C257 ARCHAEOLOGY CENTRAL

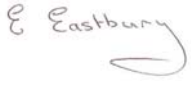
Method Statement

Archaeological Excavation and Watching Briefs

Broadgate Ticket Hall Utilities Corridor (XSM10)

Document Number: C257-MLA-X-GMS-C101-50001

Document History:

Revision:	Date:	Prepared by:	Checked by:	Approved by:	Reason for Issue:
0.1	13.02.13	Robert Hartle	Nicholas Elsden	Elaine Eastbury	For PC Review
1.0	18.02.13	Robert Hartle	Nicholas Elsden	Elaine Eastbury	Revised from PC Comments for CRL Review
2.0	28.02.13	Robert Hartle	Nicholas Elsden	Elaine Eastbury	Revised from CRL Comments
2.1	24.05.13	Robert Hartle	Nicholas Elsden	Elaine Eastbury	Revised for additional utilities works, for PC Review
3.0	30.05.13	Robert Hartle	Nicholas Elsden	Elaine Eastbury	Revised from PC Comments for CRL Review
					

2a. Stakeholder (Principal Contractor: C503 VCUK) review required? YES ☒ NO ☐

(If NO, strike out sections 2a & 2b and go to section 3)

This document has been reviewed by _____ in the capacity of _____ for coordination, compliance, integration, and acceptance as a safe system of work, output, control, sequence. This document is acceptable for transmittal to _____ for no objection to the works being executed as described.

Sign: _____ Name: WAKE Date: 29/05/13

2b. Review by Stakeholder (if required):

Stakeholder Organisation	Job Title	Name	Signature	Date	Acceptance
					☐
					☐
					☐

3. Acceptance by *Crossrail*

	***Crossrail* Review and Acceptance Decal** This decal is to be used for submitted documents requiring acceptance by *Crossrail*.	
☑	Code 1.	Accepted. Work May Proceed
☐	Code 2.	Not Accepted. Revise and resubmit. Work may proceed subject to incorporation of changes indicated
☐	Code 3.	Not Accepted. Revise and resubmit. Work may not proceed
☐	Code 4.	Received for information only. Receipt is confirmed

Reviewed/Accepted by:(signature)	Print Name: J. CARVER	Position: PROJ. ARCH.	Date: 20/06/13

Acceptance by *Crossrail* does not relieve the designer/supplier from full compliance with their contractual obligations and does not constitute *Crossrail* approval of design, details, calculations, analyses, test methods or materials developed or selected by the designer/supplier.

Note for Readers

Various readers of this method statement and risk assessment are likely to be directly interested in different parts of the document. The following table is intended to help readers identify which sections cover their main interests.

Reader's main interest	Most relevant sections
Principal Contractor	2.1, 2.3 3.1 4 5 15 16 17 21 22
Health, Safety, & Environment	15 17 21 22
Contractual	1.1 2 4 7 8 10 14 18 19 20
Archaeological methodology	1 3 5 6 9 10 11 12 13

Contents

Figures

(At back of document)

1 Introduction

Archaeological investigations are to be carried out on this site by the Museum of London Archaeology (MOLA). The requirements are set out in:

- A Crossrail **Site-specific Written Scheme of Investigation** (SS-WSI): *Liverpool Street Station, Site-specific Written Scheme of Investigation, Doc. No. C138-MMD-T1-RST-C101-00001 Version 2*, 29.04.10
- A draft of section 5 of the forthcoming **Addendum to the WSI**: Draft S5 WSI Addendum LIS Utilities Corridor.pdf (Addendum will be: *Addendum to WSI: Liverpool Street Utilities Corridor and Related Activities (C503),* Document Number: C503-XRL-T1-RGN-C101-50001)

The tasks from the WSI Addenda which this method statement covers are:

Task	Principal Contractor	Provisional Programme
• ~~**Excavation [and associated watching briefs],** the Utilities Corridor (GL1 to GL8) [*c* 37m].~~ COMPLETE. *C257_PMI_0037*	C503 VCUK (Vinci Construction UK Ltd)	COMPLETE
• **General & Targeted Watching Brief**, Area around Sewer Shaft **MHS1** (westward of GL1). [*c* 5 x 7m].	C503 VCUK	Start GWB: 28th May 2013 (TBC) TWB: 3rd June or later (TBC) Duration: *estimated* 4–5 weeks* depending on survival, shoring, spoil removal, etc
• **Excavation [and associated watching briefs],** the **Utilities Corridor GL8 to QVT** (Queen Victoria Tunnel). [*c* 13m]. *C257_PMI_0037*	C503 VCUK	Start: mid June or later (TBC) Duration: *estimated* 2–3 weeks* *plus* time for shoring/frames etc
• **General & Targeted Watching Brief,** Sewer Shaft **MHS2-100** (at the western end of the Open Cut Sewer Trench). [*c* 3 x 3m]. *C257_PMI_0043*	C503 VCUK	TBC: early August 2013 Duration: *estimated* 4 weeks* depending on survival, shoring, spoil removal, etc
• **General & Targeted Watching Brief**, Sewer Shaft **MHS2** (eastward of QVT). [est. *c* 3 x 5m].	C503 VCUK	TBC: August 2013 or later Duration: *estimated* up to 3–4 weeks* depending on survival, presence/absence of burials, shoring, spoil removal, etc
• **General Watching Brief, Heading from MHS2-**100 to Blomfield Street sewer.	C503 VCUK	TBC October 2013 Duration: *estimated* 10 days, depending on Principal Contractor's programme
• **General Watching Brief, Heading MHS2 to QVT** sewer.	C503 VCUK	TBC October 2013 Duration: *estimated* 10 days, as above

*See Figs 1 to 4 for locations. * programme estimates are for extended hours, see 4.7*

The overall purpose of these tasks is to mitigate the impact of the works upon archaeological remains, by making an adequate record of them in during the construction ground works (a mitigation strategy of *preservation by record* in line with Crossrail requirements), and to recover any human remains for further study and/or reburial in accordance with the burial licence (see 14.4).

These archaeological investigations form part of the mitigation for the Broadgate Ticket Hall site.

This Method Statement has been developed in conjunction with the Principal Contractor, C503 VCUK, who will be responsible for ensuring that the archaeological works may be carried out as specified. It has included assessing their method statement and other documentation for these works (see list below).

The Principal Contractor's documents used in production of this method statement were:

- Taylor Woodrow, C503 Liverpool Street, Method Statement, Excavation Works for Manhole MH-S1 and Utility Corridor west to GL1, Doc. no. C503-VIN-C-GMS-C101-50118, v2.0 13/03/13 [C503 MHS1 MS]
- VCUK, C503 – Liverpool Street, Method Statement – Construction of Pre-Cast Manhole MHS2-100, Doc. no. C503-VIN-C-GMS-C101_WS102-50009, v4.0, 28-10-12 [C503 MHS2-100 MS]
- VCUK, C503 – Liverpool Street, Method Statement – Heading for Sewer diversion between Manhole MHS2-100 and existing Thames Water Sewer, Doc. no. C503-VIN-C-GMS-C101-50083, v4.0, 04-04-13 [C503 TW Heading MS]
- Taylor Woodrow, C503 Liverpool Street, Method Statement, Utility Corridor Excavation between GL9 and QVT, Doc. no. C503-VIN-C-GMS-C101-50131, v2.0 20/05/13 [C503 GL9–QVT MS]

At the time of writing, method statements were not available for MHS2 or the heading from it to the QVT.

If the project design or scope/method of working are subject to changes during the works, the method statement will be updated and re-issued to the Project Archaeologist for approval, in accordance with the specified document control procedures (see 10).

1.1 Site Description

The Broadgate Ticket Hall worksite (site of a new ticket hall) consists of an area in the road and pavement of Liverpool Street, to the east of Blomfield Street and to the south and west of the existing ticket hall/sub-station (see Fig 1). This lies within the City of London.

The 7m-deep utilities corridor lies on the southern side of this section of Liverpool Street. The new section from GL8 to the Queen Victoria Tunnel lies towards the centre of its length.

Sewer shaft MSH1 and the associated area around it lie in the south-western corner of the site (at the western end of the utilities corridor). Sewer shaft MSH2 lies in the south-eastern corner of the site (at the eastern end of the utilities corridor).

Sewer MHS2-100 lies in the north-west corner of the site.

1.2 Previous work on the site

The Broadgate Ticket Hall site has been the subject of a series of archaeological evaluation trenches/pits, and various watching briefs on utilities and other works. The results are included in the following sections, and are reported on in:

- MOLA for Crossrail, 2012a *Central Section Project, Fieldwork Report, Archaeological Evaluation and Watching Brief Broadgate Ticket Hall (XSM10),* Doc. No. C257-MLA-X-RGN-CRG02-50064, v2, 07.03.12.
- MOLA for Crossrail, 2012b *C257 Archaeology Central, Fieldwork Report, Archaeological Excavated Evaluations and Watching Briefs, Pit 4, Pit 11, Trench 14 and 15, Pile Line Pits and SSET/UKPN Utility Diversions, Broadgate Ticket Hall (XSM10),* Doc. No. C257-MLA-X-XCS-CRG02-50015, v2, 20.06.12.

1.3 Geological and Topographical setting

The site lies on the sands and gravels of the Third (Taplow) Thames Terrace. The river terrace deposits are overlaid by a layer of alluvium, probably associated with the River Walbrook and its tributaries. Sporadic deposits of brickearth have been known to occur in areas of the site, overlying the terrace gravels.

Previous Crossrail archaeological fieldwork on the Broadgate Ticket Hall site, together with boreholes, suggest that the terrace gravels lie at *c* 107.3m ATD (*c* 107.25 to 107.4m ATD) over much of the length of the utilities corridor.

This level is likely to decrease in the western *c* 20m, perhaps to approx 106m ATD or below, reflecting the slope of the former Walbrook valley dipping into the stream channel.

1.4 Archaeological and Historic Background

The archaeological and historic background was covered in the WSI (see section 1 above) and is updated by the reports listed in section 1.2, and the recent excavation of GL1 to GL8 in March to April 2013. Only the archaeological potential of the site is summarised below. The presence of many of the predicted deposits has been demonstrated by previous work on the site, and is described as 'demonstrated potential'.

The **utilities corridor** (incl. GL8 to QVT) has:

- **Demonstrated potential for Roman remains** such as Walbrook deposits (potentially channels, alluvium with palaeoenvironmental evidence, revetments, overbank flooding), reclamation of the Walbrook valley, land drainage ditches, re-deposited human bone and grave goods (possibly *in situ*), as-yet undefined extra-mural activity and possibly occupation.
- **Demonstrated potential** for the fringes of the Saxon (or earlier) to medieval **Moorfields Marsh**, including artefacts such as the bone skates and leather working remains recovered in evaluation.
- **Demonstrated potential for reclamation/consolidation dumps** (and possibly quarrying) from reclamation of the marsh the **medieval and early post-medieval** periods. *These are only likely to survive in the area of higher survival at c 3.0m below ground level (bGL), 109.2m ATD, and below.*

- *Low potential* for Saxon activity, owing to the presence of the Moorgate Marsh. *Only likely to survive in the area of higher survival, as above.*
- *Low potential* for prehistoric activity, which is likely to be limited to stray finds and sporadic truncated features.

In addition, the **area around MHS1, MHS2-100**, and potentially **MHS2** have:

- Demonstrated potential for post-medieval remains in the form of both disarticulated human remains and *in situ* burials relating to the Bethlehem hospital burial ground (BG208), the dumping of waste artefacts from craft industries such as bone and glass working, and the later post-medieval buildings and occupation of the area.

  Whilst this potential has been demonstrated in the central roadway of Liverpool Street, it is believed that all burials have been removed from the utilities corridor by a combination of later basements, utilities, and other intrusions, and clearance as part of earlier Crossrail works.

  It is not known whether manhole **MHS2** lay within or outside the burial ground. Modern disturbance seen in a 1.2m-deep trial pit at this location suggests that some of any burials once present may have been removed by later activity at that location. However, the burials seen in the nearest piece of earlier work this this location (Pit 10, *c* 27m to the west) extended to *c* 2.8m below ground level, and the presence of a considerable number of burials below 1.2m below ground level cannot be ruled out.

  The two sewer headings are at depths (*c* 5m bGL) which lie below the Bedlam burial ground horizon.

In addition, MHS2-100, and has:

- Demonstrated potential for Roman gravel road surfaces and embankment/abutment, potentially crossing the Walbrook by a bridge, or possibly a ford.

1.5 Deposit survival

Predicted Schematic typical sections

1.5.1 North-west corner of the site – manhole MHS2-100 (associated heading similar)

Note: *the exact depth of existing utilities and modern truncation is not currently known, but is predicted to be at least 1m bGL. This predicted schematic typical section is based on the results of the recent Open Cut Sewer Trench (in the same location), and the 1985 excavation trench TP7 (LSS85) (within 4m eastward).*

Deposit	Thickness	Depth of Surface below ground level – *Approximate*	Depth of base below ground level – *Approximate*
MODERN (overburden/truncation)	*Estimated* *c* 1.0–1.5m	0m (Ground level = *c* 112.9m ATD)	*c* 111.4–111.9m ATD (*c* 1.0–1.5m bGL)
BURIAL GROUND (***c* 8 bodies per m³** in LSS85 excavation, immediately east (3 to 6 per m3 in previous XSM10 fieldwork))	*c* 1.2–1.7m	*c* 111.6m ATD (*c* 1.3m bGL)	*c* 109.9–110.1m ATD (*c* 2.8–3.00m bGL)
BURIAL GROUND CONSOLIDATION	*c* 0.3–1.1m	110.20–110.80m ATD (*c* 2.7–2.1m bGL)	*c* 109.1–109.9m ATD (*c* 3.0–3.8m bGL)
MOORFIELDS MARSH (medieval to early post-medieval)	*c* 0.5m	*c* 109.9m ATD (*c* 3.0m bGL)	*c* 109.5m ATD (*c* 3.5m bGL)
MOORFIELDS MARSH (Late-Roman to medieval)	*c* 0.9–1.1m	*c* 109.5m ATD (*c* 3.5m bGL)	*c* 108.4–108.6m ATD (*c* 4.1–4.3m bGL)
ROMAN DEPOSITS (Road surfaces, potentially meeting the main Roman Walbrook river channel with possible revetment and bridge structures)	*c* 1m	*c* 108.5–108.6m ATD (*c* 4.30m bGL) Second road surface = *c* 108.6m ATD *c* First road surface = 108.3m ATD	*c* 107.5–107.6m ATD (*c* 5.3–5.4m bGL)
RIVER CHANNEL (Pre-Roman Road)	*c* 1m	*c* 107.5–107.6m ATD (*c* 5.3–5.4m bGL)	106.5–106.7m ATD (*c* 6.3–6.5m bGL)
TERRACE GRAVELS (archaeologically sterile)	Unknown	106.5–107.5m ATD (*c* 5.5–6.5m bGL)	

1.5.2 South-west corner of the site – Area around manhole MHS1

***Note:** the exact depth of existing utilities and modern truncation is not currently known but is predicted to be up to at least 1m bGL. The backfilled subterranean public lavatory is located within this area, although it full extent is not currently known. The construction cut is known to have truncated archaeology down to c 107.3m ATD in adjacent areas (Pile Line Pit 1). This predicted schematic typical section is based on the results of the recent Utility Corridor Trench (immediately eastward), combined with previous watching brief and evaluation trenches (Trench 1 (c 7m eastward), Trench 6 (c 9m) Pit 1 (immediately eastward) and Pit 3 (c 3m eastward).*

Deposit	**Thickness**	**Depth of Surface below ground level – *Approximate***	**Depth of base below ground level – *Approximate***
MODERN (overburden/truncation)	Variable *c* >1m, up to 5m (subterranean lavatory)	0m (Ground level = *c* 112.3m ATD)	*c* 111.3m or lower (*c* >1.0m bGL)
POST–MEDIEVAL WALLS/BUILDINGS (Cemetery and post–cemetery buildings, and the potential cemetery boundary wall)	*c* 1.0–1.3m	*c* 110.7–111.3m ATD (*c* 1.0–1.6m bGL)	*c* 110.3m ATD (*c* 2.0m bGL)
BURIAL GROUND (*c* **3 to 6 per m3** in previous fieldwork)	*c* 1.3–1.9m	*c* 110.9–111.3m ATD (*c* 1.0–1.4m bGL)	*c* 109.5m ATD (*c* 2.9m bGL)
BURIAL GROUND CONSOLIDATION	*c* 0.9m–1.6m	*c* 110.4–110.6m ATD (*c* 1.7–1.9m bGL)	*c* 109.0–109.3m ATD (*c* 3.0–3.3m bGL)
MOORFIELDS MARSH (medieval to early post–medieval)	*c* 0.2–0.9m	*c* 109.0–109.5m ATD (*c* 2.8–3.3m bGL)	*c* 108.6–108.8m ATD (*c* 3.7–3.9m bGL)
DRAINAGE DITCH/?WALBROOK	*Up to 1.5m*	*c* 108.8m ATD (*c* 3.9m bGL)	*c* 107.3m ATD (*c* 5.0m bGL)
MOORFIELDS MARSH (Late–Roman to medieval)	*c* 0.4–0.7m	*c* 108.5–108.7m ATD (*c* 3.6–3.8m bGL)	*c* 108.0–108.1m ATD (*c* 4.2–4.3m bGL)
ROMAN DEPOSITS *(dumps, occupation, drainage, **and** Walbrook deposits. Potential burials.)*	*c* 0.9 – 1.2m	*c* 108.1–108.2m ATD (*c* 4.1–4.2m bGL)	*c* 107.0–107.3 m ATD (*c* 5.0–5.3m bGL)
TERRACE GRAVELS (archaeologically sterile)	*c* 1m	*c* 107.30 ATD (or slightly lower) (*c* 5.0m bGL)	*c* 106.2–106.3m ATD (*c* 6.1–6.0m bGL

1.5.3 Southern edge of the site – Utilities Corridor (incl. GL8 to QVT)

Note: *the corridor is understood to have been truncated down to c 109.3m ATD in the area of higher survival in the northern c 0.6m (this may be in discontinuous areas, not along the whole length), and c 107.8m ATD over the remainder of its width. Both figures are approximate predictions.*

There are no data closer to manhole MHS2 than Pits 9A and 10, *c* 25–30m to the west.

Predicted **Schematic typical section:**

Deposit	**Thickness**	**Depth of Surface below ground level – *Approximate***	**Depth of base below ground level – *Approximate***
MOORFIELDS MARSH *Only in area of higher survival*	*c* 0.5 – 1m	*c* 109.3m ATD (*c* 3.0m bGL)	*c* 108.9m ATD (*c* 3.3m bGL [west] – 4.2m bGL [east])
ROMAN DEPOSITS *(occupation, drainage, **and** Walbrook deposits)*	*c* 0.8 – 1.4m	*c* 108.9m ATD (*c* 3.3m bGL [west] – 4.2m bGL [east])	*c* 107.3 – 107.9 m ATD (*c* 5m bGL)
Terrace Gravels (archaeologically sterile)	>300mm	*c* 107.9 m ATD (*c* 5m bGL)	*c* 106.9m ATD(1) (*c* 5.5-5.3m bGL)

1.5.4 South-eastern corner of the site – manhole MHS2 100 and associated heading

There are no data closer to manhole MHS2 than Pits 9A and 10, *c* 25–30m to the west; therefore it is uncertain whether the sequence and levels seen to the west form a reasonable model for MHS2.

In particular, as mentioned in section 1.4, it is not known whether manhole MHS2 lay within or outside the burial ground. It is also possible that the terrace gravels rise from west to east, reflecting the former shallow valley of the Walbrook, so the total depth of archaeology *may* be slightly less than seen in Pit 10.

Therefore, a much simplified, and speculative, deposit model is presented below. **It should be used with caution, bearing in mind the lack of data.**

Deposit	**Thickness**	**Depth of Surface below ground level – *Approximate***
MODERN (overburden/truncation)	Unknown, ≥ 1.2m	0m
BURIAL GROUND **OR** **POST–MEDIEVAL OCCUPATION road/buildings/gardens**	*Estimated* up to *c* 1.6m ?	Unknown, ≥ 1.2m bGL
BURIAL GROUND etc CONSOLIDATION ? possibly earlier marsh or make up ?	*Estimated c* 0.2m–1.2m ?	*Estimated c* 2.8m bGL
ROMAN DEPOSITS *(Dumps, occupation, drainage ? Greater potential for burials than to the west)*	*Estimated c* 1–2m ?	*Estimated c* 3–4m bGL ?
TERRACE GRAVELS (archaeologically sterile)	*n/a*	*Estimated c* 5.0m bGL or higher

2 Interfaces and Communication Plan

2.1 Interface with Project Archaeologist

The Method Statement has been developed jointly with the Principal Contractor and then submitted to the Project Archaeologist for approval. Any comments have been incorporated. Regular progress reports will be submitted to the Project Archaeologist and will be augmented by progress meetings and site visits when required, in order to optimise communications and feedback.

2.2 Interface with C257 Contract Administrator

MOLA shall submit costings and timesheet reports in accordance with the C257 Contract to the Contract Administrator.

2.3 Interface with Principal Contractor

MOLA has liaised with the Principal Contractor to prepare the Method Statement. The archaeological investigations will be undertaken under the auspices and supervision of the Principal Contractor. This interface extends to joint Health and Safety planning under CDM requirements. MOLA will provide the Principal Contractor with all necessary information to support site start-up (eg names of staff for inductions), health and safety planning; and (if required) to support the Principal Contractors' Permits to Dig/Penetrate. The majority of this information will be contained in this Method Statement. MOLA will liaise with the Principal Contractors regarding access, order of works, programme and commencement date. The Principal Contractors shall give MOLA 4 weeks notice of start date(s) for each work area or task.

2.4 Interface with Crossrail Archaeologist

MOLA shall liaise with Crossrail Archaeologist to implement the correct archaeological design specification, described in the SS-WSI (Section 1 above).

2.5 Interface with External Consultees

The Crossrail Archaeologist shall liaise with the City of London and English Heritage to inform them of the archaeological works.

3 Scope of Works

3.1 Planned Fieldwork Events

This Method Statement sets out the methodology and health and safety requirements for the tasks described in section 1 for the future Crossrail Broadgate Ticket Hall in Liverpool Street.

The mitigation strategy for the site is *preservation by record*.

3.2 Confirmation of Methods and Standards

The archaeological fieldwork and reporting will be conducted in accordance with the following guidance and standards:

- Brickley M and McKinley JI 2004. (eds.) Guidelines to the Standards for Recording Human Remains, BABAO/IFA paper no. 7
- Campbell, G, Moffett, L and Straker, V 2011 'Environmental Archaeology. A Guide to the Theory and Practice of Methods, from Sampling and Recovery to Post-excavation (second edition)'. Portsmouth: English Heritage
- Corporation of London Department of Planning and Transportation, 2004 Planning Advice Note 3: Archaeology in the City of London, Archaeology Guidance
- Crossrail Environmental Minimum Requirements (Crossrail 2008)
- Crossrail Archaeology Generic Written Scheme of Investigation (draft July 2009)
- Crossrail Archaeology Specification for Evaluation & Mitigation (including Watching Brief) (CR-PN-LWS-EN-SP-00001)
- Crossrail Code of Construction Practice
- Crossrail SS-WSI – Liverpool Street Station, Site-specific Written Scheme of Investigation, Crossrail April 2010, Doc. No. C138-MMD-T1-RST-C101-00001 Version 2 and addendum to the SS-WSI: Package C138 – Liverpool Street Station, Addendum to Written Scheme of Investigation, Crossrail August 2010, Trial Trench Evaluation – Broadgate Ticket Hall (XSM10), Doc. No. C138-MMD-T1-RST-C101-00004 Revision 4.0
- English Heritage, 2004, Geoarchaeology: using earth sciences to understand the archaeological record
- English Heritage/Church of England, 2005, Guidance for best practice for treatment of human remains excavated from Christian burial grounds in England
- English Heritage, July 2009, Standards for Archaeological Work, London Region, External Consultation Draft
- Institute for Archaeologists (IFA) Standards and guidance for watching briefs and field evaluation (IFA 2001a and 2001b)
- Mays S, Brickley M, and Dodwell N, 2004, Centre for Archaeology Guidelines. Human Bones from Archaeological Sites: guidelines for producing assessment documents and analytical reports.English Heritage
- McKinley, J and Roberts, C, 1993, Excavation and Post-Excavation treatment of cremated and inhumed human remains. IFA technical paper 13

- Museum of London Archaeological Site Manual (1994)
- Museum of London General Standards for the preparation of archaeological archives deposited with the Museum of London (1998)
- Museum of London (Powers N (ed.)), 2008, Human osteology method statement, http://www.museumoflondon.org.uk/NR/rdonlyres/2D513AFA-EB45-43C2-AEAC-30B256245FD6/0/MicrosoftWordOsteologyMethodStatementMarch2008.pdf
- Museum of London Archaeology Service (Powers N), undated, Guidelines for the assessment of inhumations and disarticulated bone, unpublished
- United Kingdom Institute for Conservation's Conservation Guidelines No. 2

3.3 Aims and Objectives

3.3.1 Research Aims

The original aims and objectives were listed in the WSI (Crossrail 2010) and stated that 'Archaeological investigation and mitigation within the Crossrail worksites for Liverpool Street Station have the potential to contribute to the research themes set out below':

Evidence relating to the Walbrook, its tributaries and Moorfields Marsh deposits may provide data relevant to the following themes:

- Understanding London's hydrology, river systems and tributaries and the relationship between rivers and floodplains;
- Understanding how water supply and drainage provision were installed and managed;
- 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 the relationships between urban settlements and royal villas or religious estates;
- Examining the proposal that there was an ideological polarity between town and anti-town systems: Roman towns did not so much fail as were discarded;
- The end of the Roman occupation: developing explanatory models to explain socio-political change and considering the influence of surviving Roman structures on Saxon development; and
- Examining the use in any one period of materials from an earlier period (e.g. Saxon use of surviving Roman fabric) and the influence on craftsmanship, manufacture and building techniques.

Evidence relating to the Medieval Bethlehem Hospital precinct and cemetery (BG208), bisected by Liverpool Street, may provide data relevant to the following themes:

- Understanding the differences, if any, between burial practices in the city and outlying cemeteries;

- Understanding life expectancy, origins and belief, seen through studying health, diet and disease, and preparing models for future research;
- Considering the relationship between cemeteries and major or minor roads, in terms of symbolism, status, privacy and convenience; and
- Synthesising data on known religious sites and buildings, their chronology, use and influence locally, regionally and nationally.

3.3.2 Fieldwork Objectives

The overall objectives of the excavation and watching briefs are to mitigate the impact of the relevant parts of the Crossrail works within their footprint, contributing to the wider mitigation for the Broadgate Ticket Hall.

The task-specific aims and objectives from the former Addendum to the WSI (Doc. No. C138-MMD-T1-RST-C101-00004 Revision 3.0, section 2.1.1 and 2.2.1) are:

- The aim is to investigate and report on surviving archaeological deposits within the footprint of the Crossrail works in Liverpool Street, including those relating to a post medieval burial ground (BG208), which survives within the worksite footprint, and also deposits relating to the medieval and Roman periods that have been positively identified.
- Mitigation in the form of archaeological excavation and general and targeted watching brief to excavate and record archaeological deposits for analysis and dissemination in accordance with the Crossrail Generic WSI (document number CRPN- LWS-EN-SY-00001) and the standards listed therein.

3.3.2.1 Topography and Geology

- What is the character of **natural geology** across the site, and is there any variation westward toward the Walbrook channel (truncation or topography) ?
- Does any **brickearth** survive, and if so, what does this indicate about truncation by Roman or later activity ?
- Is there evidence of any **palaeochannels** (eg precursors to the Walbrook channel of the Roman and post-Roman periods) or other topographic or geological features ?

3.3.2.2 Roman:

- What is the nature, layout, and date of the different phases of **Roman** extra-mural activity and land use ? For example, land reclamation (including drainage ditches of/into the Walbrook), potential occupation (including buildings), or other land uses (such as pitting, quarrying, or farming).
- Does the hypothesised **Roman road** lie within the site and, if so, how does it relate to other Roman activity within the area ?
- Are there any **Roman burials**, **disarticulated human remains** or **potential grave goods** within the Roman deposits ?
- What are the extent, orientation, dating, and character of the **Walbrook channel(s) from the Roman period** ?

- Do any waterlain deposits have potential for **organic preservation and palaeoenvironmental remains**, and what do they indicate about the **environment and conditions in and around the Walbrook** ?
- Is there evidence that the **Walbrook channel** was **revetted, canalised or bridged** from the Roman period onward ? Did the timber posts seen in Blomfield Street during the 1925 (GM122) and 1981 (FIN81) watching briefs belong to a revetment(s) which extended into the Liverpool Street site ?
- Is the **ditch found in Pit 11/Trench 1** the canalised eastern edge of the Blomfield Street Walbrook channel, and was this feature open into the post-Roman period ?

3.3.2.3 Medieval:

- What is the character, extent and date of the **Moorfields Marsh** in this area ? Do the thin marsh deposits represent a continuum of medieval to post-medieval deposition, or post-medieval with residual medieval artefacts ?
- Is there any further evidence for activities in the area of the marsh, for example ice skating, or in the surrounding area, perhaps from any refuse dumped in/on it ?
- Is there any evidence of attempts to reclaim the marsh, eg by drainage (ditches etc) and dumping (land raising and consolidation) before the post-medieval ?

3.3.2.4 Bethlehem cemetery:

- What is the character and date of the sequence of post-medieval dumping and reclamation associated with the establishment of the cemetery ?
- What is the character, sequence, and dating of burials, in particular the date at which the cemetery went out of use ?
- What is the character of the burial practice, and how does it change spatially and chronologically ?
- What is the evidence for organisation/management and zoning of the burial ground ?
- Are multiple or pit burials confined to the northern part of the site around Trenches 13 and 14, and the 1985 excavations ?
- Can gravestones or marker/ledger slabs provide evidence which will identify individuals, and can these be correlated with documentary sources ?

3.3.2.5 Other post-medieval:

- What is the date and taphonomy of deposition of the important worked bone assemblage? For example, are these finds residual in the post-cemetery deposits, or does it represent continued deposition during and after the use of the cemetery? Also, what is the spatial and chronological division of the different types of bone artefact across the site ?
- What activities and industries in the surrounding area are represented by waste materials within dumps and the cemetery sequence ?
- What is the character and date of any activity and occupation outside the burial ground ?

- What is the character and date of structural remains relating to 18th and 19th-century urbanisation and development;

3.4 Event Codes

The sitecode is **XSM10**.

4 Site Management Plan

4.1 Tools and Equipment

Tools and equipment appropriate for the archaeological works will be ordered by the Supervising Archaeologist and delivered to site by the MOLA Equipment Officer from the MOLA central store. See 21.8.2 for details.

4.2 Training and Certification

MOLA provides Safety Training for its staff as follows:

- Induction Training for all staff (undertaken on joining MOLA, and as appropriate on individual projects).
- General H&S Training for supervisory staff (an H&S awareness course targeted at Field and Support Staff).
- Specialist H&S Training (designed to cover specialist areas and to update professional knowledge; as appropriate to deployment)

All MOLA staff on site will be competent to carry out their archaeological work. On site all staff will be supervised by a competent person.

For certain specific aspects of MOLA work only those members of staff with the relevant training and certification will be allowed to undertake them. These include Cable and Pipe/Underground Service Location, Chainsaws, Confined Spaces (see 21.7.3). However, only the confined spaces training is likely to be required on this site.

NB: chainsaws are banned on VCUK sites.

All MOLA staff have passed a CITB Health and Safety Test to operative level and will carry the CSCS card on site at all times (CSCS, Construction Related Organisation CRO White Card for Archaeological Technician, Code 5363; other cards are available for site visitors etc).

All staff will have their MOLA ID cards with them (see 21.6.1).

4.3 Site Monitoring

The site will be monitored by the MOLA Project Manager (Elaine Eastbury, BSc) or Assistant Project Manager (Nicholas Elsden, BSc) via site visits, as and when required, in order to provide advice and support to the MOLA Supervisor. The MOLA H & S Compliance Manager, Ian Grainger, and if required their Advisor (AgilityUK, formerly Hascom) will also regularly monitor the site, see 15.4.

4.4 Progress Reporting

MOLA has agreed a programme of weekly written progress reports and progress meetings (If appropriate) with the Project Archaeologist. MOLA shall provide

information describing progress on-site to date, the processing of samples and artefacts and feedback from initial assessment, and a BMOS report (see 15.6).

4.5 Resource Plan

Excavation:

- The excavation will be supervised by a MOLA Supervisor (Grade 4 or 5) assisted by up to an estimated 4 members of the MOLA field team (Grade 6), with support from MOLA Geomatics, Geoarchaeology, and Photographic team members when required. Other archaeological specialists (Grade 8) may be called in if necessary.

General/Targeted Watching Briefs:

- The watching briefs will be supervised by a MOLA Supervisor (Grade 4 or 5) assisted *when required* by up to an estimated 3 members of the MOLA field team (Archaeologist, Grade 6), with support from MOLA Geomatics, Geoarchaeology, and Photographic team members, and other specialists (Grade 8), as necessary.

Staff will be drawn from the pool of CVs submitted to Crossrail for approval.

The named Supervisor will be confirmed to Crossrail and the Principal Contractor in advance, and added to subsequent versions of this method statement, once the firm start date has been notified to MOLA. Other staff to be assigned when required

For the tasks in this method statement:

- Robert Hartle, BA (Hons), MA, Senior Archaeologist, overall responsibility for site supervision and conduct of the fieldwork.

  Direct Line (office): 020 7410 2238

  Mobile: 07730 646060

- Graham Spurr, BSc (Hons), MSc, Senior Geoarchaeologist, responsibility for Geoarchaeology and environmental recording and sampling, and specialist advice to the Senior Archaeologist, via visits as required.

  Direct Line (office): 020 7410 2232

  Mobile: 07939659057

Other staff and specialists are to be determined when required.

All archaeological staff are direct MOLA employees, ordinarily full time. The working hours are set out in 4.7 below.

4.6 Provisional Programme

The predicted overall start dates and durations for the work are included in section 1.

4.7 Working Hours

Work on site shall only take place within the core Crossrail working hours, which are between 0800 to 1800 on weekdays and 0800 to 1300 on Saturdays as specified in the Environment Requirements (Section 4 of Works Information Vol 2). Operations anticipated to cause disturbance are limited to these hours (or as specified within a Section 61 consent obtained by the Principal Contractor), in order to minimise disruption to local residents and the general environment.

Any extensions to these hours will require further dispensations to be approved by CoL.

It is currently envisaged by C503 that all tasks will be worked from 8:00 to 17:30, Monday to Friday. However, it is likely that Crossrail will request work to 18:00 and weekend working, if the relevant consents can be obtained by the Principal Contractor (TBC). The programme estimates in section 1 are based on this likelihood.

MOLA will provide a site attendance when required during these specified periods, so that all the relevant Principal Contractor's ground works defined in this method statement are monitored and recorded.

5 Fieldwork Methodology

*It should be emphasised that the levels quoted for archaeological deposits are **general predictions** based on the earlier fieldwork on the site. They are **likely to vary considerably** across the site, with both depths of modern disturbance and the thickness of archaeological features. Therefore, it is **not possible to give precise levels** for removal of modern overburden to the surface of archaeological deposits, or for the base of archaeology. Approximate levels are given here, to the nearest 0.1m, but in practice the levels at which archaeological deposits are present will need to be **determined by the MOLA supervisor** during the course of the work. See also the caveats about the lack of data for predictions at MHS2 in section 1.5.4.*

5.1 Detailed Excavation Methodology for the Utilities Corridor

To be read in conjunction with sketch section Fig 6

5.1.1 Assumptions:

- There is an area of potential higher archaeological survival along the northern edge of the corridor. This is unlikely to be present along the whole of corridor, but is *predicted* to be *c* 0.6m wide, top *c* 3.0m below ground level (bGL) = 109.3m ATD, *c* 1.5m deep (down to level of more extensive survival). This predicted upper level (where present) is 100mm above the construction level for the first props.
- Extensive archaeological survival is predicted to be from *c* 4.5m bGL (107.8m ATD), down to *c* 5.3m bGL (107.0m ATD) along the majority of the corridor, but deeper in the western approx. 15m (Walbrook channel), and in the vicinity of archaeological Trial Trench 2 – depths uncertain, perhaps down to at least approx. 6m bGL (106m ATD) at western end.

5.1.2 Overall methodology

The following methodology forms an outline of intentioned methods, but as with the earlier phase (GL1 to GL8) will need to be adapted to both the deposits present and practical engineering requirements, not least shoring.

- Initial ground reduction to the construction level for the first prop will be monitored as a General Watching Brief (ie monitoring and recording of deposits exposed by the ground reduction, see 5.2). See Phase 1 in 5.1.3.
- The area of higher survival against northern side of the corridor will be excavated and recorded as a Targeted Watching Brief (ie localised archaeological excavation and recording during construction work, see 5.3), following a safe distance behind initial machining in a rolling programme. See Phase 4 in 5.1.3.
- Spoil removal is the main limiting factor. Therefore, the archaeological excavation will proceed by areas: cells between the props, or groups of cells.
- Any areas that are not being excavated will be used to place spoil, skips etc.

5.1.3 Planned sequence *(see* Fig 6*)*

Phase 1. **C503 excavate (mostly modern material) down to construction level for 1st props:** 3.1m bGL (109.2m ATD) – **MOLA will monitor this as a General Watching Brief**, to record the predicted upper 100mm of archaeology (marsh or dump layers) against the northern side of the corridor. *Reduction of at least the lower 0.5m of modern material will require a smooth-bladed ditching bucket (where practical).*

Phase 2. **C503 insert 1st level of props.**

Phase 3. **C503 excavate modern material in southern approx. 1.4m width of the trench**, under archaeological supervision, using a smooth-edged ditching bucket. This will leave the predicted 0.6m-wide section of higher archaeology (see Phase 4) on the northern side of the trench. The material will be removed to a depth of approx. 1.0m to leave a stable face of the adjacent archaeology. Where the archaeology only survives at lower levels, it may be possible to remove more modern material, to a maximum of 1.5m (4.5m bGL; 107.8m ATD).

Phase 4. **MOLA record and excavate the area of higher archaeology** down to 4.5m bGL (spoil can be thrown to deeper side for removal in the next phase).

The above two 'phases' will be ***conducted as a rolling programme*** *along the corridor (cf a* ***Targeted Watching Brief****), as soon as there is a sufficient safety distance between machine operations and safe areas for archaeological work (barriered off from machining area).*

Phase 5. **C503 excavate remaining modern material down to surface of archaeology:** to level of more extensive survival AND that required for insertion of the second set of props: approx. 4.5m bGL.

Phase 6. **C503 Insert 2nd level of props**

Phase 7. **MOLA excavate and record Roman features (pits, ditches, etc) cut into/above dump layers**

Phase 8. **MOLA excavate and record the *northern half* of the Roman dumps** (Walbrook reclamation ?), to produce a composite east–west section.

Predicted up to 0.4m thick in places (perhaps more at W end ?), *others less or none*

Phase 9. **MOLA (or C503 where deep) excavate the *northern half* of the alluvium** (Walbrook ?), continuing the composite east–west section. **Visits/recording/sampling by Geoarchaeologist** (*may be one 'visit' per stage; it would be better to have as many sections open as possible when the Geoarchaeologist visits, preferably in continuous sections*).
Where more than *c* 1.2m deep or unstable, to be done in 2+ stages (and/or hand augering).

Predicted up to *c 0.4m thick over at least 50% of length, elsewhere up to 1.2m (western approx 15m and area of Trench 2), perhaps more at western end.*

If Phases 6 or 7 reveal structures/features (eg base of revetment ?) etc in the alluvium which **continue into the unexcavated half**, then either locally excavate the 'other half' in that phase, OR as watching brief in Phase 10.

Phase 10. **Handover to C503** for removal of rest of alluvium and natural geology (*possible MOLA watching brief, as above*).

5.1.4 Generic archaeological excavation methodology

- For stratified cut features or structures, occupation and reclamation deposits, land surfaces, etc in Phases 7 to 8 (see 5.1.3 and Fig 6): hand investigation, sampling and recording will be undertaken. This will use hand tools, such as trowels, shovels, mattocks, hoes, and dumpy level.
- Homogenous marsh/alluvial/dump deposits in Phase 9 (see 5.1.3): where these are shallow, it may be more practical to hand excavate the limited area. Where initial hand excavation shows that these are deep enough: grading down carefully by machine (supplied by C503, see 21.8.1), using a toothless ditching bucket, under archaeological supervision. This would be undertaken in individual spit depths of up to 300mm each (depending on the nature of the deposits), working along the length of the trench. If further archaeological horizons, artefact scatters, cut features etc. are present within these deposits these will be excavated by hand, recorded and sampled. The methodology will be reviewed on site and revised where necessary, in the light of ground conditions encountered and in discussion with the Project Archaeologist.
- In the earlier GL1 to GL8 excavation, practical requirements of trench width and limitations of the 'grab bucket' excavator resulted in such homogenous deposits being partly hand excavated and recorded along one side of the trench, and machine excavated under archaeological supervision in the other half.
- Where it is not possible to reach the base of the alluvial sequence in Phase 9, for practical, logistical, or programming reasons (to be determined by the Project Archaeologist), hand augering may be used to investigate the base of the sequence.

5.2 General Watching Brief (GWB) Methodology

5.2.1 Site-specific methodology

General Watching Brief is required at the commencement of all tasks (see section 1), and will involve the removal of modern material (for example, any concrete slabs and modern buildings or overburden) conducted by C503 under archaeological supervision. MOLA will monitor the initial ground reduction to identify and record the top of the surviving archaeology.

It is also required to monitor and record excavation of the **two headings** (see section 1), where:

- Only the ongoing face of the heading will be available for recording (the sides and base being obscured by shoring etc).
- The MOLA archaeologist will inspect the heading face at intervals and record the deposits present, and its location along the heading, and recover any finds that may be present.
- The watching brief will be conducted with as little disruption to the heading works as possible, but may well cause some small delays. Ideally this would be arranged in breaks between the miners' works, but without the MOLA staff being alone in the heading tunnel (and with the top man and bottom man being present).
- A system will be set up with the contractors digging the heading for any artefacts seen by them are passed to the archaeologist, and can be assigned to an individual 0.5m section.
- If timber piles from Roman revetments or a bridge were present (uncertain), they may extend through the roof and floor of the heading (and/or be present in a side wall). IF

present, MOLA would record these as well as possible in the circumstances. They would also need to be sawn/cut off for removal and retention (if required) by the archaeologist, this would be arranged with the Principal Contractor and miners.

5.2.2 Generic methodology

A general watching brief consists of a basic monitoring presence to observe the works carried out either by the Principal Contractor or their sub-contractor without constraint on their working methods (Crossrail 2009 Archaeology Specification for Evaluation & Mitigation (including Watching Brief) CR-PN-LWS-EN-SP-0001, version 3). This includes making a basic record of notes, measurements, drawings and photographs consistent with an observation role: eg depth, character, date and survival/truncation of deposit sequence, height of natural geology. Monitoring and recording during a general watching brief will generally be made by observation from ground level. During a general watching brief MOLA staff will only enter the trench or area of excavation by agreement with the Principal Contractor or their sub-contractor (providing that there is proper access and that it is safe to do).

The work will be conducted with hand tools, such as trowels, shovels, mattocks, hoes, and dumpy level.

In the event of *in-situ* human remains being uncovered during any of the GWBs, or if other potentially significant (but localised) remains are exposed, such that they cannot be recorded adequately under basic monitoring, then the status of the fieldwork event will be reviewed by Project Archaeologist, and it may be redefined as a Targeted Watching Brief (see 5.3). The presence of human remains are unlikely in the utilities corridor but are expected in the sewer shaft excavations (see 5.3). For the archaeological methodology for human remains see section 7.2.

This redefinition, if authorised by the Project Archaeologist, would permit additional resources in terms of staff and attendance to allow for more intensive recording. The decision to either excavate or remove any *in-situ* remains encountered in any structural test pits or service trenches at this stage will be made on an individual basis in conjunction with the Project Archaeologist.

5.3 Targeted Watching Brief (TWB) Methodology

Targeted Watching Brief is currently required as a method in all sewer shaft excavations and some phases of the utilities corridor excavation (see task table in section 1). See section 5.1.

Site-specific methodology for Targeted Watching Briefs at Liverpool Street

- **Removal of any concrete slabs and modern buildings or overburden** by PC under archaeological supervision will have been conducted as a **General Watching Brief** (see above), down to surface of any surviving archaeological deposits. For example, in all sewer shaft location, these deposits are expected to be pre-19th century buildings and burials of the Bedlam cemetery, predicted between *c* 1m and 1.5m below ground level (bGL).
- At this point, and continuing through subsequent excavation, the C257 MOLA Supervisor will **assess** any archaeological remains present and their significance (which dictates the subsequent response).

- It is expected from the previous archaeological investigation that a full sequence of post-medieval to geoarchaeological deposits will be present, overlaying or cut into the natural terrace gravels or London Clay.
    - If **moderate or high significance** archaeological remains are present (including, for example, burials, ditches, river channels, and structures), these will be investigated, recorded, excavated and sampled (as necessary) by C257 MOLA (using hand tools such as trowels, shovels, mattocks, hoes, and dumpy level). MOLA may request C503 to assist with excavation/removal of any extensive deposits, as appropriate.
    - In practice, it is expected that this will require MOLA to excavate and record the archaeology in the manholes/shafts, and the area around MHS1, until terrace gravels are reached, or low significance deposits have been recorded across part of the area, which may then eb removed by the Principal Contractor (see below).
    - If **low significance archaeological remains** are present, these will be recorded by C257 MOLA, and removed by C503 under similar conditions to a General Watching Brief (ie with archaeological monitoring, hand cleaning, investigation and recording, using tools as above).
    - Given limited size of these TWB working areas, this will require C503 to **stop work** until the TWB is completed.
    - Such archaeological work may continue to the base of the archaeological sequence (surface of the natural terrace gravels), or if underlying horizons are assessed as being only of low significance, work may proceed under similar conditions to a General Watching Brief (as above).
- The watching brief will **cease** at the **natural terrace gravels**, predicted to be at between *c* 5m to 6.5m bGL.

5.3.1 Generic TWB methodology

A targeted watching brief comprises the observation and recording of the Principal Contractor's or their sub-contractor's works with specific operations carried out under the supervision of a MOLA Senior Archaeologist. Targeted watching briefs are either carried out in areas where the density of archaeological features or deposits is not considered of sufficient significance to warrant investigation in advance of construction, or they may be carried out in areas where access prior to construction has been impossible and where, as a result, there is a possibility of unexpected discoveries (Crossrail 2009 Archaeology Specification for Evaluation & Mitigation (including Watching Brief) CR-PN-LWS-EN-SP-0001, version 3).

It should be noted that during a targeted watching brief, the Archaeological Contractor may impose constraints on, or require changes to, the Principal Contractor's or his sub-contractor's method of working to enable the archaeological investigation to take place alongside construction works. These constraints may include restrictions on the type of equipment used, the methodology employed, stopping excavation works to allow time for recording and the installation of temporary works or other attendances such as pumping out, in order that the archaeologists may enter the works excavations safely. In addition to man-made deposits, some assessment and basic recording of any naturally deposited levels will be necessary, eg alluvial deposits. This may require the attendance of a MOLA Geoarchaeology specialist to take samples of such deposits. Normally, if the remains are localised in a larger site, the Principal Contractor's works may continue in other areas (subject to a safe method of working and monitoring). It is expected that the Principal Contractor will make allowance in their work programme to take account of the delays that a targeted watching brief may cause.

The watching brief shall be carried out to archaeologically sterile ground, specifically, the River Terrace Deposits (noting that features such as pits or ditches will be cut *into* the terrace deposits).

During a targeted watching brief MOLA staff will, as a minimum, compile a basic record consisting of notes, measurements, drawings and photographs consistent with an observation role; eg depth, character, date and survival/truncation of deposit sequence, height of natural geology. If significant deposits are present, more detailed excavation and recording, corresponding more closely to full archaeological hand excavation, may well be required.

If potentially very significant (but localised) remains are exposed, such that they cannot be recorded adequately under the scope of the targeted watching brief, then subject to the Project Archaeologist's approval, additional archaeological resources and time may be required at that location (to allow for more detailed follow-up recording and perhaps limited excavation). Such work would be considered separately to the procedure for unexpected archaeological discoveries that fall outside the scope of the SS-WSI (Crossrail 2009, section 7.A2 and section 14.2 of this document).

5.4 Recording Methods

The archaeological remains will be recorded to best practice standards, in order to achieve archaeological objectives. The site recording will include as a minimum:

- The written record of individual context descriptions on appropriate pro-forma sheets.
- The drawn record: including, plans and section drawings of appropriate features, structures and individual contexts (1:10 1:20 or 1:50). Isolated archaeological remains (artefacts) may be spot located in plan and a height provided where possible. Deposits which are regular in plan (pits and ditches) may be located though co-ordinates, annotated with dimensions, and may be recorded digitally.
- A stratigraphic matrix of the sequence of deposits and structures encountered in each trench will be produced.
- The photographic record: photographs taken with a digital camera of resolution of 12 megapixel or greater, providing similar resolution to a conventional 35mm SLR. The photographic record will include photographs of archaeological features, appropriate groups of features, structures, and quaternary deposits. Each photograph will be recorded on site using a proforma photographic record sheet, showing image number, area/test pit, context number(s), subject/description, direction of view, and date. In addition, appropriate record photographs will be undertaken to illustrate work in progress.
- Levels on plans, sections and other fieldwork records shall be related to OS datum.
- Other appropriate drawn and written records will be produced (for environmental sampling etc).

5.5 Survey and setting out method

MOLA will obtain from either the Principal Contractor or Crossrail's survey department the locations and values of the project datums in the area of the site.

MOLA surveyors will normally survey to LSG grid MOLA's local baselines, or the features, as appropriate to the remains encountered. If Crossrail survey control is not available, then they

will reference locations to OSGB36 co-ordinates, using GPS/GNSS, and these will then be converted to LSG. See also section 13.

In some circumstances, such as watching briefs, it may be appropriate and more efficient for the Principal Contractor's surveyors (if they are available) to survey any MOLA temporary baselines. This will be determined by liaison between MOLA and the Principal Contractor. MOLA will also obtain from the Principal Contractor or Project Archaeologist CAD plans to London Survey Grid of the area as-dug.

6 Environmental archaeology investigation methodology

6.1 Sampling strategy for Broadgate Ticket Hall

This sampling strategy addresses the whole archaeological project for the Broadgate Ticket Hall, Liverpool Street.

Sampling will be conducted taking into account the samples already taken in (albeit limited) parts of the site, with the aim of obtaining coverage of both the full area of the site and of different types and periods of features.

Such sampling would be targeted to establishing the environmental archaeology potential of deposits, eg by taking selected bulk samples. This allows the more detailed sampling described below to be undertaken in a more informed manner generally as part of the following main excavation phase of the archaeological project (where this is warranted).

6.1.1 Overview

The aim of this sampling is to evaluate the degree of preservation and range of environmental remains preserved within the archaeological deposits, assess their potential to address the overall site objectives and identify any additional research aims that might also be addressed by the archaeological deposits surviving on the site. Within the Crossrail Broadgate Ticket Hall site the focus of the environmental archaeology work will be on Roman extra-mural activity and deposits associated with the Walbrook, the Moorgate Marsh deposits, late medieval/post-medieval marsh reclamation and the likely post-medieval burials (*not predicted in the utilities corridor*). As the site lies within the area of the Moorfields Marsh, it is anticipated that there will be a geoarchaeological component to the work.

Selected Roman, medieval and post-medieval negative features, as well as any 'natural' deposits relating to past topography or burials (if present), will be targeted for environmental sampling, where suitable. Specifically, the work may potentially include the following types of deposit, if present and suitable:

- Cut features such as Roman or medieval drainage ditches and pits
- Walbrook alluvium and overbank flooding deposits
- Marsh deposits
- Reclamation dumps
- Burials (*not predicted in the utilities corridor*)

In general, sampling will be undertaken by the archaeologists excavating each trench. Given the semi-natural nature of the Walbrook channel and Moorfields Marsh deposits, however, a geoarchaeologist will be on call to visit the site, advise and where necessary record and take samples from selected deposits.

6.1.2 General Methodology

For each trench the Project Manager(s) and Site Supervisor(s) will ensure the following with the support of a MOLA Environmental Archaeologist / Geoarchaeologist:

- That a range of suitable samples are collected from the site for the recovery of an appropriate range of environmental evidence that will contribute to the research strategy that underpins the requirement for excavation and recording.

- That the environmental procedures outlined in the *Archaeological Site Manual* (MoL 1994) and *Environmental archaeology: a guide to the theory and practice of methods, from sampling and recovery to post-excavation* (English Heritage 2011) are followed.
- Wherever possible, any geo-archaeological or environmental sequences obtained (for example pollen) will be dated, for example with spot samples for dating.
- That general bulk samples, 40 litres in size (20L if waterlogged) will be the standard samples taken and that the processing methods are designed to recover a wide a range of materials from the same deposit in a single sample. In addition, as a number of post-excavation analytical techniques will be employed on the material recovered, a number of different sampling approaches will be required. These might include: gridded/spatial bulk samples, to sample horizontal stratigraphy where it survives (i.e. floor layers), the sample size will depend on feature; column bulk samples (*c* 2–20L) to sample ditches, deep refuse deposits and natural deposits; spot samples for dating; monolith and micromorphology samples to recover *in-situ* blocks of sediments or complex strata.

Sample	**Sampled by**	**Material**	**Processing**
Hand Collected	Archaeologist	Human Bone	Hand washing
	Archaeologist	Large/small mammal, bird, fish	Power-hosed
Bulk (general 40 litre sample)	Archaeologist	Large/small mammal, bird, fish, reptile, amphibian, marine molluscs, eggshell, plant macrofossils	Flotation or wet sieving
		Insects	Paraffin flotation
		Artefacts	Hand Washed
Column bulk (20 litre)	Archaeologist on advice of geoarchaeologist	Freshwater and terrestrial molluscs, ostracods	Disaggregated and wet sieved
Monolith	Geoarchaeologist	Sediments	Laboratory cleaning
		Pollen and Diatoms	Sub-sampled for external Specialist
Kubiena	Geoarchaeologist	Soils/complex strata	External Specialist
Spot/Grab	Archaeologist	Coprolites, unidentified organic materials	Specialist
	Geoarchaeologist	Pollen, diatoms, ostracods, forams, radiocarbon	Sub-sampled from auger hole cores for external specialists

- The sampling strategy will be monitored throughout the excavation and adapted in light of the preservation and the type of features encountered. A MOLA Environmental Archaeologist/Geoarchaeologist will undertake site visits to provide advice and additional advice will be sought from the EH Regional Archaeological Science Advisor when necessary. A MOLA Environmental Archaeologist will be present to discuss the sampling and results of any processing undertaken during any site visit made by the EH Regional Science Advisor and, if requested, by Kathryn Stubbs (Senior Archaeologist, Corporation of London, Planning Department).

- As a general policy, uncontaminated negative features will be bulk sampled and bone collected by hand. Horizontal stratigraphy, if it survives, will be sampled on a spatial basis where appropriate. Unstratified contexts, make-up layers and contexts thought to have a high degree of residual or intrusive material will not be sampled. Bulk samples may also be taken to recover artefacts such as evidence for metalworking and/or other industrial activity.
- If excavated by MOLA, human burials will be recovered individually and bagged on site. Samples will be taken for analysis of the abdominal area if the soil conditions are wet or moist. Control samples will also be taken by consultation with the appropriate Specialist. Cremations will be excavated in consultation with specialists.
- That the environmental procedures outlined in section 3.2, and in particular the following documents are followed if required and requested by the Project Archaeologist:
    - Archaeological Site Manual (MoL 1994)
    - Environmental archaeology: a guide to the theory and practice of methods, from sampling and recovery to post-excavation (English Heritage 2011)
    - Centre for Archaeology Guidelines. Human Bones from Archaeological Sites: guidelines for producing assessment documents and analytical reports (English Heritage (Mays S, Brickley M, and Dodwell N) 2004)
    - Human osteology method statement (Museum of London (ed. Powers N) 2008)

6.1.3 Sampling approach to main features anticipated

- *Human remains (not likely in the utilities corridor):* articulated burials (inhumations) will be recovered individually, with separate parts of the body (right arm, torso, left leg etc.) bagged separately on site. Where redeposited and/or disarticulated human remains are encountered, they will be lifted and labelled by context and retained for examination by the Osteologist. It is not anticipated that cremations will be present on this site, however if present, they will be subject to 100% sampling.
- *Cess/rubbish pit fills:* in general a 40 litre sample will be taken from each fill within the pit. If the fill is deep and homogeneous samples should be taken from the top, middle and base of the fill. The sample size may be reduced to 20 litres if waterlogged.
- *Fills behind Walbrook revetments*: If substantial dumps of refuse survive behind the riverside revetments where possible a section will be cut through the deposits and a sample column of continuous 10 to 20 litre bulk samples taken through the profile, respecting context boundaries. This sampling method allows any changes in the type of refuse dumped to be assessed throughout the profile.
- *Discrete rubbish dumps/middens*: a single 40 litre sample will be taken, if they are extensive these will be sampled spatially with smaller bulk samples (for example: 10–20 litres at 1m intervals), and if deep, at different depths, as there may be variations within the deposit.
- *Occupation deposits (sunken floors, cellars etc)*: as for midden deposits, but paying particular attention to corners and other areas where greater accumulation occurred. Where appropriate soil blocks for micromorphology will also be taken from these deposits.
- *Ditches/Linear cuts*: will be sampled at several locations along the length (40 litre bulk samples at intervals for macro-remains (plants, insects, molluscs) and 20 litres for waterlogged deposits). Any natural accumulations encountered within such features will have monolith samples taken (for study of sediments and micro-organisms eg pollen),

with an adjacent column of continuous bulk sample slabs, respecting context interfaces, for macro-remains.

- *Walbrook and Moorfields Marsh deposits:* examination and sampling of these deposits will be undertaken by the MOLA geoarchaeology team. A key requirement is for a section face to be cut or maintained through deposits of interest for recording and sampling. Sampling would typically consist of overlapping monoliths for off-site sedimentary examination and micro-fossils, with an adjacent column of continuous bulk sample slabs, respecting context interfaces, for macro-remains and grab samples for dating as appropriate.

7 Archaeological Science Strategy

Where necessary the strategy for sampling archaeological and environmental deposits and structures (which can include soils, timbers, animal bone and human burials) will be developed by MOLA in accordance with English Heritage and IFA guidelines. Advice will be sought from appropriate MOLA specialists and if additionally required from English Heritage. Subsequent on-site work and assessment of the processed samples and remains will be undertaken by MOLA Specialists.

If necessary, samples for absolute dating such as C14 or timber samples for dendrochronology will be submitted to nominated MOLA external laboratories. This will only be done with the prior approval of the Project Archaeologist where there are particular research objectives to be addressed by such dating. It may be necessary to date (eg radiocarbon) environmental sequences, such as pollen.

See 6.1 for the site-specific sampling strategy.

7.1 Specialist Strategy

An appropriate programme of ceramic dating and study of other excavated artefactual and environmental materials will be undertaken by MOLA Specialists as their contribution to the Fieldwork Report.

7.2 Excavation and Recording of Human Remains

Unlikely to be required for the utilities corridor or headings, but expected in MHS1 and MHS2-100, and uncertain in MHS2.

The required methodology for human remains is set out in detail in the SS-WSI and the MOLA Framework Method Statement (Technical Submission 2.4, section 4.6) and is not repeated here. It is anticipated that human remains will be present on this site, and therefore an exhumation licence has been applied for by C257 MOLA and received from the Ministry of Justice (see 14.4).

If human remains are present, the **Principal Contractor will be required to screen the burials from any public view, including views from above** – eg windows of buildings overlooking the site on Liverpool Street, Blomfield Street and Old Broad Street (see 21.8.1, also WSI Addendum 3.2.5).

Any *in situ* human remains will be recorded (cleaned, location recorded and photographed). The advice of a MOLA Osteologist will be sought where appropriate.

Any re-deposited, disarticulated human bones will be collected for possible further examination. At the end of the fieldwork, a MOLA osteologist will determine whether further examination of the disarticulated material is required, taking into account not only the condition and deposition etc of the bones, but any *in situ* burials excavated.

The soil from grave fills and cemetery deposits, even where hand excavated, has potential to contain human remains. Such soils will be visually inspected by MOLA staff, and will be stored separately by the Principal Contractor from other spoil. If deemed necessary by the Crossrail Project Manager, they will be subsequently taken by an exhumation contractor to remove human remains and rebury them in accordance with the burial licence.

It currently appears unlikely that soft tissue, sealed or unsealed lead coffins, sealed crypts, (or animal hair with potential for Anthrax spores), might be present. If they are encountered, work will stop immediately, the excavation area will be vacated, and the specific individual circumstances will be assessed. Work will not recommence until a new task specific risk assessment has been produced, and its requirements enacted (eg provision of task-specific PPE (see Risk Assessment 34), and method of safe removal and storage of remains).

7.2.1 Processing of Human Remains

Where detailed excavation of in-situ burials has been required, the following processing methodology will be employed:

- Treatment of all remains and samples will be to professional standards and in accordance with United Kingdom Institute for Conservation guidelines.
- Inhumations will be washed over a 1mm mesh using a spray hose. Any block lifted remains such as those of neonates, will be processed using a flotation tank with a 1 mm mesh to ensure complete recovery.
- The remains will be washed and packaged.
- Separate processing methods exist for cremated remains but it is not currently envisaged that these will be encountered during evaluation.
- The remains will be transferred to a purpose-built facility where they will be slowly air dried.
- The remains will then be packaged to archive standard under the direction of the Senior Osteological Processor. Human bone will not be marked.

7.2.2 Assessment Scanning of Human remains

Following processing as in 7.2.1, the following assessment scanning methodology will be employed:

- Inhumations will be assessed by a MOLA Human Osteologist. Assessment of all stratified deposits of human remains will be carried out according to English Heritage Centre for Archaeology Guidelines 2004 and MOLA standards (Powers, unpublished).
- Assessment data will be recorded in an Excel worksheet. For each context, the level of preservation and completeness will be estimated and a basic catalogue (by body area, not bone, ie skull, dentition, arms, legs etc) will be compiled.
- The remains will be rapidly scanned to provide basic demographic data. Remains will be classified as adult or subadult. Subadults will be subdivided into age

groups based on the timings of the eruption of the molar teeth. Basic observation on adult sex will be made.

- Gross pathological changes will be noted using a coding system compatible with that used at analysis.
- The minimum number of individuals within each context will be noted.
- A summary catalogue of disarticulated bone will be produced if appropriate, to aid in establishing the number of individuals within each trench.

8 Artefact Recovery and Conservation

Sampling strategies are developed on a site specific basis to meet the evaluation objectives stated in the Crossrail Site-specific WSI; and the following professional standards, in consultation with appropriate specialists;

- MOL Archaeological Finds Procedure Manual (2006)
- Relevant English Heritage Centre for Archaeology Guidelines eg on Environmental Archaeology (English Heritage 2011)
- Guidelines of the Society of Museum Archaeologists for the Selection, Retention and Dispersal of Archaeological Collections (SMA 1993).
- IFA Guidelines to the standards for recording human remains (2004)
- Minimum Standards for the Processing, Recording, Analysis and Publication of Post-Roman Ceramics produced by the Medieval Pottery Research Group Occasional Paper 2, (Slowikowski, A, Nenk, B. and Pearce, J 2001)

In general all material from stratified archaeological deposits is retained unless it is clearly residual or part of a large but routine assemblage, in which case samples of both typical and diagnostic items are retained.

Due allowance will be made for occasional specialist attendances which may be needed on and off-site to complete the investigation to the appropriate specified standard. These would only be called upon on a case-by-case basis, if significant structures or strata are revealed. Such attendances may include artefact conservation, photography, surveying, environmental sampling, finds assessment, geoarchaeology and scientific dating. MOLA has a full range of in-house specialists and can therefore deploy such resources at short notice, if needed, e.g. to advise on sampling strategies.

All finds and samples will be treated in a proper manner and to Museum of London standards. They will be exposed, lifted, cleaned, conserved, marked, bagged and boxed in accordance with the guidelines set out in the United Kingdom Institute for Conservation's Conservation Guidelines No. 2 and the Museum of London's Standards for the Preparation of Finds to be permanently retained by the Museum of London. Metal objects will be x-rayed and appropriate objects then selected for conservation.

8.1 Retention and Disposal

The finds retrieval policies of the Museum of London will be adopted. An adequate and representative sample of finds and deposits as advised by appropriate MOLA specialists who will be available to attend site as required (see 7.1).

9 Treasure

All finds falling within the definitions of treasure (Treasure Act 1996) shall be reported immediately to the Project Archaeologist and all subsequent works must be undertaken in accordance with the relevant legislative requirements as set out in the Environmental Requirements (archaeology) section of the relevant package Works Information.

To protect the finds from theft, MOLA shall record the finds and remove them to a safe place. Where recording and removal is not feasible or appropriate on the day of discovery, MOLA shall ensure, on liaison with the Project Archaeologist that adequate site security is provided by the Principal Contractor.

10 Deliverables and Submission Programme

MOLA shall provide the following reports in accordance with the C257 Contract and the Site Specific Written Scheme of Investigation (C136-SWN-C2-JLT-M123-00001) and Addendum (C136-SWN-T1-XAP-M123_WS098-00001) to the Project Archaeologist, or as otherwise instructed by the Project Archaeologist:

- Organisation of site monitoring visits, as and when requested by the Project Archaeologist.
- A weekly illustrated progress report to the Project Archaeologist containing the information required at part 5.10 of the C257 Contract.
- A short illustrated interim statement, with the addition of a composite section along the utilities corridor (as discussed between Mike Court and Nick Elsden on 26.02.13).
- A survey report within 2 weeks of the completion of fieldwork (only where MOLA have conducted the surveying).
- A fieldwork report will comprise a combined report with previous archaeological works undertaken for the utilities corridor for the Broadgate Ticket Hall.
- All levels cited in these reports should be Above Tunnel Datum (TD = OD +100m). All Co-ordinates cited in these reports should be based on the Crossrail survey grid, apart from archive copies which will use OS National Grid.
- MOLA will produce monthly progress photographs of archaeological work on the sites in this method statement to contribute to the 30 per month required across the whole of the C257 contract (see 14.3).
- MOLA will complete an SMR (OASIS) Summary Sheet for the works (ie one per fieldwork event). This Summary Sheet will be included in the Fieldwork Report if required.
- A Summary Report of no more than 500 words for the works shall be prepared by MOLA for submission to the Project Archaeologist for subsequent publication within the London Archaeologist Annual Fieldwork Round-up.

11 Document Control and Record Keeping

MOLA will access the Crossrail eB control system for transmitting reports and other deliverables. The primary report deliverables (as per 10) will be submitted to the Project Archaeologist in draft form (Version 1.0). Any tracked changes or comments added by the Project Archaeologist will then be incorporated and future dated versions (2.0 etc) will be returned via eB accompanied with the appropriate Checklist with Contractor's responses.

12 Archiving and Dissemination Method

The required methodology for off-site work including specialist method statements, assessment, analysis, publication and archive is set out in the SS-WSI and is not repeated here.

The site-specific publication and archive requirements will be agreed in conjunction with the Project Archaeologist in the light of the overall approach being developed for the Crossrail project (eg publication format and the extent to which individual sites may be grouped spatially or thematically; and degree to which the archive will be systematised and deposited as a single whole).

13 IT Capability – Digital Survey Recording, Data Capture and Curation

The required methodology for IT (including site survey) will be carried out in accordance with the C257 Contract and project standard survey requirements.

- For the GWB on the utilities corridor, it is assumed that the Principal Contractor will survey the as-dug location of the corridor, and that the plans will be passed to MOLA.
- Targeted Watching Briefs: the Principal Contractor's surveys, *if available*, may be requested to assist with the location of temporary base lines and the plotting of significant archaeological features where appropriate.
- Otherwise, in the excavation, and if required the targeted watching brief, MOLA Geomatics staff will survey MOLA's local baselines to Crossrail London Survey Grid co-ordinates, using Crossrail survey control (where available).
- In the event of MOLA Geomatics staff surveying without Crossrail survey control (*unlikely at Liverpool Street*), then they will reference locations to OSGB36 co-ordinates, through using GPS/GNSS.
- It is expected that the survey methodology employed will vary depending on the individual circumstances of each site, and the availability or suitability of using London Survey Grid control and co-ordinates.
- Upon completion of the fieldwork a Site Survey Report will be compiled for any surveying conducted by MOLA.

14 Additional Details

14.1 Standards and Guidance

See Section 3.2.

14.2 Unexpected and Nationally-important remains

In cases where unexpected discoveries cannot be preserved in situ, the response plan would revert to the normal Crossrail mitigation strategy of further archaeological investigation (preservation by record). The aim would be a rapid and commensurate response, targeted to just those remains unavoidably affected by the works. Recording and sampling methods would also be proportionate to the significance of the remains. Additional archaeological resources would be deployed to achieve this, in order to minimise any delay to the Principal Contractor's works. With flexibility and good communication it is often possible for the development works to continue in other areas while localised discoveries are recorded.

14.3 Progress Photographs

In addition to the archaeological photography specified in the SS-WSI and this Method Statement MOLA will submit a monthly professional photographic record of the progress of the archaeological scope of works. The photographs from the sites in this method statement will form part of the 30 required each month across the whole of the C257 contract.

14.4 Management of Consents

MOLA will liaise with the Employer and Principal Contractor regarding supply of any necessary information in support of required consents, eg road closures, Permit to Dig.

In general separate consents for archaeological works are unlikely to be required, the exception being human remains.

Burial licence 11-0110 to exhume human remains for archaeological purposes has been applied for by MOLA (variation letter (OPR/072/60, 21.09.11)) and received by MOLA in advance of the fieldwork. It has been forwarded to the Project Archaeologist for distribution to the Principal Contractor and any others who require them. A copy will be kept on site with the site supervisor. It covers **fieldwork up to 24th December 2014** on the whole Crossrail Broadgate Ticket Hall site.

15 Health and Safety

15.1 CDM Responsibilities and Reporting

- MOLA will be supporting and reporting to the Principal Contractor and to the Crossrail Project Archaeologist and CDM Co-ordinator:
- MOLA will be implementing archaeological designs in the SS-WSI prepared by the appropriate FDC consultant or the Project Archaeologist, therefore not acting as CDM Designer under the Construction (Design and Management) Regulations 2007.

MOLA will provide:

- A current health and safety policy, including defined operational procedures and managerial responsibilities, risk assessment/control, and measures to ensure that a safe method of working is implemented by the archaeological team on site, including appropriate advice and support from office-based managers.
- Adequate safety information in the MOLA site accommodation including the WSI, current Health and Safety Policy, Health and Safety at Law Poster, Data Protection Compliant Accident Book, and copies of Public and Employers Liability Insurance. The Supervisory Archaeologist is responsible for ensuring that this information is made available.
- Compliance with current legislation and HSE guidance; including the Construction Design and Management Regulations (CDM) 2007 as a Designer; and the Principal Contractor's Health and Safety Policy, safety inductions and fire and emergency procedures.
- Field staff qualified to operative level (or higher) of the CITB Health and Safety test and therefore eligible to carry a Construction Related Organisation (CRO) White Card for Archaeological Technician (Code 5363).
- Services of a Contract Manager and Supervisory Archaeologist to manage site investigations, including liaison with the Principal Contractor's Health and Safety Co-ordinator and Principal Contractor, attendance at site meetings etc. The Supervisory Archaeologist will act as principal liaison with the Principal Contractor.
- Services of the MOLA H&S Compliance Manager, and a professional health and safety consultant to attend site when required; reporting to the Supervisory Archaeologist, with any concerns or recommendations copied to the Principal Contractor's site manager
- A safety monitoring/reporting procedure. This should include accident reporting by the Supervisory Archaeologist to non RIDDOR and RIDDOR standard and any necessary liaison and follow-up of agreed safety actions with the Principal Contractor's site manager
- All necessary staff supervision, training and personal protective equipment (PPE) including tool box talks and safety inductions for new staff.
- Review and compliance with the Principal Contractor's Construction Phase Plan under the CDM Regulations 2007.
- Trained First Aiders, 'Where to get First Aid' poster and a First Aid kit (to be located in the MOLA site accommodation). The Principal Contractor will also have first aid facilities on site.

The Principal Contractor will provide:

- Overall control and supervision of the site and a safe working environment. The archaeological organisation will be unable to complete the specified works in any area where this is not provided.
- Technical services and attendances to the archaeologists as required. These services may include providing, site accommodation, plant for the excavation of trenches and other equipment such as handrails, shoring and ladders. These requirements are listed in detail in separate documents.
- Construction Phase Plan (CPP).

The CDM Co-ordinator will provide:

- Overall co-ordination of health and safety planning and management.
- A communications structure; including contact details for key personnel, meetings, reporting, etc.
- Supply of material information: eg services and contamination reports; any relevant requirements regarding rights of way, noise, hours of operation, etc.

15.2 Rail Sites

This is not a designated rail site.

15.3 Highway Sites

The majority of the works in Liverpool Street are on a highway, but in a closed-off worksite – MOLA will comply with any Principal Contractors regulations.

15.4 Health and Safety Reporting

Adherence to health and safety procedures will be monitored by the MOLA Health and Safety Compliance Manager, Contract Manager, and Site Supervisor. The H&S Compliance Manager will attend site for regular monitoring visits and, on each occasion, will supply a report on the archaeological work, containing any necessary health and safety recommendations. This will be forwarded to the Principal Contractor's site manager. Where appropriate to the scale of work, regular on-site progress meetings will be held between MOLA, the Project Archaeologist and the Principal Contractor at which any safety issues may be discussed, agreed and actioned.

15.5 Liaison with Principal Contractor

The MOLA supervisory archaeologist will act as the principal point of contact with the Principal Contractor's site manager throughout the periods of site investigation. Contact details will be exchanged. The supervisory archaeologist will be supported and advised by the MOLA project management team as needed.

15.6 Behavioural Safety BMOS

Mobile phones, personal CD players, i-pods and similar will not be used by MOLA staff in archaeological trenches or areas of work. Smoking and naked flames are not permitted in the trenches or areas of work. Alcohol is not permitted on site. This aspect will be monitored by the MOLA Supervisor and H and S Compliance Manager and reported on in the progress report (see 4.3).

16 Emergency Response

16.1 Emergency Preparedness & Response Plan

MOLA staff will comply with the Principal Contractor's Emergency Plan.

An Emergency Preparedness/Continuity Plan is has been prepared by MOLA and submitted to Crossrail for approval.

A General Emergency Preparedness Plan (EPP) was prepared within the MOLA Health and Safety Plan for C257 – Document Number: C257-MLA-X-XWI-CRG02-50003 v2. This should be referred to for generic emergency and accident issues.

Site-specific issues are as follows:

Employers Incident Response Contact	Crossrail Incident Response Desk – 020 8197 5000
Principal Contractor Incident Response Contact	• Martin Lloyd, VCUK Site Supervisor Mobile: 07 816 515 57
MOLA Incident Response Contact	• Elaine Eastbury, Project Manager eeastbury@museumoflondon.org.uk Direct Line: 020 7410 2237 Mobile: 07 730 646 063 or • Nicholas Elsden, Assistant Project Manager nelsden@museumoflondon.org.uk Direct Line: 020 7410 2282 Mobile: 07 872 127 296
Local A&E location	*Full A & E at:* The Royal London Hospital Whitechapel Road London E1 1BB Telephone 0207 377 7781 Tube: Whitechapel (Hammersmith and City and District Lines) *Minor A& E at:* St Bartholomew's West Smithfield Street, EC1 Telephone 020 7377 7000 Tube: St Paul's (Central Line)

16.2 Training

MOLA provides Safety Training for its staff as in Section 4.2.

The MOLA Senior Archaeologist will attend all emergency training/inductions on Preparedness/Response Plan provided by the Principal Contractor.

16.3 Emergency & Accident Equipment

- MOLA Archaeologists when working singly on the watching brief tasks will carry a single person First Aid Kit and mobile phone.
- During larger tasks a first aid box will be located in the archaeological office on site.
- It expected that the Principal Contractor will also provide basic first aid facilities on site.

16.4 Monitoring & Testing

MOLA staff will comply with Crossrail requirements.

16.5 Emergency & Accident Incident Reporting

All accidents and emergencies must be reported to the Principal Contractor, who will call the emergency services, if required.

Principal Contractor (C503 VCUK) Incident Response Contacts:		
Contact	Name	Telephone Number
VCUK H&S Manager & Emergency Manager	Tony Taylor	07816 517 070
VCUK Site Supervisor	Martin Lloyd	07816 515 557
VCUK Environmental Manager	John Dwyer	07884 114 727
VCUK Utilities Manager	Robert Scheele	07816 515 324
VCUK Project Manager	Doug Pybus	07794 216 054
VCUK 1-14 Liverpool Street Office	Charmaine Myers	0207 947 9658

They will also be reported to the Incident Report Desk, call: 020 3197 5000. In critical situations, MOLA staff will call for an ambulance immediately, and then inform the site manager.

All accidents and emergencies must be reported to the following personnel at Crossrail and MOLA:

- Jay Carver, Project Archaeologist, Crossrail Central, Crossrail Ltd, |25 Canada Square | London E14 5LQ

  DD 0203 229 9258, Int 2258

Mobile 07870 191 705

- Projectwide CDM Co-ordinator, Crossrail Central, Crossrail Ltd, 25 Canada Square, London E14 5LQ

  Mobile 07718 861941

- George Dennis, Senior Project Manager, Museum of London Archaeology, Mortimer Wheeler House, 46 Eagle Wharf Road, London N1 7ED

  DD 0207 410 2200, Int 2256

- Ian Grainger, H&S Compliance Manager, Museum of London Archaeology, Mortimer Wheeler House, 46 Eagle Wharf Road, London N1 7ED

  DD 0207 410 2200, Int 2255

17 Environmental Management

The archaeological works will be carried out whilst the Principal Contractor is in possession of the site. MOLA will therefore request a copy of the Principal Contractor's Environmental Management Plan prior to commencement and will supply any necessary inputs with regard to MOLA works. MOLA will comply with the Principal Contractor's Environmental Management System as documented in their Environmental Management Plan, and contribute to their EMS reporting if required.

If any remedial action is needed, eg controls for dust, water, noise or controlled waste, this will be agreed with and undertaken by the Principal Contractor as part of the required attendances (see 15 and Appendix: 21.8.1). In addition an updated MOLA corporate Environmental Management Plan is currently being prepared for submission to Crossrail.

The nominated environmental person is: Alison Telfer, atelfer@museumoflondon.org.uk, 020 7410 2276.

17.1 Contamination

MOLA will comply with the Principal Contractor's requirements in relation to any contamination issues. MOLA staff will not disturb or damage asbestos, or undertake asbestos removal from a building, structure, or buried material. If asbestos is found the Principal Contractor will be responsible for having it dealt with by a licenced contractor.

C503 have stated that the only issues identified are from human remains and Leptospirosis.

17.2 Water Disposal

The Principal Contractor is responsible for disposal of any ground water pumped from the trenches or other excavations, in accordance with their environmental management plan, with which MOLA will comply.

17.3 Site Waste Management Plan

MOLA staff will adhere to the Principal Contractor's site waste management plan.

It is anticipated that very little waste will be removed from the site from the archaeological works, but any produced will be disposed of by the Principal Contractor in accordance with their Waste Management Plan.

17.4 Vehicles/Motorised Equipment

MOLA staff will liaise with the Principal Contractor to provide safe access and parking for MOLA vehicles if required to attend site. The vehicles are compliant with Crossrail requirements.

All deliveries must be booked 24 hours in advance with:

- Andreas Michael, 07 917 068 774, andreas.michael@vinciconstruction.co.uk

NAME	VEHICLE REG NO
M Cox	KC54 XTZ & DY59 YWB
A Chopping	KC54 XTZ & DY59 YWB
G Spurr	KC54 XTZ & DY59 YWB
B Saunders	EA55 NBJ
W Reid	EA55 NBJ
S Jones	KC54 XTZ & DY59 YWB
C Drew	KC54 XTZ & DY59 YWB
M Burch	KC54 XTZ & DY59 YWB
V Yendell	KC54 XTZ & DY59 YWB
CONTACT (All)	**020 7410 2200**

17.5 Other Requirements

MOLA staff will always be courteous with any members of the public they have dealings with.

18 Quality Assurance Plan

An updated Quality Assurance Plan has been prepared for submission to Crossrail in accordance with the format specified at part 5.4 of the C257 contract. Records will be kept and supplied to Crossrail in accordance with procedures set out in Crossrail Specification CR-PN-LWS-EN-SP-00001, as amplified by the SS-WSI. The MOLA responsible procurement representative is Dawn Jackson, who is a member of the Senior Management Group.

19 Community Relations

19.1 General

MOLA will co-operate with the Principal Archaeologist and Principal Contractor regarding any notified community relations issues in relation to the Construction Community Relations Strategy Framework as defined in the Works Information.

19.2 Confidentiality

MOLA will in the first instance refer any media enquires or community relation issues to the Crossrail Helpdesk and the Project Archaeologist.

All MOLA staff working on Crossrail projects will be instructed before commencement to adhere to the confidentiality clause (Conditions of Contract 19.2, and Works Information vol. 2 – 9.7) that they **must not disclose information about any Crossrail project to the public, media or other parties (including social networking sites); either before, during or after working on a Crossrail project**. This instruction will be repeated at toolbox talks on a regular basis on site.

20 Responsible Procurement

An updated Responsible Procurement document was submitted to Alison Jackson, Crossrail on 15th January 2013.

21 Health and Safety Method Statement

21.1 Introduction and Purpose

21.1.1 Project Background

Archaeological investigations are to be carried out on this site by Museum of London Archaeology (MOLA). The requirements are set out in the WSI and WSI Addendum (see section 1).

21.2 Scope of Document

This Method Statement sets out the specific MOLA safe methods of working to be applied to the tasks listed in section 1 of the method statement, above.

This method statement has been developed in conjunction with the Principal Contractor, who will be responsible for ensuring that the archaeological works may be carried out as specified.

21.3 Responsible Persons and Site Management

21.3.1 Site Management

The MOLA Senior Archaeologist/Site Supervisor will ensure that a copy of the MOLA Welfare, Health & Safety Method Statement is made available to the Principal Contractor at the site. Where further changes or additions to the WH&S Method Statement are required and agreed these should appended to the site master copy by the MOLA Senior Archaeologist/Site Supervisor.

All changes to the WH&S Method Statement will be signed off by the Project Archaeologist, Crossrail H & S Advisor, MOLA Senior Contract Manager and MOLA H&S Compliance Manager.

21.4 Scope of Works

21.4.1 Proposed archaeological works

The scope of archaeological works is set out in section 1 of the method statement, above.

21.5 Methodology, Programme and Sequence

The overall programme is set out in section in the table in section 1 of the method statement, above, and a detailed programme in section 4.6.

The first task to start is currently expected to be:

Targeted Watching Brief in the area around MHS1: 3rd June 2013 (TBC).

21.6 Health and Safety Control Measures

21.6.1 Site Access/Vehicle Movements

On arrival at the site, MOLA staff will sign in, establish contact with the nominated Site Manager (or equivalent) attend any inductions etc. in accordance with the required access procedure for the site (to be notified to MOLA in advance by the Principal Contractor). All MOLA staff working on site will carry identification and CSCS cards.

Safe access routes from the site gate to work Areas and any offices and/or facilities will be erected and maintained at all times throughout the course of the archaeological monitoring of the works by the Principal Contractor.

21.6.2 Services

The location and making safe of live services before or during archaeological works is the responsibility of the relevant Principal Contractor in control of the site. MOLA staff will exercise care and due diligence and report any discovery of unexpected services or other ground hazards promptly to the Principal Contractor, Project Archaeologist and MOLA H & S Officer.

MOLA will comply with any **Permit to Enter or Penetrate/Dig** procedure operated by the Principal Contractor.

21.7 Safety of Excavations

21.7.1 Entering the trenches during Excavation and watching briefs

- MOLA staff will not enter any excavation until the Principal Contractor has issued a **Permit to Enter** confirming that it is safe to do so and that there is safe access/ingress to the archaeological investigation areas. The Principal Contractor will also ensure that the excavations are maintained in safe condition for the duration of the archaeological investigation. The Principal Contractor will supply attendances as required in 21.8.1.
- MOLA Staff will not enter a shaft/trench if it is declared unsafe by the Principal Contractor.

21.7.2 Shoring

- Where required, a trench will be shored in a suitable manner by the Principal Contractor and safe access arranged.

21.7.3 Confined Spaces

- All tasks, including the utilities corridor, headings and shaft excavations (including the larger area around MHS1), will be designated **confined spaces**.
- The **Principal Contractor** is responsible for **monitoring and control of Confined Spaces, and for provision of gas monitoring, rescue equipment** (10 minute personal escape sets, harnesses, first aid rescue stretcher, emergency hoist), and **other equipment or procedures required**. The appointed C503 (or their sub-contractor) 'top man' will carry out an initial assessment of the confined space atmosphere, and continually monitor at regular intervals, recording this as excavation progresses.

- The MOLA Site Supervisor will not start work until it is confirmed that C503 (or their sub-contractor) have **checked the rescue equipment (in particular hoists) on set up and conducted a daily visual inspection**.
- MOLA staff will **check the rescue harnesses** provided to them by C503 on a daily basis, before use.
- MOLA staff will not enter any trench designated as a confined space until C503 have issued a daily **Permit to Enter** (C503 Utilities Corridor MS).
- **No staff will enter an area when plant is performing a lifting operation**. See ***removal of spoil from trenches and lifting operations*** **in 21.8.1.1*.***
- All MOLA personnel will be trained and certified in confined space working and deemed to be competent. All personnel entering the excavation will be required to wear a harness and be trained in the use of escape sets. The number of personnel entering the excavation at any one time is to be kept to an absolute minimum, sufficient only to carry out the task in hand.
- A topman must be constantly present while staff are in the trench.

21.7.4 Additional Provisions for the Headings

As mentioned in section 21.7.3, the two tunnelled headings (see section 1) form confined spaces. MOLA is conducting a general watching brief only for the headings. As tunnels, they also have the following extra provisions in addition to those in section 21.7.3:

- There will be an 'intermediate top man' (or 'bottom man') at the heading entrance, in addition to the top man at the top of the entrance shaft (= shaft for manhole MHS2-100 or MHS2), with radio and light signal communication.
- MOLA staff will be briefed by the Principal Contractor, including the emergency light and other communications.
- Forced ventilation will be provided by the Principal Contractor.
- Shoring will be installed by accredited contractors in 0.5m stages as the heading advances, and inspected daily.
- The base of the heading will be concreted daily as the heading advances.
- 110v lighting will be installed; no working without lighting.
- A minimum 0.6m wide escape route will be maintained along the heading at all times.
- Casualty evacuation will be either by a plank laid on the spoil truck, or a rescue stretcher (to be available at all times).
- There will be secondary emergency lifting devices for individuals at the entrance shaft/manhole.
- The following specific emergency procedures will be implemented:
    - The whole confined space will be evacuated in the case of:
        - Gas monitor alarm sounds
        - Casualty/accident
        - Flood
        - Fire
        - Lack of power supply for the lights

- ♦ Lack of fresh air supply
- ♦ Ground movement
- ♦ Other dangerous circumstances

○ Evacuation alarm can be raised by any member of the team using a red flashing torch within the heading or flashing of the heading lighting two times.

○ In the event of fire, the contractors will fight the fire *only for evacuation purposes*, with the RED-marked (water) fire extinguishers or fire blanket provided. ***MOLA staff are not trained to fight fires.***

○ An evacuation will be reported immediately to site management, and general emergency procedures will follow.

21.7.5 Machine Excavation

- The machined trenches/shafts will be monitored by MOLA Senior Archaeologist/ Site Supervisor, but will at all times be under the control of the Principal Contractor.

21.7.6 Hand Excavation

- Hand excavation will be limited to selected times/areas defined by the MOLA Senior Archaeologist/ Site Supervisor, with the agreement of the Principal Contractor, and will be properly fenced, demarcated and signed.

21.7.7 Lone Working

- The monitoring MOLA Supervisor will complete the necessary signing in procedures for each site visit and will also notify the Principal Contractor's Site Manager of their presence, which works are to be monitored. The MOLA Supervisor will only be providing an attendance to observe, monitor and record the defined Principal Contractors works and therefore will not be working alone. In particular the MOLA Supervisor will not attend works or enter excavations when the Principal Contractor is not present.
- As a minimum, a top man must be present for work in the confined space (see 21.7.3), and a top man and bottom man for the headings (see 21.7.4).

21.7.8 Contamination – General

- C503 have stated that the only issues identified are from human remains and Leptospirosis.
- If ground contamination is present or suspected, the Principal Contractor will implement the measures required to protect those affected by the works, including provision of suitable additional PPE and adequate welfare facilities for the changed situation (PPE in addition to that included in section 21.8.3 will need to be provided by the PC, rather than MOLA).
- MOLA shall be issued with all relevant contamination test results for above and below ground hazards by the Principal Contractor prior to commencement. Any necessary remedial action will then be agreed with the Principal Contractor as part of the H & S Plan and supplied as an attendance item (9.1 below). Wherever possible such action

must be undertaken by the Principal Contractor prior to MOLA commencement on site. If this is not done there may be operational constraints on the MOLA safe method of working that could restrict achievement of the archaeological scope of works set out in the SS-WSI.

21.7.9 Ordnance

Information previously provided by the C503 Principal Contractor (and provided to them in their contract) states that;

> The potential for unexploded ordnance to be present within the Superficial Deposits is discussed in detail in the Construction Phase Explosive Ordnance Threat Assessment volumes 1 and 2 provided for information in the Site Information. Volume 2 of this document: Royal Oak Portal to Pudding Mill Lane makes reference to Liverpool Street and states that:
>
> *"The risk of encountering UXO on this route is considered possible, based on the level of bombing in the region and the items found post-WWII. However, given the active region, the possibility of UXO existing is considered remote.*
>
> […] for the Works at Liverpool Street Station, the Baseline Statement relating to unexploded ordnance is:
>
> - Unexploded ordnance will not be encountered during the construction of the Works.

MOLA staff shall comply with the PC's rules. If Ordnance is unexpectedly found the MOLA Supervisor shall inform the PC immediately and withdraw to a safe place outside the area designated by the PC.

21.7.10 Site Rules

- All MOLA Staff will comply with the Principal Contractor's site rules and with the MOLA single person watching brief rules (when applicable).

21.8 Planning and Resources

21.8.1 Principal Contractor's Supply of Attendances

The site specific requirements for services, facilities and attendances to be provided by the Principal Contractor, to enable MOLA to undertake the defined archaeological works are set out above. Those items in **bold (21.8.1.1) are likely to be required** for these sites, depending on site conditions, which will be reviewed on site by the MOLA Supervisor in conjunction with the Principal Contractor's nominated Site Manager (these requirements will be communicated to the Principal Contractor in the event that they are needed):

21.8.1.1 <u>Likely to be required</u>

- ***general site security*** including hoardings, gateway, warning notices, etc; to create a secure site perimeter, sufficient to prevent unauthorised access. If the Principal Contractor has retained security guards, it is recommended that the archaeological investigation areas be added to their schedule for regular patrols, particularly out of hours.

- ***specific site security***: it will be necessary to separately secure individual archaeological trenches via a physical barrier (such as Heras fencing) as the trenches are located in public areas. Secure storage (eg lockable tool store/hut) is required for finds, samples, and tools and equipment (and any human remains: *not likely in the utilities corridor*), other at the worksite in Liverpool Street.
- ***providing safe access*** to the site and the specified archaeological investigation areas via separately identified pedestrian routes, signing, safety guard-rails, secure ladders etc. This includes segregating these areas from any vehicles and plant operating nearby eg via a robust physical barrier.
- ***adequate ventilation and protection from noise, fumes and dust where plant is in use, especially within confined spaces and standing buildings***
- ***managerial services*** – nominated points of contact for Principal Contractor and other key members of development team.
- ***site accommodation and welfare facilities with electricity and water.*** To include furnished main base cabin as work space; separate male/female changing areas, toilets and washing facilities; plus additional steel cabin for secure storage of MOLA PPE, equipment, camera and paperwork and finds. It is estimated that accommodation etc **for 4 to 7 people** will be required, depending on phase of fieldwork.
- ***removal of spoil from trenches and lifting operations***. Equipment (eg hoists/machine) will be operated by a suitably qualified person supplied by the Principal Contractor, and checked at the intervals specified in the Principal Contractor's method statement/risk assessment for the use of the equipment. Should mechanical or electrical hoists be used, the area in which the hoist is in use must be clearly demarcated. **MOLA staff will leave the area before the bucket is raised or lowered (and in the interval between these operations) and not re-enter until completed (in accordance with MOLA H&S Policy).** The PC will supply a banksman to control plant at all times and an experienced slinger/signaller to control the lift to ensure that the bucket is not re-lowered or suspended over the trench while staff are working below in the trench. The PC will ensure the provision of only certified lifting equipment and implement an approved Lifting Plan.
- ***transport/mounding/storage of spoil*** from archaeological investigation areas. This includes removal from site, if necessary.

  Any spoil which may contain human remains will be stored separately and dealt with by an exhumation contractor. Such spoil will also need to be screened from public view both during transportation and temporary storage. *Unlikely to be required for the utilities corridor*
- ***temporary roofing and side screening to archaeological excavations where burials are exposed*** (eg monoflex on scaffolding frame or similar) in order to screen any human remains from public view, including views from above – eg windows of buildings overlooking the site on Liverpool Street, Blomfield Street and Old Broad Street (see WSI Addendum 3.2.5). This will need allow sufficient light through for archaeological work (eg translucent plastic sheeting/tarpaulin). The roof needs to have adequate water drainage and ventilation and temporary openings will need to be incorporated into the design to enable the safe removal of spoil from the trench. Any areas adjacent to the trench where spoil containing human remains may be visible from surrounding buildings should also be screened from the public gaze. *Likely to be required in the shaft works but unlikely to be required for the utilities corridor*
- ***site preparation and clearance***. Removal of structures, vegetation, rubbish, spoil heaps, demolition materials, slab, modern obstructions, infill, made ground, etc. as

required, prior to and during the archaeological investigation. The majority will be mechanical excavator, under archaeological supervision, but occasional hand work by labourers may be needed (eg clearing individual obstructions or removing spoil from investigation areas if the machine cannot re-enter). *Likely to be required in the shaft works, particular MSH1 where underground brick and concrete structures have been identified, but unlikely to be required for the utilities* corridor, where obstructions have already cleared and broken out.

- ***supply of plant and equipment***; as per the C503 MS; supplied with driver, toothed digging bucket and toothless ditching blade. Other plant such as ~~dumpers, compressor/breakers, and~~ pumps may also be needed.
- ***accreditation and supervision of operatives, plant and equipment***, including supply of sufficient qualified banksmen and slinger/signallers to control plant movements and lifting, and adequate certification for plant and all operatives.
- ***temporary support***: design, installation and maintenance of appropriate temporary support to excavations, where deeper than *c* 1.2 m (or as required in unstable ground). This will be via benching/battering back and/or shoring (the sides of the utilities corridor are secant pile walls), depending on a depth and ground conditions.
- ***other safety measures in deep excavations*** Air quality will be monitored and rescue facilities and equipment will be provided in any areas defined by the Principal Contractor as a **confined space**. Beyond a depth of 1.2m within such areas gas monitoring equipment will be required to ensure appropriate air quality for those working there.
- ***locating and making safe any live services or hazardous substances*** (above or below ground): preliminary services searches should be carried out by the Principal Contractor via the statutory undertakers etc, plus on-site inspection and testing where required. Where there is reason to believe from previous uses that the ground or adjacent buildings may be contaminated the Principal Contractor should make arrangements for advance inspection, sampling, testing and where necessary specialist remediation. The results of such surveys should be forwarded to MOLA *prior to commencement on site*. Any identified hazards will be addressed in the health and safety planning. Any unexpected hazards encountered during the investigations will also need to be made safe by the Principal Contractor before archaeological fieldwork may continue. In the event of the accidental disruption of a live service by archaeologists or sub-contractors under archaeological supervision the MOLA supervisor will inform both their project manager and the Principal Contractor and, when appropriate, call the relevant emergency number. Any remaining exposed services will be protected by the PC prior to the works starting. Any utilities remaining live in excavation areas will be clearly demarcated, safely segregated and suitably protected.
- ***development of a safe method of working***: archaeologists will not be able to work within excavations whilst attendances (such as installing temporary support or removing spoil) are taking place, and when demolition, construction or heavy plant activity occurs adjacent or overhead.
- ***110v. site lighting*** for the headings, and for access routes to excavations, plus individual task lighting within trenches (eg tripod-mounted spotlights) if required. The need for lighting depends on the depth, season and weather conditions or on ambient light level if working inside a standing building.
- ***First Aid:*** provision of First Aid facilities, and an emergency plan. On watching briefs with small numbers of staff, MOLA may not be able to supply a first aider. In that case, the services of the Principal Contractor's qualified first aider(s) may be required.
- ***pumping-out*****:** a suitable method to keep the trenches dry.

- ***technical advice*** to be available if required (eg via client or Principal Contractor's consulting engineer) re protection of adjacent streets and buildings, removal of obstructions, depth of excavation, live services etc.

21.8.2 Equipment

Equipment will be supplied by the MOLA equipment central store:

- First Aid Kit
- Hand tools, dumpy levels, stationary, grid pegs, digital camera, hand auger, etc.

Any specialised equipment such as power augers (not likely in the utilities corridor or shafts) will have certification of maintenance kept at MOLA headquarters.

21.8.3 Basic PPE

All MOLA staff are supplied with and will wear or use the following PPE where required and as appropriate:

Safety Helmets (EN397) – to Crossrail's PPE requirements for hard hats – blue for operatives, white for supervisors and orange for banksmen

Hi-visibility vests **and trousers** (EN471) - Crossrail's PPE requirements = **Orange**

Flame retardant overalls - Crossrail's PPE requirements = **Orange**

Ear Defenders (EN 352-3)

Safety spectacles (EN166)

Dust masks plain and valved (EN149 2001)

Gloves Nitrile and latex disposable, PVC, EN374

Safety footwear - steel toecap and mid-sole boots and Wellingtons EN345-47 (No riggers are allowed)

21.8.4 Additional PPE

The additional PPE listed below will also be required.

This PPE in addition to that included in section 21.8.3 will need to be provided by the PC, rather than MOLA.

- Confined spaces escape gear, eg harnesses, personal escape kits

21.8.5 Staff

See detailed programme in section 4.6.

MOLA will notify the Principal Contractor if more staff are required.

21.9 Briefing Arrangements

21.9.1 MOLA Staff Induction – New Starters

- All MOLA staff shall receive a full induction including Health and Safety on commencement of their first day of work with the organisation. A record of the induction is kept.
- The MOLA Supervisor will be briefed by MOLA Project Manager/Assistant Project Manager on all relevant aspects of work before work commences. This briefing will include all SS-WSI, Method Statements (PC's and this document).
- The MOLA Supervisor will be responsible for briefing any other MOLA staff on site before they commence work on all aspects of the work and documents.

21.9.2 Site Specific Inductions, Weekly Briefings and Tool Box Talks

- Where a site is under the control of a Principal Contractor (as in this case), MOLA staff will attend all initial site inductions and subsequent toolbox talks as required and managed by the Principal Contractor.
- Irrespective of whether the site is controlled by MOLA or a Principal Contractor, on larger projects eg those with more than 2 to 3 staff and of a week or longer duration, regular toolbox talks will be given by the MOLA Supervisor or other suitable member of staff using the CITB: construction site safety tool box talks manual. As a minimum requirement these talks will occur 1 to 2 times per week and be of 10 to 15 minutes duration.

21.10 First Aid

21.10.1 Trained First-Aid Personnel

Where possible with the small numbers of MOLA staff during watching briefs and small evaluations, there will be at least one MOLA Archaeologist who is a qualified First Aider (ie 3 day FA at work course) on site. If not, the Principal Contractor's first aider(s) responsible for the watching brief task(s) will be identified by MOLA at the Principal Contractor's Induction, and their services used if required.

21.10.2 First Aid Documents

The MOLA site safety documents will be located with the first aid kit in the site office/mess hut/canteen. The safety documents will include a minimum of:

- Current Health and Safety at Law Poster for display where legislation requires
- Accident Reporting Forms compliant with the Data Protection Regulations.
- MOLA Public Liability Insurance & Employers Liability Insurance for display
- Where To Get First Aid poster – to be displayed if required.
- Current MOLA Health and Safety Policy
- A copy of the site Welfare, Health and Safety Method Statement, extracted from the Site WSI, and modified as agreed during the course of the site.

21.10.3 First Aid Equipment

For 1 to 2 person watching briefs, a 'bum bag' will be carried by the MOLA Senior Archaeologist at all times. During larger scale work, a MOLA First Aid kit, of an appropriate size for the site, will be located in the site office/mess hut/canteen.

21.11 Accident, Incident, Near Miss and Environmental Incident Reporting

21.11.1 Reporting of Accidents/Incidents and Dangerous Occurrences

The Reporting of Injuries, Diseases and Dangerous Occurrences (RIDDOR) Regulations, 1995 sets out requirements for the reporting of certain types of accidents. RIDDOR notifiable accidents will be reported immediately by the MOLA site supervisor as specified in Section 16.5 of the method statement, above.

21.11.2 Documentation

In order to identify quickly problem areas and allow corrective action to be taken all accidents, dangerous occurrences and near misses, including those that do not cause injury, will be reported immediately to:

Principal Contractor's Site Manager

MOLA supervisor

MOLA H&S Compliance Manager

MOLA Senior/Project Manager

Crossrail Project Archaeologist

Crossrail Incident Response Desk

The site accident books/reporting forms for *both the Principal Contractor and MOLA* should be filled in giving details of the incident.

21.11.3 Investigation of Accidents and Dangerous Occurrences

MOLA will comply with the Principal Contractor's and Crossrail procedures.

MOLA will also initiate internal procedures as follows:

- Initial accident/incident report to MOLA Senior Contract Manager and Field Manager and action taken as appropriate.
- Non Riddors investigated by Senior Contract Manager/H&S Compliance Manager.
- Riddors investigated and reported on to Senior Management Consultant by MOLA H&S Compliance Manager.

21.11.4 Key Project Personnel

- George Dennis, Senior Project Manager, MOLA
- Elaine Eastbury, Project Manager, MOLA
- Nicholas Elsden, Assistant Project Manager, MOLA

21.12 Emergency Procedures – Site General

All MOLA staff will comply with the Principal Contractor's procedures as outlined at the Site Specific Induction.

21.13 Emergency Services Contact Details

The Principal Contractor will confirm the hospital location:

Full A & E is at:

The Royal London Hospital

Whitechapel Road

London E1 1BB

Telephone 0207 377 7781

Tube: Whitechapel (Hammersmith and City and District Lines)

Minor A& E at:

St Bartholomew's

West Smithfield Street, EC1

Telephone 020 7377 7000

Tube: St Paul's (Central Line)

The MOLA supervisor will dial 999 for fire, ambulance and police in the case of an emergency if the Principal Contractor's Site Manager or his deputy is not present on site.

21.14 Route to Hospital

The Principal Contractor will advise on route to hospital at their site specific induction (see C503 MS p 19).

22 Risk Assessments

MOLA RISK ASSESSMENT REGISTER

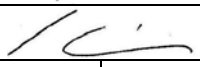
For Site/Task: Crossrail, Broadgate Ticket Hall Excavation and Watching Briefs (XSM10)		**Type: Excavation and Watching Briefs**	
Persons Affected	**No**	**Classification**	**No**
Employees	1-7	Experienced	1-7
Other workers	-	Inexperienced	-
Public	-	Disabled	-

Known and Suspected Hazards on site with Remaining Risk (mark as appropriate) and include numbered risk assessment in WSI

	L	M	H		L	M	H		L	M	H
1 Access	x			26 Dust				50 Glass Recording			
2 Ladders	x			27 Noise	x			51 COSHH: Sthil Lubricant			
3 Plant	x			28 Deep Excavations	x			52 COSHH: Sthil two stroke oil			
3a Plant (loading and unloading)				29 Power Tools				53 SHARPS (hypodermics)			
4 Dumpers	x			30 Vibration				54 Task Lighting (laniro etc)	x		
5 Scaffolding (inc Towers)	x			31 Vehicles (Driving)				55 Site Walk Over			
6 Excavations	x			31a Vehicles (Site)				56 Processing: Finds washing			
7 Work at height				31b Vehicles (loading/ unloading)				56a Processing: Environ samples			
7a Work at Height (Cherry Picker)				32 Lifting Equipment	x			56b Processing: Artefact marking			
8 Slips, Trips, falls	x			33 Plant (lifting)	x			56c Processing: Manual handling			
9 Underground services	x			34 Human Remains	x			56d Processing: Power hose			
10 Overhead Power Lines				35 Public Safety				56e COSHH: Paraffin (Processing)			
11 Electrical				36 Violence				57 Office Work			
12 Fire (inc LPG)				37 Chainsaw				58 DSE (Work Stations)			
13 Confined spaces	x			38 Power Auger (COBRA)				59 Young Person			
14 Breaking Out				38a Power Auger (Compressor)				60 Person Specific/Expectant Mother			
15 Hand Tools	x			38b Power Auger (Electric)				61 Light Duties			
16 COSHH: Spray paint				39 Hand Auger	x			62 Individual Stress			
17 Contaminated Land				40 Foreshore/water							
18 Weil's Disease	x			41 Adverse Weather	x						
19 Psittacosis				42 Spoil Mounding							
20 UXO				43 LPG(Butane)							
21 Asbestos				44 Waste							
22 Welfare	x			45 Storage							
23 Lone working				46 Animals							
23a Empty Premises				47 Non-ionising radiation							
24 Manual Handling	x			48 COSHH: Petrol							
25 Fumes/Gas				49 Spot Dating							

General Controls
Contracts Manager in overall charge of project is: Elaine Eastbury Tel: 020 7410 2237, m. 07730 646063
Supervisor(s) in daily charge of project is: Robert Hartle Tel: 02074102280, m. 07730646060
Number, training and experience of supervisors will be sufficient for the project
Supervisor(s) holds IOSH Supervising Safely Cert
All staff will comply with the: MOLA H&S policy, Principal Contractors site rules, all WSIs, Risk assessments, safe systems of work Permits to work.
All staff will have sufficient training and experience for the tasks they undertake or be under close supervision
All staff will be CITB H&S tested and hold a CSCS card appropriate to their profession
All staff will be fit to undertake their work
All staff will be inducted on first day of work, briefed on the WSI and the specific hazards and control measures attendant on their work on site.
The full site induction will be undertaken by the MOLA supervisor if no Principal Contractor present.
All staff will sign the induction and WSI register to confirm that they have received, understood and will comply with both.
Tool box talks/staff briefing will be conducted on the hazards and control measures on a regular basis (at least weekly or more frequently if circumstances dictate)
Appropriate PPE to be worn for each task.
Minimum site PPE (unless otherwise stated by supervisor): Steel Toe-cap/midsole boots, Safety helmet, Safety spectacles, Gloves, high visibility vest (orange) or jacket (orange)
First Aid kit on site, First aider/appointed person on site. Nearest accident and emergency unit located and contact numbers obtained

Competent Person(s) appointed to take action:	**All Risk Assessments seen by (initials)**	
MOLA Ian Grainger H&S Compliance Manager	**PM**	**Archaeologists**
MOLA Project Manager: Elaine Eastbury	**SA(s)**	
MOLA Senior Archaeologist: Robert Hartle	**Client**	
Principal Contractor –	**Contractor**	
VCUK H&S Manager & Emergency Manager: Tony Taylor	**Other**	
VCUK Site Supervisors: Martin Lloyd and Mick Groh		
Crossrail Site Manager		

MOLA RISK ASSESSMENTS		**SITE: Utilities Corridor, Crossrail Broadgate Ticket Hall, Liverpool Street, (XSM10)**	
APPROVAL (Name and Title)		**SIGNATURE**	**DATE**
Prepared by:	**R Hartle**		**15/05/13**
Approved by:	**I Grainger**		

RA N^{O}	ACTIVITY	Hazards	RISK	Risk Class L/M/H	N^{o} at Risk	Control Measures	Final Risk L/M/H	Action by
01	**ACCESS** general site access routes	Fall of persons from height, Fall of objects from height, Vehicle/plant collisions, Slips Trips falls	**Personal Injury, Equipment Damage**	**M**	Staff Contractors Visitors	Obey warning signs, verbal and written PC and traffic marshal instructions. Use pedestrian access gate. Keep to designated pedestrian routes. Be aware of plant and vehicle routes and movements. Do not obstruct pedestrian routes – be tidy. Report unsafe routes.	**L**	MOLA SA and staff PM Elaine Eastbury APM Nick Elsden McNicholas Supervisor VCUK mgr Crossrail site mgr
02	**LADDERS**	Fall of person from ladder, Fall of material from ladder, Collapse of ladder	**Personal Injury, Equipment Damage**	**M**	Staff Contractors Visitors	Use correct length and type, not painted. Daily inspection when in use, do not use if damaged. Must project at least 1.50m above stepping off point. Check/Fix securely at top and base. Check/Install at an angle of 75 degree (1:4 ratio over length). Three points of contact: make sure any load can be carried comfortably with one hand free for ladder. Arrange stair access if possible.	**L**	MOLA SA and staff PM Elaine Eastbury APM Nick Elsden McNicholas Supervisor VCUK mgr Crossrail site mgr
03	**PLANT** 36 and 20t Tracked Excavator with grab bucket	Persons Struck by Machine Shovel or load dropping Hydraulic fluid spray Overturning of machine Fire/explosion	**Personal Injury, Equipment Damage**	**M**	Staff Contractors Visitors	**MOLA staff will not operate plant**. Check operator trained and certificated and not permit uncertified operators to start work. Operator must inspect plant before work commences and before each shift. Defective plant must not be used. Service and repair by qualified contractor only. Operations supervised by MOLA staff (supervisor or deputy). Plant to be switched off and secured when not in use. No work with or near plant operator under influence of drugs/alcohol or behaving erratically. Operations to be under supervision of MOLA supervisor or deputy and trained banks person also where applicable. Staff working near machine to ensure that the operator has seen them and that they are at a safe distance.	**L**	MOLA SA and staff PM Elaine Eastbury APM Nick Elsden McNicholas Supervisor VCUK mgr Crossrail site mgr

						Staff briefed on plant operations and changes to them. High visibility clothing. Separate routes and work areas for plant and pedestrians, warning signs to be displayed where practicable.		
04	**DUMPERS** eg 2.5 tonne dumper	Overturning or tipping. Falling into excavations. Falls of persons and load. Collision.	**Personal Injury, Equipment Damage**	**M**	Staff Contractors Visitors	**MOLA will not drive dumpers** Check training and certification of drivers and not permit uncertified drivers to commence work. Drivers must be over 18. Operator must inspect and certify dumper as fit to operate before use and carry out checks prior to each shift. Checks will include brake testing. A banksman will be used where driver's vision is impaired or operating in congested areas. Dumpers are not to be left unattended with engines running or keys in. Dump skips are to be kept clean A site speed limit will be imposed Separate pedestrian and vehicle routes and work areas will be established where practicable and warning signs will be displayed. No work with or near dumper driver operator under influence of drugs/alcohol or behaving erratically. Use designated pedestrian routes where available. Caution: be vigilant of dumper movements in work area, maintain safe distance. Staff to be briefed on dumper movements and changes to them.	**L**	MOLA SA and staff PM Elaine Eastbury APM Nick Elsden McNicholas Supervisor VCUK mgr Crossrail site mgr
05	**SCAFFOLDING** (Access)	Fall of persons Fall of materiel Collapse of scaffolding	**Personal Injury, Equipment damage**	**M**	Staff Contractors Visitors	**MOLA staff will not erect scaffolding.** Only use scaffolding (inc stairs) that displays green scaffold tag with current weekly inspection record. Do not use if obviously damaged. Do not use in high winds and/or heavy rain. Maintain three points of contact, always have one hand free for guard rail when carrying load.	**L**	MOLA SA and staff PM Elaine Eastbury APM Nick Elsden McNicholas Supervisor VCUK mgr Crossrail site mgr
06	**EXCAVATION**	Collapse of sides Fall of persons Falls of Plant, equipment, material Flooding	**Personal Injury, Equipment damage**	**M**	Staff Contractors	A Permit to Penetrate and a Permit to Enter will operate. Determine the depth for the installation of shoring/ battering back as outlined in WSI. Shoring will be installed by competent sub-contractor and maintained by them. Shoring will be inspected by competent sub –contractor or MOLA supervisor instructed by them. If Netlon fencing or similar is erected it must be at least 1m back from trench edge and warning signs displayed. If Herras fencing is erected it must be at least 1m or more back from trench and warning signs displayed. Robust scaffolding edge protection will be erected and warning signs displayed Inspect all excavations before each	**L**	MOLA SA and staff PM Elaine Eastbury APM Nick Elsden McNicholas Supervisor VCUK mgr Crossrail site mgr

						day/shift and record results. Supervisor will report unsafe excavations to principal contractor. Staff will not enter any excavation they consider unsafe until it is made safe. Staff will report unsafe excavation to supervisor. Shoring installed by contractor under direction of the principal contractor. Edge protection installed by contractor under direction of the principal contractor. Warning and information signs in MOLA excavations. Pumps if required inspected and certified.		
08	**SLIPS/TRIPS/ FALLS**	Falls of persons Dropping of equipment/material	**Personal injury, Equipment damage**	**M**	Staff Contractors Visitors	Assess work in adverse weather and suspend if appropriate. Keep all surfaces level and dry where practicable. Keep all areas free of unnecessary obstruction and debris. Keep all areas well lit. All safe pedestrian routes to be sign posted. Staff to be physically fit for the conditions on site. No running or horseplay. Be cautious moving about site.	**L**	MOLA SA and staff PM Elaine Eastbury APM Nick Elsden McNicholas Supervisor VCUK mgr Crossrail site mgr
09	**UNDERGROUND SERVICES (UTILITIES)** Identified remaining live services (see C503 Utilities Corridor MS, 2.2): Electricity, LV cable feeds from Austin Reed toward Blomfield Street along 1-14 Liverpool Street building façade. HV cables coming out of the substation and crossing the pile lines. Water – feeds from Austin Reed toward Blomfield Street along 1-14 Liverpool Street building façade.	Electrocution Flooding Asphyxiation Fire/explosion Bacterial infection	**Personal injury, Equipment and environ-mental damage, Annoyance to public**	**M**	Staff Contractors	A Permit to Penetrate will operate. Briefing on live utilities to be given to all staff Competent C503 staff will use a cable location scanner calibrated within last 12 months to scan for live electrical services: before initial breaking out; before machine clearance of first level; and each machining level thereafter. All existing services that will be exposed will be protected prior to the works starting. Any utilities remaining live in excavation areas will be clearly demarcated and segregated. - 1m either side zone. All staff will wear flame retardant overalls in trenches with remaining utilities. The Principal Contractor will protect live services using timber box-outs or plastic rigid ducts, supported by straps and a fixed ladder beam (see C503 Utilities Corridor MS, 2.2). Work will stop immediately on discovery of unidentified service and not resume until confirmed/made safe. **Inform principal contractor and utilities company immediately of any contact with live utility**.	**L**	MOLA SA and staff PM Elaine Eastbury APM Nick Elsden McNicholas Supervisor VCUK mgr Crossrail site mgr
13	**CONFINED SPACES** Included areas: TWB Sewer Shaft MHS1 TWB Sewer Shaft MHS2 TWB Sewer Shaft	Collapse of sides/ structure Flooding Free flowing solids Fire/ explosion	**Personal Injury, Disease, Equipment damage**	**M**	Staff Contractors	Supervisor to brief staff on task prior to commencement. Permit to Enter in Confined Space will operate. Only staff trained in entry into confined spaces will undertake task. Only physically fit/suitable staff will be deployed. Staff health will be visually monitored and all ill health will be reported immediately. No smoking or naked flames/lights.	**L**	MOLA SA and staff PM Elaine Eastbury APM Nick Elsden McNicholas Supervisor VCUK mgr Crossrail site mgr

	MHS2-100 Excavation of the Utility Corridor MHS2-100 to Blomfield Street sewer **heading** MHS2 to QVT sewer **heading**	Electrical Gas, fumes Toxic atmospheres, oxygen deprivation Bacteria				Fire extinguisher to be available. Only equipment specified in the permit will be used. Ventilate adequately. A top-person (lookout) will be in place and present at all times. Escape and emergency procedures implemented. An escape plan for an unconscious/immobile casualty will be in place and the rescue party trained regularly. The following safety equipment will be used: gas environmental check (gas detectors), escape sets (10 or 15' ELSA), emergency sets (gantry, full body harnesses), winch/tripod, life lines. Daily check of harnesses before use. **Additional Provisions for the Headings** There will be an 'intermediate top man' (or 'bottom man') at the heading entrance, in addition to the top man at the top of the entrance shaft (= shaft for manhole MHS2-100 or MHS2), with radio and light signal communication. There will also be 'stand-by men' available at all times when there is work in the heading, who will ????? [function TBC]. MOLA staff will be briefed by the Principal Contractor, including the emergency light and other communications. Forced ventilation will be provided by the Principal Contractor. Shoring will be installed by accredited contractors in 0.5m stages as the heading advances, and inspected daily. The base of the heading will be concreted daily as the heading advances. 110v lighting will be installed; no working without lighting. A minimum 0.6m wide escape route will be maintained along the heading at all times. Casualty evacuation will be either by a plank laid on the spoil truck, or a rescue stretcher (to be available at all times). There will be secondary emergency lifting devices for individuals at the entrance shaft/manhole. The following specific emergency procedures will be implemented: The whole confined space will be evacuated in the case of: • Gas monitor alarm sounds • Casualty/accident • Flood • Fire • Lack of power supply for the lights • Lack of fresh air supply • Ground movement • Other dangerous circumstances Evacuation alarm can be raised by		

						any member of the team using a red flashing torch within the heading or flashing of the heading lighting two times. In the event of fire, the contractors will fight the fire only for evacuation purposes, with the RED-marked (water) fire extinguishers or fire blanket provided. *MOLA staff are not trained to fight fires*. An evacuation will be reported immediately to site management, and general emergency procedures will follow.		
15	**HAND TOOLS** Covers use of: Mattock, Shovel, spade, pick axe, trowel, draw hoe, garden fork, hand shovel, brush, lump hammer, sledge hammer, chisel, bolster and similar simple non mechanical tools	Manual handling Impact from tool Impact from flying debris	**Personal injury, property damage**	**M**	Staff	All hand tools to be to industry safety standard. Inspect tools on delivery. Discard tool if not fit for purpose. Assess staff fitness to use tools. Task briefing where applicable. Training and supervision for inexperienced staff. Adequate breaks/rest periods	**L**	MOLA SA and staff PM Elaine Eastbury APM Nick Elsden McNicholas Supervisor VCUK mgr Crossrail site mgr
18	**WEILS DISEASE** (Leptospirosis) RATS	Rat (and Cattle) faeces and urine	**Personal injury Illness**	**L**	Staff Contractors Visitors	Brief staff on hazard. Carry HSE G 406 instruction card Wear gloves. Clean and cover any cuts or abrasions promptly with a waterproof plaster. Wash hands before eating, drinking, smoking. No eating drinking and smoking outside designated areas. Keep Welfare facilities dry, tidy and secure. Keep food covered and secure. Basic surveillance of staff for flu like symptoms. Report ill health.	**L**	MOLA SA and staff PM Elaine Eastbury APM Nick Elsden McNicholas Supervisor VCUK mgr Crossrail site mgr
22	**WELFARE** Welfare facilities being provided by the PC	Fire/explosion Electrical Filth/bacteria Cold/damp	Personal Injury and illness, property damage	**L**	Staff Contractors Visitors	Larger projects: toilets, office, canteen, tool storage, drying rooms, heating, hygiene facilities (hot & cold running water). Separate Male and female facilities. COSHH and DSEAR controlled substances will be not be stored in office/canteen. Welfare facilities to be kept clean and tidy. Cleaning Rota will be established where cabins not cleaned by contractor. No Smoking in welfare facilities. No eating or drinking in work areas.	**L**	MOLA SA and staff PM Elaine Eastbury APM Nick Elsden McNicholas Supervisor VCUK mgr Crossrail site mgr
24	**MANUAL HANDLING**	Too heavy, big, awkward load, Too prolonged Dropping load	Personal injury, Equipment damage	**M**	Staff Contractors	**General** Remove the need for manual handling where possible. Use mechanical aids where possible. Reduce horizontal and vertical distances. Reduce size and weight of individual load. Ensure team sufficient and fit for task. Ensure that route planned, well lit, obstruction free, and as dry as possible. Liaise with others to keep route safe, use lookouts. Brief and train staff. Rotate staff and/or sufficient breaks	**L**	MOLA SA and staff PM Elaine Eastbury APM Nick Elsden McNicholas Supervisor VCUK mgr Crossrail site mgr

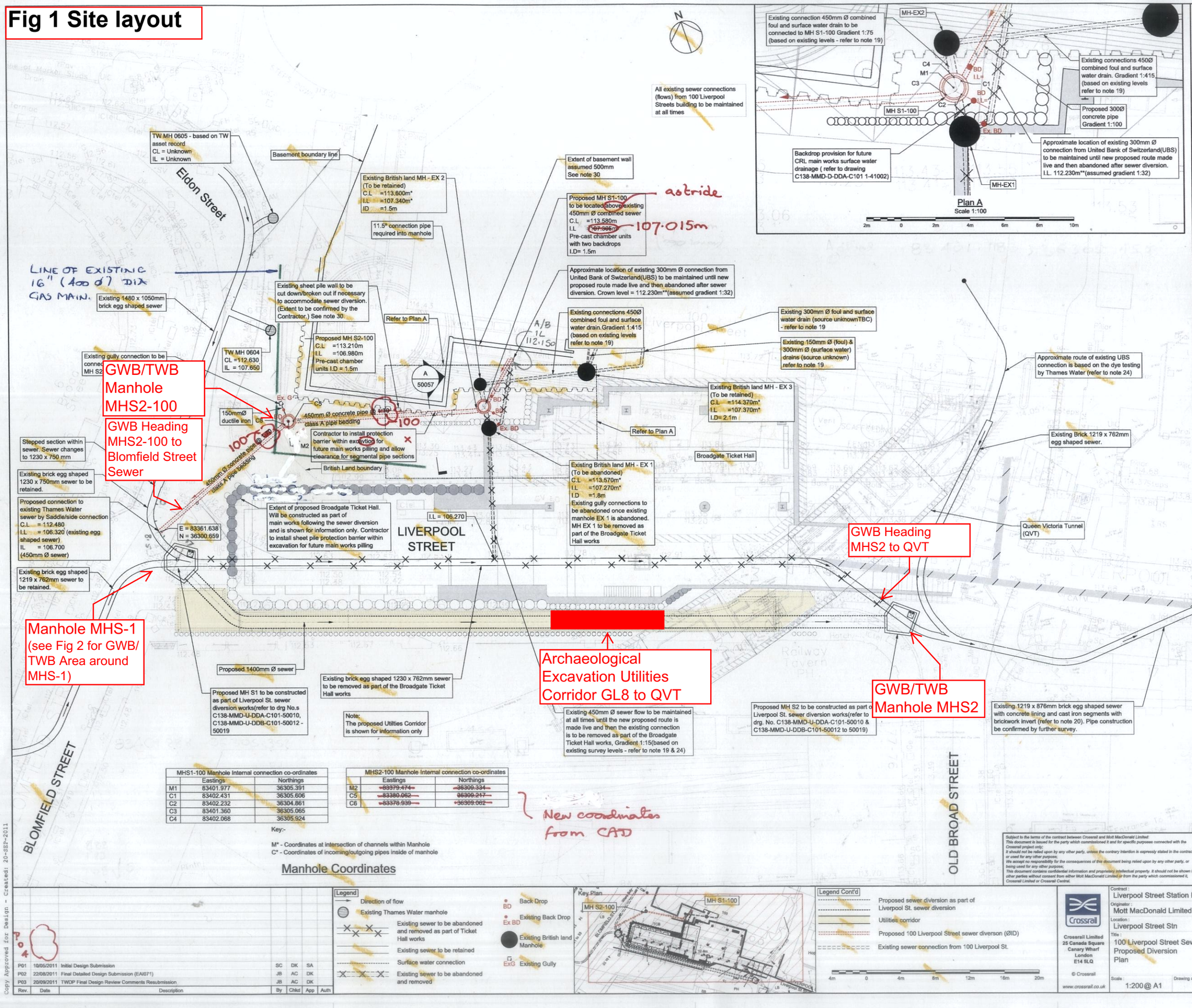
						for prolonged tasks Use gloves **Personal** Assess weight before lifting, stay comfortably within personal lifting capacity. When picking up load: stand close with feet slightly apart, crouch do not bend at waist, keep head up and maintain natural curvature of spine, thrust/lift through hips, keep object close to body, maintain clear field of vision and do not run. **Use MOLA Manual handling check lists for all significant manual handling tasks 0024a-e :** Planks, ladders and boards Drums/round containers Bags and sacks Finds/irregular shaped objects on site Office work – boxes etc		
27	**NOISE** Plant and breaking out operations, related to both MOLA and VCUK works within the site.	Excessive, prolonged noise levels, Nuisance to public	Personal injury – temporary or permanent damage to hearing, loss of hearing Headache/ nausea	**M**	Staff Contractors Visitors	Minimise exposure– rotate staff, plan work to avoid noisy times/work areas if possible. Wear appropriate ear protection. Report unwell symptoms immediately. Vacate area if headaches/nausea etc.	**L**	MOLA SA and staff PM Elaine Eastbury APM Nick Elsden McNicholas Supervisor VCUK mgr Crossrail site mgr
28	**DEEP EXCAVATIONS**	Collapse of sides Fall of persons Falls of Plant, equipment, material Flooding Hazardous atmosphere (see RA 13)	Personal injury, Equipment damage	**M**	Staff Contractors	Determine the depth for the installation of shoring/ battering back as outlined in WSI. Shoring installed and maintained by competent sub-contractor. Shoring inspected by competent sub –contractor or MOLA supervisor instructed by them. Access ladders/scaffolding installed and inspected by competent contractor. Edge protection –fixed scaffolding barrier –installed around trench by a competent person 'Danger Deep Excavation' Warning signs displayed ie on site boundary/entrance, trench edge protection Where appropriate a fixed hoist to remove spoil rather than a crane or mechanical excavator. Hoist and plant operators will be briefed on MOLA works and operating procedures for deep trenches. The size and shape of the bucket or skip used for spoil disposal will be suitable for the size of trench, shoring, and other obstructions. Task specific briefing before commencement. Only staff physically fit and suitable. Basic visual health surveillance. report all unwell, symptom immediately. A mechanical pump(s) where necessary. Gas monitoring equipment where appropriate (see RA13).	**L**	MOLA SA and staff PM Elaine Eastbury APM Nick Elsden McNicholas Supervisor VCUK mgr Crossrail site mgr

33	**LIFTING EQUIPMENT** (PLANT) Buckets/skips attached to the following plant: 1 No 36 Tracked Excavator with hydraulic clam shell bucket 1 No 20 tonne excavator	falling bucket, material, collapse, Striking overhead obstruction	Personal Injury, equipment or property damage	**M**	Staff Contractors	**MOLA staff will not operate plant** Only trained plant operatives will operate plant. Plant used as crane must be correctly fitted to do so. All loads/skips/buckets must be within the safe working load of the machine. A banksman will be present for all operations. Loads will not be slewed over staff below **Exclusion zone in area of lift operation while the skip/bucket is being raised or lowered or in the interval between if operations are ongoing. See MOLA H&S Policy.**	**L**	MOLA SA and staff PM Elaine Eastbury APM Nick Elsden McNicholas Supervisor VCUK mgr Crossrail site mgr
34	**HUMAN REMAINS** Possible Roman inhumations and cremations Early post-medieval cemetery inhumations , with potential for moderately well preserved coffins or possibly lead coffins.	Sharp bone/wood Lead: solid and dust (coffins) Parasite eggs, mould, spores Pathogens/ micro-organisms public outrage, affront to Staff personal/religious belief	Personal injury, psycho-logical distress, disease	**L**	Staff Contractors	Follow national and local authority environmental health guidelines and rules, and requirements of Burial Licence. Brief on the specific hazards and safe system of work Provide adequate hygiene facility hot/cold running water, paper towels, soap. No eating/drinking/smoking in work area. Report all unwell symptoms immediately. If soft tissue, sealed or unsealed lead coffins, sealed crypts are encountered, work will stop immediately, the excavation area will be vacated, and the specific individual circumstances will be assessed. Work will not recommence until a new task specific risk assessment has been produced, and its requirements enacted, and method of safe removal and storage of remains). Staff will be suitable/willing to work with human remains. Adequately screen and secured from public view. Professional attitude to human remains at all times. Be courteous - refer all public enquiries to Supervisor.	**L**	MOLA SA and staff PM Elaine Eastbury APM Nick Elsden McNicholas Supervisor VCUK mgr Crossrail site mgr
39	**HAND AUGER**	Manual handing Contact with underground service	Personal injury, equipment damage	**L**	Staff	Staff will be trained and supervised Inspect before use, obviously faulty equipment will not be used. Assess for physical aptitude for task Assess location to ensure that there is sufficient room for use, and that the deposits are suitable. Do not overstrain driving the auger into the ground. Rest breaks during prolonged periods of use. Cease work if an obstruction is encountered.	**L**	MOLA SA and staff PM Elaine Eastbury APM Nick Elsden McNicholas Supervisor VCUK mgr Crossrail site mgr
41	**ADVERSE WEATHER**	Slips trips and falls Snow, sleet, hail, rain, - Frozen ground Ice covered ponds holes	Personal Injury, equipment damage, lost time	**M**	Staff Contractors Visitors	Monitor weather forecasts. Ensure staff can get to and from work safely in reasonable time – send home early if necessary. Cancel work in advance if necessary consider remote sites/ poor transport links. Ensure drying and heating in welfare facilities. Assess site conditions before commencement.	**L**	MOLA SA and staff PM Elaine Eastbury APM Nick Elsden McNicholas Supervisor VCUK mgr Crossrail site

		freezing temperatures, high winds -				Keep walk ways and pedestrian route clear of ice and snow, mud. Check barriers/warning signs in place around all deep holes. Rotate staff tasks. Do not use hand tools on heavily frozen ground or in heavy rain. Report unwell symptoms. Wear warm clothing.		mgr
54	**TASK LIGHTING** (Stand alone, Laniro etc)	Fire Electrocution Trip hazard Light falling on person	Personal injury, equipment damage	**M**	Staff Contractors	Current PAT test Visual inspection before use, do not use if defective, switch off and report immediately. Repair only by competent person. Use only for minimum amount of time to complete task. Position to minimise falling on operatives. Leads and extension cables routed to minimise trip hazards.	**L**	MOLA SA and staff PM Elaine Eastbury APM Nick Elsden McNicholas Supervisor VCUK mgr Crossrail site mgr
All persons affected by these hazards must be made aware of the contents of this Risk Assessment								

23 Figures

Fig 1 Site layout



MHS1-100 Manhole Internal connection co-ordinates		
	Eastings	Northings
M1	83401.977	36305.391
C1	83402.431	36305.606
C2	83402.232	36304.861
C3	83401.360	36305.065
C4	83402.068	36305.924

MHS2-100 Manhole Internal connection co-ordinates		
	Eastings	Northings
M2	~~83379.474~~	~~36309.334~~
C5	~~83380.062~~	~~36309.217~~
C6	~~83378.939~~	~~36309.062~~

New coordinates from CAD

Key:-

M* - Coordinates at intersection of channels within Manhole
C* - Coordinates of incoming/outgoing pipes inside of manhole

Manhole Coordinates

Safety, Health and Environmental Information
Notes below are additional to hazards/risks normally associated with this type of work:
Construction
Ci. LIV-001 - Striking or damage to identified/ unidentified utilities
Cii. LIV-003 - Working with or near a live sewer
Ciii. LIV-010 Contaminated Land
Operations
Oi. LIV-002 - Confined space working
Oii.
Oiii.
Maintenance
Mi.
Mii.
Miii.
Dismantling/Demolition (Future)
Di. LIV-004 - Damage to Thames Water Assets
Dii.
Diii.
These notes are based on the use of experienced and competent contractors carrying out the work using an approved safe method of working.

Notes
1. Do not scale from this drawing.
2. All dimensions are in metres unless specified otherwise.
3. Coordinates to the London Survey Grid, heights to the London height datum which is 100 metres below Ordnance Datum Newlyn. See Crossrail standard CR-STD-010.
4. All levels shown on this drawing are based on the existing Topographical survey drawing received by Crossrail File No. CRL1-XRL-G-DMA-CR088-00015
5. The drainage design is based on the Sewers for Adoption 6th edition.
6. For proposed water main diversion plan refer to Drg. No. C138-MMD-U-DDA-C101-50063.
7. For section between 100 Liverpoi Street basement and proposed Broadgate Ticket Hall piling refer to Drg No. C138-MMD-U-DDB-C101-50057.
8. For construction details refer to Drg. No. C138-MMD-U-DDD-C101-50053 & 50054.
9. For sewer longitudinal section refer to Drg. No. C138-MMD-U-DDB-C101-50053.
10. This drawing shall be read in conjunction with all structural Liverpool Street utilities corridor works and other consultants drawings, reports and specifications.
11. Chamber/Manhole locations subject to position of existing sewer connections from 100 Liverpool Street and to be confirmed on site by the Contractor. Any changes on site to be checked with the Engineer.
12. All temporary works required for construction are the responsibility of the Contractor.
13. All incoming and outgoing pipes to be laid with level soffits.
14. All necessary approval/agreement to be obtained prior to commencement of works.
15. Detailed design to be agreed with Thames Water.
16. All exisitng sewer connections to be maintained in operation at all times
17. Internal diameter of existing & proposed pipe shown on drawing.
18. Existing Liverpool, Eldon & Blomfield Street sewer alignments are based on the Thames Water drg. No. A041-XX-00525-DES-A
19. All levels shown suffixed with an asterisk, thus *, are based on a site survey, report No. C138-MMD-U-RGN-C101-50008.
20. Pipe construction information is based on archive record drg. No. LE30-21/07
21. 100 Liverpool Street sewer diversion works to be completed in advance of Liverpool Street sewer abandonment. For Liverpool St. Sewer diversion drawing refer to drg. No. C138-MMD-U-DDA-C101-50010, C138-MMD-U-DDB-C101-50012 to 50019.
22. All levels shown suffixed with double astrix, thus** are based on Drg. No. CRL1-XRL-U-DDB-C101-00008 received from Crossrail Central
23. MH S2-100 to be located within the British Land boundary.
24. Existing connection location and alignment is based on Thames Water dye testing survey, and City of London survey drg. No. LSS/CS/01.
25. Levels shown suffix 1, are based on Thames Water line & level survey drg. No. A041-XX-00525-DES-A.
26. Other utility diversions from 100 Liverpool St. to be coordinated by Crossrail.
27. For combined utilities plan refer to drg. No. CRL1-XRL-U-DDA-C101-00147.
28. For proposed highway arrangements refer to drg. No. C138-MMD-U-DDA-C101-50062.
29. Existing cables and ducts need to be accommodated and protected during trench excavation for sewer installation
30. Conctractor to confirm route can be constructed without impacting the existing structure of 100 Liverpool Steet

Legend
Direction of flow
Existing Thames Water manhole
Existing sewer to be abandoned and removed as part of Ticket Hall works
Existing sewer to be retained
Surface water connection
Existing sewer to be abandoned and removed
Back Drop
Existing Back Drop
Existing British land Manhole
Existing Gully

Key Plan
MH S2-100
MH S1-100

Legend Cont'd
Proposed sewer diversion as part of Liverpool St. sewer diversion
Utilities corridor
Proposed 100 Liverpool Street sewer diverson (ØID)
Existing sewer connection from 100 Liverpool St.
4m 0 4m 8m 12m 16m 20m

Rev.	Date	Description	By	Chkd	App	Auth
P01	10/05/2011	Initial Design Submission	SC	DK	SA	
P02	22/08/2011	Final Detailed Design Submission (EAI071)	JB	AC	DK	
P03	20/09/2011	TWDP Final Design Review Comments Resubmission	JB	AC	DK	

Crossrail
Crossrail Limited
25 Canada Square
Canary Wharf
London
E14 5LQ
© Crossrail
www.crossrail.co.uk

Contract : Liverpool Street Station Design
Originator : Mott MacDonald Limited
Location : Liverpool Street Stn
Title : 100 Liverpool Street Sewer Proposed Diversion Plan
By : J.BHAMBRA
Chk : A.CHAUDHRY
App : D.KEOGH
Auth :
Scale : 1:200@ A1
Drawing and CAD file No : C138-MMD-U-DDA-C101-50052
Rev : P03
Suitability : S4

Fit for authorisation
RESTRICTED
Copy Approved for Design - Created: 20-SEP-2011

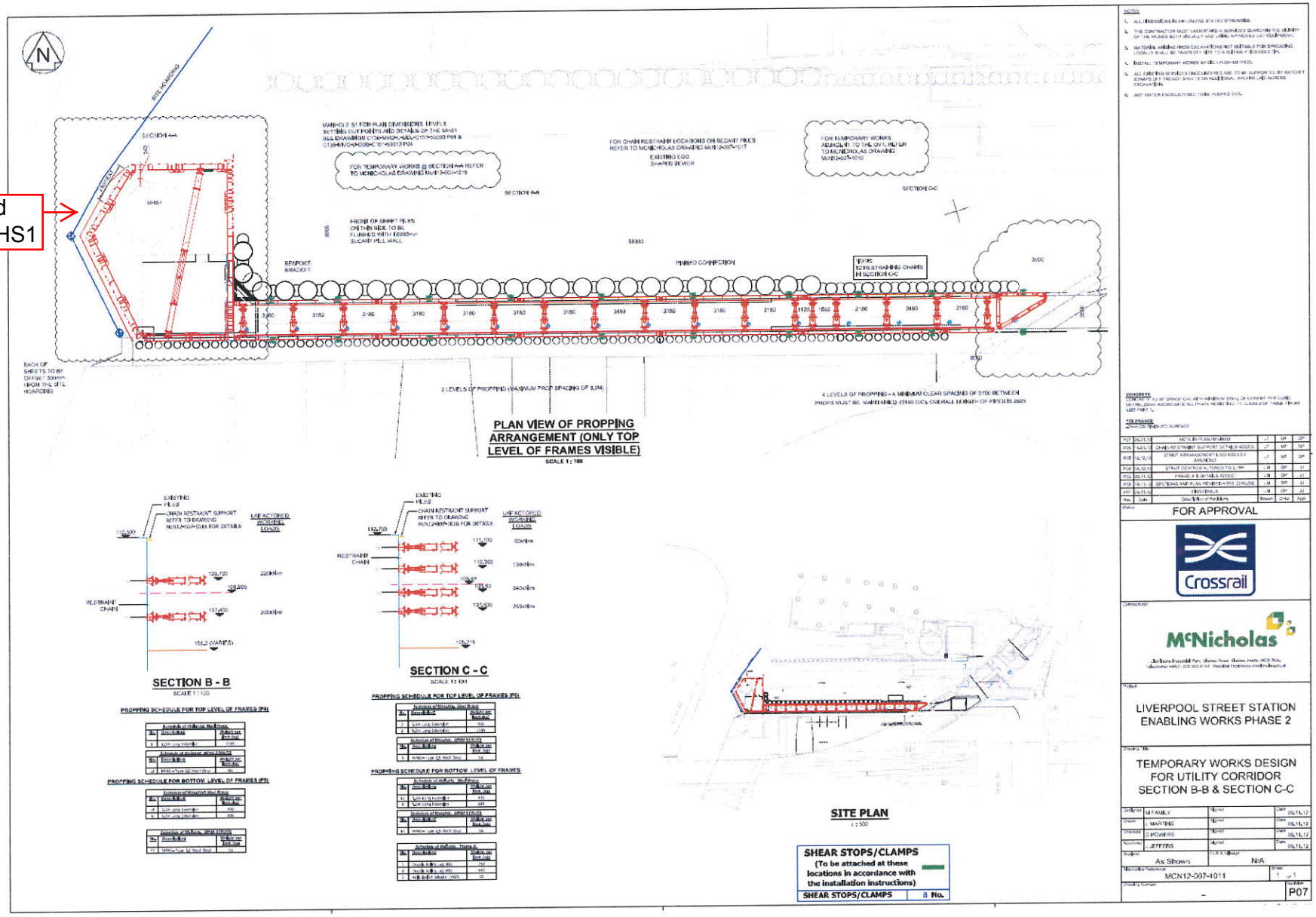


Fig 2 Utilities Corridor showing area around manhole MHS1

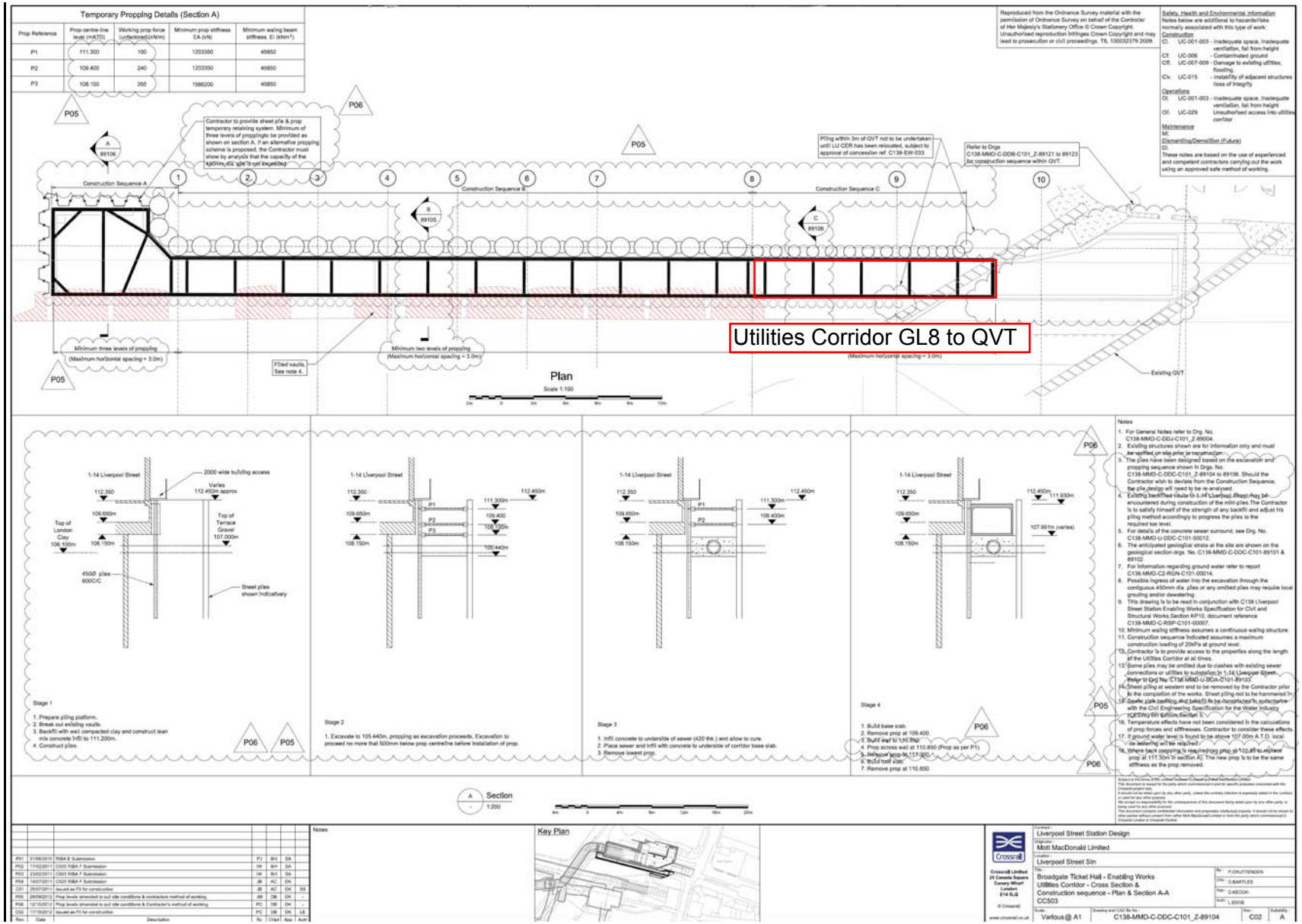
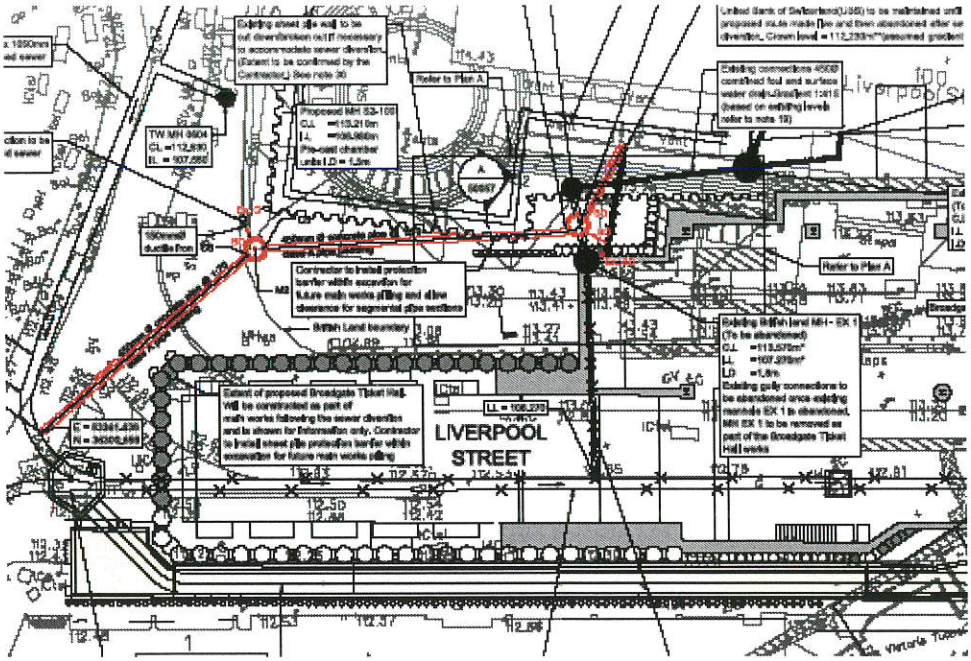


Fig 3 Utilities Corridor GL8 to QVT

Appendix 2 - Drawings



Ignore !

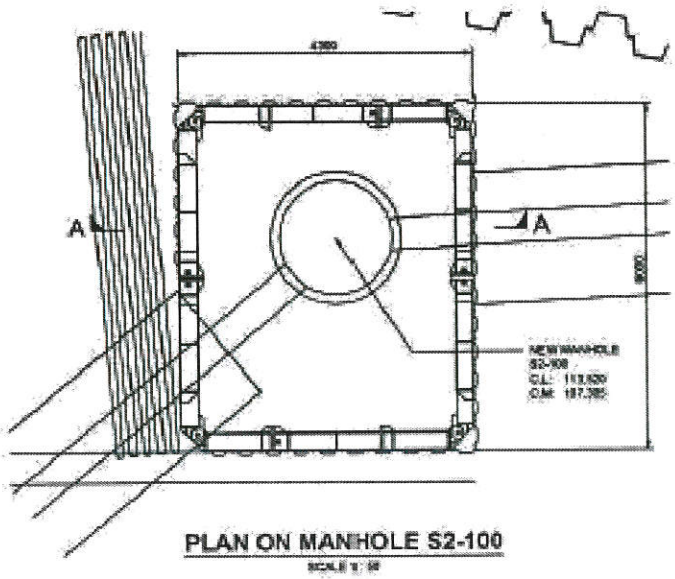


Fig 4 Manhole MHS2-100

6. The heading will then be advanced to a 500mm beyond the1st Frame, pushing the Head Boards forward as they excavate. A temporary steel frame, constructed at the front of the excavated tunnel will be installed to support the Head Boards with side boards to follow.

7. Advance the heading a further 500mm into the heading. At this point the floor is to be excavated to the required level from the start of the heading to this point and the base to the steel frame will be installed at the 1m mark.

8. The steel side and head trees will then be installed with the head boards being pushed above the steel frame with side boards will follow.

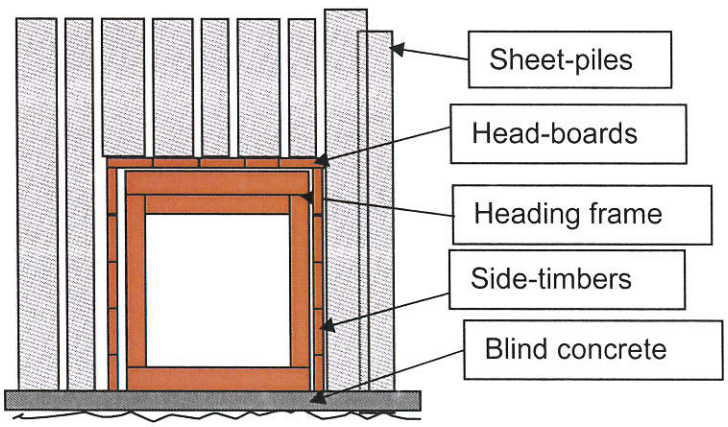
9. Choc Blocks will be installed above the Steel Frame and below the Head Boards. The gap for these Choc Blocks is created while driving the Head Boards forward using the Temporary Frame to keep them in place at an upward angle.

10. As the Excavation advances another 500mm the New Head Boards are installed by knocking out the Choc Blocks, one at a time, with the advancing Head Boards staying in place being held with the steel frame that is already installed.

11. A temporary Frame is to be installed at this point to support the head boards.

12. At this point wooden wedges are wedged between the 1st set of Head Boards and the new set of Head Boards and repeated with every newly installed set of Head Boards.

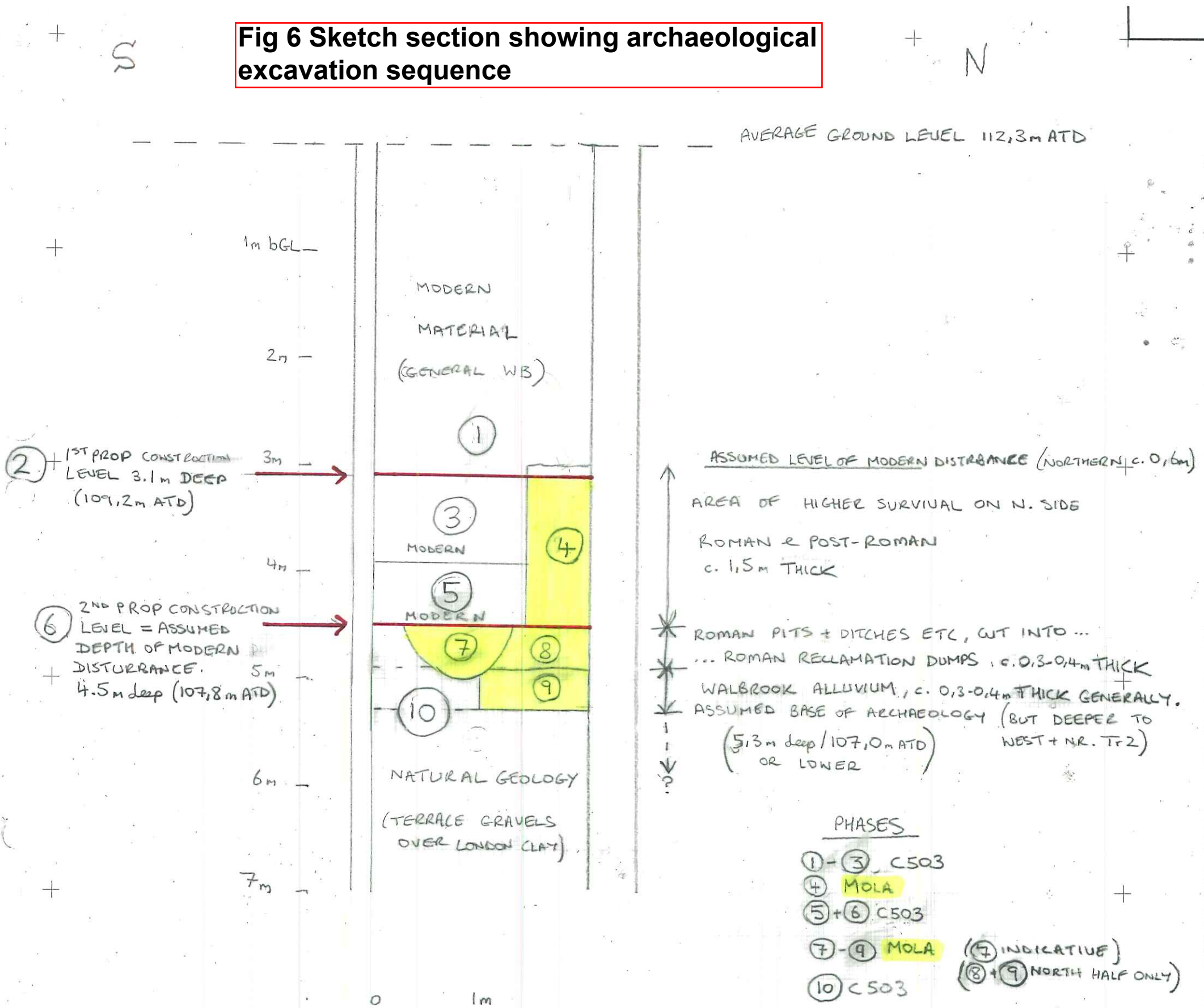
13. Repeat as per points 7-12 until reaching the existing sewer and additional settings will be installed if the gap is greater than 500mm at this point.



14. As the excavation of the heading proceeds, rails will be bedded on the floor of the heading, on which the bogeys with ¼ M3 muck skips will be placed and used to transport excavated material out of the heading to the launch pit. The fully loaded bogey will be lifted to ground level by a 20t excavator, unloaded into disposal container and returned back down the pit. The bogey track will be placed asymmetrically to the line of heading to allow a min 600mm clearance for escape/emergency route at all times.

Fig 5 Heading MHS2-100 to Blomfield Street sewer

Fig 6 Sketch section showing archaeological excavation sequence



PLAN/SECTION NO.	
DRAWN BY NE	
CHECKED BY	
DATE 31/1/13	
SCALE 1:40 - APPROX	
MUSEUM OF LONDON	SITE

NOTES

BTH UTILITIES CORRIDOR

SKETCH SECTION v2

24 Registers

HEALTH & SAFETY METHOD STATEMENT REGISTER

Date	Name of Inductee	Signature of inductee To: confirm that you have read this Method Statement and understood its contents and you will work in accordance with the method statement.	Confirmation Signature of Supervisor/Manager

MOLA INDUCTION REGISTER

Date of Induction	Name of Inductee	Signature of inductee To confirm that you have attended the induction and understood its contents and that you will work in accordance with the induction content, MS, Risk assessments and resulting safe systems of work and all legal and reasonable safety requirements and instructions	Confirmation Signature of MOLA inductor

For further names append more pages