



CROSSRAIL
ARCHAEOLOGICAL WATCHING BRIEF
& EVALUATION
Utilities trial trenches, Liverpool Street
and London Wall
November 2009

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Document History (MOLA Internal):

Version:	Date:	Prepared By:	Checked By:	Approved By:	Version History
1.0	24.11.09	David Sankey, Adrian Miles, Nicholas J Elsdon	Nicholas J Elsdon	George Dennis	First Issue
2.0	10.03.10	Nicholas J Elsdon	–	George Dennis	Comments from Claire Wright addressed

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Executive Summary

Ten 1.5m-deep engineer's trial trenches to trace existing utilities within streets at London Wall, Old Broad Street and Liverpool Street, in the City of London were monitored in a watching brief commissioned by Crossrail, and conducted by MOL Archaeology. The trial trenches selected for monitoring were those across the line of the Roman and medieval city wall, a Scheduled Monument (LO26N and LO26P), and those within the former burial ground of the hospital of St Mary Bethlem, where human remains have been discovered previously.

This monitoring serves as both an archaeological watching brief, and as the Required Evaluation for the city wall, as set out in a Scheduled Monument Deed under the Crossrail Act (2008). A further aim was to ensure that the works did not damage the Scheduled Monument, should the city wall be encountered.

Remains of the city wall were recorded in London Wall (road) east of the junction with Moorgate. A second fragment of the city wall was found in London Wall south of the junction with Blomfield Street. Protective materials were installed before the trenches were reinstated.

In general these results substantially confirm the reconstruction of the line of the city wall produced in 2008 for the Crossrail utility works (DDBA), which differs from the English Heritage Schedule mapping in the area around Blomfield Street. There is a minor change in the reconstruction between Moorgate and Blomfield Street, illustrated in the accompanying figures.

These observations will inform design of the proposed utility diversions that will be required in advance of the main construction phase for Crossrail. In particular, although negative results should be used with caution (because of the limited depth and area of the trenches), the trenches at the junction of London Wall and Blomfield Street do appear to indicate that there may well be a considerable area at that location where 1.5m-deep utility diversions would not disturb the Scheduled Monument. The two sections of the city wall which were found support (and slightly refine) the 2008 reconstruction (Crossrail 2008a), allowing it to be used with greater confidence in designing utility diversions parallel with the city wall in this area.

Disarticulated human bone was observed in two trenches in Liverpool Street. One group may represent the top of a deposit containing burials at greater depths than those reached in the trial trench, the other was found amongst modern overburden. Both have been reburied in the respective trenches.

Remains of 18/19th-century cellars were recorded beneath modern services in Old Broad Street, near the junction with London Wall.

The limited amount of human remains encountered in Liverpool Street should be treated with caution. Whilst it does demonstrate the extensive modern disturbance within c 1.5m of ground level already known from previous work in Liverpool Street, it should be expected that more extensive, or deeper, trenches for utility diversions have a high potential to encounter further localised areas of dense burials.

1 Introduction

1.1 Site background

A new station is to be constructed in the Liverpool Street/Moorgate area of the City of London for the Crossrail project. In order to construct the station, a large number of existing utilities will have to be diverted in advance of construction, and utilities trial trenches were conducted to inform the plan for those diversions.

This report describes the results of an archaeological watching brief on utilities trial trenches in the Liverpool Street–Moorgate area, at London Wall (street), Liverpool Street, Blomfield Street, and Old Broad Street (Fig 1), hereafter called the site. The centre of the site is at OS National Grid Reference 532893 181531. The site code is XRF09. The trial trenches were monitored between 9th May and 1st August 2009.

The Roman and medieval city wall is often referred to as London Wall; but since this is also a modern road name, the historic structure is referred to in this report as the city wall, reserving 'London Wall' for the road.

The trial trenches in London Wall, Blomfield Street, and Old Broad Street lie across the line of the Roman and medieval city wall, a Scheduled Monument (LO26N and LO26P). This work was conducted in accordance with a Scheduled Monument Deed under the Crossrail Act (2008), which replaces Scheduled Monument Consent (see 1.2).

The archaeological survival data obtained during this monitoring also forms the *Required Field Evaluation* as set out in the Scheduled Monument Deed. Any further field evaluation requirements, and mitigation measures for the utilities diversions, will be determined from the results of the current work and will be inserted within the Crossrail Site-Specific Written Scheme of Investigation for Liverpool Street Station.

1.2 Planning and legislative framework

Crossrail will be built under the powers of the Crossrail Act (2008), which disapplies various pieces of legislation, and replaces them with alternative provisions. Those pertinent to these works are:

- The Ancient Monuments and Archaeological Areas Act 1979, is modified by Schedule 9 (Paragraph 4) of the Crossrail Act in respect of works authorised by the Act. Alternative provisions are set out within a Scheduled Monument Deed: *Crossrail: Works affecting scheduled monuments in the City of London* (Crossrail 2008c)

The Scheduled Monument Deed is included in full as Appendix 1. The following is a summary of the requirements and procedures relating to approvals and archaeological requirements under the Deed:

- A *Required Field Evaluation* is required before requesting approval for construction works that might affect the Scheduled Monument (Clause 2.1).
- Following the *Required Field Evaluation*, English Heritage shall be consulted as to whether any *Additional Field Evaluation* is required before requesting approval for construction works (Clause 2.2).

- Where the carrying out of either a *Required Field Evaluation* or *Additional Field Evaluation* may cause damage to an affected monument, Crossrail shall not carry it out without obtaining the prior approval of the proposals in writing from the Secretaries of State.
- The main construction works (in this case the utilities diversions) require works details to be submitted for approval by the Secretaries of State for Transport and for Culture, Media, and Sport.
- The monitoring of the trenches which lie across the city wall is intended to fulfil the requirement for an initial *Required Field Evaluation*.
- The Burial Act 1857, modified by Schedule 15 of the Crossrail Act, provides the mechanism for obtaining the necessary authority to remove human remains from a burial ground which is either still in use or continues to have the appearance of a burial ground. Since Schedule 15 of the Act was confirmed not to apply at Liverpool Street, a burial licence (MoJ number 09-0064) was obtained in advance of the fieldwork, in case circumstances would require burials to be excavated and removed from the site. In the event, this did not happen, and the small quantity of human remains present were reburied before backfilling the trenches (see 3.1.3).
- *Planning Policy Guidance 16 (DoE 1990)*. The principles of PPG16 are encompassed within the *Crossrail Environmental Minimum Requirements* (EMR; Crossrail 2008b), in particular *Annex 2: Planning & Heritage Memorandum*, and the *Crossrail Generic Written Scheme of Investigation* (Crossrail 2009c).

1.3 Summary of Previous Crossrail Studies

Environmental Impact Assessment was conducted to support the Crossrail Bill, resulting in:

- *Crossrail Environmental Statement* (Crossrail 2005a)
- Supporting Specialist Technical Reports: *Crossrail, Assessment of Archaeology Impacts, Technical Report*, Parts 1 (Introduction and Summary), Part 2 (Central Section), and Part 6 (Figures). (Crossrail 2005b – STR)
- During the passage of the Crossrail Bill through Parliament, and subsequent to enactment in 2008, archaeological studies have proceeded in tandem with the development of the engineering design for Liverpool Street Station and the outcomes are set out in the *Crossrail Liverpool Street Station Site-Specific Written Scheme of Investigation*, doc. no. CR-PN-LIV-EN-SP-00001 (Crossrail 2009b – SS-WSI).
- *Crossrail Utilities Diversions: London Wall, Moorgate, Blomfield Street, Old Broad Street, Bishopsgate, Past Observations Of City Wall* (Crossrail 2008a – detailed desk based assessment (DDBA) for the city wall only)

This work involved collating records of past observations of the city wall in the area of the utilities trial trenches, assessing the reliability of their locational data (which varied considerably, especially for the older observations), and digitising them. From these records, it was possible to produce a reconstruction of the alignment of the city wall in this area, that differs from that of the English Heritage mapping of the Scheduled Monument in the area around Blomfield Street (see Annex 1). The reconstruction has been slightly refined as a result of the watching brief (see 3.3, 4.1, & Fig 12).

- The DDBA for the city wall informed the design (Method Statement) prepared by MOL Archaeology for this watching brief: *Liverpool Street & Moorgate, Utilities Trial Trenches, Archaeological Watching Brief & Evaluation Method Statement*, April 2009.

1.4 Origin and scope of the report

This report was commissioned by Crossrail and produced by Museum of London Archaeology (MOLA). The report has been prepared within the terms of the relevant Standard specified by the Institute for Archaeologists (IFA, 2001).

The purpose of the present report is to assess and present the results of the watching brief against the original research aims, in particular the reconstruction of the line of the city wall in the 2008 DDBA, and to comment on possible effects on the Crossrail utility diversions. This work is also intended to act as the Required Field Evaluation under the Scheduled Monument Deed.

1.5 Aims and objectives

The prime purpose of the watching brief was to prevent damage to the Scheduled Monument, and to ensure that human remains were dealt with in accordance with the burial licence under the 1857 Burial Act. Secondly, archaeological recording was to provide information on the presence, absence, and survival quality of the city wall (within the limited depth of the trial trenches), to form the *Required Field Evaluation*, and inform the detailed design of future Crossrail utility diversions. Similarly, recording was intended to provide further archaeological data on the extent, location, survival quality, and density of human remains within Liverpool Street.

The following are the specific objectives of the fieldwork set out in the *Method Statement* (Crossrail 2009a, Section 5):

1.5.1 The City Wall in London Wall, Blomfield Street, and Old Broad Street

- RA1: *To determine, if possible, the line of the city wall between Moorgate and Bishopsgate with more certainty than current reconstructions, in order to locate utilities diversions away from the monument.*
- RA2: *To determine the survival of the city wall at the junction of Blomfield Street and London Wall, and options for utility diversion routes across it.*
- RA3: *To determine the line of the city wall in Old Broad Street.*

1.5.2 Burials in Liverpool Street

- RA4: *To record human remains from the trial trenches in Liverpool Street in accordance with relevant applicable standards and guidelines.*
- RA5: *To provide further archaeological data on the extent, location, survival quality, and density of human remains within Liverpool Street (to contribute to both the design of the utility diversions and mitigation works for the future Broadgate Ticket Hall and link passage).*

1.5.3 Research Aims

This fieldwork also has potential to contribute to wider academic research aims. The following generic research aims have been selected from those in *A research framework for London archaeology* (Museum of London 2002, 82 & 85) as being applicable:

- Refining our understanding of the chronology and function of the landward and riverside defences and extramural evidence of defensive or military structures in the Roman period.
- Understanding life expectancy, origins and belief, seen through studying health, diet and disease, and preparing models for future research.

2 Topographical and historical background

The following summary of the archaeological background concentrates on those elements likely to be affected by the utilities trial trenches, ie those likely to survive within c 1.5m of modern ground level in the areas of the trenches.

The archaeological potential of the whole Crossrail Liverpool Street site is described at greater length in the Specialist Technical Report (Crossrail 2005b) and SS-WSI (Crossrail 2009b).

The natural geology consists of Taplow terrace gravels generally c 3.5 to 6m below modern ground levels, forming the base of the archaeological sequence.

2.1 Roman Period (AD 50–450)

There is limited evidence for prehistoric activity in the Liverpool Street area, but the northern edge of the Roman city of Londinium ran through it. When the city boundary was formally marked by a wall in AD 120–290 this ran approximately east–west either along the line of the road named London Wall, or a short distance to the north. The wall divided the urban area of the city to the south, from extra-mural areas to the north, where various activities, possibly including some occupation, took place. Roman cemeteries were placed outside the city boundaries, in particular along roads leading out of the city such as Ermine Street, modern Bishopsgate. Although Roman burials can be expected in this area (below the level of the proposed utilities diversions, with the possible exception of any deep sewer works), many have been washed into the Walbrook stream, at least one of the numerous branching channels of which passed through the northern side of the city in the vicinity of Blomfield Street.

Construction of the city wall appears to have blocked or constricted the course of the Walbrook, and from the later Roman period through to the end of the medieval period, a marsh was formed in this extra-mural area. These deep marsh deposits account for some of the considerable depth of archaeological deposits in this area.

The wall itself was constructed of Kentish ragstone with tile courses around a rubble and mortar core. It generally survives to a width of up to c 2.5 to 3.0m, at variable heights, anywhere between c 0.3m and c 4m or more below modern street level (depending upon the extent of later truncation).

2.2 Medieval Period (AD 450–1540)

Whilst the Moorgate Marsh would have inhibited human activity in this area north of the wall during the medieval period, repairs and reconstruction of the wall included the addition of new exits from the City at Moorgate (The Moor Gate) and a postern (small gate or doorway) at what would become Blomfield Street. During the later medieval period the marsh was drained.

The hospital of St Mary of Bethlehem (later Bethlem Hospital) was founded in 1247, located east of the Moor Fields, between the Great Ditch (probably a course of the Walbrook, around Old Broad Street) and the road north out of the Bishopsgate.

2.3 Post-medieval (AD 1540–1900)

The 'Bethlem burying ground', also known as the New Churchyard, was founded in 1569 by the City to relieve the congestion occurring in parish burial grounds. The

cemetery was used up to at least 1720. The burials that were found during excavations at Broadgate in the 1980s were of a high density, some eight per cubic metre, but extensive truncation beneath modern Liverpool Street is reflected in the relatively localised areas of burials discovered in the course of past utilities works in that road.

The area between Moorgate and Bishopsgate gradually filled in with buildings during the 17th and 18th centuries, with the exception of the open Moor Field lying west of Blomfield Street, which survived as the open grounds of the relocated Bethlem Hospital (Bedlam).

Parts of the city wall, notably the gates at Moorgate and Bishopsgate, had been rebuilt or refaced in brick during the 17th century, but from the mid 18th century onwards, large portions of the wall, and eventually the gates, were demolished to ground level.

2.4 Archaeological Potential within 1.5m of ground level

Archaeological potential within the 1.5m-deep utilities trial trenches, located in roadways, is extremely limited.

Truncation from existing services and other modern disturbance is extensive, particularly in Liverpool Street. However, it is clear from past observations, fieldwork, and records of police call-outs to MOL Archaeology's Head of Osteology that localised densely-packed areas of burials survive in Liverpool Street, and that, despite later damage, sections of the Scheduled city wall (both known and unknown) survive beneath London Wall, Bishopsgate, and potentially Old Broad Street. These potentially include the Moor Gate (probably fragmented remains as appears to be the case with the Bishop's Gate).

Any such remains are of high importance. Although the majority would be present only at a greater depth than the utilities trial trenches, there is potential for structural remains of the city wall to be present from 0.3m below ground level (bGL), and for burials from 0.5m bGL, although the majority of burials seen previously lay below 1.2m bGL.

In addition, the trenches were also likely to affect the upper parts of low-grade late post-medieval deposits, mostly dump layers or levelling deposits associated with late post-medieval construction.

3 The watching brief

3.1 Methodology

3.1.1 General

All on-site archaeological work was carried out in accordance with the Crossrail *Method Statement* (Crossrail 2009a), and the Museum of London *Archaeological Site Manual* 3rd edition (1994).

The trenches were dug at weekends, following road closures, by the trial trench contractors: J B Riney & Co Ltd. The primary intention was to establish utility routes and sub-surface obstructions, and trenches were 1.5m deep wherever possible (Crossrail 2009a). They were backfilled at the end of each working day, which required the longer trenches to be dug in separate segments, on different days.

The trial trench contractors removed modern road surface and concrete sub-base using machines where necessary. Excavation beneath the sub-base was conducted carefully by the trial trench contractor with hand tools, under close archaeological supervision. The archaeologist(s) inspected the trench at appropriate intervals, entering when required.

When archaeological remains were reached; the archaeologist exposed and recorded them. There were no finds from the trial trenches, with the exception of the features and deposits left *in situ*.

3.1.2 City wall

Six trenches across the predicted line of the city wall were monitored (MOR18 & 19: Fig 2; and LIV16, 19, 25, & 26: Fig 3).

The city wall and associated deposits were left *in situ*. Care was taken throughout the process of excavation and other fieldwork to avoid damage to the Scheduled Monument. Removal of modern material was conducted by the GI contractors under close supervision by an experienced Senior Archaeologist for each trench, and ceased when the archaeologist determined that archaeological deposits, in particular the Scheduled Monument (city wall), had been reached. The Senior Archaeologist, aided by an Archaeologist, then exposed, cleaned, and recorded the city wall and any other archaeology.

The locations of archaeological remains were recorded by the archaeologists using local baselines. The reference points for these baselines, a limited number of levels, and the trench outlines were surveyed by the GI contractor's surveyors.

Following the completion of archaeological (and utilities) recording, protective materials were installed for the scheduled monument before the trenches were backfilled.

Kathryn Stubbs for the City of London Corporation and Jane Sidell, the English Heritage Inspector of Ancient Monuments, visited the site whilst work progressed.

3.1.3 Burial ground of St Mary Bethlem

The four trenches within the predicted area of the burial ground of the Hospital of St Mary Bethlem were monitored (LIV5, 6, 8, & 29). A fifth trench, LIV12, was cancelled; for the location of the remaining trenches see Fig 3.

The need to reinstate the trial trenches for road traffic and good archaeological practice required that stratified human remains were not exhumed at this stage, and were left *in situ* following recording. Unstratified disarticulated material from modern overburden was collected and reburied when the trench was backfilled. Similarly, spoil from excavation beneath the modern sub-surface slab was returned to the trenches, in order that any human remains did not leave the site.

The trench outlines were surveyed by the archaeologists, using off-sets from buildings shown on Ordnance Survey mapping.

3.2 Results of the watching brief

Ten trenches were monitored, the results are tabulated below. For trench locations see Fig 2 and Fig 3.

3.2.1 Trial trenches along the projected line of the city wall

Trial Trench MOR18 (Fig 4, Fig 5, Fig 6, & Fig 7)	
Location	London Wall east of Moorgate
Dimensions	17.6m (including north and south pavements) x 0.6m x 1.5m deep
Modern ground level	12.42–12.54m OD (carriageway)
Base of modern fill/surface	North pavement: Concrete and tarmac 0.24m bGL Carriageway: Concrete and tarmac 0.5m bGL South pavement: slabs and concrete be 0.2m bGL
Modern subsurface deposits	Pipes, ducts and loose grey ashy fill with modern inclusions mostly to 1.2m bGL (base of trench) but to 1.5m bGL in north pavement
Level of base of archaeological deposits observed and/or base of trench	1.5m bGL (max) base of trench
Natural observed (truncated/not truncated ?)	None observed
Extent of modern truncation	Mostly to or below 1.2m bGL, but only to 0.5m bGL, over part of the city wall (below)
Archaeological remains	Date
Orange-brown silty sand [4] and gravel with loose stones thought to be derived from the city wall. This abutted:	Unknown
The city wall [2], 2.75m-wide, and surviving from 0.5m bGL (12.04m OD), immediately below the concrete road bed. It was made of ragstone rubble <190mm across, set in yellow sandy lime mortar. The north and south edges of the wall were obscured by fibre optic cables and a gas main. Parts of the top of the wall had been reduced by <750mm by the insertion of modern ducts (Fig 4)	Undated
Trench interpretation and summary	
The city wall description is consistent with that of the Roman poured core of the city wall (Fig 5, Fig 6, & Fig 7). Unfortunately the faces were obscured by modern services. The 2.75m breadth is wider than that of some nearby exposures, but is not inconsistent with the known construction details. The wall lies on the predicted route (Fig 12). Apart from some mixed demolition deposits [4], the rest of the trench was occupied by modern services.	

Trial Trench MOR19	
Location	London Wall west of Moorgate
Dimensions	13.4m (including south pavement) x 0.6m x 1.5m deep.
Modern ground level	N carriageway: 12.64 m OD N carriageway: 12.54 m OD
Base of modern fill/surface	Carriageway: Concrete and tarmac 0.5m bGL South pavement: tarmac and concrete 0.1m bGL
Modern subsurface deposits	Pipes, ducts and loose modern cellar fill mostly to 1.5m bGL (base of trench)
Level of base of archaeological deposits observed and/or base of trench	1.5m bGL base of trench
Natural observed (truncated/not truncated ?)	None observed
Extent of modern truncation	South pavement: ducts to 0.45m bGL (no further excavation). South carriageway: pipes and ducts to 1.5m bGL. North Carriageway, central reservation, and part of south carriageway: remains of buildings demolished in the 1950s to below the 1.5m limit of excavation
Archaeological remains	Date
None observed	
Trench interpretation and summary	
The remains of buildings demolished in the 1950s, including in-filled cellars, extended across the predicted line of the city wall, and may have truncated it to a greater depth than the base of the trial trench. No indications of the wall were found, or any of any other archaeological remains.	

Trial Trench LIV16 (Fig 8 & Fig 9)	
Location	Junction of London Wall and Blomfield Street
Dimensions	14.5m (not including the central reservation – not dug) x 0.6m x 1.5m deep
Modern ground level	Road surface varies 12.53m OD (north) 12.58m OD (adjacent city wall remains) and 12.37m OD (south)
Base of modern fill/surface	Road: Concrete and tarmac 0.5m bGL
Modern subsurface deposits	Cables, pipes, etc continued to 1.5m bGL except where the remains of the city wall were observed. The top of a BT manhole was exposed at the bottom of the trench in the south carriageway.
Level of base of archaeological deposits observed and/or base of trench	1.55m bGL base of trench.
Natural observed (truncated/not truncated ?)	Not reached
Extent of modern truncation	0.8m–1.55m bGL
Archaeological remains	Date
A firm dark brown silt [5], at 0.8m bGL (11.78m OD). This overlay:	Unknown
A disturbed or reworked section of masonry [7] 200mm north–south at, or about the same level, to the north of and stratigraphically above:	Unknown
The city wall [6] 1.2m east–west and 500mm north–south, 380mm deep made of ragstone rubble <300mm across, set in hard yellow lime mortar. The top of the wall lay at 11.42m OD (1.17m bGL). Part of this section of wall was recorded in trench LIV26 below (Fig 8 and Fig 9).	Undated
Trench interpretation and summary	
<p>All three contexts can be regarded as part of the Scheduled Monument, which therefore survives to 0.80m below ground level (11.78m OD). The city wall has previously been observed east of LIV16 beneath the adjacent pavement cellars of 85 London Wall. The earliest fragment of the city wall [6], at 11.42m OD, is consistent with the Roman construction of the wall, of ragstone rubble poured into a retained core with hard yellow lime mortar. The vertical face may imply that this is near the true edge of the original wall, here at a tangent to London Wall road, and that the facing blocks have been removed for reuse. The exposure was too small to determine whether the fragment of masonry that lay above it [7] was part of the original construction or a modification of the wall. The silt on top was a later deposit marking the disuse of the wall [5].</p> <p>Elsewhere, modern truncations had removed deposits to below the base of the trench.</p>	

Trial Trench LIV19 (Fig 11)	
Location	Old Broad Street junction with London Wall
Dimensions	14.2 (including east and east pavements) x 0.6m x 1.5m deep
Modern ground level	Road surface varies 13.14m OD (west) 13.21m OD (centre) and 13.10m OD (east)
Base of modern fill/surface	Road: Tarmac 0.1m bGL Decayed concrete bed merges with crushed concrete filling service trenches. Pavement: slabs 70mm thick over <200mm of concrete bed.
Modern subsurface deposits	Cables, pipes etc occupy the full 1.5m deep trench, except for the remains of a late 18th or 19th-century cellar. The top of a BT manhole was exposed at the bottom of the trench in the south carriageway.
Level of base of archaeological deposits observed and/or base of trench	1.5m bGL base of trench.
Natural observed (truncated/not truncated ?)	Not reached
Extent of modern truncation	1.2m–1.5m bGL
Archaeological remains	Date
Two red-brick cellar walls [3], 1.2m bGL (c 12.0m OD, see Fig 11).	Late 18th- or 19th-century, based on brick styles and late 19th-century pottery in disturbed fills
Trench interpretation and summary	
A great many services occupied the width of this trench. The walls of a late 18th- or 19th-century cellar were observed between gaps in the services. There were no observations of the city wall, but there were also many areas where the full depth of the trench (1.5m) could not be reached because of the multiple services. Therefore the city wall might survive beneath the services, although it may be truncated if later cellars are also present.	

Trial Trench LIV25	
Location	Junction of London Wall and Blomfield Street
Dimensions	13.3m x 0.6m x 1.7m deep
Modern ground level	12.40–12.45m OD
Base of modern fill/surface	Road: Tarmac on a concrete bed 500mm thick, from 12.40m OD north, 12.52m OD at junction with LIV26, and 12.45m OD south
Modern subsurface deposits	Cables, pipes etc occupy the full depth of the trench which varied from 0.73m in the south carriageway (limit caused by the density of services, to 1.7m in the north carriageway.
Level of base of archaeological deposits observed and/or base of trench	1.7m bGL (max) base of trench.
Natural observed (truncated/not truncated ?)	Not reached
Extent of modern truncation	1.7m bGL
Archaeological remains	Date
No <i>in-situ</i> remains, but a single ashlar corner block of a yellowish limestone (not retained) was possibly from part of the post-medieval postern gate	17th- or 18th-century (onset of using ashlar corner blocks)
Trench interpretation and summary	
The entire depth of this trench has been disturbed or reworked by services. An 18-inch and a 36-inch gas main were observed in the vicinity of the projected line of the city wall. This, together with the adjacent area of LIV26 may indicate a potential route for diverting services, if they can avoid the gas mains.	

Trial Trench LIV26 (Fig 8 & Fig 10)	
Location	Junction of London Wall and Blomfield Street
Dimensions	16.0m x 0.6m x 1.8m deep
Modern ground level	c 12.40–12.58m OD
Base of modern fill/surface	Tarmac and concrete 300–500mm thick (from 12.52m–12.58m OD west to east)
Modern subsurface deposits	Cables, pipes etc to base of trench in parts
Level of base of archaeological deposits observed and/or base of trench	1.8m bGL base of trench.
Natural observed (truncated/not truncated ?)	Not reached
Extent of modern truncation	1.2m–1.8m bGL
Archaeological remains	Date
The city wall [6]. Part of this section of wall was recorded in trench LIV16 (above). See LIV16 for the description, and Fig 8 and Fig 10.	Undated
Trench interpretation and summary	
<p>This trench was designed to follow the line of the city wall exposed in LIV16. It uncovered the masonry remains to the point at which it had been truncated by a modern water main.</p> <p>West of the water main was a manhole, and west of that the width of the trench was reduced to fit between services. Collapsing sides required excavating the trench deeper than the intended depth, to 1.8m bGL. No evidence of the city wall or the later postern gate were found in this western area of the trench, but modern batteries in backfill indicated the location of headings dug below the level of ducts. It is possible that remains survive at a lower depth than this.</p>	

3.2.2 Trial trenches in Liverpool Street

Trench LIV5	
Location	Liverpool Street
Dimensions	27.5m x 0.6m x 1.3m deep maximum
Modern subsurface deposits	Modern backfill, concrete and service pipes and cables varying between 0.17m and 1.3m bGL
Level of base of archaeological deposits observed and/or base of trench	Base of trench: 1.3m bGL (max)
Natural observed (truncated/not truncated ?)	N/A
Extent of modern truncation	Modern backfill, concrete and service pipes and cables along majority of length of trench.
Archaeological remains	Date
Mixed dumps, consisting of a mid grey/brown silty clay, with animal bone, CBM fragments, oyster shell, CTP and occasional disarticulated human bone [1]	Post-medieval
Trench interpretation and summary	
Modern backfill, concrete and service pipes and cables along majority of length of trench. Small area of undisturbed mixed dumps with occasional disarticulated human bone was observed at 1.3m bGL, but not excavated. <i>Ex situ</i> Human bone was bagged and reburied within the trench.	

Trench LIV6	
Location	Liverpool Street
Dimensions	27.0m x 0.6m x 1.5m deep maximum
Modern subsurface deposits	Modern backfill, concrete and service pipes and cables varying between 0.25m and 1.5m bGL
Level of base of archaeological deposits observed and/or base of trench	Base of trench: 1.5m bGL (max)
Natural observed (truncated/not truncated ?)	N/A
Extent of modern truncation	Modern backfill, concrete and service pipes and cables along full length of trench.
Archaeological remains	Date
None	
Trench interpretation and summary	
Modern backfill, concrete and service pipes and cables occupied the whole area of the trench. A small quantity of disarticulated human bone found throughout this modern disturbance, and was bagged and reburied within the trench.	

Trench LIV8	
Location	Junction of Liverpool Street and Old Broad Street
Dimensions	9.85m x 0.4m x 1.2m deep max
Modern subsurface deposits	Modern backfill, concrete and service pipes and cables varying between 0.17m and 1.2m bGL
Level of base of archaeological deposits observed and/or base of trench	Base of trench: 1.2m bGL (max)
Natural observed (truncated/not truncated ?)	N/A
Extent of modern truncation	Modern backfill, concrete and service pipes and cables along full length of trench.
Archaeological remains	Date
None	
Trench interpretation and summary	
Modern backfill, concrete and service pipes and cables along full length of trench.	

Trench LIV29	
Location	Liverpool Street
Dimensions	6.5m x 0.55m x 1.4m deep max
Modern subsurface deposits	Modern backfill, concrete and service pipes and cables varying between 0.15m and 1.4m bGL
Level of base of archaeological deposits observed and/or base of trench	Base of trench: 1.4m bGL (max)
Natural observed (truncated/not truncated ?)	N/A
Extent of modern truncation	Modern backfill, concrete and service pipes and cables along full length of trench.
Archaeological remains	Date
None	
Trench interpretation and summary	
Modern backfill, concrete and service pipes and cables along full length of trench.	

3.3 Summary of results

3.3.1 City wall

The city wall was recorded in two areas. To the west it was recorded in trench MOR18, context [2] (Fig 4). The exposure was up to 0.75m wide in the trench, and the wall continued for an unknown distance to the west and east of it (Fig 5 & Fig 6). Whilst the external faces were obscured by cables and a gas main (Fig 7), the width of the wall exposed (2.75m) is comparable to reliable observations elsewhere.

The wall core was made of ragstone rubble up to 190mm across, set in yellow sandy lime mortar. The highest surviving stone was at 12.03m OD, 0.51m bGL. A small amount of sandy gravelly brickearth abutted and overlay the wall on the north side [4]. It was left in place. The edges of the wall were obscured by live services, therefore the external faces probably lay near to the point where the wall was obscured. This section of masonry lies on the line of the city wall predicted in the DDBA (Crossrail 2008a, see Annex 1), but the width is marginally wider than that predicted (Fig 12, red dashed line).

The results of the watching brief allow the reconstructed line of the city wall to be slightly revised in the area between Moorgate and Circus Place (Fig 12, blue dashed line), if an allowance is made for the facings which did not survive in trench MOR18. The southern edge of the wall foundations were observed at site AOP99 and the revised reconstruction uses that as the south line of surviving masonry. The northern face of the wall at the nearest modern observations on which to base a projection (site AOP99), had been refaced at some period – removing the ferruginous sandstone decorative plinth seen elsewhere. It is possible that the thickness of the wall was reduced when this occurred. However, slightly further to the east, the original wall face survived at LON82, and this has been used as a reference point for the northern edge.

A further part of city wall [6] was exposed in trenches LIV16 and LIV26 (Fig 8–Fig 10). It was 1.3m long east–west (truncated on the west side and continued for an unknown distance beyond the trench edge to the east) and 0.5m north–south. Part of the south edge had a vertical face, and may reflect where the facing blocks had been removed. It falls within the 2008 reconstruction of the line of the city wall, which therefore does not need revision in this area.

The western end of city wall [6] appears to be the southern end of the section recorded by Compass Archaeology in a watching brief for Thames Water in 2008, see Fig 8 (site WBH06, Geoff Potter, pers comm & Crossrail 2009a). The location of the latter was plotted from features shown on OS mapping, and does not match the directly-surveyed section [6]. It is most likely that the WBH06 section is relatively accurately located north–south (ie in relation to the width of the city wall), but that on the east–west axis (ie along the wall), it should be relocated c 0.4m to the west, to make the western edges of the sections match. It should be noted that whilst wall section [6] was truncated to the west, the WBH06 section was only truncated in its southern part; to the north it appears to have extended west and east of the Thames Water trench.

The top of the wall [6] was at 11.47m OD. However, additional masonry [7] (Fig 9) over the top of this wall (which can also be considered part of the Scheduled Monument) survived to 11.78m OD (0.8m bGL – the same depth recorded for the

Compass Archaeology finding, WBH06). This area of masonry was observed in an exposure 600mm east–west, 200mm north–south and 200mm high, and is of the same materials as the city wall elsewhere, yellow sandy hard lime mortar and ragstone rubble. This masonry fragment [7] may be a separate part of the original construction from that recorded below it [6], or it could be a later remodelling of the city wall. The northern edge does not align with the earlier phase of the city wall, and this later masonry may be truncated in that area. Over both areas of masonry [6] and [7], there was firm dark grey-brown ashy silt [5]. It filled cavities in the masonry up to 400mm deep (left *in situ*).

A potential route for new services was identified at the junction of the west side of Blomfield Street and London Wall. It includes the western carriageway and the central reservation. The area of LIV26 south of these points did not expose remains of the city wall (it is possible that remains survive at a greater depth, below 10.75m OD, 1.8m bGL).

3.3.2 Human remains

Of the trenches in Liverpool Street, only trench LIV5 produced any potential archaeological deposits within the depth of excavation (1.2–1.5m). Here mixed dumps with occasional disarticulated human bone were observed at 1.3m bGL, but not excavated [1]. This may be the disturbed upper levels of deep cemetery deposits, similar to those seen in earlier fieldwork in this area, eg as exposed within a shaft in Liverpool Street where the densely-packed burials extended down to 3.2m bGL (Crossrail 2009a, 3.2).

Disarticulated human bone was also observed within modern backfill in trench LIV6.

3.3.3 Other remains

At the junction of Old Broad Street with London Wall, the only archaeological remains exposed were a red-brick cellar [3] in LIV19 (Fig 11). Remains of buildings demolished in the 1950s were recorded in the north carriageway of London Wall, west of Moorgate (trench MOR19). Such cellars may have abutted and/or cut into the Roman and medieval city wall, although the latter was not exposed within the trenches.

The line of Blomfield Street is that of one channel of the former Walbrook stream. A BT manhole exposed at the base of LIV16 south of the central reservation (beneath which it extended) was observed in the 1980s, and had stream sediments from approximately 2m to 4m bGL (LWB89).

4 Conclusions

4.1 City wall

Two sections of the wall were recorded, and substantially confirmed the reconstruction of the city wall in the DDBA (Crossrail 2008a, see Annex 1). The western section in trench MOR18 was a little wider than previous projections of the city wall (Fig 12), and the top of the wall was truncated by ducts, but survived in part to 0.50m below road level. The eastern observations in trenches LIV16 and LIV26 at the junction of London Wall and Blomfield Street (and the earlier WBH06 work) fell within the projected line of the wall, surviving up to 1.2m bGL (Fig 8 & Fig 12).

The city wall does not survive within 1.5m below the modern road surface in trench MOR19 west of Moorgate, suggesting localised truncation west of the section recorded as GM108, but the extent of this truncation outside the trench footprint, and its depth, are unknown.

There were no remains of the city wall or the postern gate to Moorfields surviving within 1.5m below the road surface in LIV25 and the western part of LIV26 (ie the area of London Wall south of the traffic island and the western carriageway in Blomfield Street).

Similarly, no surviving remains of the city wall were exposed in trench LIV19 in Old Broad Street, where remains of a red-brick cellar were revealed in the western carriageway. However, there were areas of this trench which did not reach 1.5m below ground level because services were too crowded to allow excavation between. Therefore the presence of the city wall in this location remains uncertain.

It should be noted that the levels to which the city wall survives are highly variable and localised (Crossrail 2008a). The depths (and areas of absence) seen in the watching brief are not necessarily a guide to survival outside the trenches concerned, or below their bases.

Notwithstanding the above, the results from the comprehensive array of trenches at the junction of London Wall and Blomfield Street (LIV16, 25, and 26) do appear to indicate that there is a considerable area at that location where 1.5m-deep utility diversions would not disturb the Scheduled Monument (although some or all of this might already be occupied by existing services).

However, the section of wall found by Compass Archaeology in 2008 (WBH06) suggests that there may be greater survival of the wall just to the north of trench LIV26, but over an unknown area. The WBH06 section was mostly located just to the north of trench LIV26, and to the west of LIV16 (Fig 8); how far it may extend to the west (or east) is unknown.

These data may be used, cautiously, in designing the utility diversions and new utilities in the area of Blomfield Street, avoiding the relatively small sections of the wall shown on Fig 8 – taking into the uncertainty over the extent of the WBH06 section.

The two sections of the city wall which were found support (and slightly refine) the 2008 reconstruction, allowing it to be used with greater confidence in designing utility diversions parallel with the city wall in this area.

The western part of trench LIV19 (Old Broad Street) lies over the predicted line of the city wall. Because of the density of existing services and an earlier vault, it is not possible to draw conclusions about the western pavement, only excavated to 0.50m bGL. However, the cellar walls at 1.2m bGL in the carriageway suggest an area which may be suitable for utility diversions.

4.2 Burials in Liverpool Street

in situ burials and/or disarticulated or redeposited bone may be found throughout the area adjacent to Liverpool Street Station, but within the 1.5m maximum depth of the trial trenches, human remains were limited to disarticulated bone found in trenches LIV5 and LIV6. The depth of 1.3m bGL for the remains in LIV5 falls within the 1.2–1.5m bGL range for previous finds noted in the Method Statement, although one deposit has been found within 0.55m of modern ground level (Crossrail 2009a, 3.2).

The human bone in LIV5 was present in the top of an archaeological deposit that was recorded and preserved *in situ*, unexcavated. It is likely from previous archaeological work in this area that *in situ* human burials are to be found deeper within these deposits, but the trial trenches dug for utilities purposes were not deep enough or extensive enough to confirm this.

The bone from trench LIV6 was redeposited in modern overburden, probably from the installation of the existing services or other modern disturbance.

These results suggest that survival of archaeological deposits is highly variable and localised within Liverpool Street, mainly as a result of the high density of modern services and other disturbance. The limited amount of human remains encountered in this group of trial trenches should be treated with caution. Whilst it does demonstrate the extensive modern disturbance within c 1.5m of ground level (already known from previous fieldwork), it does not alter earlier predictions of a high potential for dense, but localised, pockets of burials within c 1.5m bGL (also demonstrated by earlier fieldwork), much of which is likely to be *in situ*.

Such burials probably extend over a much larger proportion of Liverpool Street at depths below 1.5m (except where significant disturbance has taken place, such as the known railway tunnels). This indicates that utility diversions would require mitigation in the form of an archaeological watching brief, with sufficient resources and time available in the programme to deal with any such local areas of surviving burials.

These trial trenches were too few and too shallow to provide useful data that would inform mitigation designs for the deeper and more extensive station box etc at Liverpool Street.

4.3 Significance of the data

These two new observations of the city wall, surveyed to modern standards, are of considerable local importance, in that they help to confirm and slightly refine the reconstruction of the line of the city wall in the area of the Crossrail utility diversions

(Crossrail 2008a). for example, it can be seen that between approximately Circus Place in the west and Blomfield Street in the east, the projected line of the city wall diverges from the Scheduled area (Fig 3).

These data will contribute to the design for Crossrail utility diversions, and towards protection of the Scheduled Monument.

The results from Liverpool Street regarding human remains provide some data that will contribute towards utility diversions in that area, but broadly confirm previous observations.

In both cases the depth limitations of the utilities trial trenches, and the density of existing services, limits any wider inferences with regard to predictive modelling of archaeological deposit survival in relation to proposed Crossrail works (other than utilities).

4.4 Publication and archiving

The observations of the city wall, a Scheduled Monument, and the refining of the DDBA reconstruction of the route of the wall (which differs significantly from English Heritage's schedule mapping) are significant results of these two pieces of work. They will be included in the post-excavation assessment for the archaeological works to be conducted for Crossrail's Liverpool Street Station, and published in an appropriate form.

The site archive containing original records (no finds were removed) will be stored in accordance with the terms of the *Method Statement* (Crossrail 2009a).

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6 NMR OASIS archaeological report form

OASIS ID: molas1-66202

Project details

Project name Crossrail Utilities trial trenches, near Liverpool Street and Moorgate Stations

Short description of the project 1.5m-deep Trial trenches to investigate the locations of utilities were monitored. Two fragments of the city wall were exposed along the line of London Wall road and two trenches exposed disarticulated human bone near to Liverpool Street Station. The results will be used to inform the design of utilities diversions in the area.

Project dates Start: 09-05-2009 End: 01-08-2009

Previous/future work No / Yes

Any associated project reference codes XRF09 - Sitecode

Type of project Recording project

Site status Scheduled Monument (SM)

Current Land use Transport and Utilities 1 - Highways and road transport

Monument type CITY WALL Roman

Monument type BURIAL GROUND Post Medieval

Investigation type 'Watching Brief'

Prompt Scheduled Monument Consent

Prompt The Ancient Monuments and Archaeological Areas Act 1979, replaced with a Scheduled Monument Deed: Crossrail: Works affecting scheduled monuments in the City of London (Crossrail 2008c)

Project location

Country England

Site location GREATER LONDON CITY OF LONDON CITY OF LONDON Crossrail Utilities trial trenches, near Liverpool Street and Moorgate Stations

Postcode EC2

Study area 11709.48 Square metres

Site coordinates TQ 3289 8153 51.5165425440 -0.08455126364940 51 30 59 N 000 05 04 W Point

Site coordinates TQ 33012 81635 51.5174574470 -0.08275420440790 51 31 02 N 000 04 57 W Line

Site coordinates TQ 33012 81635 51.5174574470 -0.08275420440790 51 31 02 N 000 04 57 W Line

Site coordinates TQ 33116 81604 51.5171542843 -0.08126775386160 51 31 01 N 000 04 52 W Line

Site coordinates TQ 33080 81465 51.5159135338 -0.08183883842330 51 30 57 N 000 04 54 W Line

Site coordinates TQ 32661 81564 51.5169020613 -0.08783724478460 51 31 00 N 000 05 16 W Line

Site coordinates TQ 32938 81490 51.5161717278 -0.08387490719350 51 30 58 N 000 05 01 W Line

Project creators

Name of Organisation MoL Archaeology

Project brief originator Crossrail and HMI-AM

Project design originator MoL Archaeology

OASIS ID: molas1-66202 (cont'd)

Project George Dennis
director/manager

Project supervisor David Sankey

Project supervisor Adrian Miles

Type of Local authority controlled infrastructure development company
sponsor/funding
body

Name of Crossrail
sponsor/funding
body

Project archives

Physical Archive No
Exists?

Digital Archive LAARC
recipient

Digital Media 'Images raster / digital photography','Survey','Text'
available

Paper Archive LAARC
recipient

Paper Contents 'Stratigraphic'

Paper Media 'Context sheet','Manuscript','Notebook - Excavation',' Research',' General
available Notes','Photograph','Plan','Section','Unpublished Text'

Paper Archive trench record sheets
notes

Project

bibliography 1

Publication type Grey literature (unpublished document/manuscript)

Title ARCHAEOLOGICAL MONITORING OF GROUND INVESTIGATIONS, utilities trial
trenches, near Liverpool Street and Moorgate Stations

Author(s)/Editor(s) Sankey, D. Miles, A.

Date 2009

Issuer or publisher Museum of London

Place of issue or London
publication

Description A4 report

Entered by David Sankey (DSankey@museumof london.org.uk)

Entered on 23 October 2009

Figures

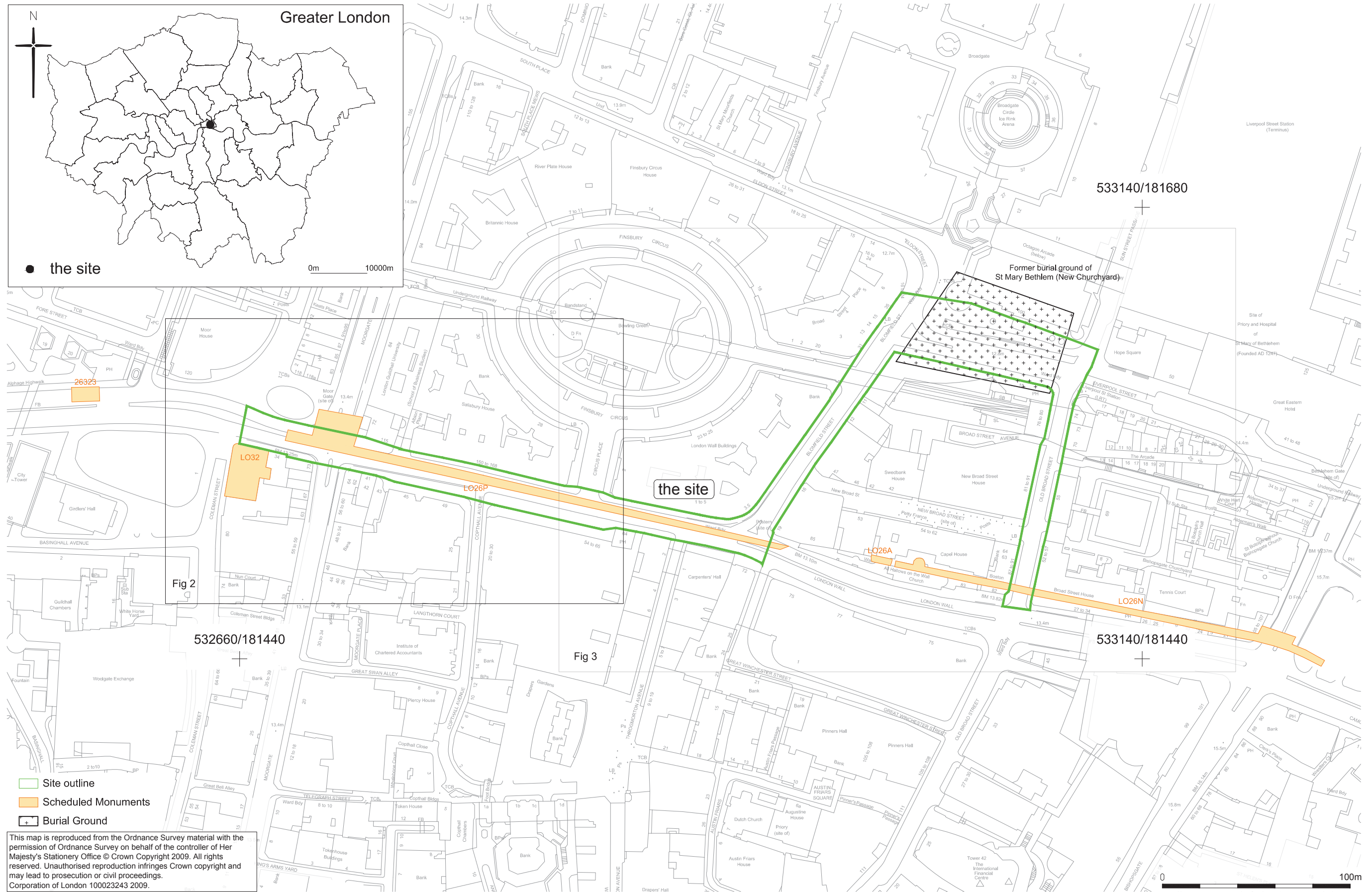
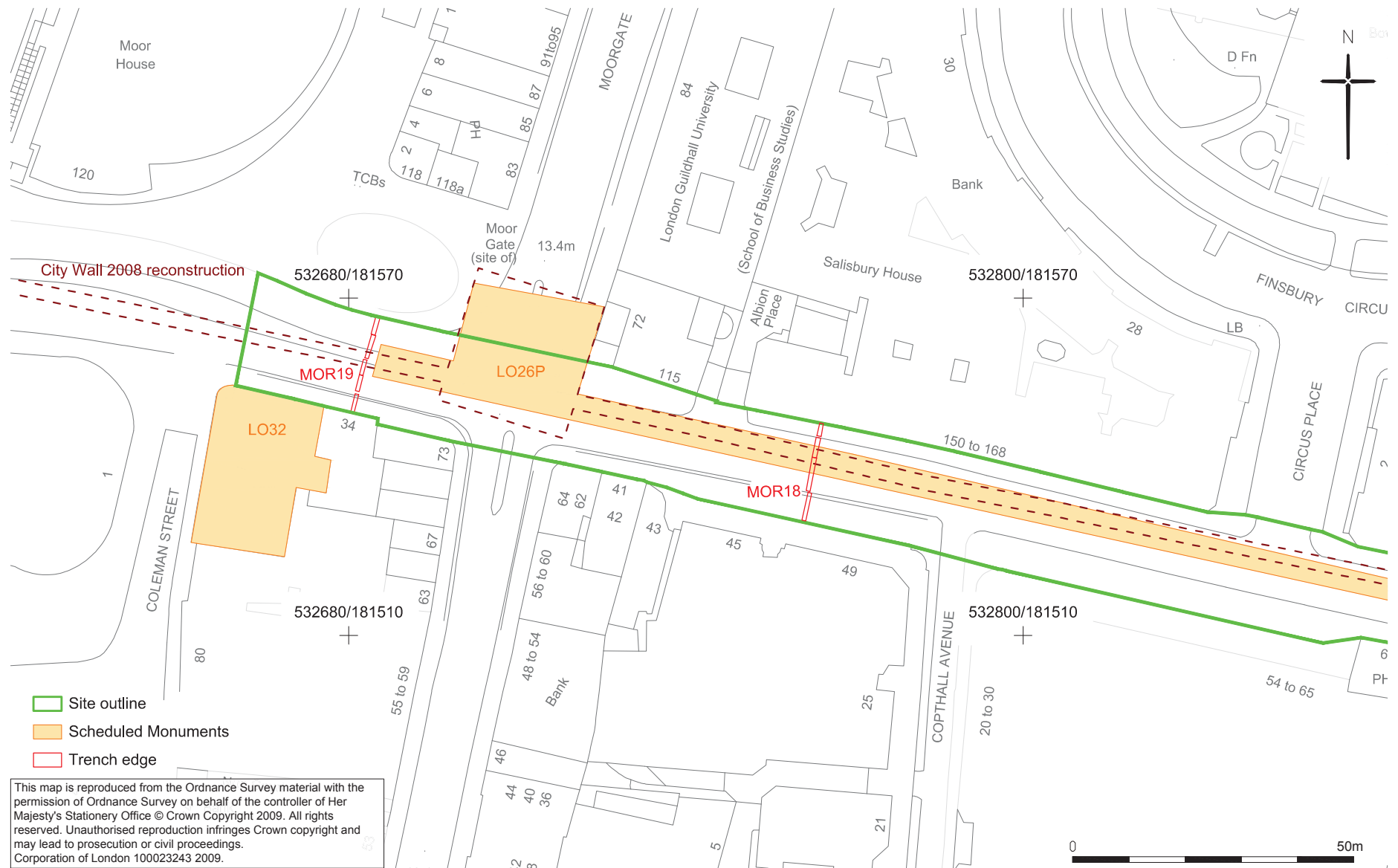


Fig 1 Site location



MULTI1051WB09#02

Fig 2 Trench location (west)

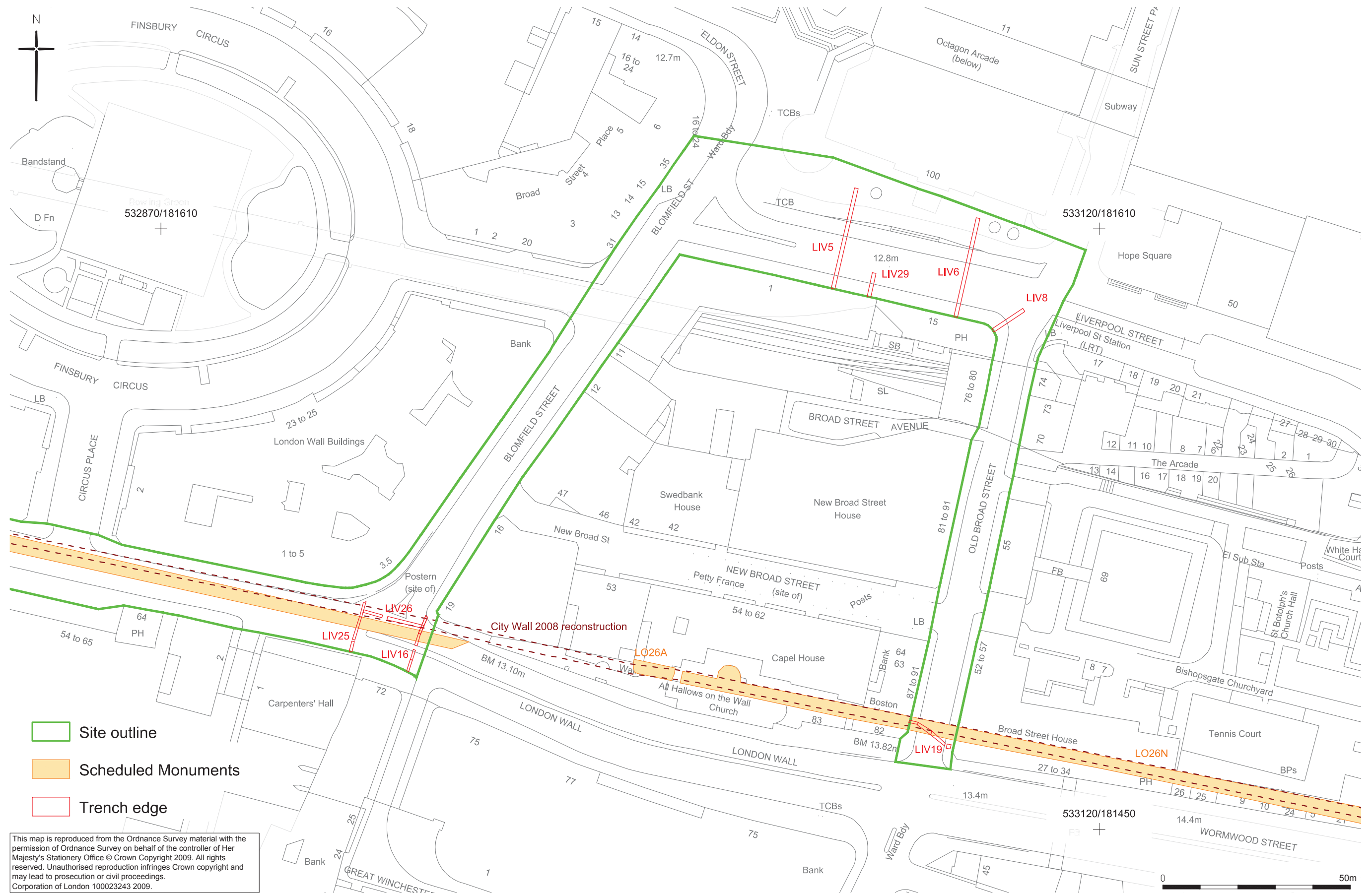


Fig 3 Trench location (east)

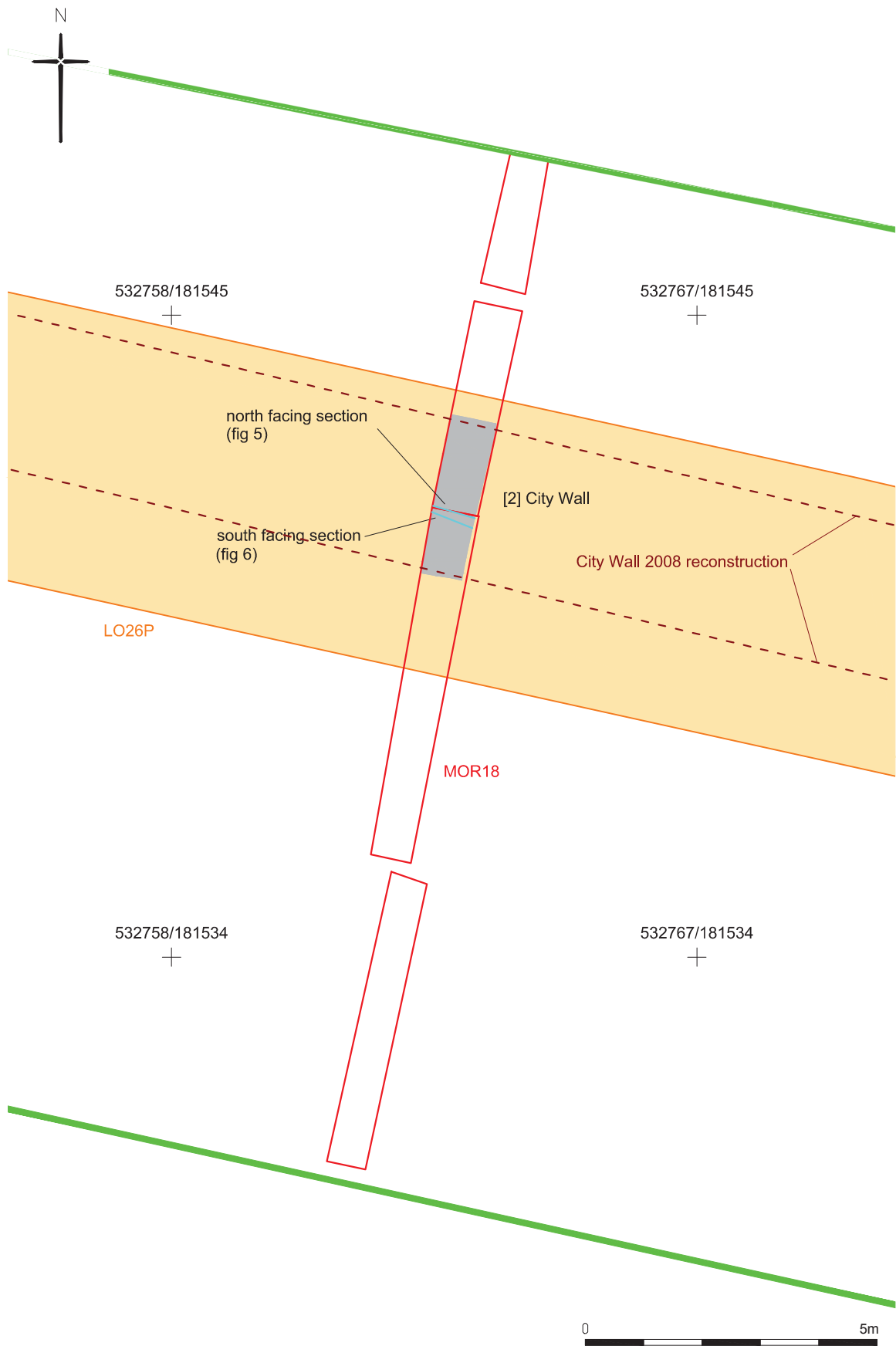


Fig 4 Plan of city wall in MOR18

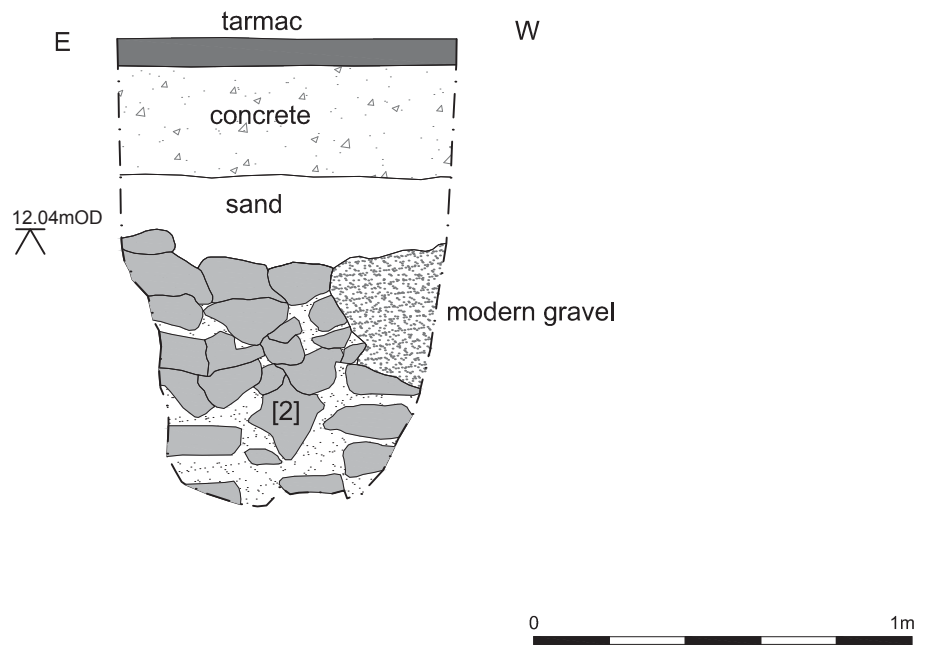


Fig 5 Section across city wall E - W in Trench MOR18

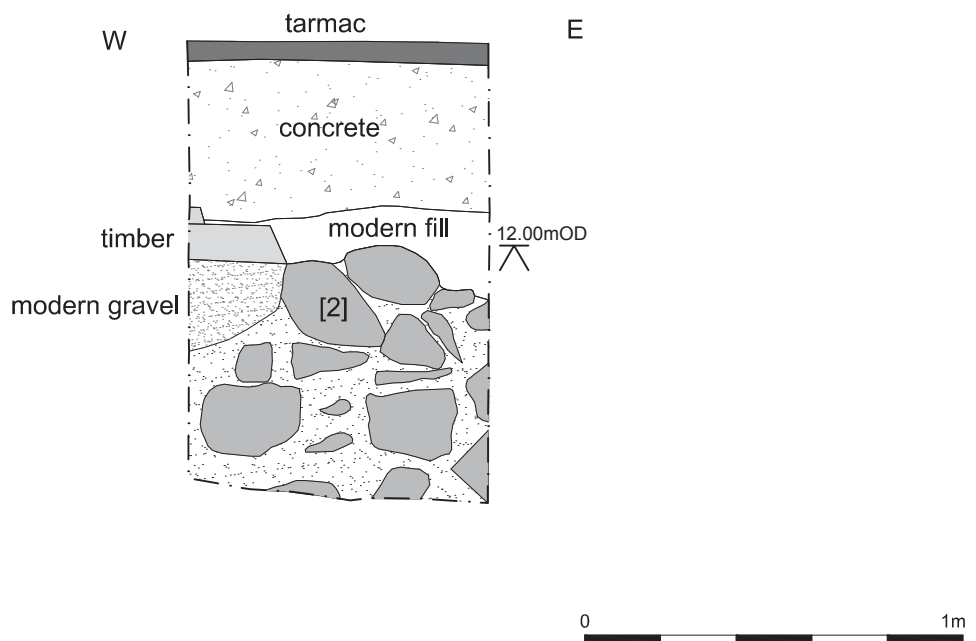


Fig 6 Section across city wall W - E in Trench MOR18

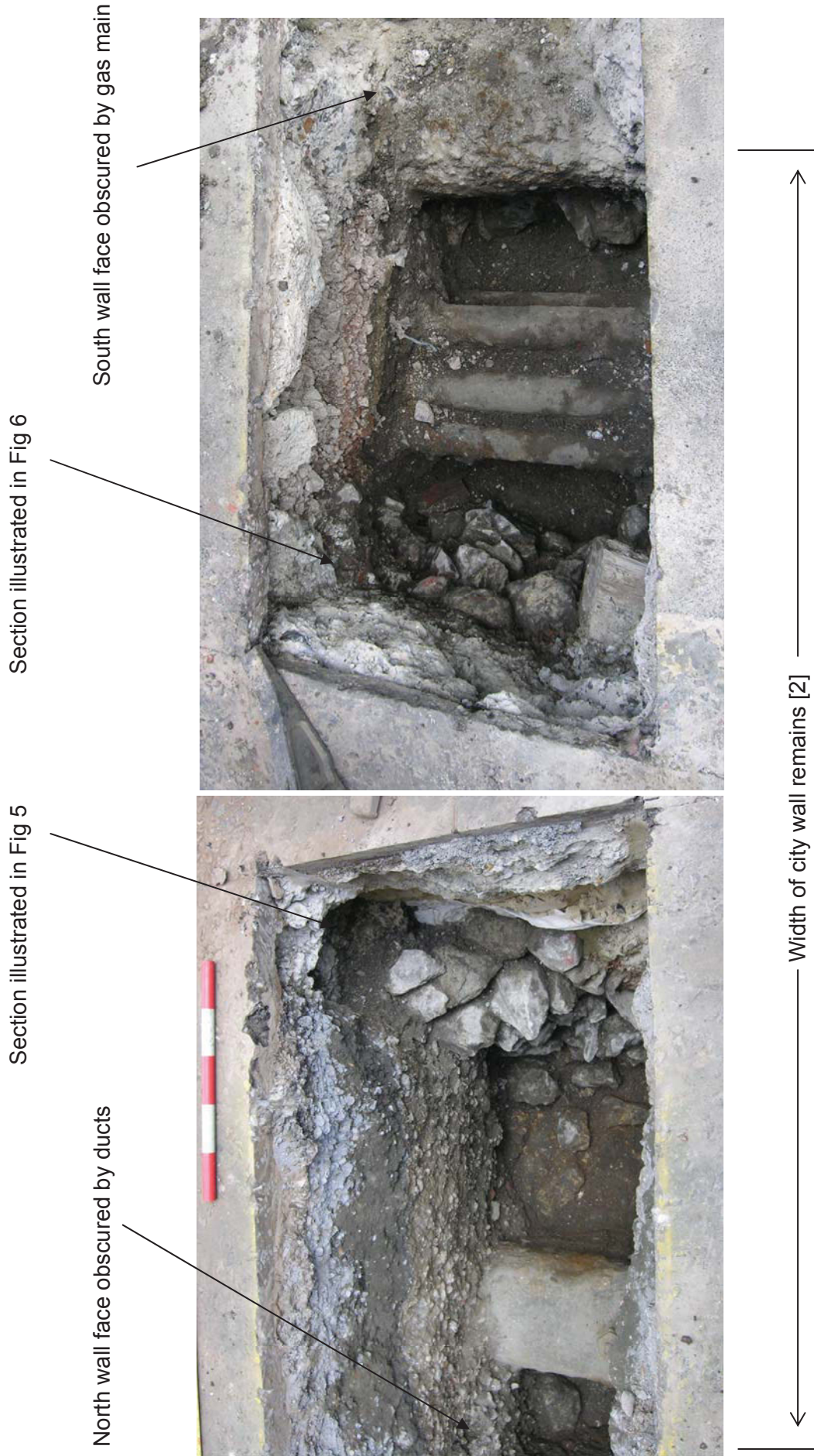


Fig 7 MOR18, looking east. Scale is 500mm (half-metre)

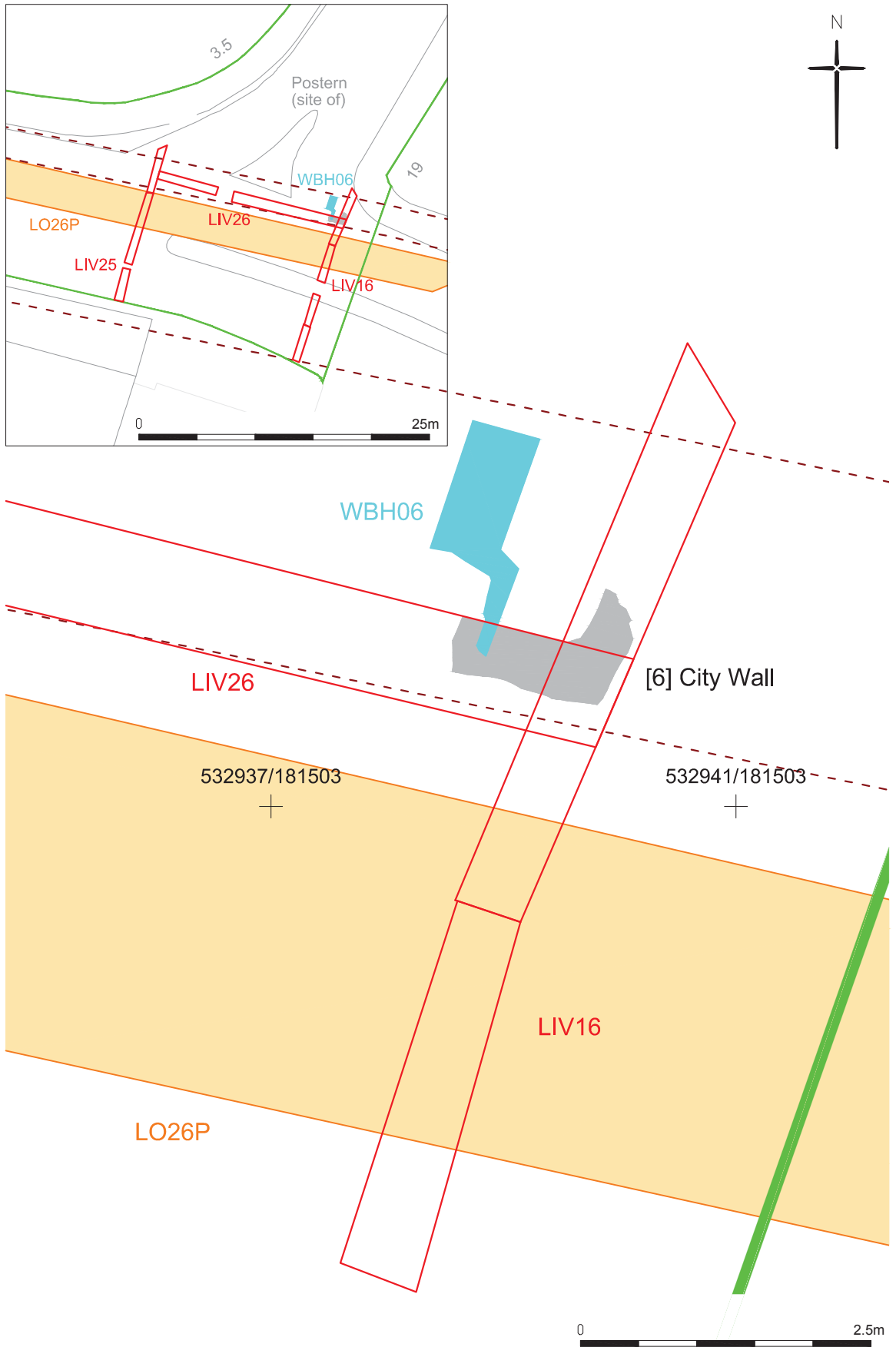


Fig 8 Plan of city wall at the junction of London Wall and Blomfield Street

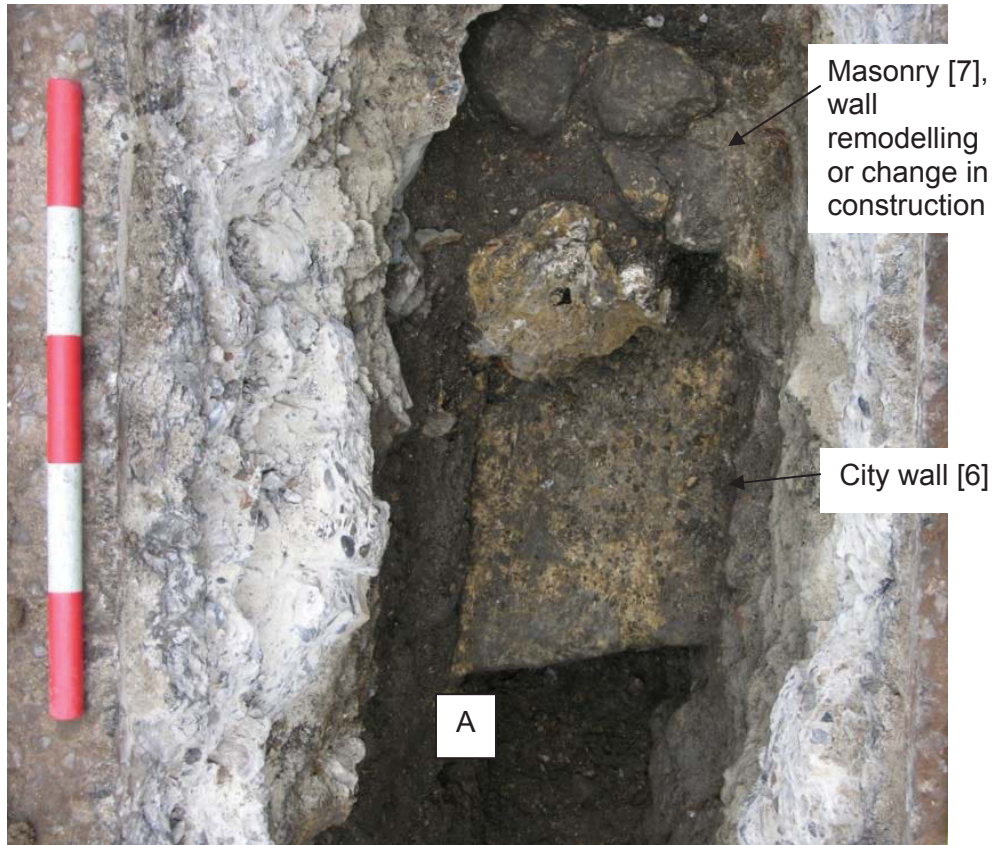


Fig 9 Vertical view of the city wall in LIV16, looking north



Fig 10 City wall in LIV26, looking north. Wall context [6], earlier exposed in LIV16, continues beneath ducts. Position "A" is the same in both photographs.

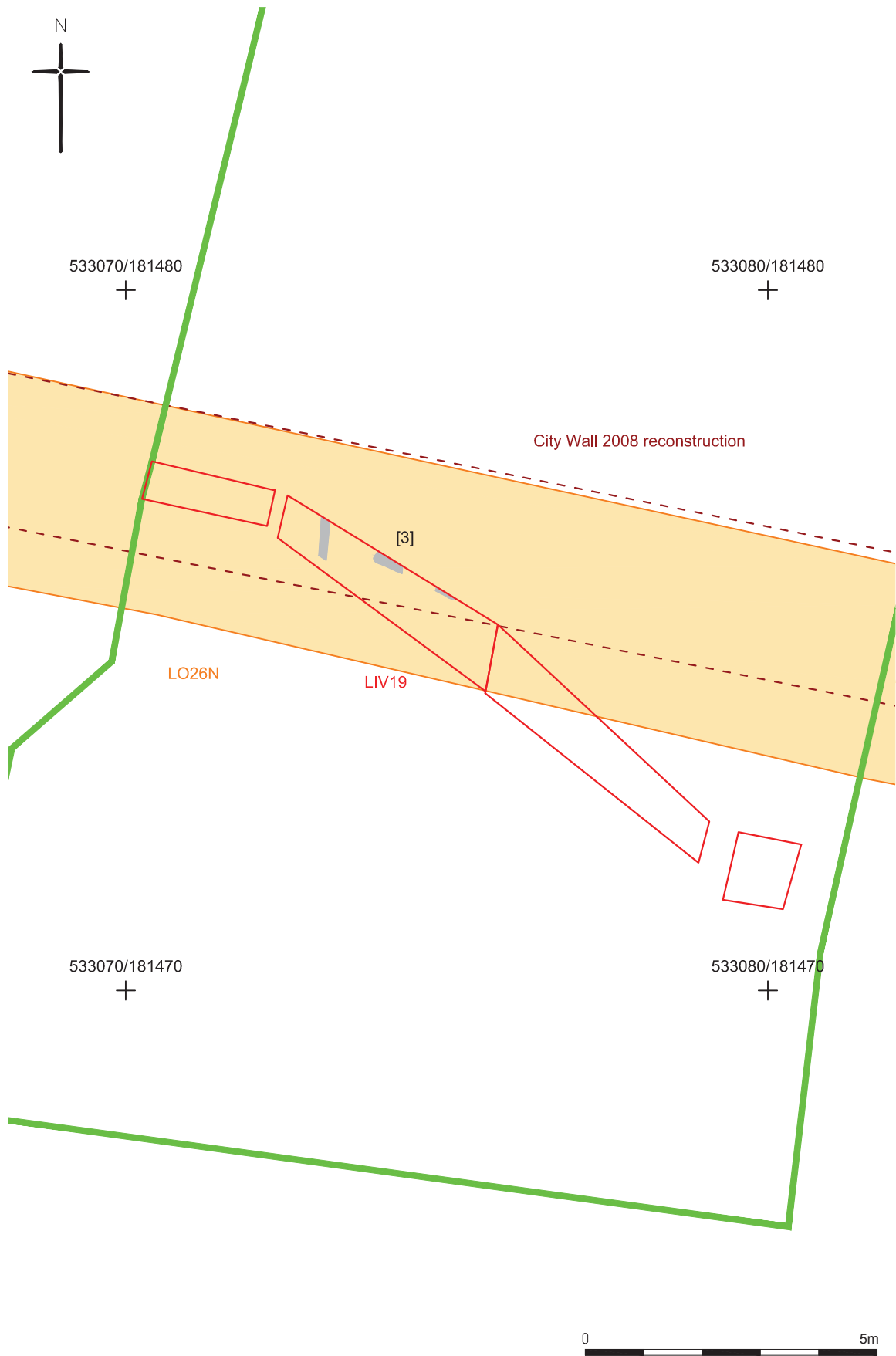
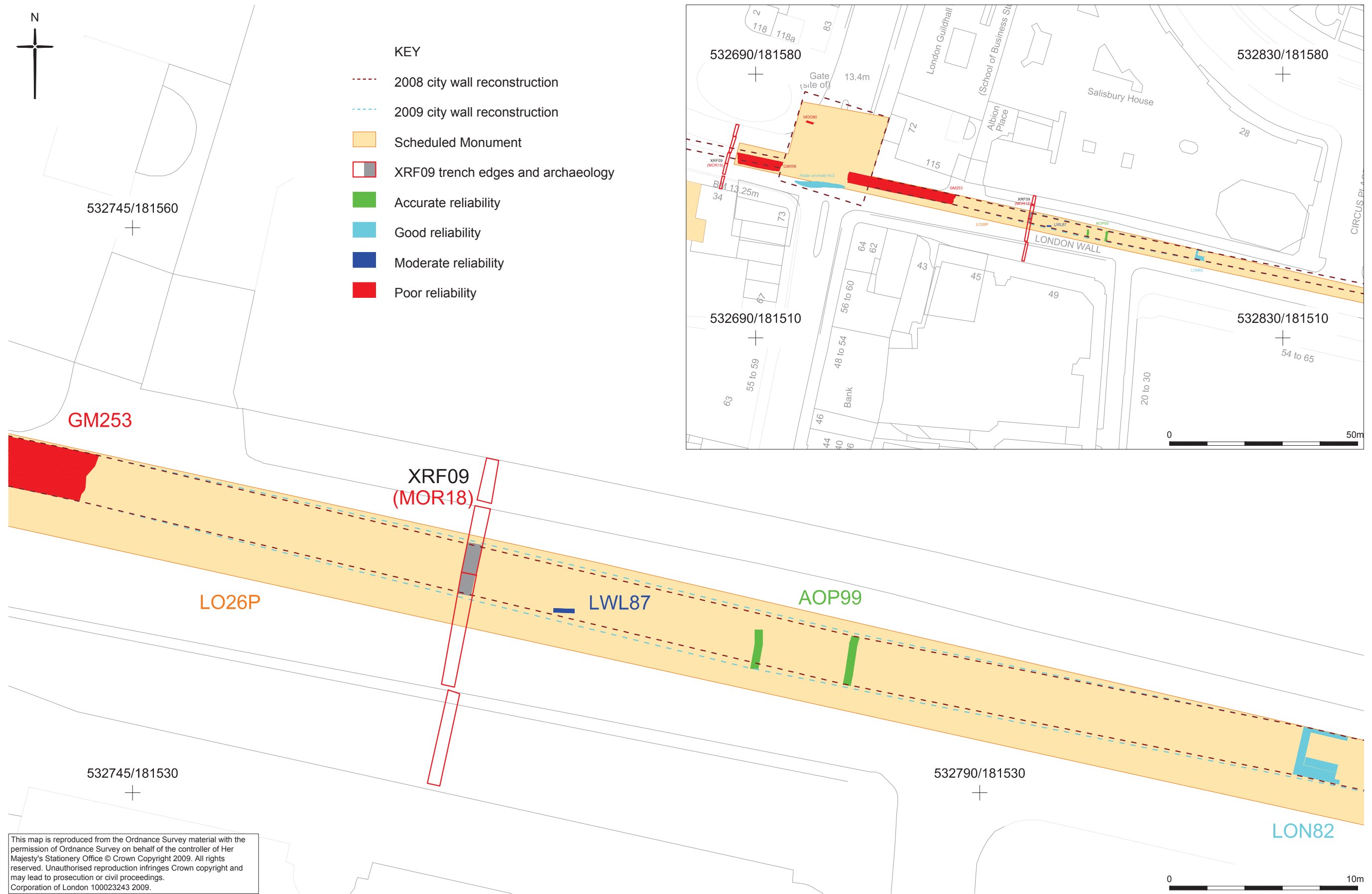


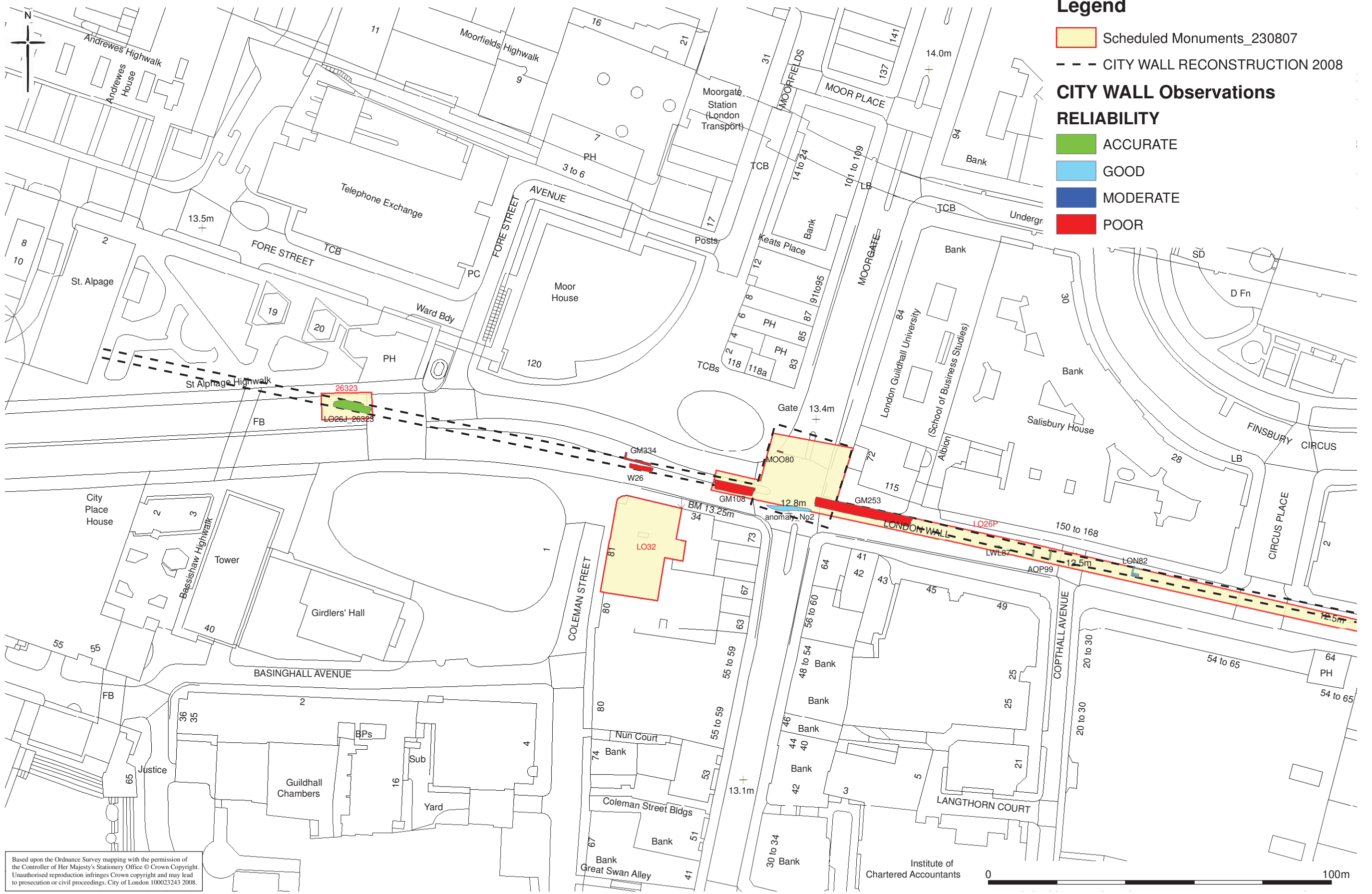
Fig 11 Plan of cellar walls in LIV19



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Fig 12 Revised reconstruction of City Wall location (inset shows revised reconstruction in relation to surrounding area)

Annex 1: Additional figures from city wall DDBA (Crossrail 2008a)



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City wall DDBA: west

Legend

Scheduled Monuments_230807

- - - RECONSTRUCTION_2008

CITY WALL Observations

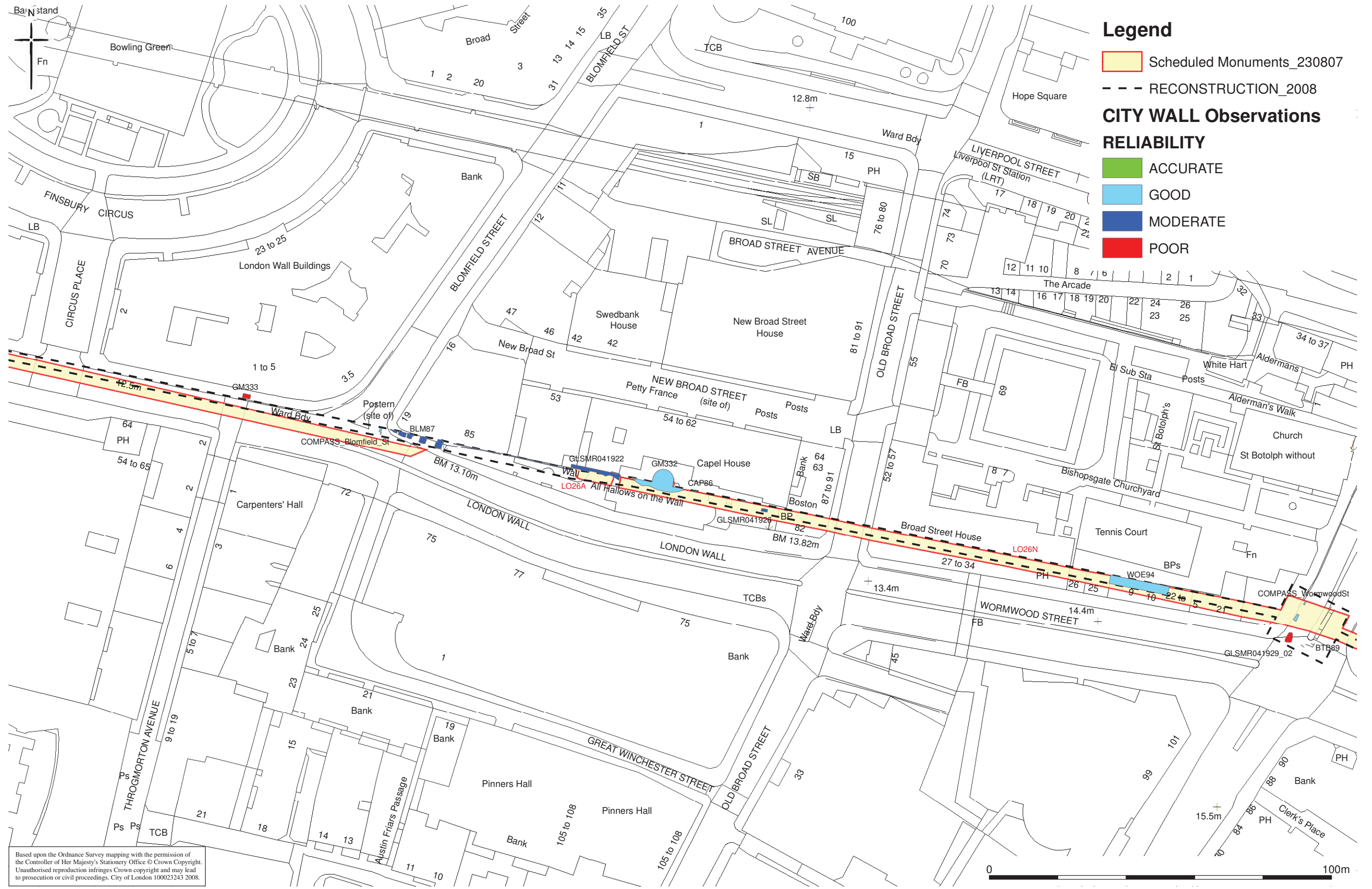
RELIABILITY

ACCURATE

GOOD

MODERATE


POOR



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City wall DDBA: centre

Legend

 Scheduled Monuments_230807

 RECONSTRUCTION_2008

CITY WALL Observations

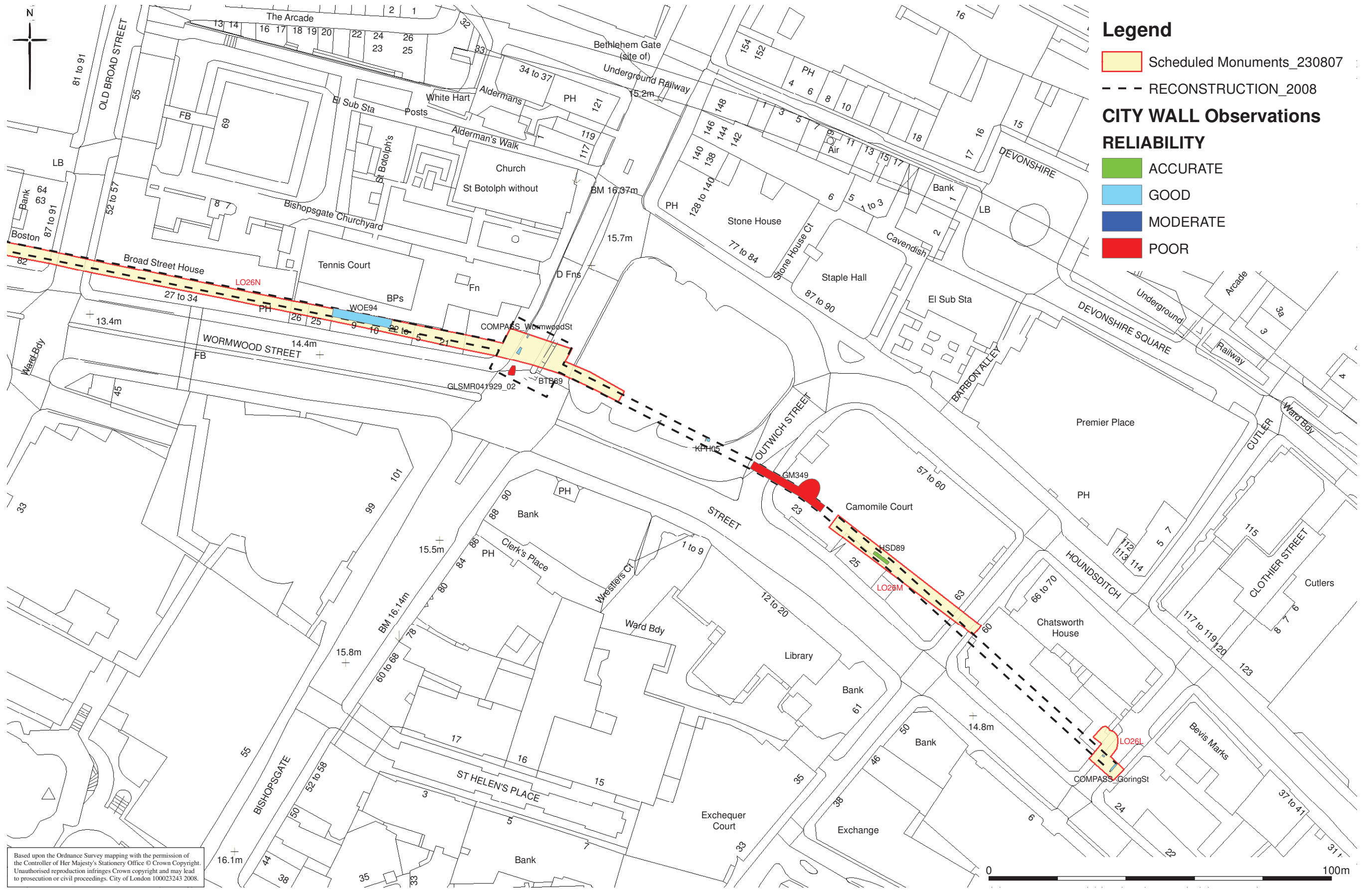
RELIABILITY

 ACCURATE

 GOOD

 MODERATE

 POOR



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City wall DBA: east