



SILVERTOWN TUNNEL




DOCUMENT TITLE:

**Archaeological Written Scheme of Investigation – Royal
Borough of Greenwich**

DOCUMENT NUMBER:

ST150030-RLC-ZZZ-06-ZZ-PLN-AC-0001

PURPOSE OF ISSUE	For Acceptance	DOCUMENT SUITABILITY	S3 - For Review & Comment	TOTAL PAGES (Including this page)	41
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Prepared by	Checked by	Approved by	Date	Revision
 CJV Archaeology Advisor	 CJV Archaeology Advisor	 CJV Project Director	15/07/2020	P02

Issue and Revision Control

Distribution and revision control is managed through the Electronic Document Management System – ASITE, with the latest revision displayed.

Document uncontrolled when printed.

Revision History			
Rev No	Date	Summary of Changes	Section & Number
P01	30/06/2020	First Issue	
P02	15/07/2020	Second Issue following consultation with GLAAS and comments from RBG	multiple

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1. Introduction

1.1 Scheme background

Riverlinx CJV have prepared this Archaeological Written Scheme of Investigation (AWSI) for a programme of archaeological investigation to be carried out in advance of works in the Silvertown Tunnel scheme (see the Site Plan in Appendix A). The scheme involves construction of a twin-bored road tunnel providing a new connection between the A102 Blackwall Tunnel Approach on Greenwich Peninsula (Royal Borough of Greenwich) and the Tidal Basin roundabout junction on the A1020 Lower Lea Crossing/Silvertown Way (London Borough of Newham). The tunnel is approximately 1.4km in length. In May 2018, the Secretary of State granted the application by Transport for London (TfL) for a Development Consent Order (DCO) for the construction and operation of the Silvertown Tunnel, including the associated approaches and area. The Code of Construction Practice (CoCP) was prepared in support of the DCO and is a certified document such that the Authorised Development must be undertaken in accordance with the CoCP. The development stages of the authorised works are as follows:

- Detailed design
- Site preparatory works
- TBM chamber and cut-and-cover tunnel
- Tunnel service buildings
- Highways, bridges and civils
- Bored tunnel (TBM drives, secondary lining and cross-passage construction)
- M&E fit out
- Commissioning and testing

Riverlinx CJV will seek to minimise any impact on heritage assets, their setting and the wider historic environment through the measures set out in the CoCP including:

- General Management Measures;
- Consultation with stakeholders;
- Measures in the event of unexpected discoveries; and
- Evaluation and monitoring.

This document provides an Archaeological Written Scheme of Investigation (AWSI) for the Greenwich site of the Silvertown Tunnel scheme.

1.2 Purpose

The purpose of the AWSI is to set out the archaeological investigation strategy, procedures, standards and techniques to be followed during the works taking place south-west of the River Thames (North Greenwich). It is intended for use by archaeologists, design engineers, programme managers and contractors. This document is intended to provide these groups with the information necessary to design, plan, support and carry out appropriate historic environment work on the scheme. This AWSI provides the technical scope of work for each aspect of the early works where archaeological investigation has been identified as necessary, incorporating a review of the geoarchaeological deposit model and detailed design/ construction planning. This AWSI has been developed in consultation with the Greater London Archaeological Advisory Service (GLAAS), prior to the start of the associated works. All works shall be undertaken in accordance with this AWSI and carried out/overseen by a suitably qualified person or body. This document provides the standards and framework from which the statutory consultees can monitor the investigation and provide feedback to Riverlinx CJV. The key consultee for the Greenwich site of the Silvertown Tunnel scheme is [REDACTED], the Greater London Archaeological Advisor for the London Borough of Greenwich. [REDACTED], GLAAS's Regional Science Advisor will also be consulted where relevant.

This document also includes the high-level Archaeological Research Framework in Appendix G, which will ensure a consistent and targeted approach to archaeological investigation. The document provides information to allow the scheme delivery team to design and plan construction programmes such as to minimise delays and risks.

2. Background

Nationally significant archaeological sites (both above and below-ground remains) can be identified as scheduled monuments and are protected under the Ancient Monuments and Archaeological Areas Act 1979. However, no likely significant effects on scheduled monuments or their setting are predicted to result from the Scheme. Since 1990 archaeology has been a material consideration in the planning process and it is protected through planning policy and guidance detailed in section 2.1 below. The Burial Act 1857, the *Disused Burial Grounds Act 1884 and 1981*, the *Pastoral Measure 1983*, and the *Town and Country Planning (Churches, Places of Religious Worship and Burial Grounds) Regulations 1930* together provide a legal requirement for the exhumation and re-interment of human remains. The *Environmental Statement* has not identified any known disused burial grounds within the Site. Any unexpected discoveries of human remains will be dealt with under the Riverlinx CJV procedures for unexpected discoveries (see Section 6.6).

The *Treasure Act 1996* and the *Treasure (Designation) Order 2002* covers finds of treasure – generally items of gold or silver over 300 years old (including two or more coins in the same find); or ten or more coins of base metal in the same find; plus any object such as a container associated with a treasure object. Treasure must be reported to the local Coroner and then taken to a designated local museum where it can be kept safely pending further decisions. The local museum would also offer specialist opinion on whether a reported object does fall under the definition of Treasure. The Museum of London is the designated museum for Greater London. The British Museum advises the Secretary of State whether or not a museum wishes to acquire the treasure (in which case the Coroner would hold an Inquest). Additionally, the *CoCP* contains good practice measures to protect and manage historic structures and archaeological assets during the construction process.

2.1 Policy and guidance

The National Policy Statement for National Networks (NPS NN) is the key document providing planning guidance for nationally significant infrastructure projects on road and rail networks. Paragraph 5.141 of the NPS NN provides that the Secretary of State may add requirements to the DCO to ensure that any archaeological investigation that has been identified in relation to the scheme is undertaken in accordance within an agreed timetable and to appropriate standards. The investigation will be undertaken in accordance with this AWSI produced in consultation with GLAAS during the detailed design stage and updated as works progress. The strategy, procedures, standards and techniques also conform to the requirements of relevant planning policy. These are set out in the *Environmental Statement*¹. Relevant professional standards and guidance for the historic environment that apply to the scheme include:

- a) The *National Planning Policy Framework 2019 (NPPF)* which places the emphasis on understanding and conserving the significance of heritage assets as part of sustainable development.
- b) *By-laws, standards and policy statements of the Chartered Institute for Archaeologists (CIfA)*², which provide detailed technical guidance and standards for all aspects of archaeological work.
- c) *Guidelines for Archaeological Projects in Greater London* (Greater London Archaeological Advisory Service, 2015) provides detailed technical guidance and standards for archaeological work undertaken in Greater London boroughs.

¹ TfL. 2016. Silvertown Tunnel: Environmental Statement. Table 8-1.

² CIfA. By-Laws; Code of Conduct (2010); CIfA. By-Laws; Code of approved practice for the regulation of contractual arrangements in archaeology (2014); CIfA. Charter and By-law (2014); CIfA. By-Laws; Regulations for the registration of organisations (2014); CIfA Policy Statement (2018); CIfA Standard and Guidance for the archaeological investigation and recording of standing buildings or structures (2014); CIfA, Standard and Guidance for archaeological field evaluation (2014); CIfA Standard and Guidance for an archaeological watching brief (2014); CIfA, Standard and Guidance for the collection, documentation, conservation and research of archaeological materials (2014); CIfA Standard and Guidance for archaeological excavation (2014); CIfA Standard and Guidance for the creation, compilation, transfer and deposition of archaeological archives (2014). CIfA Standard and Guidance for geophysical survey (2014). CIfA Standard and Guidance for nautical archaeology recording and reconstruction (2014).

- d) *A research framework for London archaeology* (Museum of London and English Heritage, 2002), the *Research strategy for the historic environment of Greater London* (MOLA 2015) and *The Greater Thames Estuary Historic Environment Research Framework* (Essex County Council, 2010) have been used to identify themes that encompass the historic environment assets within the scheme study area for the purposes of informing the archaeological research framework document.

Archaeological investigation will be coordinated by professional archaeologists who are suitably qualified and experienced (e.g. members of the Chartered Institute for Archaeologists (CIfA) or equivalent standing). Organisations undertaking and coordinating fieldwork will normally be expected to have CIfA accreditation as Registered Archaeological Organisations (RAO).

2.2 Site Description

This section has been summarised from the Silvertown Tunnel Environmental Statement (ES) Chapter 8. The boundary of the scheme is defined by the DCO Limits (Appendix A), and hereby referred to as ‘the Scheme’. The area of the scheme south-west of the River Thames (Greenwich) is also shown in Appendix A and for the purpose of this document is hereby referred to as ‘the Site’. There are no World Heritage Sites or Scheduled Monuments within the Site or a 1km radius. No Conservation Areas lie within the Site; East Greenwich Conservation Area lies just over 1km to the south-west. The Grade II listed Southern Gatehouse to the Blackwall Tunnel falls within the south-west of the Site (NHLE 1212100). The whole Site lies within the Greenwich Peninsula and Foreshore Area of High Archaeological Potential (AHAP), as designated by the Royal Borough of Greenwich.

2.3 Location, Topography and Geology

The Scheme crosses the River Thames and incorporates terrestrial sites on either side of the river. The Greenwich site is located to the south of the Thames of the Greenwich Peninsula, formed and bounded by a meander of the Thames to the west, east and north of the Site. The Site is located on naturally low lying land within the former floodplain of the River Thames; as such, the Site is underlain by alluvium, which contains deposits of peat in places. To the south of Greenwich Peninsula, alluvium is mapped to approximately the position of the A206, where it meets higher drier ground. Beneath the alluvium, sand and gravel is present and is assigned by Gibbard (1994) to the Late Devensian Shepperton Gravel. The bedrock beneath the gravel is the Palaeocene London Clay³.

2.4 Historic and Archaeological Background

The archaeological and historical background for the Site was assessed as part of the Environmental Statement prepared for the scheme. The following is a summary of the results.

Prehistoric (pre-30,000 BC to AD 43)

No direct occupation evidence of human activity has been found within the Site, but artefacts from the Palaeolithic onwards have been found in the general area. Boreholes undertaken in advance works associated with the adjacent Emirates Air Line cable car, adjacent to the Site, produced sequences of peat and alluvial clay from the Mesolithic to Bronze Age periods. The geoarchaeological deposit modelling for the Site indicates a potential for peat and relict land surfaces at the locations of the tunnel portal and the cut-and-cover area of the tunnel. These are believed to likely date to the prehistoric period, with a potential for archaeological and palaeoenvironmental evidence. Such deposits also have the potential to preserve organic remains, including artefacts and ecofacts. They may also contain or seal former land surfaces, particularly on the former high points on gravel ridges.

³ TfL. 2016. Silvertown Tunnel: Environmental Statement. Appendix 8.B, p 3.

Romano-British (AD 43 to 410)

There are no records of evidence from the Romano-British period from within the Site or surrounding area. The area is suggested to have been characterised by a landscape of marshy meadowlands during this period, so any archaeological evidence is likely to be associated with riverside activity and transport.

Early Medieval (AD 410 to 1066)

No evidence from the early medieval period has been recorded within the area; evidence from this period in London is typically focussed around Covent Garden and the Strand, to the west of the Site.

Medieval (AD 1066 to 1540)

Flood defences are recorded in the area since the 12th century and a putative causeway in the area is speculated as possibly dating to this period.

Post-medieval (AD 1540 to 1901)

Cartographic evidence indicates that Greenwich Peninsula remained largely undeveloped until towards the end of the post-medieval period. Rocque's map of 1762 shows the site as being located within agricultural fields. Evidence associated with the post-medieval whaling industry has been recorded within the area. A partial whale skeleton was recovered from during dredging work in the Thames in the vicinity of the Site. The Grade II listed Enderby House (NHLE 1079026), located to the south-west of the Site, was constructed for the whaling firm of Samuel Enderby. By the early 19th century the area was starting to undergo development and was changing from an area of agricultural fields to being part of London's urban periphery. Development was largely industrial, although there is evidence for residential buildings on the peninsula in the 19th century.

Modern (AD 1901 to present)

Development across Greenwich Peninsula intensified throughout the 20th century, with an increasing number of industrial buildings and wharfs being built. Buildings that have been present within the area of the Site include chemical works and extensive gas works, and much of the made ground within the Site will likely be associated with such development and later material.

2.5 Previous archaeological work

No previous archaeological investigations have taken place within the site to date.

Geoarchaeological model

A geoarchaeological deposit model was compiled in 2015 using the data from existing boreholes⁴. The results of the current deposit modelling indicate that the sediments recorded across the area of investigation are similar to those recorded elsewhere in the Lower Thames Valley, with a sequence of Late Devensian (Marine Isotope Stage 2, ca. 16,000-11,500 cal BP) Shepperton Gravel, overlain by Holocene Alluvium and capped by Made Ground. However, this deposit model needs to be updated and analysed with additional Ground Investigation material in order to inform the next stages of evaluation and excavation. Utilising data from available borehole records the older geoarchaeological deposit model identified six deposit units:

- Unit 1 - Shepperton Gravel
- Unit 2 - Sand
- Unit 3 - Lower Alluvium
- Unit 4 - Peat
- Unit 5 - Upper Alluvium

⁴ QUEST 2015

• Unit 6 - Made Ground

The southwestern area of investigation lies to the south of the River Thames on Greenwich Peninsula, formed and bounded by a meander of the Thames to the west, east and north of the Site, and opposite the confluence of the River Lea. To the south of Greenwich Peninsula Alluvium is mapped to approximately the position of the A206, where it meets higher drier ground. Beneath the alluvium, sand and gravel is present and is assigned by Gibbard (1994) to the Late Devensian Shepperton Gravel, and in the northern area of investigation, to the Lea Valley Gravel of similar age. The bedrock beneath both areas is the Paleocene London Clay. In the southern area of investigation the Shepperton Gravel surface generally lies at between -1.5 and -3m OD. The highest points on the gravel surface are recorded towards the centre.

Figure 1: N – S section of Greenwich site (QUEST 2015)

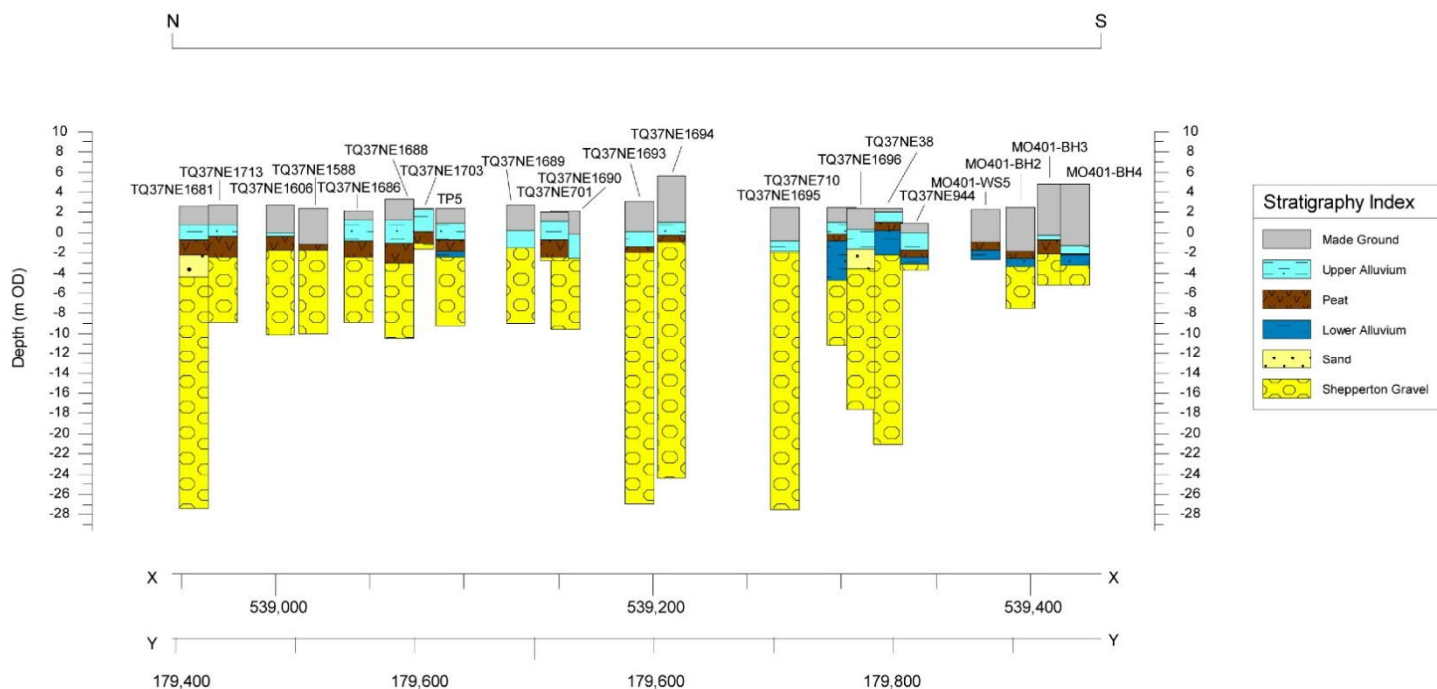
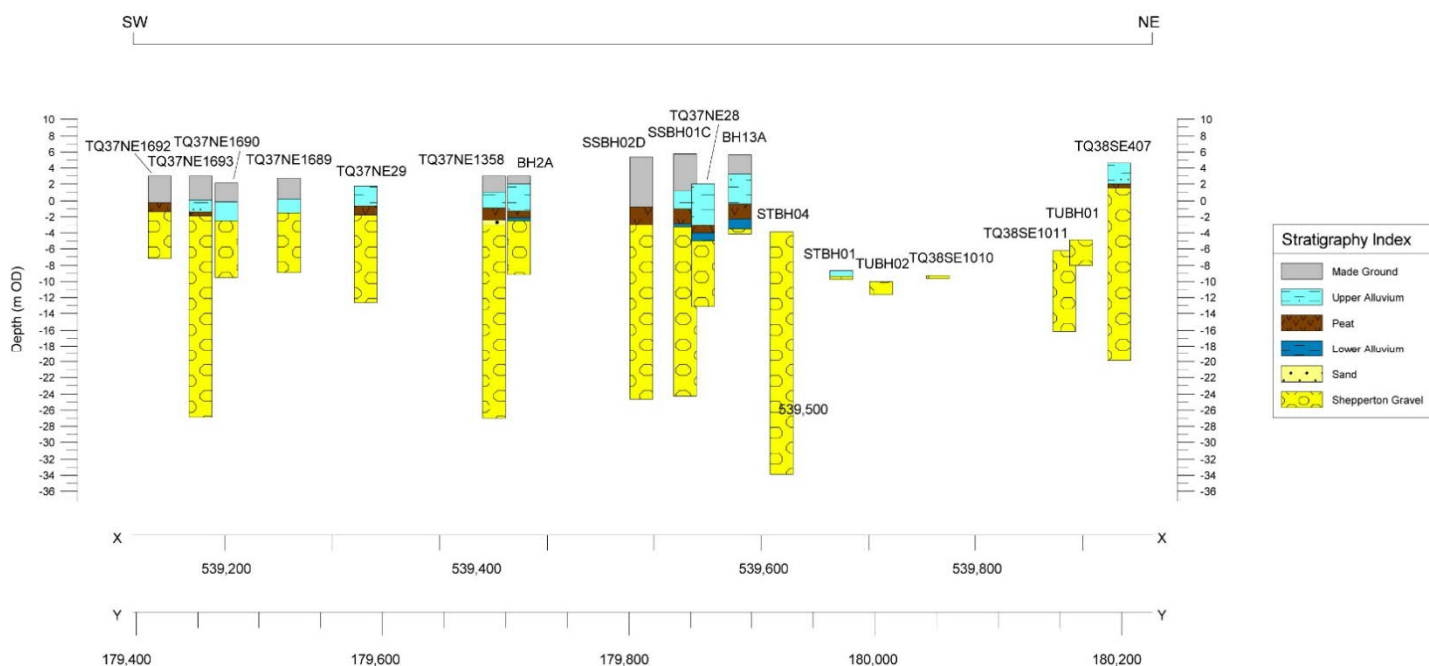


Figure 1 displays the N – S transect of the Greenwich site, roughly parallel to Blackwall Tunnel Southern Approach, generated by the geoarchaeological model. Figure 2 displays the SW-NE transect of the Greenwich site, including beneath the River Thames to the North East. As can be seen in both transects, large deposits of Peat were recorded across the site, and the amount of made ground is generally quite variable. It was noted during the deposit modelling that significant gaps are present in the distribution of the borehole records (e.g. between Edmund Halley Way and Millennium Way), and that additional geoarchaeological investigations would be necessary to fully understand the depth and thickness of the major stratigraphic units, as well as any evidence of human occupation preserved in the Peat horizons.

Figure 2: SW – NE section of Greenwich site and River Thames



2.6 Consultation

GLAAS were initially contacted 16th June 2020 regarding the production of AWSI, initial comments for which have been integrated into this report.

Further consultation with GLAAS took place 14th July 2020 to further discuss some comments given on 16th June, for both the Greenwich and Silvertown site. With regards to Greenwich, the primary focus of the discussion was the necessity and feasibility of archaeological trenching. GLAAS had initially expressed a desire for trenching in advance of construction to better understand the archaeological potential of the site. However, in light of the low archaeological potential and the high contamination risk of the made ground, as well as the deep concrete base of a former gas holder occupying a large portion of the site and the programme of works, it was agreed that trenching is not feasible and that monitoring is the most practical and safest course of action, avoiding unnecessarily deep and potentially contaminated trenches. Measures will be in place to minimise risk to archaeological remains and any remains of interest that are encountered at the level of monitoring are still to be investigated by hand. It was also agreed that GLAAS would provide contacts for local groups and societies of interest in order to aid in the development of a Public Outreach strategy.

Any updates on archaeological work planned and in progress will be reported to GLAAS. This will be provided by phone call and in person where agreed dependent on the tempo of on-site works. GLAAS may require a site visit and site access arrangements will be discussed as required.

A programme for regular site meetings with GLAAS, updates and other relevant liaison will be established once the programme of works is finalised. This will involve reporting to GLAAS prior to, during and after any archaeological work that takes place.

The Port of London Authority (PLA) were consulted on the first draft of this AWSI on 30th June 2020, whose only comment was in relation to the riverbed; the following condition would usually be imposed by the PLA on any River Works Licence/Dredging Licence and it was requested that the same procedure be followed during the Silvertown Tunnel Scheme:

“To hold all coins, fossils, articles of value or antiquity and any other remains of geological or archaeological interest discovered during the course of the works as the absolute property of the PLA and to take reasonable precautions to prevent persons from removing or damaging any such articles and immediately upon discovery to notify the PLA’s Planning and Environment Department of such discovery.”

3. Construction requirements and impact

The construction of the Silvertown Tunnel will require a number of activities, each with varying impacts to identified and potential buried archaeology.

3.1 Bored tunnels

Tunnels will be bored through London Clay, Harwich Formation and Lambeth Group geology. These geologies predate human and hominin evolution and are considered archaeologically sterile.

3.1 Rotation chamber

The main excavations for the rotation chamber are due to start in late Autumn 2021, following preliminary excavation of the made ground to a depth of c 1.25m OD (1.25mbgl) in advance of the piling. Temporary secant bored piles will be drilled to a depth of -30.00m OD before a bulk excavation to a depth of c -19.00m OD. The excavation of the made ground will unlikely impact any archaeological remains of significance; however, the bulk excavation would extend through all superficial deposits and into the London Clay, removing all potential archaeological remains within its footprint. A plan and elevation of the rotation chamber can be found in Appendix B.

3.1 Cut and cover tunnel

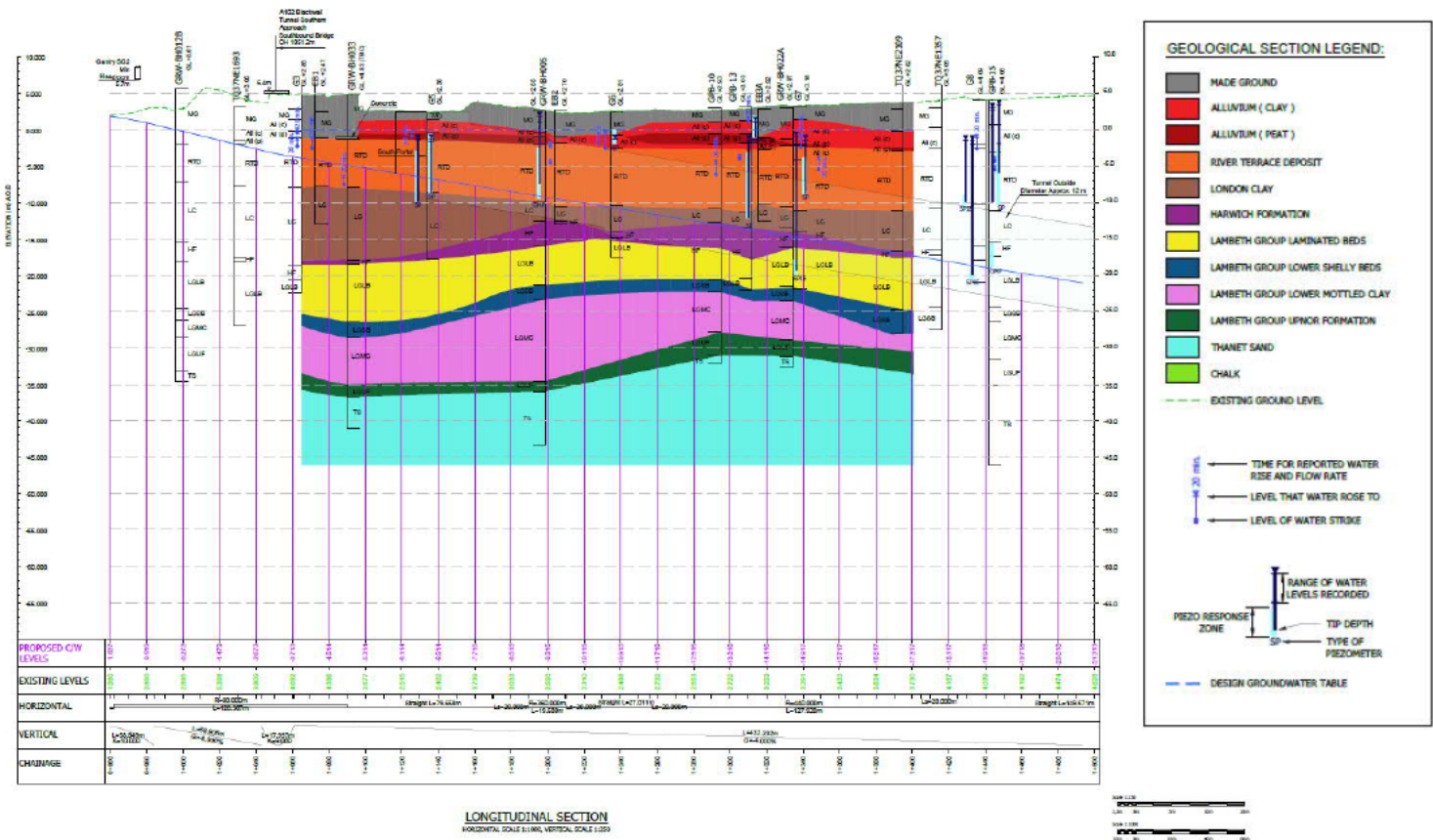
The construction of cut and cover tunnels will include installing temporary sheet piles to a depth of -18.5m OD (21.5mbgl) before excavating to a depth of -10.48m OD (13.48mbgl). The bulk excavation required for the cut and cover tunnel at the Greenwich site is due to start in late Spring 2022. The installation of sheet piles will require the pre-excavation of a trench along the pile line, the depth of which is to be confirmed but will likely be between 3 and 4m. Any excavation of this depth would potentially impact the deposits of Peat beneath the made ground. The bulk excavation would extend into the natural geology and remove all potential archaeological remains within its footprint. A plan and elevation of the cut and cover tunnel can be found in Appendix C.

3.2 Tunnel portal

The main excavation for the tunnel portal is due to start in late Spring 2021, following the installation of permanent secant bored piles to a depth of -25.00m OD (28.75mbgl). Preliminary excavation before the piling will be to a depth of 0.95m (2.8mbgl), which would likely extend beyond the made ground and into the alluvium, and therefore has the potential to impact archaeological remains.

A review of the Geoarchaeological Model and Northbound Geological London Section and Location plan (ST150030-COW-BAS-TN-ZY-DR-GE-0005, ST150030-COW-BAS-TN-ZY-DR-GE-0007) shows that the tunnel portal will impact Made Ground, Alluvium with potential Peat deposits and River Terrace Deposits. A plan and elevation of the portal can be found in Appendix D.

Figure 3. Geological longitudinal section at North Greenwich launch chamber



3.3 Open cut tunnel

The bulk excavation for the open cut tunnels is to be done in stages in Winter 2021, Summer 2022 and late Summer 2023. This will follow the piling of the retaining walls; the excavation for the first phase of piling is due to start in Spring 2021. The installation of the sheet piles will require preliminary excavation, to remove any obstructions in the made ground; as such, this is not anticipated to extend below the made ground. The area between the sheet piles is to be excavated to a maximum depth of c 10.50m OD (13.5mbgl), which would extend well into the natural geology, removing all potential archaeological remains within its footprint. A plan and elevations of the open cut and retaining walls can be found in Appendix E.

3.4 Utility diversions

The utility diversions on the Site are largely considered to have minimal impact to previously undisturbed ground. The diversion involves extracting the utilities and installing them on a temporary bridge over the area of the cut and cover tunnel. The utilities will then be reinstated into the backfilled ground over the newly constructed tunnel.

A Surface Water Sewer to the north of the area of cut and cover will require diversion; currently two options are being explored:

- Rerouted along Edmund Halley Way, which would be approximately 700m in length and 2-3m in depth
- Rerouted along CJV temporary road, utilising only 150m of Edmund Halley Way.

There is anticipated to be some utility works in the vicinity of Boord Street footbridge to a depth of approximately 1m, plans for which are yet to be finalised.

A series of trial holes are to be excavated in advance of the utility works; these will be either 1x6m or 1x4m in plan, and will vary between 2m and 5m in depth. Many of the trial holes are to be excavated within the existing highway,

the ground below which will already be heavily disturbed and so are not considered to impact archaeological remains. Similarly, a number of the proposed trial holes are aiming to confirm the location of existing utilities, the excavation of which will also be within previously disturbed ground and will therefore unlikely contain remains of archaeological interest.

Two proposed trial holes have been identified as being in potentially undisturbed land; TH18 and TH19 are being excavated on the south side of Millenium Way in order to ensure the area is clear and available for the diversion route. These trial holes are to be 1x4m in plan and 2m in depth; the current geoarchaeological deposit model (2015) indicates approximately 2m of made ground in this area; it is therefore unlikely that the trial holes will impact any significant archaeological remains. This will be reviewed when the geoarchaeological model is updated. The location plans for the trial holes can be found in Appendix F.

4. Historic environment research framework

4.1 Purpose

The anticipated buried archaeological assets within the Silvertown Tunnel site are varied. Buried assets may include buried prehistoric activity, including trackways and boats (where former marshland and channels are present); occupation (on former dry land, often gravel islands or river terraces), and ritual activities (within channels or at the edges of them). It may also include associated palaeoenvironmental evidence of past landscapes and human interaction with them. In developing and implementing a detailed strategy of investigation to address effects on these different assets it is necessary to have a framework of archaeological priorities and objectives. This allows the assets that have the greatest significance⁵⁶ and potential to improve research and areas of the historic environment to be identified and targeted. The work undertaken on the scheme will be carried out with reference to the scheme's high-level Archaeological Research Framework (contained in Appendix G). This research framework will therefore assist in scoping any necessary archaeological investigation and will inform the choice of sampling strategies and techniques.

4.2 Basis for the research

Research has been based on the results of ES baseline data gathering. This has identified the potential types and classes of heritage asset that may be present at the Silvertown Tunnel sites and it also draws on the relevant research frameworks and strategies for Greater London, namely:

- a) A Research Framework for London Archaeology (Museum of London and English Heritage, 2002) which is now updated by the below;
- b) A Strategy for Researching the Historic Environment of Greater London (MOLA, Rowsome, P, et al. 2015)

4.3 Archaeological themes

As part of the ES process data has been collected from a wide range of sources, from which four overarching archaeological and historical themes have been identified. The social and historical context of these themes are detailed in the Archaeological Research Framework document in Appendix G. The themes are as follows:

- a) Palaeoenvironment and prehistory (SE2 – Inhabiting the pre-urban landscape);
- b) Industrial archaeology;
- c) River management, transport, infrastructure and trade; and
- d) Industries associated with the Thames and its tributaries.

⁵ In determining significance at the ES stage, potential and known heritage assets have been considered against four values set out in English Heritage Conservation principles, policies and guidance, (2008). These values remain valid during the mitigation design and fieldwork stages and complement the research framework objectives.

⁶ English Heritage. Conservation principles, policies and guidance, (2008).

5. Approach to determining archaeological fieldwork

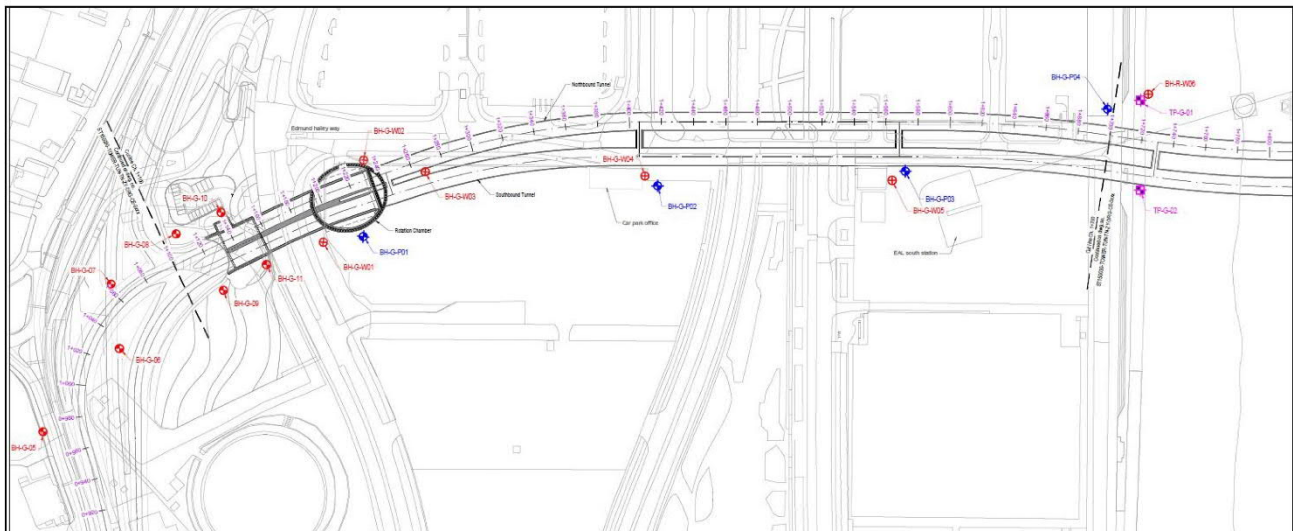
The scheme has been designed to minimise environmental effects and therefore the construction, design and methods take account of historic environment considerations. Control measures are included within the CoCP to minimise effects, for example contingency measures in the event of unexpected, highly significant remains being encountered. Where the ES has identified likely significant effects, having taken account of embedded measures, archaeological investigation has been identified where possible. The majority of archaeological impacts will occur during the construction phase.

There are two main approaches to archaeological preservation: preservation in situ or preservation by record (archaeological investigation). Preservation in situ is normally the preferred option for known assets of particularly high (i.e. national or international) significance, where feasible. For the Silvertown Tunnel Scheme, no buried archaeological assets warranting preservation in situ have been identified. Heritage assets are to be preserved by record, involving archaeological investigation, recording and dissemination at a level appropriate to the significance of the asset. Physical remains will be removed by archaeologists but the record and knowledge of them will be retained.

5.1 Geoarchaeological watching brief and deposit modelling

Geotechnical investigations have recently been undertaken within the site, at the locations shown in **Error! Reference source not found.**, which were archaeologically monitored by a third party contractor; a geoarchaeological assessment is to take place, and subsequent borehole logs and factual reports will be utilised to update the geoarchaeological deposit model. The results of the monitoring will enhance our understanding of the nature and depth of the made ground, as well as the level that deposits of Peat can be expected to be found, in the identified areas of impact.

Figure 4: Locations of Geotechnical Investigation boreholes and trial pits (Arup, 2020)

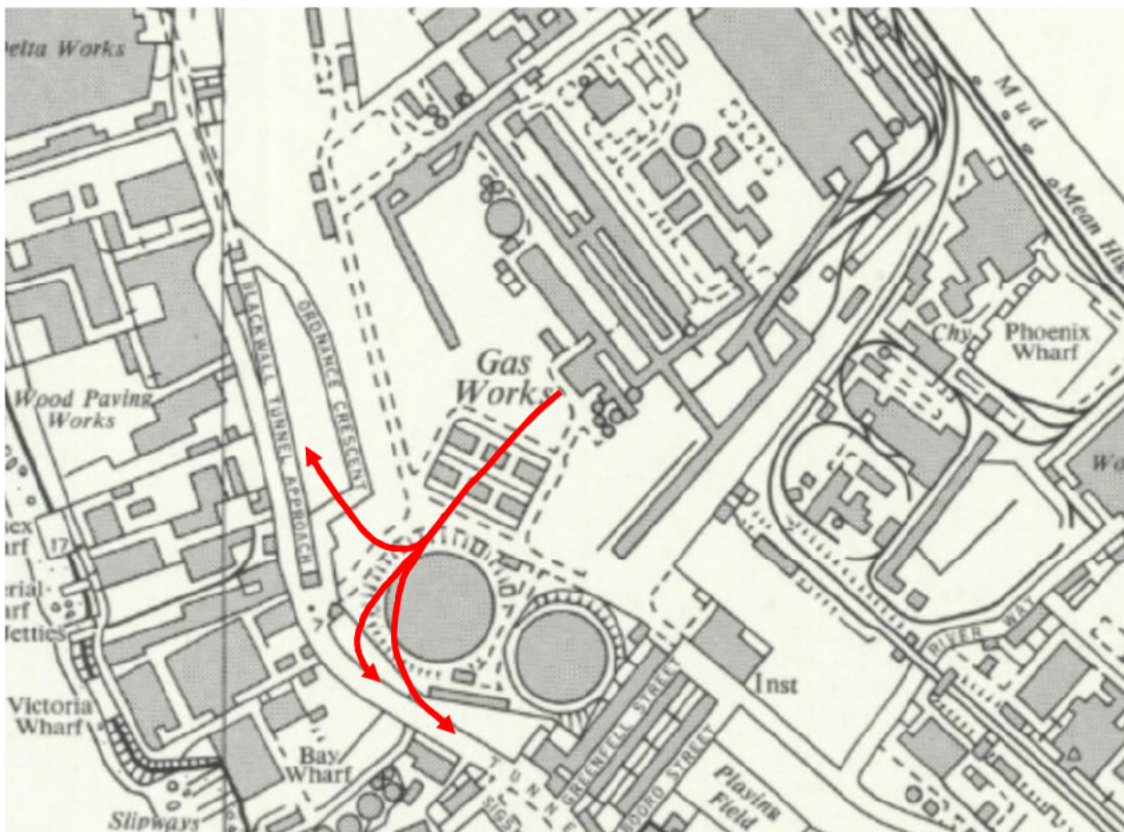


6. Archaeological monitoring

During the late post-medieval and into the modern period, the main development to occupy the Site was a large gas works which included a large gasholder. The made ground within the site is therefore not anticipated to contain remains of archaeological interest; any potential remains pre-dating the gasworks is likely to be contaminated and/or removed. As such the ground can be reduced down to the first archaeological horizon, i.e. the upper alluvium, without being archaeologically monitored, the level of which will be clarified by the results of the geoarchaeological watching brief. However, the significant levels of Peat that are anticipated within the site, as well as the alluvium, have the potential to contain well preserved prehistoric remains such as trackways and former land surfaces, which should not be removed without record.

It is therefore recommended that a programme of archaeological monitoring is implemented during the bulk excavation required for the construction of the rotation chamber, the cut and cover tunnel, the tunnel portal and areas of the open cut excavation that are not within the footprint of the former gas holder. This would aim to address Theme 1 of the Historic Environment Research Framework: Palaeoenvironment and Prehistory. All work will be undertaken in accordance the Chartered Institute for Archaeologists 'Standard and Guidance for an archaeological watching brief' (CIfA 2014e), 'Standard and Guidance for the Collection, Documentation, Conservation and Research of Archaeological Materials' (CIfA, 2014c) and the 'Standard and Guidance for the Creation, Compilation, Transfer and Deposition of Archaeological Archive' (CIfA, 2014d).

Figure 5: Ordnance Survey Map of Greenwich Peninsula, 1949. The red line is roughly indicative of the tunnel alignment; the tunnel portal is roughly located to the immediate north of the north-western gas holder.



Historic drawings of the former gas holder indicate that the structure had a substantial concrete base, and historic boreholes within its footprint indicate that the slab is still present, up to a depth of 7mbgl. This will extend well into the natural geology, removing all potential for archaeological remains in this area, and can therefore be scoped out of further archaeological work. This will include a portion of the open cut excavations that are to take place, plans for which can be seen in Appendix E.

6.1 Aims and Objectives

The objective of the archaeological monitoring is to identify, investigate and record any buried archaeological finds or features revealed on site during the excavation of the Peat and alluvium, whilst causing minimal delays to the programme of the Scheme.

6.2 Methodology

The bulk excavation required for the construction of the rotation chamber, cut and cover tunnel, tunnel portal and open cut tunnel will be machined by the principal contractor under archaeological supervision at all times. The area will be opened by a suitable mechanical excavator; a breaker and/or toothed bucket may be used to remove the existing hardcore and made ground to an appropriate level above the first anticipated archaeological horizon, to ensure no archaeological remains are removed or damaged without record (i.e. 0.5m). Any subsequent deposits are to be carefully removed using a toothless ditching bucket.

Care will be taken to avoid damage to archaeological remains during machining. Mechanical excavators will not track over the trench once excavated. It is the responsibility of the supervising archaeologist to ensure that the finished surface is machined to a suitable 'clean' state in order to identify, define and investigate any exposed archaeological deposits. If the surface is not sufficiently clean, hand cleaning of the surface will be required.

The groundworks are to be monitored by a qualified archaeologist to a depth where archaeological remains are unlikely to be present (the upper layers of the terrace gravels). If remains are identified that are considered to be of archaeological interest, excavation will temporarily cease to allow the hand excavation and recording of such remains (if it is safe to do so).

Should remains be identified that are considered to be of high (national) significance, excavation is to halt and the archaeological contractor is to contact Riverlinx CJV's Archaeological Advisor, who will contact GLAAS to arrange an on-site meeting to discuss mitigation.

6.3 Planning and recording

All identified features will be planned at a scale of 1:20 and either digitally or hand drawn and located on appropriate scale plans. Plans will show the limits of the excavation and will be related to the Ordnance Survey National Grid.

If appropriate, sections of identified features will be drawn at a scale of 1:10 and will be levelled to Ordnance Datum.

All archaeological features or finds will be allocated unique context numbers prior to any hand excavation. These will be recorded on pro-forma context sheets detailing: character, contextual relationships, a detailed description, associated finds, interpretation and cross referencing to the drawn, photographic and finds records. On-site matrices will be compiled during the excavation such that the results of the written stratigraphic records may be fully analysed and phased.

An adequate photographic record of the investigations will be made of all excavated areas and all archaeological features and finds. The primary photographic record will be captured in digital images in uncompressed TIFF format using a DSLR camera of not less than 10 megapixels. This should be done in accordance with Historic England Guidance Digital Image Capture and File Storage (2015). The photographic record will include photographs and images of all archaeological features (pre- and post-excavation) and working shots. Photographic records will include information detailing: site code; date; context(s); section number; a north arrow and a scale unless they are to be used for publication purposes. All photographs will be listed and indexed on context record sheets.

A record or index will be maintained of all site drawings and these will form part of the project archive. All site drawings will contain the following information: site name; site number and code; scale; plan or section number; orientation, date and compiler.

6.4 Finds

All finds will be exposed, lifted, cleaned, conserved, marked, bagged and boxed in accordance with First Aid Kit for Finds⁷ and ClfA's Standards and Guidance for the collection, documentation, conservation and research of archaeological materials⁸. Any ferrous objects are to be x-radiographed in accordance with Guidelines in the X-Radiography of Archaeological Metalwork⁹.

All finds will be collected and bagged according to archaeological context; no finds will be left loose on site. Records of finds assemblages (e.g. flint scatters) will clearly state their manner of excavation, how they have been sub-sampled and how they have been processed.

All finds of gold and silver will be recorded, removed to a safe place and reported to the Coroner in accordance with the Treasure Act 1996 and the Treasure (Designation) Order (2002) and GLAAS. Where retrieval cannot be effected the same day, the Archaeological Contractor (with support of the Principal Contractor if required) will take appropriate security measures to safeguard the finds. Contingency provision will be made for additional specialist advice, e.g. for finds analysis and conservation.

6.5 Sampling

Where necessary, a suitably qualified geoarchaeologist will record any deposits of particular significance such as buried soils, or to advise on depositional processes. The environmental strategy will be devised by the Archaeological sub-contractor's suitably qualified environmental archaeologist and will be agreed with Riverlinx CJV's Archaeological Advisor and GLAAS. This will follow the guidance provided by Historic England Environmental Archaeology: A Guide to the Theory and Practice of Methods, from Sampling and Recovery to Post-excavation (Historic England, 2011).

GLAAS's Regional Science Advisor will be contacted should advice concerning specialist sampling requirements, scientific dating techniques and scientific applications be required.

If appropriate, bulk samples will be taken from selected, sealed deposits. Preparation, taking, processing and assessment of environmental samples will be in accordance with guidance provided by Historic England (2011). Environmental samples will only be taken where organic remains survive in well stratified deposits. Flotation samples (40 - 60 litres or the whole context dependent upon size) will be taken where there is clear indication of good analytical potential and samples for coarse-sieving measuring 100 litres (or the entire fill in smaller features) will be taken for the recovery of animal bones and other artefacts.

Sub-samples or monolith samples of waterlogged deposits and sealed buried soils with potential for pollen preservation will be taken for assessment, from suitable contexts, and columns of such samples will be taken through deposits where there is clear potential for recovering a datable sequence of environmental information. Recovery of small animal bones, bird bone and large molluscs will normally be achieved through processing other flotation samples or coarse-sieved samples may be taken specifically to sample particularly rich deposits. Details of environmental specialists will be provided in the Archaeological Contractor's method statement.

6.6 Unexpected discoveries

Archaeological monitoring during construction provides a contingency arrangement for managing occasional unexpected discoveries or major finds. It enables archaeologists to be on hand to advise and to handle any discoveries. In the event of unexpected discoveries during construction, where an archaeologist is not in attendance, Riverlinx CJV will cease works in the vicinity and contact an archaeologist to advise. A 'No Dig' zone will be demarked and fenced off, if appropriate. The area will be made safe, sufficient for the archaeologist to inspect the remains and advise on what, if any, further investigations are required. In the case of small-scale routine remains, the archaeological team may be able to investigate and record them immediately, so that construction work may continue. In the case of more extensive or significant discoveries, where a halt to works is called the archaeologist will liaise with Riverlinx CJV's Archaeological Advisor who will promptly communicate the

⁷ Watkinson and Neal (2001)

⁸ ClfA (2014d)

⁹ Historic England (2006)

discovery to GLAAS, who may wish to arrange a visit to the site, in order that suitable mitigation may be agreed and implemented with minimum delay. In the event of the discovery of human remains work is to stop immediately and the police to be called if the remains are not identified to be historic¹⁰. Any human remains will need to be covered and screened from public view and suitable security provided pending a decision regarding how the remains be treated. Human remains will be treated in accordance with the HBMCE guidelines¹¹.

6.7 Health and Safety

The Archaeological Contractor will comply with the Riverlinx CJV health and safety procedures and systems at all times, including the CDM regulations. This is in addition to the RAMS to be prepared by the Archaeological Contractor themselves as part of the project set up. The Principal Contractor will make available any health or safety requirements before the commencement of the works.

The RAMS must be sent to and approved by Riverlinx CJV prior to commencement of the works. The RAMS will confirm appropriate levels of Personal Protective Equipment (PPE) to be worn by workers on site and all other pertinent risk avoidance procedures. The RAMS will also detail the staffing, programme and proposed methodology in accordance with this AWSI. Appropriate welfare facilities are to be provided by the Archaeological Contractor. All Archaeological Contractor site staff will hold a valid (and appropriate) CSCS card and the Archaeological Contractor will provide evidence of the cards to the Principal Contractor.

The Archaeological Contractor will be responsible for undertaking a Dynamic Risk Assessment prior to and during the work. Any new hazards/risks/near misses identified prior or during the on-site work will be reported to the Principal Contractor/ Riverlinx CJV in a timely manner (including any action taken) with the RAMS updated accordingly.

Ground Contamination

A potential risk of ground contamination has been identified at the Greenwich site, consistent with the condition in the local area which is known to be historical contamination from the former gas works. Site safety and control measures will be developed for each excavation area, based on the nature and degree of contamination of the soils and groundwater, as identified in by the ground investigation and risk assessment. All archaeological works in areas identified to have potentially contaminated ground will be undertaken in accordance with the Ground Contamination Risk Assessment¹² and Ground Contamination Remediation Strategy¹³.

6.8 Neighbouring and concurrent projects

The archaeological subcontractor is to make contact and arrange regular liaison with those appointed to carry out archaeological work on neighbouring development projects, to exchange results and findings, prior to their publication and dissemination.

¹⁰ BAJR (2012)

¹¹ English Heritage(2005)

¹² Riverlinx 2020 Silvertown Tunnel – Greenwich Ground Contamination Risk Assessment

¹³ Riverlinx 2020 Silvertown Tunnel – Greenwich Ground Contamination Remediation Strategy

7. Post excavation requirements

7.1 Processing of site data and finds

During and upon completion of fieldwork all site records, finds will be processed, packaged, entered on a database and stored, to create an initial fieldwork archive. The objective is to produce a checked, ordered and retrievable corpus of data, with supporting stratigraphic matrices and digitised feature plans, ready to be worked on when the post-excavation process begins. For the same reason, the initial processing, cleaning and cataloguing of finds will also be undertaken at this stage. Initial first aid conservation and stabilisation of some artefacts may be required.

7.2 Reporting

The level of post-excavation reporting will be commensurate with findings of the archaeological monitoring and will comply with the requirements of this WSI, the guidance within MoRPHE (Management of Research Projects in the Historic Environment) (Historic England, 2015), and ClfA Standards and Guidance for archaeological field evaluation and archaeological watching briefs (ClfA, 2014b and ClfA, 2014e).

Reporting should consider the results of the archaeological monitoring in the context of local, regional and national research agendas and frameworks. As a minimum, it is considered that the report should contain the following:

- a QA sheet detailing as a minimum - title, author, version, date, checked by, approved by;
- a non-technical summary; a summary summarising the scope and results of the monitoring;
- an introduction to the site location, the scheme and archaeological works;
- a site location drawing;
- the archaeological and historical background (including geological and topographical background and an assessment of the results of previous phases of fieldwork);
- the methodology employed for the archaeological fieldwork;
- the aims and objectives of the investigations;
- the results of the fieldwork;
- interpretation of results and recommendation for further work and/or publication;
- detailed plans and sections illustrating archaeological features and/relationships between features (at an appropriate and recognised scale); and
- colour photographic plates illustrating the site setting, work in progress and archaeological discoveries.

In the first instance, a digital copy of the reports will be submitted to Riverlinx CJV's Archaeological Advisor for review by the Project Team. Any alterations required will be carried out by the Archaeological Contractor and a revised digital document submitted. This will be submitted by Riverlinx CJV's Archaeological Advisor for GLAAS to review.

The Archaeological Contractor will submit a completed approved version of the reports to the Archaeological Data Service's (ADS) online database OASIS and a copy of the completed OASIS forms will be appended to the back of the reports. Provision will be made for publicising the results, and will be included in the Archaeological Contractor's Method Statement.

7.3 Publication/dissemination

In the case of archaeological sites and results that do not advance understanding of the themes and objectives of the research framework, the minimum dissemination requirement is to submit a short summary of the results to the Greater London Historic Environment Record (HER) and National Monuments Record (NMR) (using the appropriate OASIS¹⁴ archaeological report form), and for publication in the 'Excavation Round-up' of the London Archaeologist and other period-based archaeological journals as appropriate. This will be carried out by the Archaeological Subcontractor. Further publication may also occur, dependant on finds, in order to realise the objective of preservation by record - to improve public understanding and appreciation of the past. Dissemination of the archaeological results of a large infrastructure scheme may range from technical volumes (thematic or period-based) to popular booklets, temporary exhibitions, work with schools, web-based initiatives etc.

7.4 Public Outreach and Interpretation

A strategy of Public Outreach and Interpretation is to be developed during the programme of archaeological works, which will enable The Scheme to secure wider social, economic and environmental benefits in line with the Social Value Act 2013¹⁵. The strategy will be developed in liaison with key stakeholders, the project team and the Riverlinx CJV Community Construction Liaison team, in line with The Scheme's Community Engagement Plan¹⁶, with the aim of making the heritage work that is undertaken throughout the Scheme available for the public to view and be educated by. This will enhance the public's understanding and enjoyment of the local history, as a result of the Scheme going ahead.

7.5 Final scheme archive

The report for the archaeological monitoring and data from subsequent analysis and publication, will be systematised into an ordered and retrievable final scheme archive suitable for public access for future research. This will be agreed with by Riverlinx CJV, GLAAS and the archaeological subcontractor. The scheme archive will then be transferred to a nominated public receiving body (normally a local museum). This completes the planning requirements for preservation by record by placing all results into the public domain. The receiving body for the Silvertown Tunnel archaeological archive will be the Museum of London's London Archaeological Archive and Research Centre (LAARC). The final scheme archive should therefore be prepared to Museum of London deposition standards (2009)¹⁷. These are supplemented by the following guidelines:

- a) Institute of Conservation (ICON, formerly known as UK Institute for Conservation) Conservation Guidelines No. 2,
- b) Museum of London Standards for the Preparation of Finds to be permanently retained by the Museum of London.
- c) Museums and Galleries Commission's Standards in the Museum Care of Archaeological Collections, (1992),
- d) Society of Museum Archaeologist's (draft) Selection, retention and dispersal of archaeological collections, (1992)

¹⁴ <https://oasis.ac.uk/pages/wiki/Main>

¹⁵ Social Value Act 2013 (updated 3 May 2016) <https://www.gov.uk/government/publications/social-value-act-information-and-resources/social-value-act-information-and-resources>

¹⁶ Silvertown Tunnel: Community Engagement Plan – Planning (Royal Borough of Greenwich) 2020 document number ST150030-RLC-ZZZ-XX-ZZ-PEM-TP-0003

¹⁷ ¹⁷ Museum of London, General Standards for the preparation of archaeological archives deposited with the Museum of London, (2009).

¹⁷ Archaeological Archives Forum, Archaeological Archives. A guide to best practice in creation, compilation, transfer and curation (2007).

- e) Archaeological Archives Forum Archaeological Archives. A guide to best practice in creation, compilation, transfer and curation (2007).

7.6 Ownership of finds

Ownership of any finds on a site lies with the landowner (except in certain circumstances where finds are considered to be Treasure). Approvals, licences and permissions from the landowner would be required to donate the finds to the Museum of London, to enable the Museum to carry out its obligations to curate the finds after discovery, in perpetuity, as part of the archaeological Archive from each site. Arrangements may be made if required between the landowner, Riverlinx CJV and the Museum for the conservation, display, provision of access to or loan of selected finds in or near their original location.

8. Communication

8.1 Riverlinx CJV Design Team

During the construction, design and programming phase, the Riverlinx CJV Design Team will communicate sufficient technical information to the Archaeological Advisor and Riverlinx CJV Construction Team's archaeological subcontractor to allow the archaeological programme of works to be defined and implemented. This includes ensuring that responsibilities for the historic environment are adequately defined at the tender and contract award stage for the archaeological works. Press and publicity protocols will be communicated to Riverlinx CJV and their archaeologists.

8.2 Riverlinx CJV's Archaeological Advisor

The archaeological advisor for Riverlinx CJV will act as liaison between the Riverlinx CJV Design and Construction Teams and GLAAS, working to move the archaeology programme along to meet timetables and will monitor site works. They will agree archaeological activities internally within the Riverlinx CJV Team and externally with GLAAS and the archaeological subcontractor.

8.3 Riverlinx CJV Construction Team

The Riverlinx CJV Construction Team, as the main site works contractors, will manage the construction process in a way that facilitates safe access for the archaeological team to complete the programme of archaeological works that have been defined in this AWSI and agreed with the statutory consultees. The Riverlinx CJV Construction Team will provide the necessary technical support and attendances to their sub-contracted archaeologists, Riverlinx CJV's Archaeological Advisor, and GLAAS as outlined below:

- a) Liaising with the Client team including Riverlinx CJV's Archaeological Advisor in heritage matters including seeking advice where necessary.
- b) Seeking the professional advice of their archaeological subcontractor concerning any built or buried heritage concerns, unexpected discoveries, human remains or treasure.
- c) Granting reasonable site access to GLAAS and Archaeological Advisors as appropriate.

8.4 Archaeological subcontractor

The Riverlinx CJV archaeological subcontractor will act as liaison between the Riverlinx CJV Design and Construction Teams and GLAAS, working to move the archaeology programme along to meet timetables and will monitor site works. They will undertake the required programme of archaeological works specified in this AWSI to professional standards and best practice, including:

- a) Keeping to agreed timetables and work programme and providing advance notice of cases where this would not be possible due to unforeseen circumstances or other issues.
- b) Developing archaeological priorities framework and research objectives through feedback of the results of the ongoing programme of archaeological works, so that existing priorities may be reviewed and new ones identified.
- c) Proactively communicating with the Riverlinx CJV Construction Team and their Archaeological Advisor via progress reports and meetings.

- d) Contributing actively and vigilantly (under appropriate specialist advice) to implementation of the Riverlinx CJV Construction Team's safety management system in order to maintain a safe working environment within which the agreed programme of archaeological works may be carried out.

The archaeological subcontractor will be a Registered Organisation with the Chartered Institute for Archaeologists (CIfA), who will agree to abide by the standards and guidance documents of CIfA. The scheme will be managed by a fully qualified archaeologist with full membership of the CIfA and will follow the CIfA 'Code of Conduct' (CIfA, 2014a).

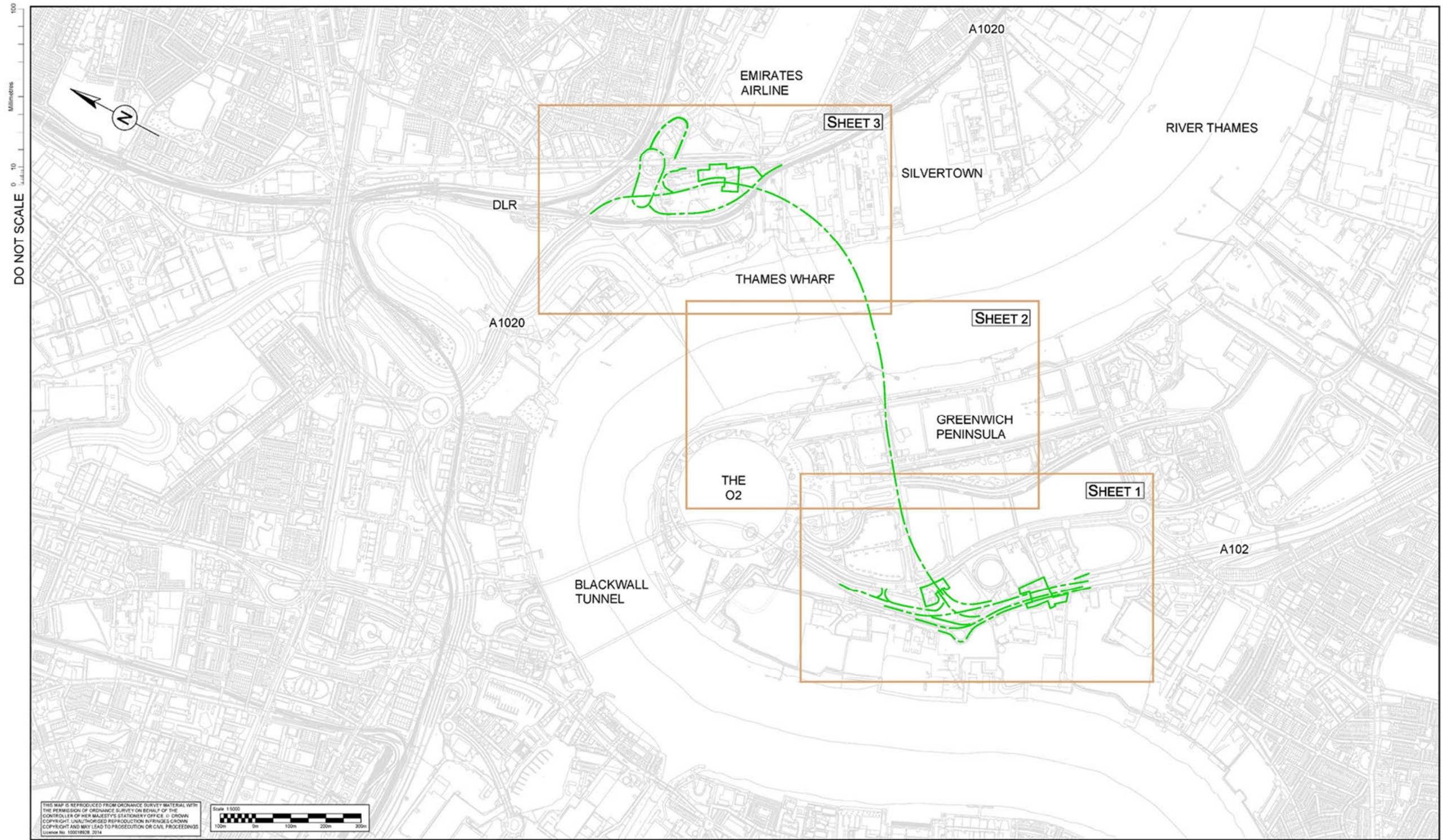
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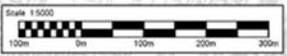
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Appendix A: Site Plan



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KEY:
--- WORKS SHOWN INDICATIVELY

NOTES:
1. THIS PLAN SHOULD BE READ IN CONJUNCTION WITH THE WORKS PLANS (SHEETS 1 TO 3) AND ALONGSIDE OTHER PLANS AND DOCUMENTS IN THE DEVELOPMENT CONSENT ORDER APPLICATION, IN PARTICULAR SCHEDULE 1 (AUTHORISED DEVELOPMENT) TO THE DEVELOPMENT CONSENT ORDER.
2. THE PROPOSED TUNNEL ROUTE IS SHOWN HERE FOR INDICATIVE PURPOSES TO IDENTIFY THE LOCATION OF THE SCHEME.

Rev	Drawn / Date	Checked	Approved	Date
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PS2	SB	GB	NK	26/04/16
PS3	SB	MB	NK	05/04/17

FOR DCO SUBMISSION

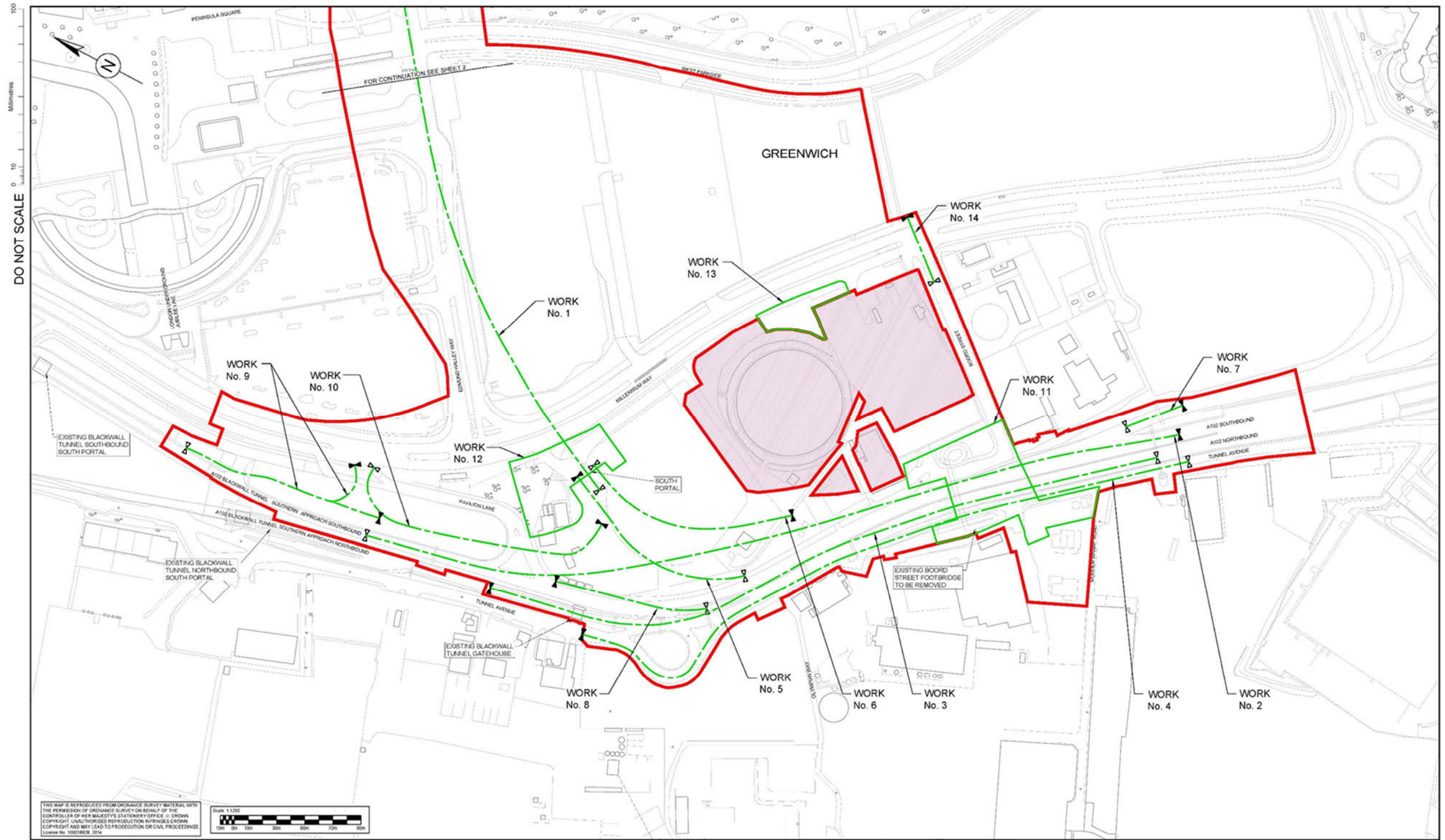
SILVERTOWN TUNNEL

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Drawing Title		WORKS PLANS REGULATION 5(2)(j) KEY PLAN			
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Original Size	A1	Date	Date	Date	Date
Project Drawing Number	ST150030-ATK-ZZZ-ZZ-DR-CE-3080	Revision	P03		

Address Ref: ST150030-ATK-GEN-0000-DR-Z-3080

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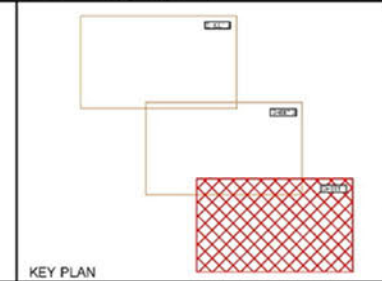
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KEY:	
	ORDER LIMITS
	AREA EXCLUDED FROM ORDER LIMITS
	LINEAR WORK CENTRELINE
	NON-LINEAR WORK LIMIT OF DEVIATION
	START OF LINEAR WORK
	END OF LINEAR WORK
	POINT REFERENCE TO CO-ORDINATES WHICH OUTLINE THE RIVER BOUNDARY WITHIN THE DCO LIMITS

- NOTES:**
1. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE STATED
 2. LINEAR AND NON-LINEAR WORKS ARE REFERENCES TO WORKS IN SCHEDULE 1 (AUTHORISED DEVELOPMENT) TO THE DEVELOPMENT CONSENT ORDER.
 3. THE WORKS WILL BE SUBJECT TO DETAILED DESIGN DEVELOPMENT IN ACCORDANCE WITH THE DEVELOPMENT CONSENT ORDER.
 4. THESE WORKS PLANS SHOULD BE READ IN CONJUNCTION WITH THE ENGINEERING SECTION DRAWINGS AND PLANS. THE DEVELOPMENT CONSENT ORDER PROVIDES FOR VERTICAL DEVIATION WITH REFERENCE TO THE LEVELS OF THE WORKS SHOWN ON THE ENGINEERING SECTION DRAWINGS AND PLANS.



FOR DCO SUBMISSION					Stability
Rev	Drawn / Date	Checked	Approved	Date	S8
PS1	SB	GB	MK	01/03/16	
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PS3	SB	MB	MK	05/04/17	
Rev	Drawn / Date	Checked	Approved	Date	

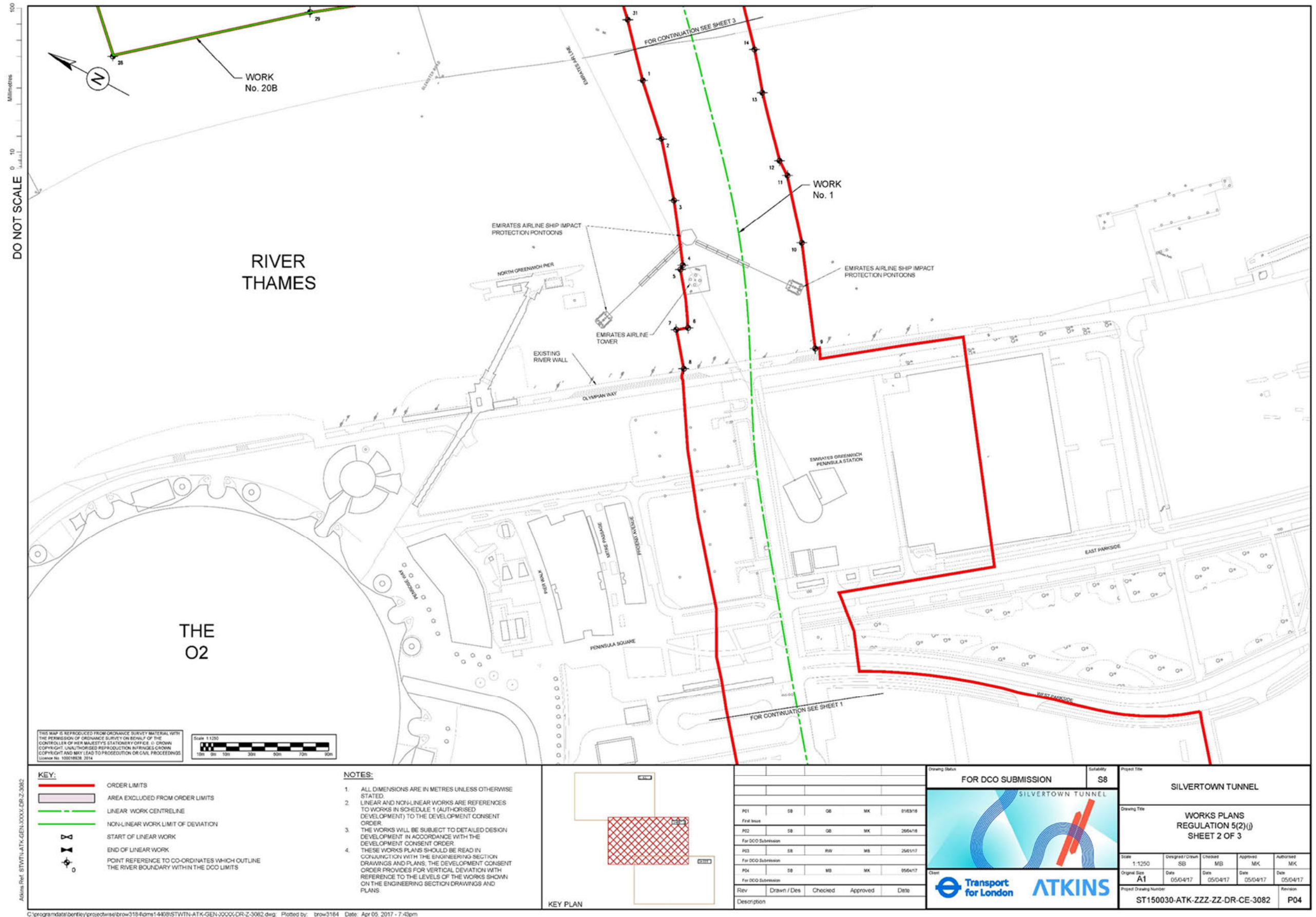
FOR DCO SUBMISSION

Client: **Transport for London** **ATKINS**

Project Title						SILVERTOWN TUNNEL					
Drawing Title						WORKS PLANS REGULATION 5(2)(j) SHEET 1 OF 3					
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Original Size	A1	Date	05/04/17	Date	05/04/17	Date	05/04/17	Date	05/04/17	ST150030-ATK-ZZZ-ZZ-DR-CE-3081	
Revision										P03	

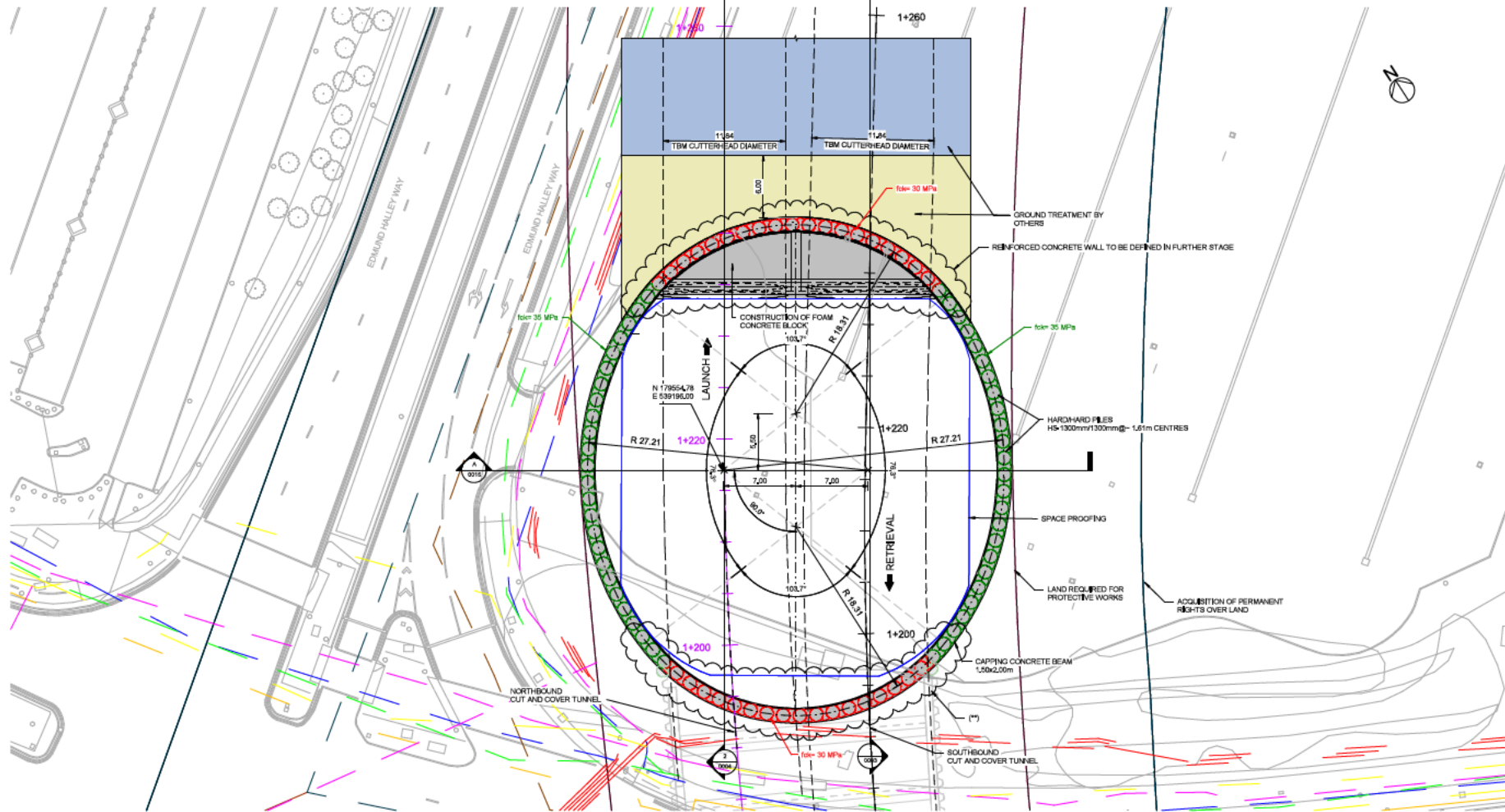
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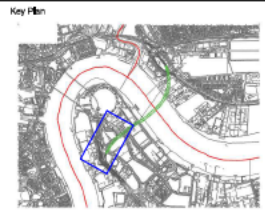
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Appendix B: Rotation Chamber



PLAN
Scale 1:200

(*) NOTE:
Openings for Permanent structure and its offering members will be designed in Develop Design.

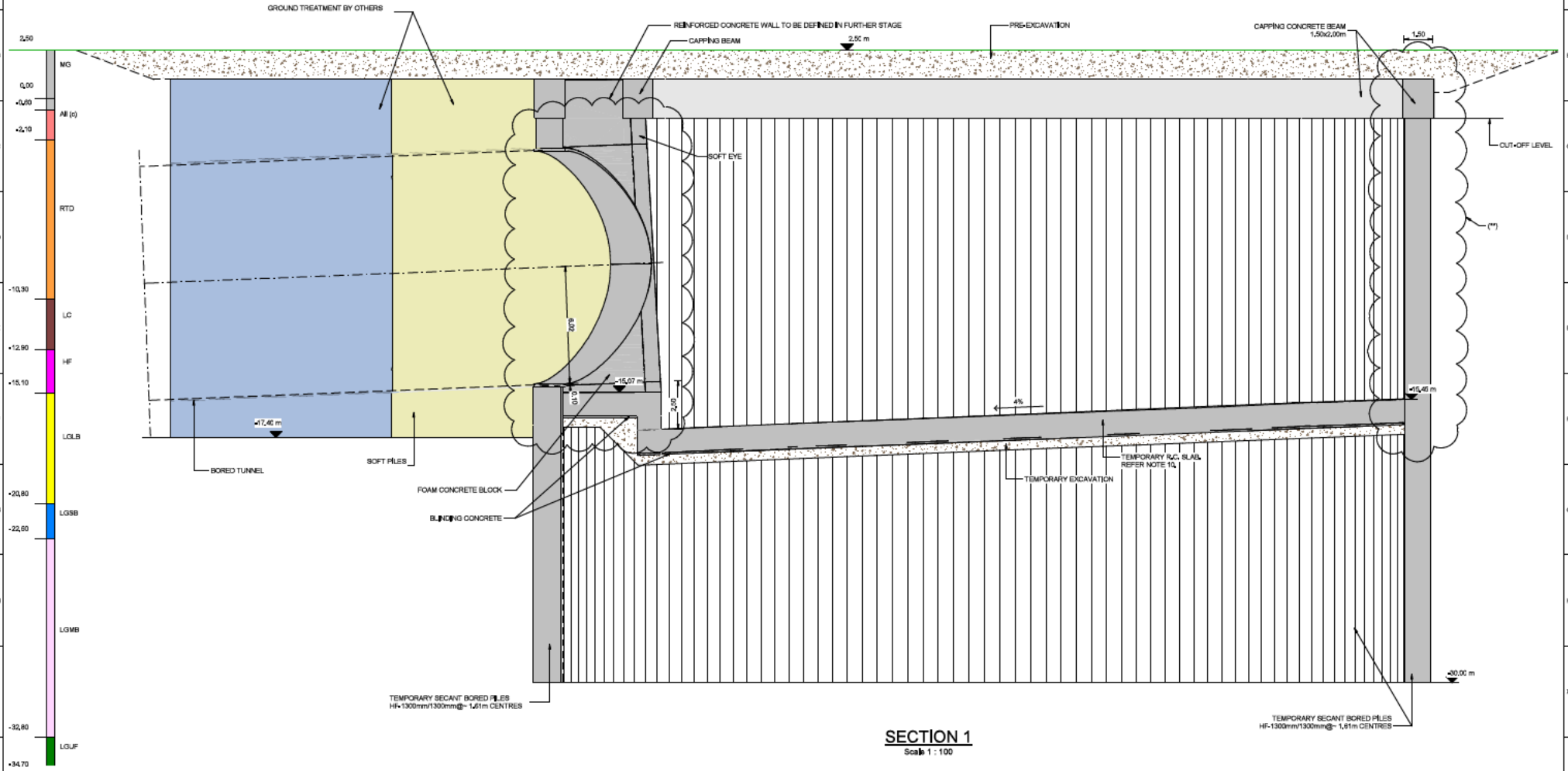


- Notes:
- All levels are noted in m above ordnance datum (m AOD).
 - All dimensions are in meters unless shown otherwise.
 - For secret bored piles, positional tolerance +25 mm, vertical tolerance 1/200.
 - Materials:
 Primary Secret Bored Piles: C30/35, C35/45 (Hard piles)
 Secondary Secret Bored Piles: C30/35, C35/45 (Hard piles)
 Capping Beam: C25/45
 Base: C35/45
 Blinding concrete: C12/15
 Steel Reinforcement Bars: B-5008
 Structural Steel: S205
 GRFP of piles: TRC
 - Conceptual design has been prepared based on the Tender requirements and information available. It is subject to further development and refinement during detail design, in accordance with the requirements of the contract and additional information.
 - Do not scale from this drawing.
 - Reinforcement at the location of the openings to be assessed during detailed design stage.
 - Confirm ground surface level of 20m AOD considering along the whole footprint of the Rotation.
 - Concrete also to be studied in conjunction with final TBM head.
 - For the Safety, Health and Environmental Information, please refer to construction sequence drawings ST150030-AYE-BAE-40-Z1-CR-G-SE-0031

Rev	Date	By	Description	1. Proposed	2. Issued	3. Revised	4. Deleted	5. Amended

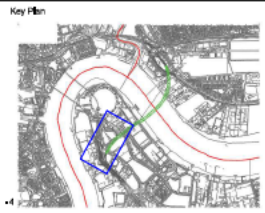
Project	Silvertown Tunnel
Originator	AYESA
Location	Silvertown Tunnel
Asset Classification	Bridges & Structures
LifeCycle	n/a
Subsidiary	n/a

	Drawing Number ST150030-AYE-BAE-40-Z1-CR-G-SE-0002
Rotation Chamber Temporary Structures Plan	Rev. P02



SECTION 1
Scale 1 : 100

(**) NOTE:
Openings for Permanent structure and its stiffening members will be designed in Develop Design.

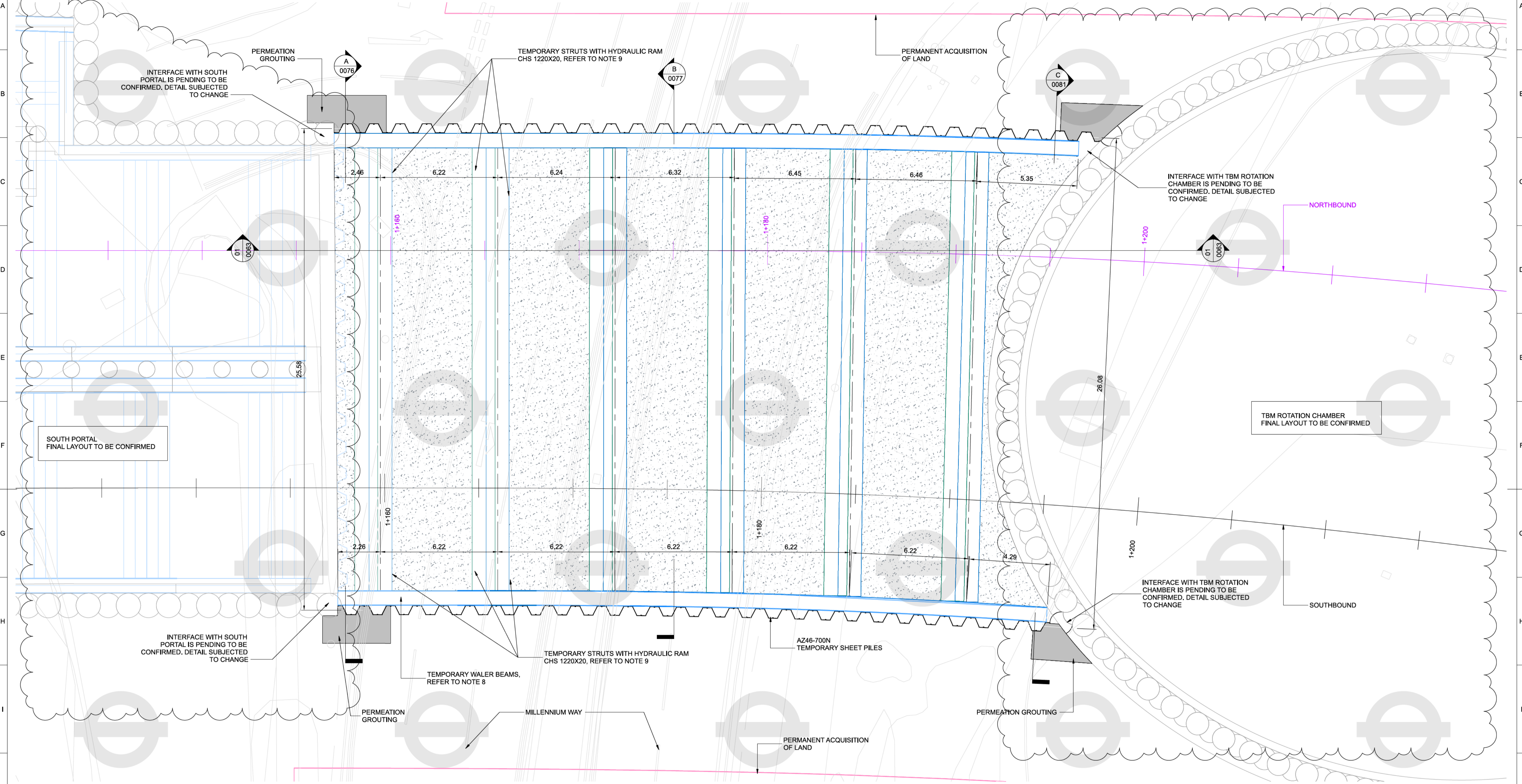


- Notes:
- All levels are noted in m above ordnance datum (m AOD).
 - All dimensions are in meters unless shown otherwise.
 - For secant bored piles, positional tolerance ±25 mm, vertical tolerance 1/200.
 - Materials:
 Primary Secant Bored Piles: C30/35, C35/45 (Hard piles)
 Secondary Secant Bored Piles: C30/35, C30/45 (Hard piles)
 Capping Beam: C35/45
 Base: C35/45
 Blinding concrete: C12/15
 Steel Reinforcement Bars: B500B
 Structural Steel: S355
 GFRP of class FR3
 - Conceptual design has been prepared based on the Tender requirements and information available. It is subject to further development and refinement during detail design, in accordance with the requirements of the contract and additional information.
 - Do not scale from this drawing.
 - Do not take detail dimensions off this drawing.
 - Reinforcement at the location of the openings to be assessed during detailed design stage.
 - Common ground surface level of 25m AOD considered along the whole footprint of the Rotation Chamber.
 - Concrete Slab to be studied in conjunction with final TSM load.
 - For the Safety, Health and Environmental Information, please refer to construction sequence drawings ST150030-AYE-BAS-4C-Z12-DRG-SE-0031

Project	Silverton Tunnel	TfL	Rotation Chamber
Originator	AYESA	Temporary Structures	
Location	Silverton Tunnel	Longitudinal Profile	
Asset Classification	Bridges & Structures	Section 1	
Life Cycle	n/a		
Subsidiary	n/a		
Rev	Date	By	Description
10			
11			
12			
13			
14			
15			
16			

Drawing Number: ST150030-AYE-BAS-4C-Z12-DRG-SE-0031
 Rev: P02

Appendix C: Cut and Cover



PLAN
Scale 1 : 100

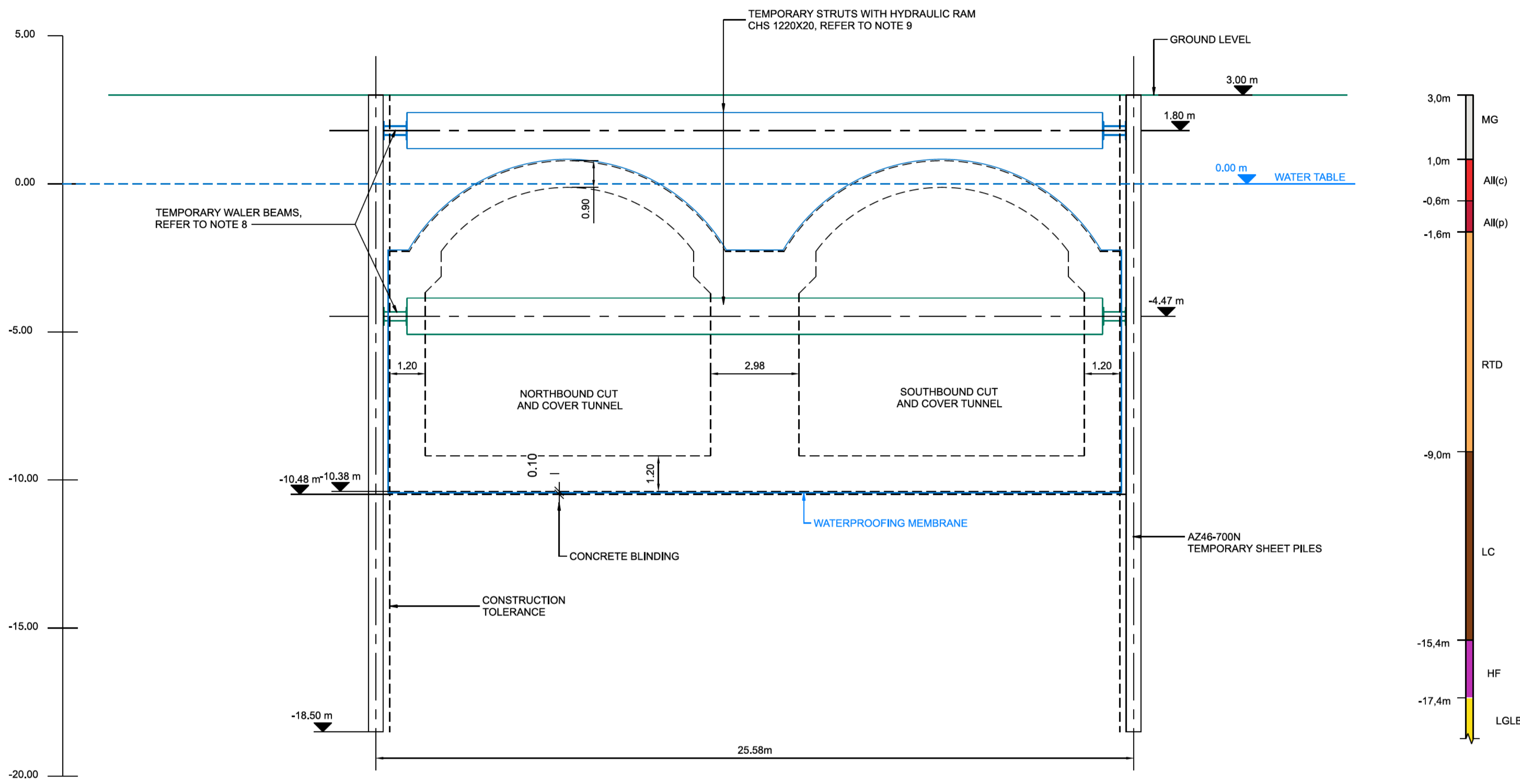
— TEMPORARY STRUTS TO BE REMOVED AFTER THE EXECUTION OF THE PERMANENT VAULT AND BACKFILLING UP TO THE BOTTOM LEVEL OF THE STRUTS.
 — TEMPORARY STRUTS AND WALER BEAM TO BE REMOVED PRIOR THE EXECUTION OF PERMANENT WALLS



- Notes:**
- All levels are noted in m above ordnance datum (m AOD)
 - All dimensions are in meters unless shown otherwise.
 - For sheet-piles, positional tolerance ± 25 mm, verticality tolerance 1/100. The Cut and Cover permanent wall shall be executed contiguous to the sheet-pile wall.
 - Structural Steel S355 required, as a minimum, for the temporary sheet piles and waler beams.
 - Surcharge load considered for construction stages: 10 kN/m²
 - Do not scale from this drawing.
 - Do not take digital dimensions off this drawing.
 - Temporary steel waler beam, 2No. Universal UKB 838x292x226 beams, grade S355.
 - Temporary struts CHS 1220x20 - high load capacity, hydraulically activated strut with prestressing. Axial characteristic capacity 7000 kN.
- For the Safety, Health and Environmental information, please refer to construction sequence drawings ST15003-AYE-BAS-40-Z12-DRG-SE-0078 & ST15003-AYE-BAS-40-Z12-DRG-SE-0079

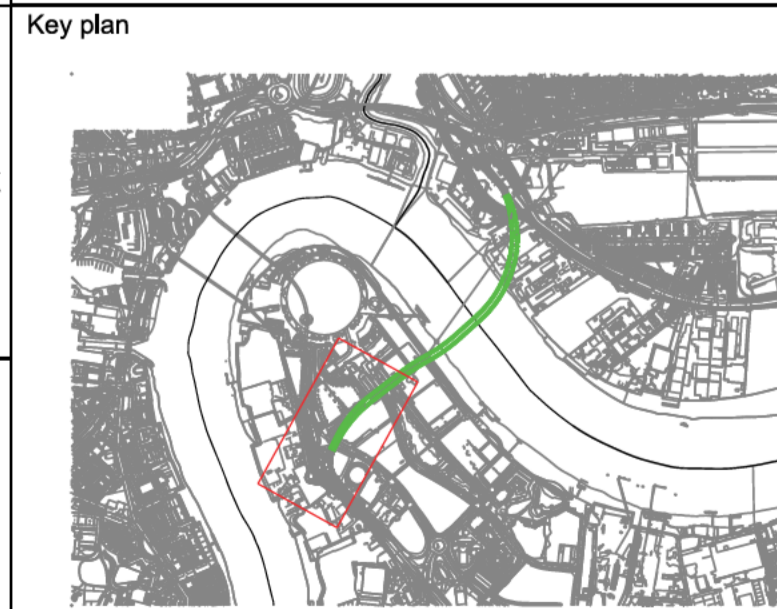
Rev	Date	Drawn	T. Checked	T. Approved	P. Approved	Authorised
PO1	16/03/20	EC	IM	IL		
PO2	16/03/20	EC	IM	IL		
CO1	23/03/20	EC	IM	IL		
PO3	13/05/20	EC	IM	SG		

Project	Silvertown Tunnel	Title	Cut & Cover South
Originator	Ayasa	Temporary Structures	
Location	Silvertown Tunnel	Plan	
Asset Classification	Bridges & Structures		
Lifecycle	Developed Design		
Suitability	S3	Drawing Number	ST150030-AYE-BAS-40-Z12-DRG-SE-0062
	Fit for Internal Review and Comment	Rev.	P03



CROSS SECTION A - CH 1+157 NORTHBOUND
 Scale 1 : 100

— TEMPORARY STRUTS TO BE REMOVED AFTER THE EXECUTION OF THE PERMANENT VAULT AND BACKFILLING UP TO THE BOTTOM LEVEL OF THE STRUTS.
 — TEMPORARY STRUTS AND WALER BEAM TO BE REMOVED PRIOR THE EXECUTION OF PERMANENT WALLS



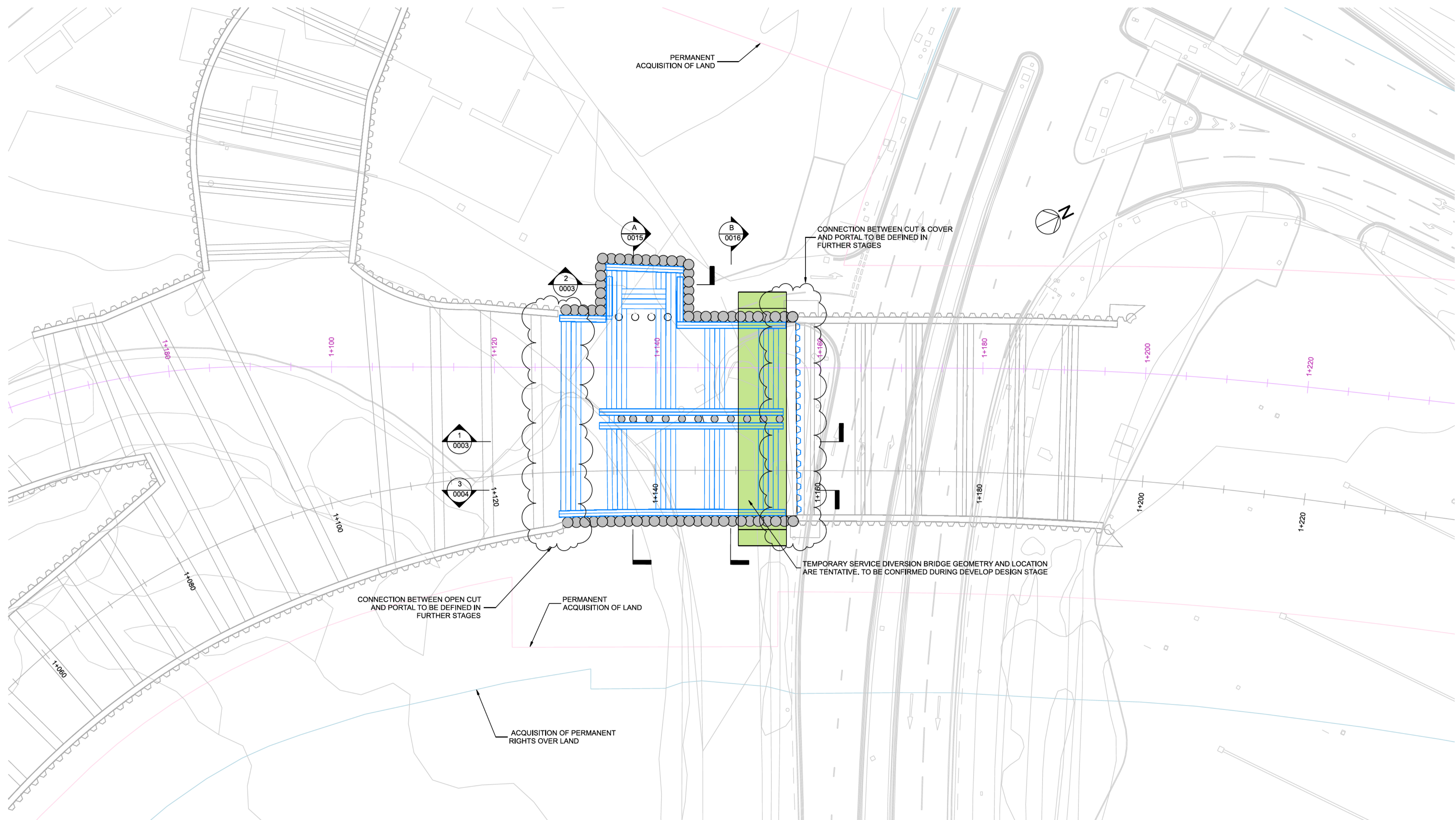
- Notes:**
- All levels are noted in m above ordnance datum (m AOD)
 - All dimensions are in meters unless shown otherwise.
 - For sheet-piles, positional tolerance ± 25 mm, verticality tolerance 1/100. The Cut and Cover permanent wall shall be executed contiguous to the sheet-pile wall.
 - Structural Steel S355 required, as a minimum, for the temporary sheet piles and waler beams.
 - Surcharge load considered for construction stages: 10 kN/m²
 - Do not scale from this drawing.
 - Do not take digital dimensions off this drawing.
 - Temporary steel waler beam, 2No. Universal UKB 838x292x226 beams, grade S355.
 - Temporary struts CHS 1220x20 - high load capacity, hydraulically activated strut with prestressing. Axial characteristic capacity 7000 kN.
 - For the Safety, Health and Environmental information, please refer to construction sequence drawings ST15003-AYE-BAS-40-Z12-DRG-SE-0078 & ST15003-AYE-BAS-40-Z12-DRG-SE-0079

Restricted	Rev	Date	Drawn	T. Checked	T. Approved	P. Approved	Authorised
	P01	16/03/20	EC	IM	IL		
	P02	16/03/20	EC	IM	IL		
	CD1	23/03/20	EC	IM	IL		
	P03	13/05/20	EC	IM	SG		

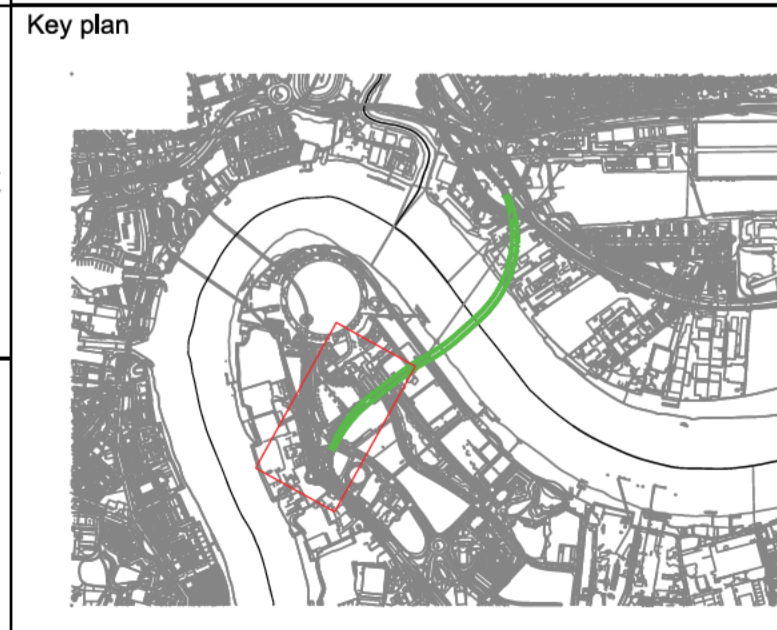
Project	Silvertown Tunnel
Originator	Ayeya
Location	Silvertown Tunnel
Asset Classification	Bridges & Structures
Lifecycle	Developed Design
Suitability	S3
Fit for Internal Review and Comment	

Title	
Cut & Cover South	
Temporary Structures	
Cross Section A	
Drawing Number	Rev.
ST150030-AYE-BAS-40-Z12-DRG-SE-0076	P03

Appendix D: Tunnel Portal



GENERAL PLAN
Scale 1 : 250



Notes:

- All levels are noted in m above ordnance datum (m AOD).
- All dimensions are in meters unless shown otherwise.
- For secant bored piles, positional tolerance ± 25 mm, vertically tolerance 1/200.
- Materials:**
 Primary Secant Bored Piles: C35/45 (Hard piles),
 Secondary Secant Bored: C35/45 (Hard piles),
 Base Slab: C35/45,
 Blinding concrete: C12/15,
 Steel Reinforcement Bars: B-500B,
 Temporary steel beam, 2N° Universal UKB 838x292x226 beams,
 Temporary struts CHS 1220x20-high load capacity,
 Hydraulically activated strut with possible prestressing,
 Axial characteristic capacity 7000 kN,
 Structural Steel: S355.
- Surcharge load considered for construction stage: 10 kN/m².
 Surcharge load considered for long term: 75 kN/m².
 Load considered on top of roof slab: 75 kN/m².
 Load considered for construction stage at the location of the foundations of the service diversion temporary bridge: 30 kN/m².
- Conceptual design has been prepared based on the Tender requirements and information available. It is subject to further development and refinement during detail design, in accordance with the requirements of the contract and additional information.
- Do not scale from this drawing.
- Do not take digital dimensions off this drawing.
- Design of Portal South performed with the following main assumptions:
 a) The Open Cut and Cut and Cover South proximity areas are excavated concurrently with Portal South.
 b) Bottom-up construction methodology.
- For construction sequence drawings refer to ST-150030-AYE-BAS-40-Z11-DRG-SE-0025-26-27.
- The service diversion temporary bridge shall not be connected to the Portal and shall be provided above the Portal roof slab.
- For the safety, Health and Environmental information, please refer to construction sequence drawings ST150030-AYE-BAS-40-Z11-DRG-SE-0025-26-27.
- Site Team to guarantee temporary pile casing up to the Toe level of the piles.
- Site Team to guarantee the complete filling of the void underneath the casing while removing it, to avoid any inclusion of the soil, in order to guarantee the minimum cover required for durability.

Restricted	PO0	4/05/20	Concept Design	SR	IL	-	-	-	-
	PO1	4/05/20	Concept Design	SR	IL	SG	-	-	-
	Rev	Date	Purpose / Description	Drawn	T. Checked	T. Approved	P. Approved	Authorised	

Project	Silvertown Tunnel	Title	Portal South
Originator	Ayesa	Temporary Structures	
Location	Silvertown Tunnel	General Plan	
Asset Classification	Bridges & Structures		
Lifecycle	Concept Design		
Suitability	S3	Fit for Internal Review and Comment	
Drawing Number	ST150030-AYE-BAS-40-Z14-DRG-SE-0002	Rev.	P01