking north-west



Plate 7: Wall 1268 with adjacent cellars, looking south



Plate 8: Furnace A, chimney 3093 associated with the earlier phase, looking north



Plate 9: Furnace A later phase, looking south-west



Plate 10: Furnace B, tension bars within the furnace walls, looking south



Plate 11: General view of Furnace C, looking south



Plate 12: Furnace C regenerative furnace chambers, looking north. The wider chamber carried air and the narrower carried gas



Plate 13: Elevations of flues in Furnace C, looking south



Plate 14: General view of Furnace D, looking west



Plate15: Furnace D, arrangement of access pits in switch room 3506, looking west



Plate 16: Gas producers 3709 towards the bottom of the picture, with the passageway, 3708, above, looking west



Plate 17: Area of the possible annealing house on the north side of the site, looking west



Plate 18: The north end of the dock 1003 with railway tracks adjacent, looking south



Plate 19: Later timber structure 1090, looking south



Plate 20: Late circular brick structures, looking north-east

APPENDIX 1: SUMMARY OF TASKS STILL TO BE COMPLETED

Stratigraphic Analysis

- Stratigraphic analysis
- Documentary research
- Input contexts to database
- Redraw matrices
- Prepare stratigraphic text
- Compile phase plans and sections
- Digitise plans and sections for final archive report
- Compile information for specialists

Artefact Analysis and Reports

- Sieving and sorting soil samples
- Production of a catalogue of relevant materials
- Chemical analysis
- Morphology and Microstructure
- Particle size analysis
- Report writing
- Preparation of publication text
- Preparation of report on pottery
- Preparation of final report on other materials
- Quality control of specialist finds reports
- Integrate specialist information into archive report
- Preparation of archive report
- Editing of archive report
- Quality control editing of archive report

Illustrations

- Stratigraphic illustrations (phase drawings, etc)
- Artefact illustrations

Archiving

- Archive preparation
- Archive deposition

Publication

- Production of an academic monograph
- Production of a 'popular' booklet publication

FIGURES

Figure 1: Site location, showing the boundary of the 2007 excavation area

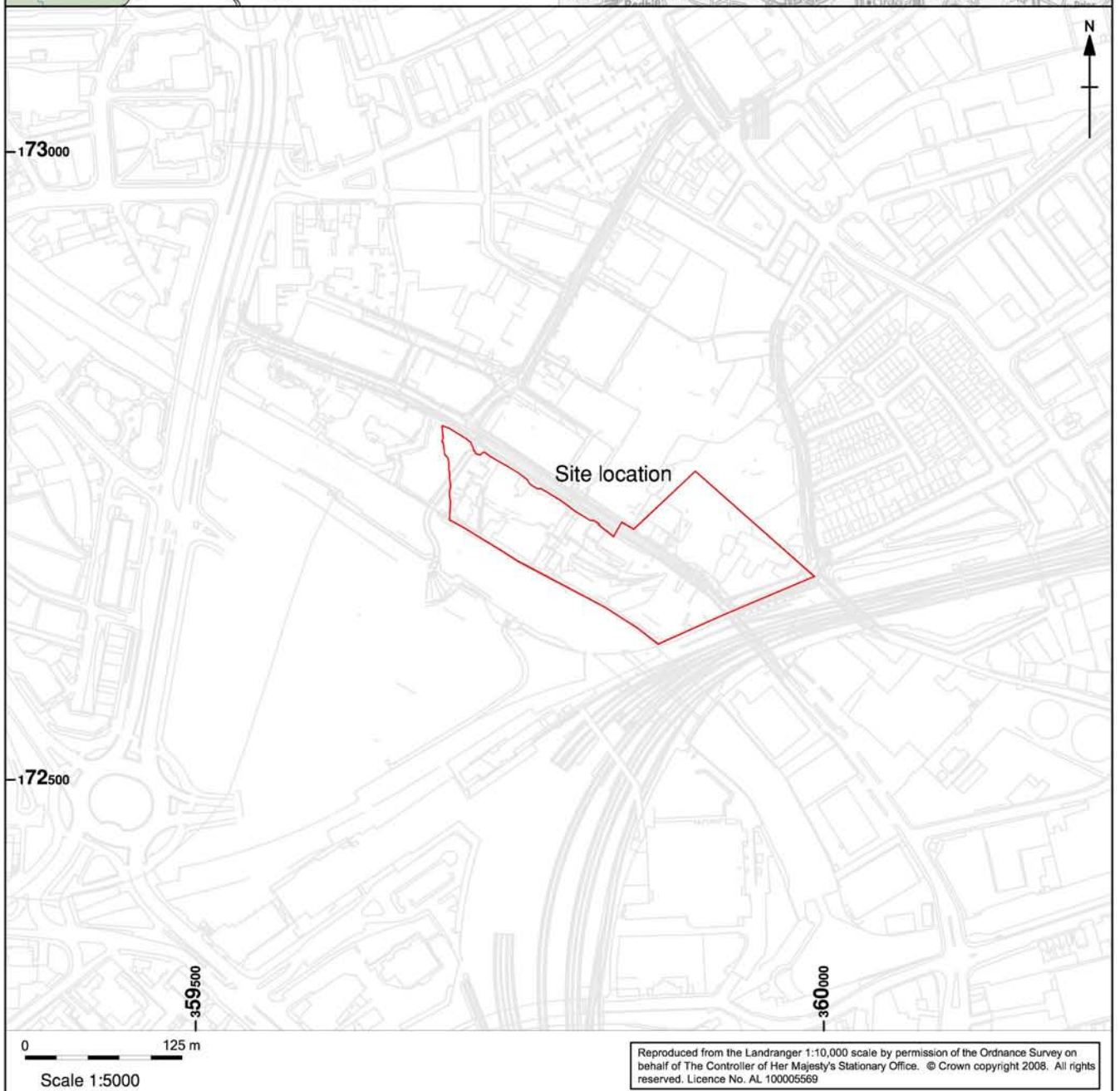


Figure 1: Site location

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