C261 WORK PACKAGE ARCHAEOLOGY EARLY EAST

Fieldwork Report
Archaeological Watching Briefs
Pudding Mill Lane Portal (XSK10)

Grout Shaft, River Lea Coffer Dam, Cut and Cover Sections 2B and 3 TWB, and Utilities GWB

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Non-technical summary

This report presents the results of an archaeological watching briefs carried out by Museum of London Archaeology (MOLA) at the Crossrail Pudding Mill Lane Portal, including a coffer dam in the River Lea, a grout shaft and cut and cover tunnel areas 2B and 3 (together with part of a covered ramp) in the London Borough of Newham. This report was commissioned from MOLA by Crossrail Ltd. It follows an earlier enhanced interim report on the remains of a possible succession of fish weirs in the EIP chamber and a targeted watching brief on cut and cover section 1 (Crossrail 2013b; Doc. No. C261-MLA-X-RGN-CR140-50123, Version 2.0, 06.02.13), and a fieldwork report on the general watching brief carried out during ground reduction for the National Grid (Crossrail 2016; Doc. No. C261-MLA-T1-RGN-CRG03-50029, Version 4.0, 20.01.16). The work was undertaken as part of a wider programme to mitigate the archaeological implications of railway development proposals along the Crossrail route.

Targeted watching briefs (TWBs) were carried out during the excavation of the above areas at the Pudding Mill Lane portal. Areas were monitored throughout the excavation of alluvial deposits, until Pleistocene gravels were reached. No remains of moderate to high significance were exposed and so there was no need to delay excavation, even within a localised area. Monitoring the portal has allowed an opportunity for close examination of a large section through Holocene alluvium in the Lea valley. No distinctively anthropogenic features or finds were recovered, although a feature (possibly a natural channel) was recorded and sampled at the east end of the cut and cover tunnel area 2B. Two site visits were also made to record timbers exposed during enabling works. In both cases the timbers are of low significance only.

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1 Introduction

Crossrail is a new Cross-London Rail Link project which will provide transport routes across the south-east of England and London. The route will link Reading in the west with Shenfield in the north-east and Abbey Wood in the south-east. In central London, from Royal Oak in the west to Pudding Mill Lane and Royal Victoria Dock in the east, Crossrail will consist of a tunnelled section with seven new stations linked to the existing transport network.

The route involved excavation of the Pudding Mill Lane Portal, east of the River Lea, south of the great Eastern Main Line railway embankment and about 1km south-west of Stratford Station, in the London Borough of Newham.

The work from east to west included the creation of a coffer dam in the River Lea and excavation below the river bed to examine the river bank and grout deposits in the ground below; a grout shaft on the west side of the portal; the creation of an Emergency Intervention Point (EIP) and Tunnel Boring Machine (TBM) reception chamber; three sections – or areas – of cut and cover tunnel and a covered ramp, and various enabling works (Fig 1).

The first section of cut and cover tunnel (Section 1) was excavated immediately east of the EIP Chamber and both it and the EIP Chamber are the subject of an earlier interim report, together with General Watching Briefs on utilities diversions in Barber Road (Doc. No. C261-MLA-X-RGN-CR140-50123). Subsequently, a General Watching Brief was carried out during remediation works south of the main portal at the National Grid Area bulk supply point, also subject of a separate fieldwork report (Doc No. C261-MLA-T1-RGN-CRG03-50029).

The excavation of the intermediate section of cut and cover tunnel (Section 2B) was followed by a hiatus during which the Docklands Light Railway (DLR) was diverted around the portal, and the final section of cut and cover tunnel (Section 3) was excavated between the DLR and Network Rail lines. A Targeted Watching Brief (TWB) was carried out during these works.

The Crossrail mitigation response to archaeology is described in the Crossrail Generic WSI (Crossrail 2012d) and the detailed desk based assessment (DDBA; Crossrail 2008), and can be summarised as follows:

- In the event that intact and important archaeological remains are identified at Crossrail worksites through this process, it may be preferable, where practicable, to preserve these where they are found (ie, preservation in situ).
- However, because of the nature of major works projects such as Crossrail, experience of other similar projects suggests that preservation by record is usually the most appropriate method of dealing with archaeological finds.
- Following an extensive Environmental Impact Assessment (EIA) supporting the Crossrail Bill, and the production of site-specific DDBAs, appropriate mitigation measures were scoped and specified in detail in individual project designs (site-specific WSIs – Written Schemes of Investigation) which were prepared in accordance with the principles set out in the Generic WSI, and developed in consultation with the relevant statutory authorities.

- Archaeological information that is gained from fieldwork will be followed by analysis and publication of the results and will be transferred to an approved public receiving body.

This fieldwork report describes the results of archaeological targeted watching briefs (TWBs) carried out within the Pudding Mill Lane Portal, by Museum of London Archaeology (MOLA) under Crossrail contract C261 Archaeology Early East. The site extends from the River Lea in the west to the City Mill River in the east. The approximate centre of the main tunnel excavation area is at Ordnance Survey National Grid Reference 537750 183440.

All levels in this document are quoted in metres Above Tunnel Datum (m ATD). To convert Tunnel Datum to Ordnance Datum subtract 100m, i.e. 1m OD = 101m ATD.

All fieldwork was conducted by MOLA Senior Archaeologists, David Sankey and Tim Johnston, between 09/05/12 and 29/07/15.

Table 1 Site Details

Task	Principal Contractor	Programme
• **Grout Shaft TWB**	C305 Dragados Sisk JV (DSJV)	09/05/2012 to 18/05/2012
• **Cut and Cover tunnel (Stage 2B) TWB**	C350 Morgan Sindall	10/09/2012 to 05/10/2012
• **River Lea works, Coffer Dam TWB**	C305 Dragados Sisk JV (DSJV)	05/02/2013 to 01/03/2013
• **Cut and Cover tunnel (Stage 3) and covered ramp TWB**	C350 Morgan Sindall	16/02/2015 to 29/07/2015
• **Enabling Works GWB (Services Diversion and City Mill River Works)**	C350 Morgan Sindall	08/11/2012 (1 day) 11/01/2013 (1 day)

The event code (sitecode) is **XSK10**.

2 Planning background

The overall framework within which archaeological work will be undertaken is set out in the Environmental Minimum Requirements (EMR) for Crossrail (http://www.crossrail.co.uk/about-us/crossrail-act-2008/environmental-minimum-requirements-including-crossrail-construction-code#).The requirements being progressed follow the principles of Planning Policy Guidance Note 16 (PPG16; DoE 1990), and its replacements Planning Policy Statement 5 (PPS5; DCLG 2010) and the National Policy Planning Framework (NPPF; DCLG 2012), on archaeology and planning. Accordingly the nominated undertaker or any contractors will be required to implement certain control measures in relation to archaeology before construction work begins.

Schedules 9, 10 and 15 of the Crossrail Act (2008) concern matters relating to archaeology and the built heritage and allows the dis-application by Crossrail of various planning and legislative provisions including those related to listed building status, conservation areas and scheduled ancient monuments (Schedule 9). Schedule 10 allows certain rights of entry to Historic England given that Schedule 9 effectively dis-applied their existing rights to the Crossrail project, and Schedule 15 allows Crossrail to bypass any ecclesiastical or other existing legislation relating to burial grounds.

Notwithstanding these dis-applications, it is intended that agreements setting out the detail of the works and requiring relevant consultations and approvals of detail and of mitigation arrangements will be entered into by the nominated undertaker with the relevant local planning authorities and Historic England in relation to listed buildings and with the Department of Culture, Media and Sport (DCMS) and English Heritage in relation to Scheduled Ancient Monuments (SAMs).

3 Origin and scope of the report

This report has been commissioned from Museum of London Archaeology (MOLA) by Crossrail Ltd. The report has been prepared within the terms of the relevant standard specified by the Chartered Institute for Archaeologists (CIfA, 2014). It considers the significance of the fieldwork results (in local, regional or national terms) and makes appropriate recommendations for any further action, commensurate with the results.

4 Previous work relevant to archaeology of site

The principal previous Crossrail studies are as follows:

- Crossrail, February 2005a *Environmental Statement*
- Crossrail, February 2005b *Assessment of Archaeology Impacts, Technical Report. Part 2 of 6, Central Section: Westbourne Park to Stratford and Isle of Dogs.* 1E0318-C1E00-00001 [Specialist Technical Report (STR)]
- Crossrail, 2008 *Archaeology Detailed Desk Based Assessment, Pudding Mill Lane Portal* (Doc. No. CR-XRL-T1-RGN-CR001-50009, Version 2.0, 05.12.08)
- Crossrail, 2013b *C261 Archaeology Early East, Enhanced Interim Statement: Archaeological Excavation on EIP/TBM Chamber and Watching Briefs on CUT and Cover Section 1 and Barbers Road Utilities, Pudding Mill Lane XSK10* (Doc. No. C261-MLA-X-RGN-CR140-50123, Version 2.0, 06.02.13)
- Crossrail, 2016 *C261 Archaeology Early East, Fieldwork Report: Archaeological General Watching Brief, Pudding Mill Lane Portal, Excavation works for National Grid (XSK10)* (Doc. No. C261-MLA-T1-RGN-CRG03-50029, Version 4.0, 20.01.16)

All on-site archaeological work was carried out in accordance with the following documents:

- Crossrail, 2010 *Package C152 Pudding Mill Lane Portal, Archaeology Site-Specific Written Scheme of Investigation,* (Doc. No. C152-SWN-C2-RSP-CR094_PT002-00001, Version 10.0, 12.05.10)
- Crossrail, 2011 *C261 Archaeology Early East, Method Statement Archaeological Watching Briefs Pudding Mill Lane Portal* (Doc. No. C261-MLA-T1-GMS-CR094-50002, Version 2.0, 19.01.11)
- Crossrail, 2012a *Package C152 Pudding Mill Lane Portal, Addendum to WSI: Trial Trench Evaluation, Watching Brief & Detailed Excavation (XSK10)* (Doc. No. C152-SWN-C2-RSP-CR094_PT002-50001, Version 3.0, dated 19.03.12)
- Crossrail, 2012b *C261 Archaeology Early East: Method Statement Addendum Archaeological Targeted Watching Briefs on Grout Shaft and River Lea works, Pudding Mill Lane Portal* (C261-MLA-X-RGN-CR140-50090, Version 3.0 08.05.12)
- Crossrail, 2012c *C261 Archaeology Early East, Method Statement Archaeological Targeted Watching Briefs Pudding Mill Lane Portal* (Doc. No. C261-MLA-X-RGN-CR140-50036, Version 5.0, 04.09.12)
- Crossrail 2013a *C261 Archaeology Early East, Method Statement, Archaeological Targeted Watching Brief on River Lea Works Pudding Mill Lane Portal* (Document Number: C261-MLA-X-RGN-CR140-50036 Version 6.0, 18.01.13)
- Crossrail 2014 *C261 Archaeology Early East Method Statement: Archaeological Targeted Watching Briefs Pudding Mill Lane Portal* (Doc. No. C261-MLA-T1-GMS-CRG03-50001 Version 2.0, 13.10.14)

The above cited reports are all available from the London Archaeological Archive and research Centre (LAARC).

5 Topographical, Archaeological and Historic Background

The Pudding Mill Lane Portal site is located south of the Great Eastern Main Line (GEML) railway embankment and lies mostly to the east of the River Lea about 1km south-west of Stratford Station (Fig 1). The majority of the Crossrail works fall within the London Borough Newham, although a small number lie west of the Lea within the London Borough Tower Hamlets. Present ground levels vary considerably due to railway and other construction, from *c* 101m to 105m ATD in the floodplain to the east of the River Lea, rising up to 104m to 110m ATD on the gravel terraces west of the Lea.

The geology of the site consists of a Holocene alluvial sequence within the floodplain of the River Lea. The gravel topography underlying the site comprises intercutting braided channels with raised gravel areas between them, with organic deposits at channel margins. One such island has been identified to the east of the site. To the east of the Pudding Mill Lane Portal, features of Late Bronze Age–Early Iron Age date were observed cutting into a relict land surface at 101.67m ATD, with a later prehistoric land surface observed at 101.84m ATD (MoLAS-PCA 2008, Olympics Planning Delivery Zone 8: a report on the evaluation, unpublished MOL report).

As the river channels dried, a more stable marsh environment of wet woodland developed that was generally unattractive to human activity (MoLAS-PCA 2008). From the later medieval period onwards the area exhibits some evidence for increased human activity. Within the EIP/TBM chamber, wattle structures were observed that have been tentatively interpreted as the remains of multiple phases of a medieval/Tudor fish weir (Crossrail 2013b).

In the 19th and 20th centuries layers of re-deposited alluvium demonstrate the early ground raising that occurred prior to the landscaping that resulted in the topography of the site today. The site developed significantly in the post-medieval period. The waterways were used as a means of transport and a source of power, and the construction of the railway also brought significant changes to the area. Historic maps show little activity on the site until the 19th century. The Stanford map of 1862 shows development on the site for the first time, and include the construction of the embanked railway, a Gas works, soap works and a small Tar works as well as other unlabelled buildings. The site continued to be developed and used for light industry during the 19th and 20th centuries as shown on later historic maps.

6 Research objectives and aims

6.1 Overall Research Aims

The original aims and objectives were listed in the WSI (Crossrail 2010) and stated that 'data collected from archaeological investigation and mitigation may contribute to the following research themes':

- Understanding London's hydrology, river systems and tributaries and the relationship between rivers and floodplains;
- Understanding the relationship between landscape, river and settlement;
- Using the understanding that comes from reconstructing London's past to contribute to wider environmental studies about contemporary concerns such as: climate change; sea level fluctuations; flood defence initiatives; links between pollution, health and quality of life;
- Understanding the reasons for evolution of the road systems, street layouts, river crossings and ferries, and their importance as engines of development and change;
- Understanding the nature and meaning of the deposition of metalwork in the Thames and at the headwaters of river tributaries;
- Understanding how water supply and drainage provision were installed and managed;
- Studying the correlation between sites associated with watercourses and meander bends, so as to understand the origin of settlements; and
- Understanding the evolving character of development in central London, in comparison to other riverine settlements.

Furthermore, the potential at Pudding Mill Lane for geo-archaeological and palaeoenvironmental deposits to be recovered will contribute to the following themes:

- The development of models for understanding the significance of geomorphology, ecology, ecosystems and climate, hydrology, and vegetational and faunal development, on human lives;
- Characterising changing climatic conditions, and air and water quality and pollution, throughout the archaeological record, towards understanding its implications for how people behaved;
- The Mesolithic/Neolithic transition: understanding the significance of horticultural experimentation at this time, and the transition from hunter-gatherers into farmers; and
- Understanding what London's past environments meant to different groups and individuals.

Any evidence for Post-medieval industrial activity will contribute to the following themes:

- Charting how and why different parts of London developed as specialist producers, and understanding the implications of this for London as a world city;
- Establishing how daily work and life in London reflected and contributed to the rise of London as the commercial centre of the British Empire, and to its continued eminence as a world city thereafter; and
- Examining the success with which small towns in the London region adapted to the capital's growth.

6.2 Fieldwork Objectives

The following overall objectives for the archaeological TWB investigations were set out within the Addendum to the WSI (Crossrail 2012a, Section 2.2):

- To record evidence for post medieval industrial buildings and structures noted in the DDBA and in particular the remains of a large building with landscaped grounds recorded on the 1867AD OS edition (within Section 1 of the cut and cover tunnel).
- To inspect, record and sample profiles in the geo-archaeological sequence of deposits present within the site to understand the site topography and date its phased development.
- To analyse the palaeo-environmental evidence recovered from the works and contribute evidence to inform the Lea Valley Pleistocene and Holocene archaeological resource.
- To inspect the sequence of post Pleistocene alluvial organic deposits and clay silt units for prehistoric, Roman and Medieval archaeological remains at channel edge and areas of higher ground (land and channel management, settlement and industry).
- To identify record and if appropriate recover, any archaeological artefacts (vessels, structural remains and small finds) preserved in the deeper channel areas.

6.3 Task-specific fieldwork objectives

6.3.1 River Lea works

Additionally, the following fieldwork objectives were identified within the Method Statement relating to works within the River Lea channel and on the west side of the River Lea (Crossrail 2013a, Section 3.3.2):

- [If required] To record [EH Level 2] the remains of the historic wharf as they are exposed during demolition and groundworks on the western side of the River Lea: item [6] in Crossrail 2010, section 5.5.
- To observe and record the fabric and construction details of any wharves revealed during the construction of two sheet pile coffer dams.

- To observe and record, and if required take soil samples from, the deposits between ground level and the top of the river terrace gravels.

And also:

- To inspect, record and sample profiles in the geo-archaeological sequence of deposits present within the site to understand the site topography and date its phased development.
- To analyse the palaeo-environmental evidence recovered from the works and contribute evidence to inform the Lea Valley Pleistocene and Holocene archaeological resource.

6.3.2 Cut and Cover tunnel (Section 3) and covered ramp

The following task-specific research questions were also identified within the Method Statement relating to the Cut and Cover tunnel (Section 3) and covered ramp (Crossrail 2014, Section 3.3.3):

- Are any prehistoric land surfaces identified, and what is their date? If prehistoric land surfaces are present, are they contemporary with surfaces previously identified at Pudding Mill Lane (MoLAS-PCA 2008, Trench PDZ8.04/5.35(C))?
- Can information about the location and extent of the gravel island identified during previous investigations and boreholes in the area of Pudding Mill Lane be refined?
- Is there any direct or indirect evidence for prehistoric activity (such as artefacts and structures, or plant microfossil and macrofossil evidence)?
- Is there evidence for the formation of peat in marginal areas, and at what date did it start and cease to form?
- Within any later alluvial deposits, is it possible to identify evidence for anthropogenic management of the increasingly wet and marshy landscape?

7 Methodology of site-based and off-site work

7.1 General methodology

All archaeological excavation and recording during the fieldwork was carried out in accordance with the WSIs and method statements listed in section 4, and:

- English Heritage Centre for Archaeology Guidelines, 2002, Environmental archaeology: a guide to the theory and practice of methods, from sampling and recovery to post-excavation
- English Heritage, 2004, Geoarchaeology: using earth sciences to understand the archaeological record
- Museum of London *Archaeological Site Manual* (MoL 1994)
- Historic England, Greater London Archaeology Advisory Service (GLAAS), April 2015, Standards for Archaeological Work, London Region
- Crossrail 2012d. Archaeology Generic Written Scheme of Investigation (Doc. No. CR-XRL-T1-XWI-CRG03-50001)
- Crossrail 2012e. Archaeology: Specification for Evaluation & Mitigation (including Watching Brief) (Doc. No. CRL1-XRL-T1-RSP-CRG03-50001)

The site records can be found under the site code **XSK10** in the MOLA archive. They will be stored there pending a future decision over the longer-term archive deposition and public access process for the wider Crossrail scheme.

7.2 Task-specific methodology

Targeted watching briefs were monitored throughout their excavation, until excavation had dug into Pleistocene gravels. No remains of moderate to high significance were exposed and so there was no need to delay excavation, even within a localised area (Crossrail 2014, Section 5.1).

Throughout the targeted watching brief, notes, measurements, drawings and photographs we taken. Observations (eg of depth, character, date and survival/truncation of deposit sequence, height of natural geology) were made and records kept on pro-forma Trench Sheets, Context Sheets, and cross-sections drawn at appropriate scales.

7.2.1 Grout Shaft

A targeted watching brief was implemented, as outlined in the WSI (Crossrail 2012b, Section 5.2). Modern and 19th-century made-ground was removed under observation of the MOLA C261 Supervisor, to expose the alluvial deposits. Excavation of the alluvial deposits was undertaken with a mechanical excavator, and the excavation was overwhelmed by groundwater at an early stage. No significant remains were observed, and observations were made from a safe position at the top of the excavation. Monitoring ceased when the excavation reached the Pleistocene gravel (at 99.1m ATD).

7.2.2 Cut and Cover tunnel (Section 2B)

A targeted watching brief was implemented during the bulk excavation of the Cut and Cover tunnel (Section 2B), as outlined in the WSI (Crossrail 2012c, Section 5.2).

Following the removal of modern overburden, excavation of alluvial deposits was undertaken with an excavator fitted with a flat blade ditching bucket in spits and monitored by the MOLA site supervisor until Pleistocene gravel was encountered at *c* 101.2m ATD. The east end of this area, where the trench narrowed to half width, was excavated separately. The facility to investigate deposits, finds or structural remains was provided by the Principal Contractor, (Crossrail 2012, Section 5.1). A feature (possibly natural channel) was exposed at this junction (and sampled).

7.2.3 River Lea Cofferdam

A coffer dam was created in the River Lea to allow inspection of the river bank and to grout the ground below the river bed. A targeted watching brief was implemented, as outlined in the WSI (Crossrail 2013a, Section 5.2.1). Following the removal of modern made-ground, excavation of the underlying alluvium was carried out under the supervision of the MOLA C261 Supervisor. Excavation was carried out using a long-reach excavator mounted on a stabilised pontoon in spits, with water pumped out of the excavation. All observations were made from a safe position on the adjacent temporary bridge, and no significant remains were observed. The watching brief ceased at 98.6m OD, within the Pleistocene gravel.

7.2.4 Cut and Cover tunnel (Section 3) and covered ramp

The Cut and Cover tunnel (Section 3) was excavated together with part of the adjacent covered ramp, following the diversion of the Docklands Light Railway (DLR) over Area 2B. Consequently it was excavated between the DLR and Network Rail Tracks. As outlined in the WSI (Crossrail 2014, Section 5.1.1), a targeted watching brief was implemented once bulk excavation of the deposits within the Cut and Cover tunnel (Section 3) and covered ramp reached *c* 102m ATD. Below this level, alluvial deposits were excavated in spits using an excavator fitted with a flat-bladed ditching bucket, under the supervision of the MOLA C261 Supervisor. A place of safety adjacent to the excavation was provided from which observations could be made, and regular access was provided into the excavation area to inspect and record deposits.

Deposits were broadly excavated from west to east, but with several hiatuses as props were inserted in different sections. Where props were inserted at levels within the alluvial sequence, the excavation of holes to allow installation of gallows brackets were monitored and photographed, and these afforded close observations of alluvium. The east end of Cut and Cover tunnel (Section 3) was excavated together with the west end of the covered ramp, and so observations were extended to that area also.

Archaeological monitoring ceased at archaeologically sterile natural gravels, at *c* 101.2m ATD.

7.2.5 Enabling Works general watching brief

The main phase of the general watching brief is reported in the Enhanced Interim Report (Crossrail 2013b). However, throughout the works a MOLA Senior Archaeologist was available on a call-out basis should items be discovered. Two such finds were made: the first during the excavation of a services diversion trench

and the second during the City Mill River Works. In both cases the MOLA Senior Archaeologist attended and took photographs of exposed timber remains, deposits and trenches. Exposures were described and notes taken and the positions of timbers and trenches were surveyed by offset measurement to features identified also on site drawings and surveys. Their locations were best-fitted to the Ordnance Survey and Crossrail co-ordinates via CAD site drawings.

8 Results and observations including stratigraphic report and quantitative report

The locations of all work areas and observations are shown on Fig 1.

8.1 Grout shaft

Photo 1 Excavating within the Grout Shaft looking south, 11/05/2012

Grout Shaft	
Location	Between River Lea and EIP chamber (Fig 1)
Dimensions	10.13m diameter (within shoring), 5.4m deep (to limit of observations)
LSG grid coordinates	88014 37856
OS National grid coordinates	537624, 183287
Modern Ground Level	104.60m ATD
Modern subsurface deposits	2.5m of concrete followed by 0.5m of coal-ashy (19th-century?) fill 104.6m – 100.5m

	ATD
Level of base of archaeological deposits observed and/or base of trench	99.1m ATD
Natural observed	Alluvial clays observed at between 100.50m ATD and 99.1m ATD [118] Pleistocene gravel at 99.1m ATD.
Extent of modern truncation	Concrete obstructions 2.5m deep (104.5m to 102.0m ATD)
Archaeological remains	**Dating Evidence, Finds, and Samples**
A blueish-grey alluvial clay [118] was seen between 100.50m and 99.10m ATD.	None
Interpretation and summary	
The alluvial clay is consistent with that found elsewhere on site, such as the nearby EIP chamber (Doc No C261-MLA-X-RGN-CR140-50123, p11)	

8.2 Cut and Cover (Section 2B)

Photo 2, Excavation of Cut and Cover tunnel (Section 2B) looking east, 24th September 2012

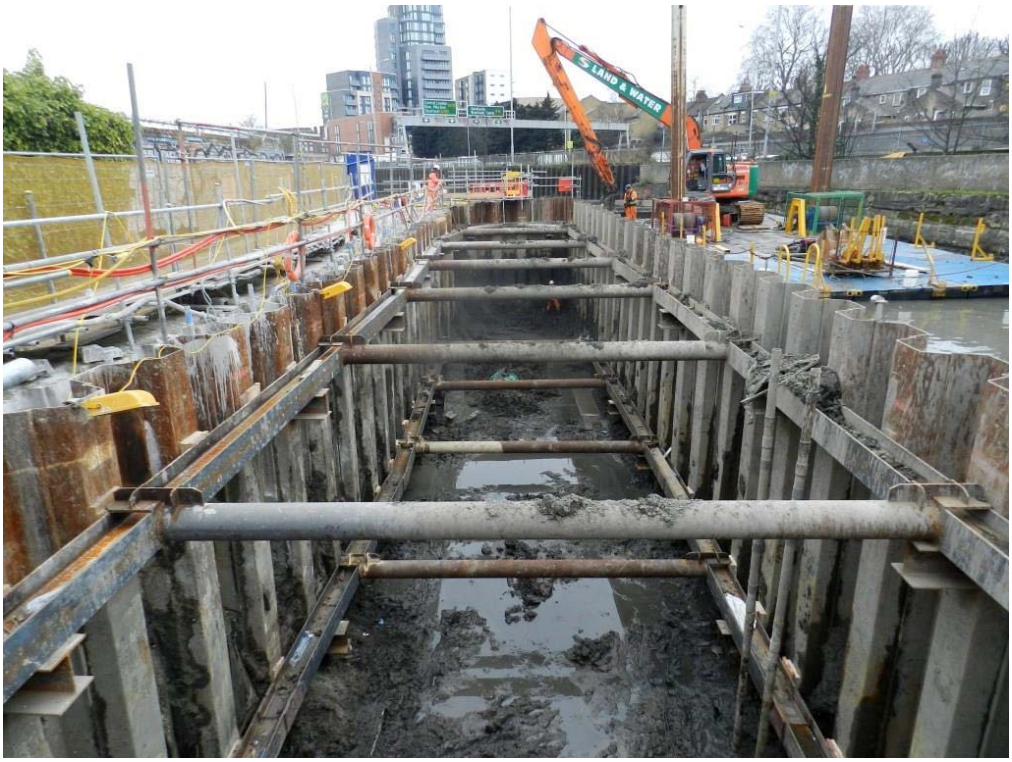
Cut and Cover (Section 2B)	
Location	East of Cut and Cover Section 1 (Fig 1)
Dimensions	85m NE–SW × 13.6m NW–SE with a 6.4m-wide area for the eastern 31m. 7m deep
LSG grid coordinates	88109 37985
OS National grid coordinates	537715,183418
Modern Ground Level	105m ATD
Modern subsurface deposits	Crushed Concrete and gravel 105m – 102.5m ATD
Level of base of archaeological deposits observed and/or base of trench	98m ATD
Natural observed	Alluvial clays observed at between 102.50m ATD and 101.2m ATD [120] Pleistocene gravel at 101.2m ATD [124].
Extent of modern truncation	Crushed concrete and gravel with lenses of coal-ashy waste 2.5m deep 105m to 102.5m ATD
Archaeological remains	**Dating Evidence, Finds, and Samples**
A blueish-grey alluvial clay [120] was seen between 102.50m and 101.20m ATD.	None
Below the alluvial clay was a possible natural feature [123] 800mm deep and 1m wide, cutting into the underlying Pleistocene gravel (Photo 3, Fig 2). The lower fill [122] was a brown organic deposit with at least one decayed timber (the surface was badly decayed but there were no identifiable signs of it being shaped or worked). The upper fill [121] was a mixture of grey alluvial clay similar to [120] and detached lenses of slumped gravels, detached from Pleistocene gravel.	Monolith sample <59> included the transition to underlying Pleistocene gravel, all of the vertical column of lower fill [122] and the transition to the upper fill [121] A 10l bulk sample <60> was taken from lower fill [122]
Interpretation and summary	
The alluvial clay [120] is consistent with that found elsewhere on site, such as the EIP chamber (Doc No C261-MLA-X-RGN-CR140-50123, p11). It is likely that feature [123] with lower fill [122] is a cross-section through a natural stream or channel which predated the formation of [120]. It may have been truncated	

horizontally by a migrating meander of the River Lea, which then deposited further alluvium [121] into the upper portion of the feature.

Photo 3 feature [123] cutting into natural gravel

8.3 River Lea Coffer Dam

Photo 4 Excavating within the coffer dam, looking south



River Lea works, coffer dam	
Location	Within the River Lea, on the east side of the site
Dimensions	32.46m NW–SE× 6.6m NE–SW
LSG coordinates	87998 37846
OS National grid coordinates	537608 183276
Modern Ground Level/top of the slab	104.60m ATD (top of pile 48)
Modern subsurface deposits	River and mixed modern river bed-load sediment deposits, gravel, concrete, car doors, etc 104.6m – 102.08m ATD
Level of base of archaeological deposits observed and/or base of trench	98.6m ATD, limit of observations
Natural observed	Alluvial clays observed at between 102.08m ATD and 99.25m ATD [128] Pleistocene gravel 99.25m ATD to 98.6m ATD (limit of observations) [129]
Extent of modern truncation	Not Applicable
Archaeological remains	**Dating Evidence, Finds, and Samples**
A blueish-grey organic alluvial clay was observed between 102.08m ATD and 99.25m ATD [128]	None
Interpretation and summary	
The alluvial clay is consistent with that found elsewhere on site, such as the nearby EIP chamber (Doc No C261-MLA-X-RGN-CR140-50123, p11)	

8.4 Cut and Cover (Section 3) and Covered Ramp

Photo 5 , Excavation of Cut and Cover (Section 3) looking east, 19th February 2015

Cut and Cover 3 and Covered Ramp	
Location	East of Cut and Cover 2B, between DLR and Network Rail lines
Dimensions	152m NE–SW × 14.5m–20m NW–SE; 12m deep
LSG grid coordinates	88171 38047
OS National grid coordinates	537776,183482
Modern Ground Level	109m ATD
Modern subsurface deposits	Crushed concrete, reinforced concrete, former DLR retaining wall, ducts and services, and gravel with large lenses of coal-ashy waste from 105m–102.5m ATD
Level of base of archaeological deposits observed and/or base of trench	98m ATD

Natural observed	Alluvial clays observed at between 103m ATD and 101.2m ATD [165] Pleistocene gravel at 101.2m ATD [166].
Extent of modern truncation	Crushed concrete and gravel with lenses of coal-ashy waste 6m+ deep from 109m to 103m–102.5m ATD
Archaeological remains	**Dating Evidence, Finds, and Samples**
A blueish-grey alluvial clay [165] was seen between 103.0m and 101.2m ATD. The top had been truncated to 102.5m ATD in the west and 103.0m ATD in the east.	None
Interpretation and summary	
The alluvial clay [165] was consistent with that found elsewhere on site, such as the EIP chamber (Doc No C261-MLA-X-RGN-CR140-50123, p11). The interface between alluvial clay and Pleistocene gravel rose from 100.08m ATD in the EIP chamber to a high point of 101.6m ATD in Cut and Cover (Section 3), a rise of 1.52m over a distance of 212m, falling back to 101.2m ATD in the east. Although this does show some topographic variation, there was no distinct break of slope, nor were there horizontal deposits that indicated earlier land surfaces. The consistent level of the top of the gravel may be consistent with Pleistocene gravel having been eroded by the migration of river meanders in the medieval period.	

Photo 6 Exposing the top of alluvium at the level for the second layer of props, Cut and Cover 3, looking east 24th February 2015

8.5 Enabling Works GWB

Two site visits were undertaken, when timber remains were encountered during shallow excavations for enabling works:

8.5.1 Services Diversion (8th November 2012)

Two timbers [125] and [126] were encountered during the excavation of a service trench for a water main diversion. They were the remains of the base of baulk timbers used to create channel sides in the 19th century, of imported soft woods and fixed with iron points to aid being driven into the underlying soil (Photo 7).

Photo 7 Timber remains excavated 8th November 2012

No further timbers were observed in this location. It is possible that they were not in situ, or that a former river channel was located at the interface between gravel and alluvium observed in the base of the trench.

8.5.2 City Mill River Works (11th January 2013)

An alignment of similar upright timbers [127] was found in situ on the east side of the infilled section of the City Mill River (Photo 8). These timbers (up to 200mm x 250mm) were exposed at 600mm below ground level and were vertically set, in a line parallel to and 800mm from the Great Northern Outfall Sewer. It is possible that they relate to enabling works for the construction of the sewer, rather than the City Mill River.

Photo 8 Timbers [127] looking north, with in-filled City Mill River to the right (east) and the Great Northern Outfall Sewer, 11th January 2012

9 Assessment of results against original research aims

As many of the original research aims for the project are geoarchaeological, an assessment of results against original expectations (as required by the current GLAAS guidelines; Historic England, 2015) will be included with the forthcoming UPD, following the assessment of the geoarchaeological data from the site.

10 Conclusions

The top of the alluvial sequence was identified at between 102.5m ATD and 103.5m ATD. This consisted invariably of blueish-grey alluvial clay. No dating evidence was present in the alluvium. An isolated feature with organic fill found cutting Pleistocene gravel is potentially an earlier man-made feature or natural channel.

11 Post-excavation assessment, analysis, publication and dissemination proposals

The fieldwork results will initially be disseminated via this report.

The fieldwork has produced results of low importance and local significance. The alluvial sequence and solitary feature sealed beneath the alluvium may have relevance to archaeological deposits and features recorded elsewhere within the PML site, and it is suggested that these results are integrated within any future proposals for the Analysis and Publication of more significant remains recorded elsewhere within the Pudding Mill Lane site. The samples taken from the feature recorded in the Cut and Cover (Section 2B) should be processed and assessed to determine the potential for further study.

A Summary Report for the Pudding Mill Lane GWB and TWB will be submitted for the annual excavation round up in London Archaeologist and also be deposited with the LAARC.

This decision lies with the Crossrail Project Archaeologist.

12 Archive deposition

The site archive containing original records and finds will be stored with the LAARC pending a future decision over the longer-term archive deposition and public access process for the wider Crossrail project.

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14 Acknowledgements

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Thanks also to [redacted] of Morgan Sindall and their on-site team, for enabling and accommodating the on-site work.

The general watching brief was supervised by Rob Hartle, Dave Sankey and Tim Johnston. The fieldwork was managed by MOLA Project Managers Elaine Eastbury and Simon Davis, and the post-excavation work by Louise Fowler.

15 Oasis form

OASIS ID: molas1-245522

Project details

Project name	Crossrail C261 Pudding Mill Lane Cut and Cover 2B + 3
Short description of the project	Targeted watching brief carried out at the Pudding Mill Lane Portal as part of the Crossrail project, including Cut and Cover tunnel Sections 2B and 3, a coffer dam in the river Lea, a grout shaft, and observations made during a general watching brief carried out during enabling works. Holocene alluvium was recorded across the site.
Project dates	Start: 09-05-2012 End: 29-07-2015
Previous/future work	Yes / No
Any associated project reference codes	XSK10 - Sitecode
Type of project	Recording project
Current Land use	Open Fresh Water 1 - Running water
Current Land use	Transport and Utilities 2 - Other transport infrastructure

Project location

Country	England
Site location	GREATER LONDON NEWHAM WEST HAM Crossrail Pudding Mill Lane Portal
Postcode	E15 1PW
Study area	850 Square metres
Site coordinates	TQ 7720 3430 51.080037013965 0.530083991946 51 04 48 N 000 31 48 E Point
Height OD / Depth	Min: 99.1m Max: 101.2m

Project creators

Name of Organisation	MOLA
Project brief originator	Crossrail
Project design originator	Crossrail
Project	Elaine Eastbury

director/manager	
Project supervisor	Dave Sankey
Type of sponsor/funding body	Transport Infrastructure Body
Name of sponsor/funding body	Crossrail Ltd

Project archives

Physical Archive recipient	LAARC
Physical Archive ID	XSK10
Digital Archive recipient	LAARC
Digital Archive ID	XSK10
Paper Archive recipient	LAARC
Paper Archive ID	XSK10

Project bibliography 1

Publication type	Grey literature (unpublished document/manuscript)
Title	C261 WORK PACKAGE ARCHAEOLOGY EARLY EAST Fieldwork Report Archaeological Watching Briefs Pudding Mill Lane Portal (XSK10) Grout Shaft, River Lea Coffer Dam, Cut and Cover Sections 2B and 3 TWB
Author(s)/Editor(s)	Sankey, D
Other bibliographic details	C261-MLA-T1-RGN-CRG03-50033
Date	2016
Issuer or publisher	MOLA
Place of issue or publication	London
Description	Unpub client report (A4)

Entered by	Louise Fowler (lfowler@mola.org.uk)
Entered on	11 March 2016

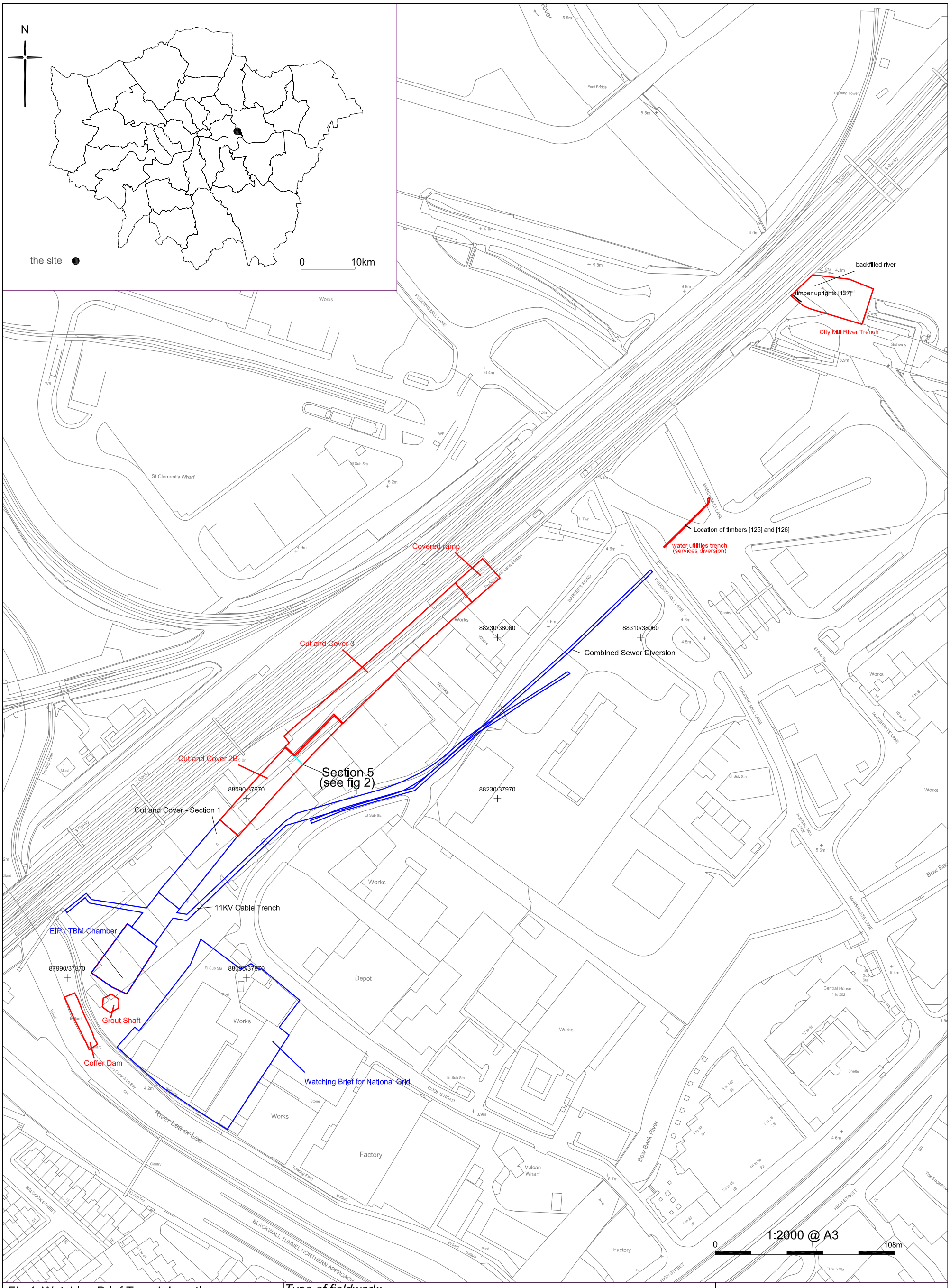
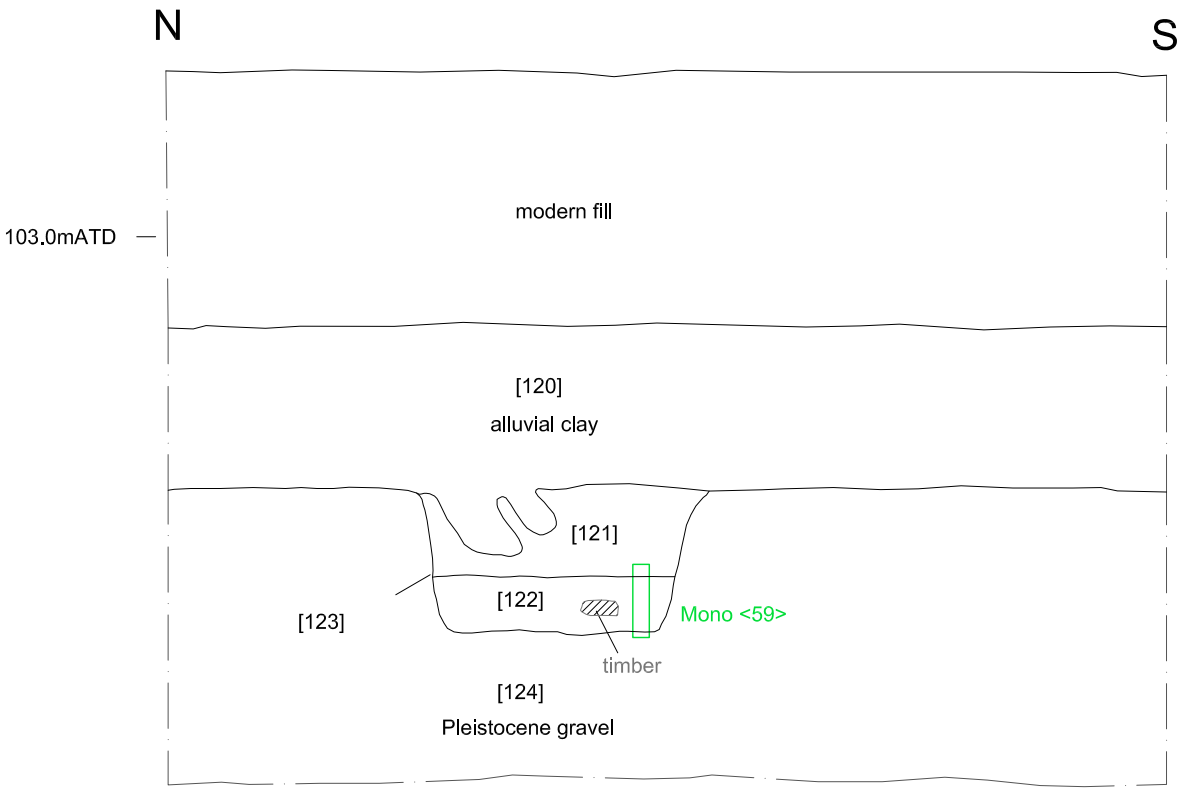


Fig 1: Watching Brief Trench Location
Site code: XSK10
Figure type: Fieldwork report

Type of fieldwork:
Targeted Watching Brief and Utilities General Watching Brief

Site Address:
Crossrail: PML Grout Shaft, Coffer Dam, EIP/TBM Chamber, Cut and Cover Section 2B adn 3, 11KV Cable Trench and Combined Sewer Diversion,
Crossrail Pudding Mill Lane Site,
Barbers Road, London E15 2PE

Trench edge / Watching brief areas included in this report
Earlier areas of watching brief
section line



1:50 @ A4

0 2.5m

Fig 2: Section 5 through deposits in Cut and Cover 2B showing isolated feature [123]. *For location see Fig 1*
Site code: XSK10
Figure type: Fieldwork report

Type of fieldwork:
Targeted Watching Brief; Utilities General Watching Brief

Site Address:
Crossrail: C261 PML Grout Shaft, Coffer Dam, Cut and Cover 2B and 3
Pudding Mill Lane Portal, Pudding Mill Lane,
London E15

Trench edge
[11] Archaeological features
103.0mATD — Section height