CROSSRAIL CENTRAL
C254 ARCHAEOLOGY WEST

OLD OAK COMMON ARCHAEOLOGICAL SITE SPECIFIC WRITTEN SCHEME OF INVESTIGATION

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CROSSRAIL CENTRAL (PDP) REVIEW AND ACCEPTANCE STATUS

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1 Executive Summary

1.1.1 This Site Specific Written Scheme of Investigation (SSWSI) applies to the Crossrail works at Old Oak Common Train Maintenance Depot (OOC TMD), located within the London Borough of Hammersmith and Fulham at TQ 21870 82390. The work will have the potential to impact on archaeological remains. The Old Oak Common Depot worksite lies within route window W3 (Old Oak Common Depot (Western Ave to Hythe Road)), as defined in the Crossrail Environmental Statement (2005). Old Oak Common Depot is a broad corridor containing an extensive railway site comprising stabling sidings, engine sheds, workshops and other railway facilities. The study area for this SSWSI comprises the Maintenance Depot occupying the northern half of the Old Oak Common Depot site, located to the north of the operational railway, and forms the footprint effected by Crossrail works (Figure 1).

1.1.2 At OOC TMD the proposed construction requires the site to be remodelled to provide depot and stabling facilities for Crossrail (design contract C160, design and build contract X2234). This includes track remodelling to provide stabling sidings, construction of a new train care facility building, maintenance staff accommodation, maintenance storage building, new access roads and turning areas, 150 car parking spaces, train crew accommodation, biohazard pit, wheel lathe facility and associated sidings, two train washers, lighting gantries, OHLE and traction substation.

1.1.3 Prior to being the location of the Crossrail depot Old Oak Common will also be used to support the main Crossrail tunnelling works (contract C300). Crossrail's twin-bore tunnels, which represent the largest engineering component of the project, will run through the central section and will be constructed from pre-cast concrete segments. These will be manufactured and stored at OOC TMD. In addition, the tunnel fit-out contractor (C610) will use the site as a logistics and storage base for four years. The implications of C610 impacts will be addressed in future revisions to this SSWSI.

1.1.4 Previous SSWSIs for OOC TMD have identified the survival of significant, although non-listed, built heritage at the site. A detailed desk-based assessment of the site has been produced by Pre-Construct Archaeology (C150-CSY-T1-RGN-CR076_PT001-00011 Rev 4.0), and this detailed the survival and importance of the built heritage at the site, and provided recommendations on the level of recording that should be undertaken prior to their demolition. It also identified structures that no longer survive, and provided a history of the development of the site. The building recording work has been undertaken by Oxford Archaeology/Gifford (OAG) under Contract C254, and is covered in OAG Archaeology Method Statement C254-OXF-W-GMS-CRG03-00004 Rev 4.0.

1.1.5 This desk-based research and subsequent below-ground observation work by C254 has established that the construction of the railway depot from *c.* 1906 is likely to have removed all archaeological deposits dating to earlier that the 20th century.

1.1.6 This SSWSI provides a strategy for mitigating impact on surviving sub-surface archaeological remains on the site. It covers any impacts deemed to affect the

archaeological resource during construction of the concrete segment yard (C300). The details of works, temporary or permanent, associated with the main depot construction (C160, design and build contract X2234) are also reviewed, and the mitigation of any impacts arising is covered.

1.1.7 Works associated with the C300 temporary concrete segment casting facility are due to commence in July 2011. The anticipated duration of the construction works at this site is approximately three years.

1.1.8 This SSWSI addresses the scope, specification, timing and order of works and the deliverables required to integrate successfully the archaeological aspects of the works into the project phasing.

2 Project Background

2.1 Introduction

2.1.1 The overall framework within which archaeological work at Old Oak Common Train Maintenance Depot (OOC TMD) will be undertaken is set out in the Environmental Minimum Requirements (EMR) for Crossrail (CR/HB/EMR/0001 (fifth draft July 2008)). The requirements being progressed follow the principles of Planning Policy Guidance Note 16 on archaeology and planning (1990), and are compliant with Planning Policy Statement 5 (PPS5). Accordingly, the nominated undertaker or any contractors will be required to implement certain control measures in relation to archaeology before construction work begins.

2.1.2 The strategy for archaeological works has been set out in the Crossrail Generic Written Scheme of Investigation (SSWSI) (CR-PN-LWS-EN-SY-00001). The Generic SSWSI presents the strategy for archaeological design, evaluation, mitigation, analysis, dissemination and archive deposition that will be adopted for the design and construction of the Crossrail facilities at OOC TMD and provides a general statement of objectives, standards and structure for the planning and implementation of archaeological works.

2.1.3 At OOC TMD the proposed construction requires the site to be remodelled to provide depot and stabling facilities for Crossrail (design contract C160, design and build contract X2234). This includes track remodelling to provide stabling sidings, construction of a new train care facility building, maintenance staff accommodation, maintenance storage building, new access roads and turning areas, 150 car parking spaces, train crew accommodation, biohazard pit, wheel lathe facility and associated sidings, two train washers, lighting gantries, OHLE and traction substation.

2.1.4 Prior to being the location of the Crossrail depot Old Oak Common will also be used to support the main Crossrail tunnelling works (contract C300). Crossrail's twin-bore tunnels, which represent the largest engineering component of the project, will run through the central section and will be constructed from pre-cast concrete segments. These will be manufactured and stored at OOC TMD. In addition, the tunnel fit-out contractor (C610) will use the site as a logistics and storage base for four years. The implications of C610 impacts will be addressed in future revisions to this SSWSI.

2.1.5 This SSWSI provides a strategy for mitigating impact on surviving sub-surface archaeological remains on the site. It covers any impacts deemed to affect the archaeological resource during construction of the concrete segment yard (C300) and works, temporary or permanent, associated with the main depot (C160). C160 is the reference design contract and the depot will be built under the X2234 PPP contract. This SSWSI is based on the reference design, produced for bidding purposes only. The depot which is eventually built under X2234 may be significantly different, and any impacts arising from its design and construction, together with C610 (system-wide fit-out),will be addressed in future revisions to this SSWSI.

2.2 Site Description

2.2.1 OOC TMD is an extensive site comprising stabling sidings, engine sheds, workshops and other railway facilities. The surrounding area is dominated by industrial estates and road, rail and canal transport systems. Small pockets of residential development are located to the west along Shaftesbury Gardens and Wells House Road, and to the south of Wormwood Scrubs Park.

2.2.2 The Crossrail-controlled site is bounded by Old Oak Common Lane to the west, the Grand Union Canal to the north, and the First Great Western TOC Depot and marshalling sidings to the south. The land is triangular in shape, narrowing towards the east and throat of the depot. The central Ordnance Survey National Grid Reference for the site is TQ 21870 82390. The site level has been significantly reduced through terracing works associated with the railway (see Sections 2.4.3 and 2.5.8).

2.3 Summary of Previous Studies

2.3.1 The general archaeological potential in the area of the Crossrail worksite for Old Oak Common is described in the Crossrail Environmental Statement (ES) (Volume 3 Page 198) as being of moderate potential. Further detailed information is presented in the Specialist Technical Reports: Assessment of Archaeological Impacts (Part 1-6), published in February 2005 in support of the Crossrail ES. This revision of the SSWSI supersedes all previous versions, including those written by Arup (CR-EG-OOC-EN-SP-00001 Ver 3.0).

2.3.2 A detailed desk-based assessment of the site was produced by Pre-Construct Archaeology (C150-CSY-T1-RGN-CR076_PT001-00011 Rev 4.0), and this detailed the survival and importance of the built heritage at the site, and provided recommendations on the level of recording that should be undertaken prior to their demolition. It also identified structures that no longer survive, and provided a detailed history of the development of the site. All known structures, past and present, are shown on Figure 1. The building recording work that the desk-based assessment recommended was undertaken by Oxford Archaeology/Gifford (OAG) under package C254 Archaeology West. The Archaeological Method Statement prepared by OAG for this work has been submitted under document reference C254-OXF-W-GMS-CRG03-00004 Rev 4.0.

2.3.3 A number of Ground Investigation (GI) works have been carried out in the area. Although these were mainly located to the south of the Crossrail worksite, they provide information on the likely below ground sequence to be encountered. Relevant previous investigations have identified made ground comprised of ballast, ash, slag, brick and

reworked clay over London Clay. Further works were undertaken during 2010, and were monitored by Pre-Construct Archaeology. Ten geotechnical trial pits for GCG were monitored and recorded, the results being presented as an appendix to the detailed desk-based assessment of the site (C150-CSY-T1-RGN-CR076_PT001-00011 Rev 4.0).

2.3.4 Further observations of below-ground soils were made during a general watching brief undertaken by C254 during the excavation of trenches to investigate for buried services. This revealed a similar sequence to that detailed above, namely ballast, ash, slag, brick and reworked clay over London Clay.

2.3.5 The study area for this SSWSI comprises the former EWS Maintenance Depot occupying the northern half of the OOC TMD site, the outline of which is shown on Figure 1.

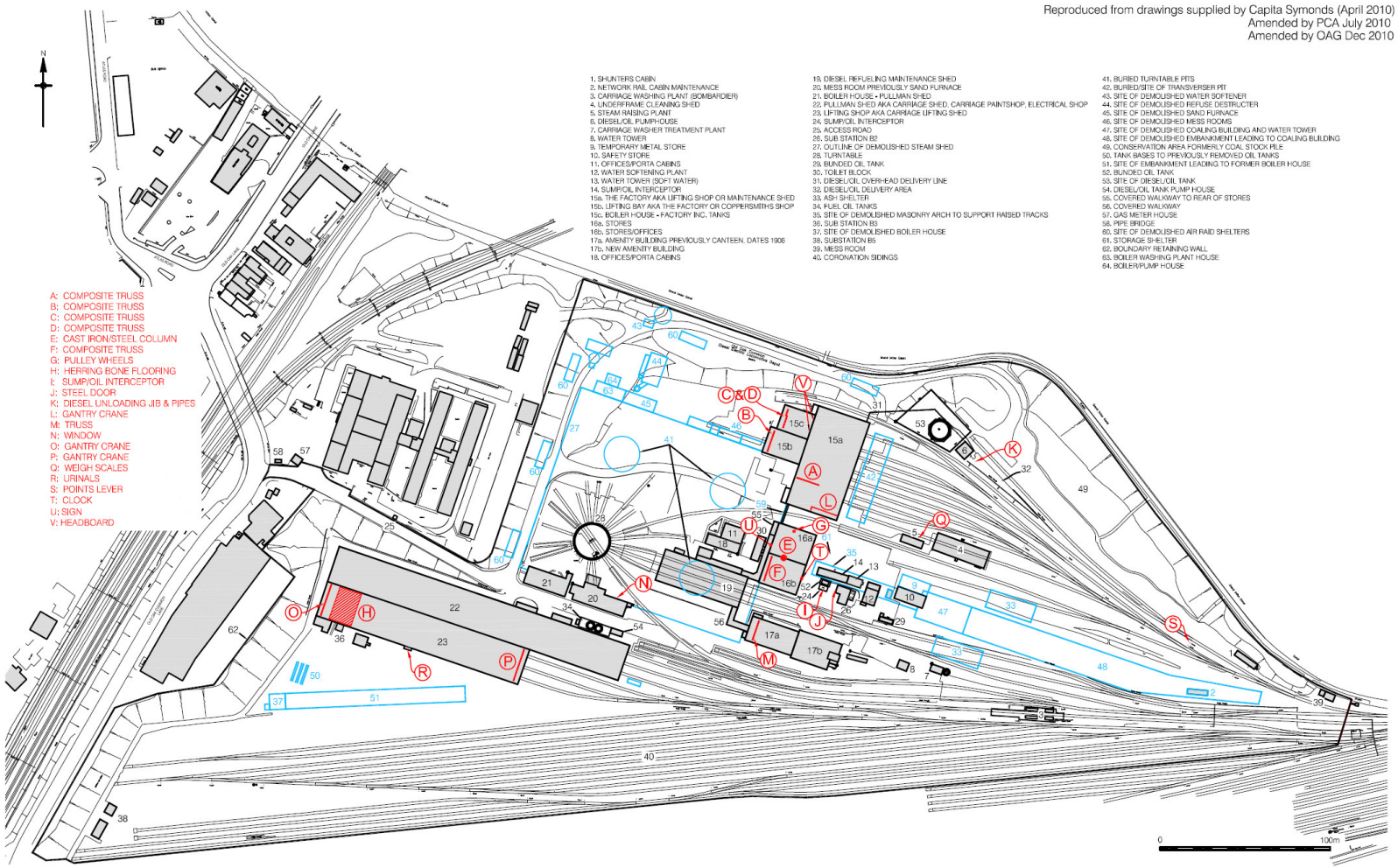

Figure 1: Site Boundary Showing Existing and Previous Structures (Numbers 1 to 64), and location of heritage items for salvage (letters A to V).

2.4 Geology and Topography

2.4.1 The regional geology of the area around Old Oak Common is typical of that for the western London region. It comprises the London Clay Formation (approximately 70 to 110m thick) underlain by Lambeth Group rock strata (approximately 18 to 20m thick) which is underlain in turn by the Thanet Sand Formation (approximately 10m thick).

2.4.2 Made ground varies in thickness between approximately 0.8m to 5.0m and directly overlies the London Clay Formation. The indications from the GI works undertaken during 2010 are that this make-up comprises material used in the construction and operation of the railway depot, or demolition material associated with its part demolition. The detailed desk-based assessment found that the Specification for the 1904 to 1906 Engine Shed instructed that prior to construction a layer of "dry filling or ashes" 15'' (0.38m) thick was to be spread across the site, topped by a bedding layer of ash 6'' (0.15m) thick underneath paved or surfaced areas (TNA RAIL 252/1340, Specification: 17). Excavations for foundations varied between 0.6m and 3.9m in depth, the spoil from which was to be "deposited and filled in over the site as directed… not exceeding 2'' (0.6m) deep" (TNA RAIL 252/1340, Schedule of Quantities Bill No. 2: 5).

2.4.3 Much of the original topography has therefore been radically altered by the removal of superficial geological deposits and truncation of the London clay during the construction activities associated with the development of the railway and the depot. The Old Oak Common site was terraced during works in 1890 and further works in the early to mid 20th century have resulted in further reduction of the natural landscape.

2.5 Archaeological and Historical Development of the Site

2.5.1 A summary of the archaeological and historical development at the site is set out below. The historic maps referred to in this section are presented in former versions of this SSWSI (CR-EG-OOC-EN-SP-00001 Ver 3.0), or the detailed desk-based assessment of the site (C150-CSY-T1-RGN-CR076_PT001-00011 Rev 4.0), upon which this section draws heavily.

2.5.2 There are no Scheduled Monuments, Listed Buildings or Registered Parks and Gardens within a 750m radius of the site's centre point. It does not fall within an Archaeological Priority Area. The Grand Union Canal is a Conservation Area in the London Borough of Hammersmith and Fulham, but because of the industrialised character of the immediate area it is considered to have a low sensitivity to change. There is also the designated nature conservation area which runs parallel with the canal towpath but within the Crossrail demise. Additionally, there is also a limited archaeological record for the area on the Greater London Sites and Monuments Record list (GLSMR). The records that exist within a 750m radius are associated with listed buildings such as the canal footbridge (GLSMR no. MLO73024), and archaeological remains such as a water channel associated with the North Pole Rail depot (MLO22673) and a moated site at Willesden Junction (MLO14245).

2.5.3 The OOC TMD site remained woodland until the beginning of the post-medieval period, after which it was used for common grazing until the end of the 1890s when it was acquired by the Great Western Railway (GWR). Local residents had pasture rights for their animals and received compensation in 1805 when the Paddington canal was developed and in 1837 by the GWR.

2.5.4 The Grand Union Canal was threaded through the area in *c.*1801, and Brunel's Great Western Railway was constructed in the area in around 1840. By 1894 the West London Sidings had been established to the south with the remainder of the site staying vacant until 1906.

2.5.5 The site was partially excavated in *c.*1900 in association with the construction of the Acton to Northolt line. Subsequently, the site was remodelled in 1904 in advance of the construction of GWR's Old Oak Common locomotive and carriage depots. The detailed desk-based assessment concluded that the potential for the presence of archaeological evidence pre-dating *c.*1900 within the present site boundaries is negligible to low. However, there is a very high potential for post-1900 (*ie* modern) archaeological material to survive. Archaeological evidence of the demolished elements of the 1904-6 locomotive depot has been assessed by PCA in document C150-CSY-T1-RGN-CR076_PT001-00011 Rev 4.0 to be of regional significance, while evidence of other demolished 20th-century structures has been assessed by PCA to be of local significance.

2.5.6 Built under the auspices of the GWR's Locomotive Superintendent George Jackson Churchward, the Old Oak Common locomotive depot was one of the most up-to-date locomotive repair facilities in the country when it opened in 1906. A combination of tried-and- tested construction techniques and modern materials was used to create a depot capable of accommodating and servicing the company's latest and largest locomotives. Churchward took advantage of readily available electrical power and procured a range of the latest electrically-operated machinery for the new depot.

2.5.7 As the first of a number of new locomotive depots built by the Great Western during the Churchward era, the layout of Old Oak Common served as the template for those that followed, the majority of which were closed and demolished in the late 1960s. In contrast, Old Oak Common was retained and converted into a motive power depot (MPD) for diesel locomotives in the mid-1960s. Despite the demolition of much of the Engine Shed, a substantial amount of Churchward's depot survived and continued to flourish into the diesel era. Old Oak Common represents the last remaining 'factory' repair facility on the former Great Western Railway network, and for this reason the standing elements of Churchward's depot of 1904 to 1906 has been assessed by PCA to be of regional significance.

2.5.8 During construction of the depot the site was comprehensively graded, being levelled to *c.* 26m ATD. It is expected (and has been partly demonstrated) that this terracing into the natural slope has truncated or removed any pre- 20th-century deposits.

2.5.9 Structures assessed by PCA to have been of regional importance included the 'factory' complex (Structures 15a to 15c), the Stores (Structures 16a and 16b), the amenity building (previously the yard offices and subsequently a canteen: Structure 17a), electricity sub-station B2 (Structure 26) and the messroom (previously the sand furnace: Structure 20).

2.5.10 The late 1930s carriage repair depot (Structures 22 and 23) was also assessed by PCA to be of regional significance. While the former carriage paint shop/Pullman shed (Structure 22) featured a shelter/dormitory dating to the Second World War, the former carriage lifting shop (Structure 23) featured a workshop area containing well-preserved

original elements such as a floor paved with teak blocks made from the centres of old carriage wheels.

2.5.11 In 1946 the GWR built a heavy oil fuel depot (Structures 6 and 53) in order to refuel coal-fired locomotives converted to run on oil. The depot was converted at the end of the decade by the recently nationalised British Railways into a fuelling plant for gas-turbine locomotives, only two of which ever operated on the national railway network. The former heavy oil fuelling depot (Structures 6 and 53) has been assessed by PCA to be of regional to national significance.

2.5.12 Elements including the pre-war sump/oil interceptor (Structure 24) and the surviving surface air raid shelter (Building 1) have been assessed by PCA to be of local importance. The Engine Shed, which originally housed four 65' turntables, was demolished in the mid 1960s when the depot was converted from a steam-locomotive depot to a diesel-powered rolling stock depot. One turntable (a 70' replacement) survived until 2010, when it was lifted and transported for display at Swanage Railway, Dorset.

3 Construction Impacts

3.1 Summary

3.1.1 Crossrail works completed or substantially completed at OOC include historic building recording of above-ground structures (undertaken by C254), demolition of above and below-ground structures in Areas 2 and 3 (undertaken by C277) and construction of a new access road and sub-station base and service connections (undertaken by C280).

3.1.2 Remaining Crossrail works at OOC TMD involve construction of a temporary concrete segment construction factory and depot (C300), system-wide fit-out (C610) and a new train maintenance depot (design contract C160, PPP contract X2234).

3.1.3 The temporary concrete segment factory (C300) entails the construction of a concrete batching plant, a pre-cast factory, concrete segment and materials storage facilities and new track (slab track in areas adjacent to all permanent buildings and standard ballast track elsewhere). The C300 works are shown on drawing Site Layout for C300 OOC – Model v2.pdf (Fig. 2).

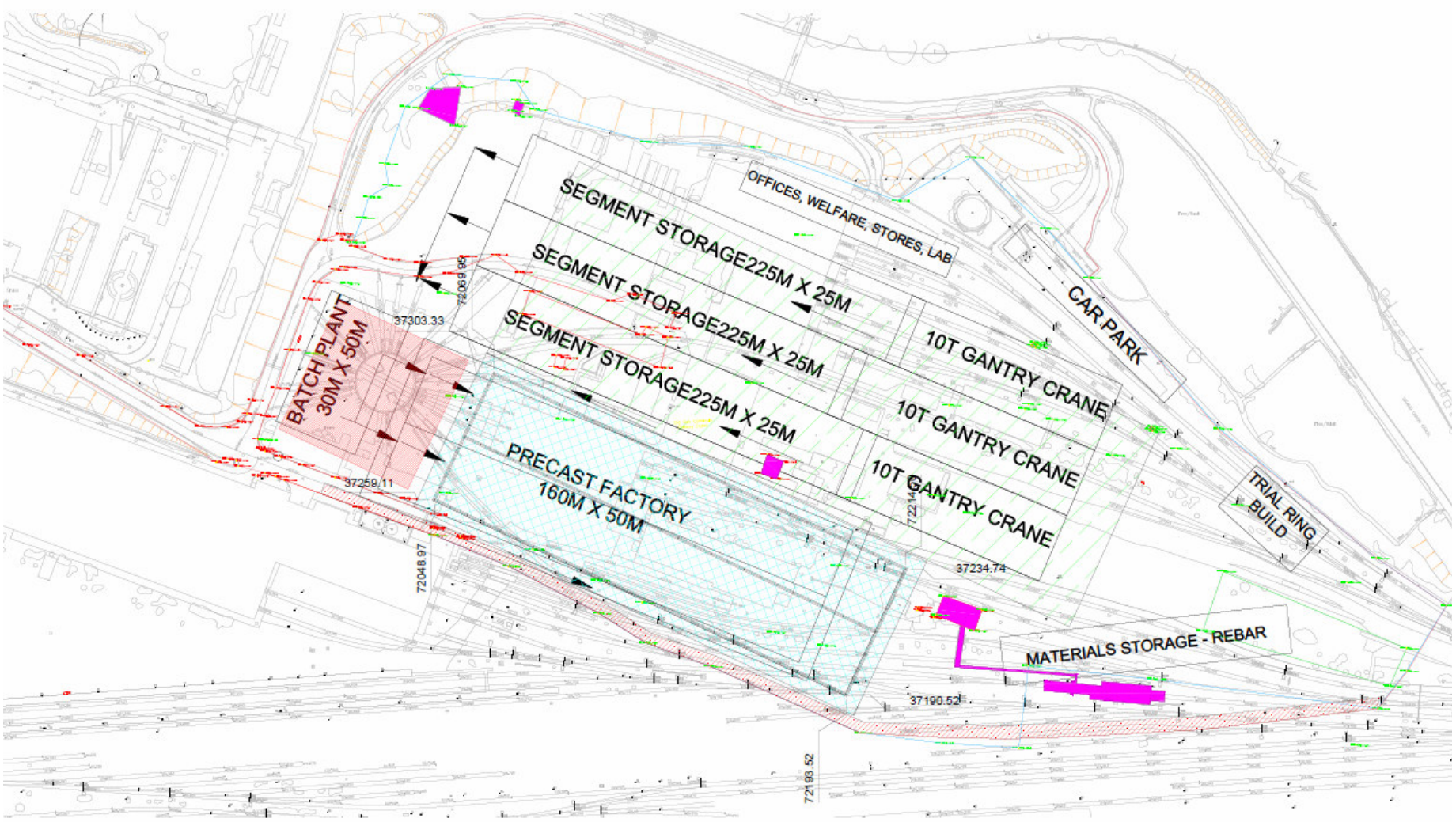

Figure 2: C300 site layout overlaid on site layout current in 2010

3.1.4 The C160 design (see Fig. 3) includes track remodelling to provide an operations, maintenance and control building, 34 stabling sidings, maintenance staff accommodation, maintenance storage building, new access roads and turning areas, *c.* 150 car parking spaces, train crew accommodation, biohazard pit, wheel lathe facility and associated siding, washing plant, lighting gantries, drainage and attenuation and a OHLE and traction substation.

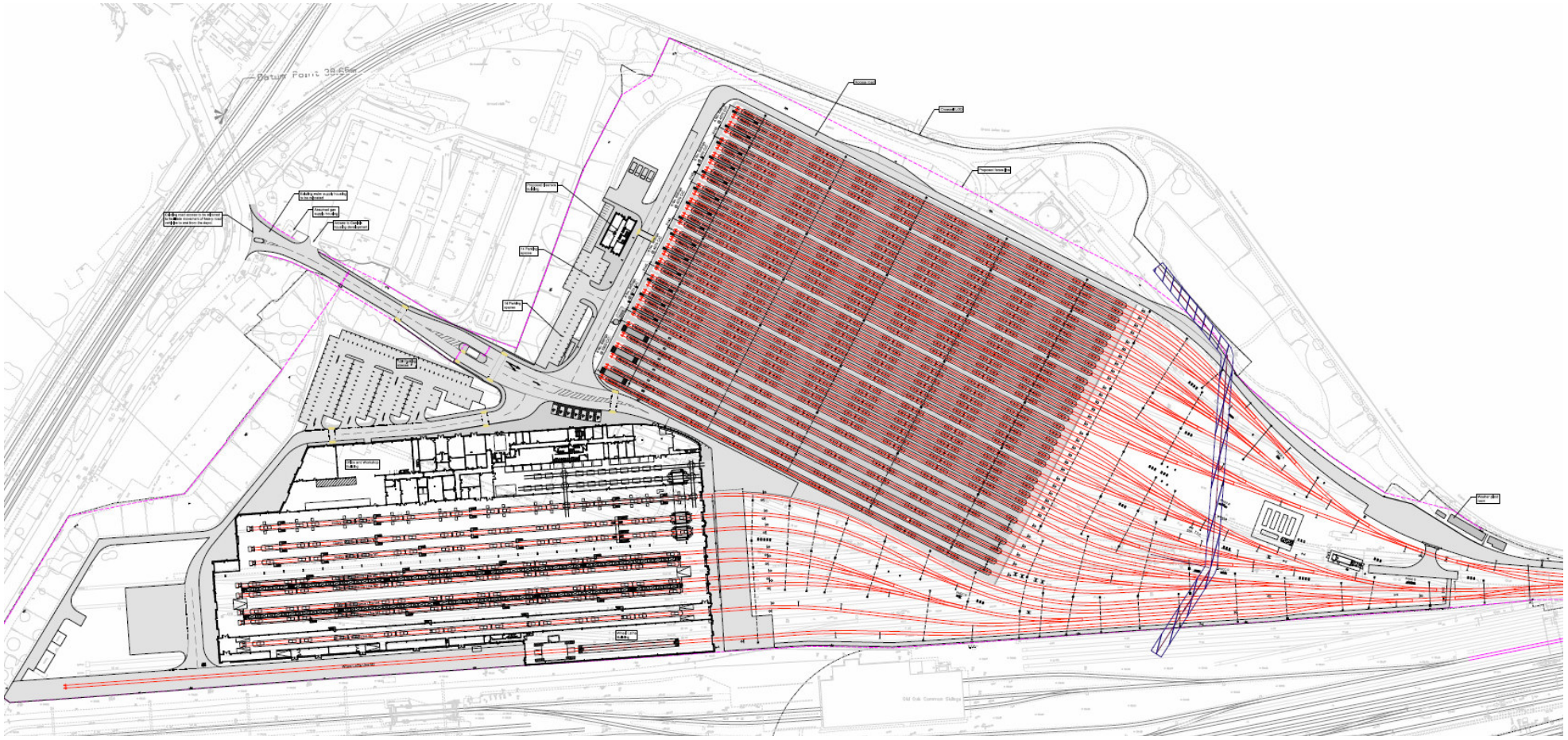

Figure 3: C160 site layout

3.2 Construction Impacts

3.2.1 C300 facilities comprise:

- Pre-cast factory – Constructed from 700mm deep strip foundations. Situated over Structures 8, 17, 19 and 56. No impacts to significant archaeological remains.
- Batch plant – no construction information available. Situated over Structures 20, 21 and turntable 28. No impacts to significant archaeological remains.
- Materials storage – rebar - no construction information available. Situated over Structures 2 and 48. Possible impacts to significant archaeological remains - the former watercourse that crosses the site (Item F on Fig.4). No impacts to significant archaeological remains.
- Segment storage - no construction information available. Situated over Structures 4, 5, 9, 10, 11, 12, 13, 14, 15, 16, 18, 24, 26, 27, 29, 30, 33, 35, 41 (north-eastern turntable), 47, 52, 55 and 59. Possible impacts to significant below-ground archaeological remains will occur if construction of the segment storage slabs or their foundations penetrate below-present ground surface. These archaeological remains are Structure 35 (site of demolished masonry arch to support raised tracks, Item B on Fig.4) and the site of the 'Four ton crane base' shown on the 1913 to 1916 Ordnance Survey plan (Item D on Fig.4).
- Trial ring build - no construction information available. Possible impacts to significant below-ground archaeological remains will occur if construction of the trial ring build slabs or their foundations penetrate below-present ground surface. Situated over Item E (Fig.4), the 'Stone' shown on the 1913 to 1916 Ordnance Survey plan.
- Car-park - no construction information available. Situated over Structure 6. Possible impacts to significant archaeological remains - the former watercourse that crosses the site (Item F on Fig.4).
- Offices, welfare, stores, lab - no construction information available. Situated over Structures 15a, 15b, 15c and 42. Possible impacts to significant below-ground archaeological remains will occur if construction of the offices, welfare, stores and lab or their foundations penetrate below-present ground surface. These archaeological remains are Structure 42 (Traverser Pit, Item G on Fig.4).
- Service connections, including drainage - no construction information available. Possible impacts to significant below-ground archaeological remains will occur if construction penetrates below-present ground surface, dependent on service locations.
- Access roads - no construction information available. Possible impacts to significant below-ground archaeological remains will occur if construction penetrates below-present ground surface, dependent on locations.

3.2.2 C160 reference design facilities comprise:

- Proposed cleaners building, 28 car-parking spaces, lorry parking. Situated over Structures 27 and 60. Possible impacts to significant archaeological remains - one of the site's air raid shelters (Structure 60, Item C on Fig.4), if it survives.
- Stabling sidings S16-S43 and Servicing/Stabling Sidings 10-15. Situated over Structures 4, 5, 7, 8, 9, 10, 12, 11, 13, 14, 15a, 15b, 15c, 16a, 16b, 17a, 17b, 18, 19, 20, 24, 26, 27, 29, 30, 33, 35, 41, 42, 44, 45, 46, 47, 52, 55, 56 and 59. Possible impacts to significant archaeological remains - the foundations of the raised track structure to the west of the coaling stage (Structure 35, Item B on Fig.4), 'Four ton crane base' shown on the 1913 to 1916 Ordnance Survey at the external north-eastern corner of Structure 16 (Item D on Fig.4), the traverser pit to the east of the Lifting Shop (Structure 42, Item G on Fig.4), the former north-western 65' turntable (Structure 41, Item H on Fig.4) and the foundations to the wall of the Engine Shed (Structure 27, Item I on Fig.4).
- Roads into Stabling Sidings S16-S43 and Servicing/Stabling Sidings 10-15. Situated over Structures 2, 3, 33 and 48. Possible impacts to significant archaeological remains - the 'Stone' shown on the 1913 to 1916 Ordnance Survey (Item E on Fig.4) and the former watercourse that crosses the site (Item F on Fig.4).
- Vehicular access road encircling the Stabling Sidings S16-S43 and Servicing/Stabling Sidings 10-15 to the west and north. Situated over Structures 15a, 21, 41, 42, 44, 45, 60 and 63. Possible impacts to significant archaeological remains - one of the site's air raid shelters (Structure 60, Item C on Fig.4), if it survives, and the former north-western 65' turntable (Structure 41, Item H on Fig.4).
- Vehicular access road to washer plant room, and washer plant room. Situated over Structures 39 and 48. No impacts to significant archaeological remains.
- 120 car-parking spaces and vehicular access road encircling the office and workshop building. Situated over Structures 20, 22, 23, 34, 36, 37 and 50. Possible impacts to significant archaeological remains - Structure 37 (Site of Demolished Boiler House, Item A on Fig.4).
- Vehicular access road into the site from Old Oak Common Lane. Situated over Structures 57 and 58. No impacts to significant archaeological remains.
- Office and workshop building (including sidings M1-M9). Situated over Structures 22, 23, 34, 36, 37, 50, 51. Possible impacts to significant archaeological remains - Structure 37 (Site of Demolished Boiler House, Item A on Fig.4).
- Roads into office and workshop building. Situated over existing tracks. Possible impacts to significant archaeological remains - the former watercourse that crosses the site (Item F on Fig.4).
- Drainage system. The proposed drainage system is extensive, and is shown on drawing C160-MMD-D-DDL-CR074-SD004-3-50000-Rev-01. This has the potential to impact widely on significant archaeological remains including Structure 37 (Item A on Fig.4), Structure 35 (Item B on Fig.4), Structures 60 (Item C on Fig.4), the 'Four ton crane base' shown on the 1913 to 1916 Ordnance Survey at the external north-eastern corner of Structure 16 (Item D on Fig.4), the 'Stone' shown on the 1913 to 1916 Ordnance Survey (Item E on Fig.4), the former watercourse that crosses the site (Item F on Fig.4), the traverser pit to the east of the Lifting Shop (Structure 42, Item G on Fig.4), the former north-western 65' turntable (Structure 41, Item H on Fig.4) and the foundations to the wall of the Engine Shed (Item I on Fig.4).

3.2.3 In summary, the following heritage assets of, or potentially of, archaeological significance (see Figure 5) may be impacted on;

Table 1: List of Heritage Assets (Items) requiring archaeological mitigation

Heritage Asset (item)	**Description**	**Structure Number**
A	Site of the demolished boiler house	Structure 37
B	The foundations of the raised track structure to the west of the coaling stage	Structure 35
C	The demolished air raid shelters	Structures 60
D	'Four ton crane base' shown on the 1913 to 1916 Ordnance Survey map at the external north-eastern corner of Structure 16	None
E	The 'Stone' shown on the 1913 to 1916 Ordnance Survey map and located between tracks at the east end of the site	None
F	The former north-to-south aligned watercourse	None
G	The traverser pit to the east of the Lifting Shop	Structure 42
H	The former north-western 65' turntable	Structure 41
I	The foundations to the wall of the Engine Shed	Structure 27

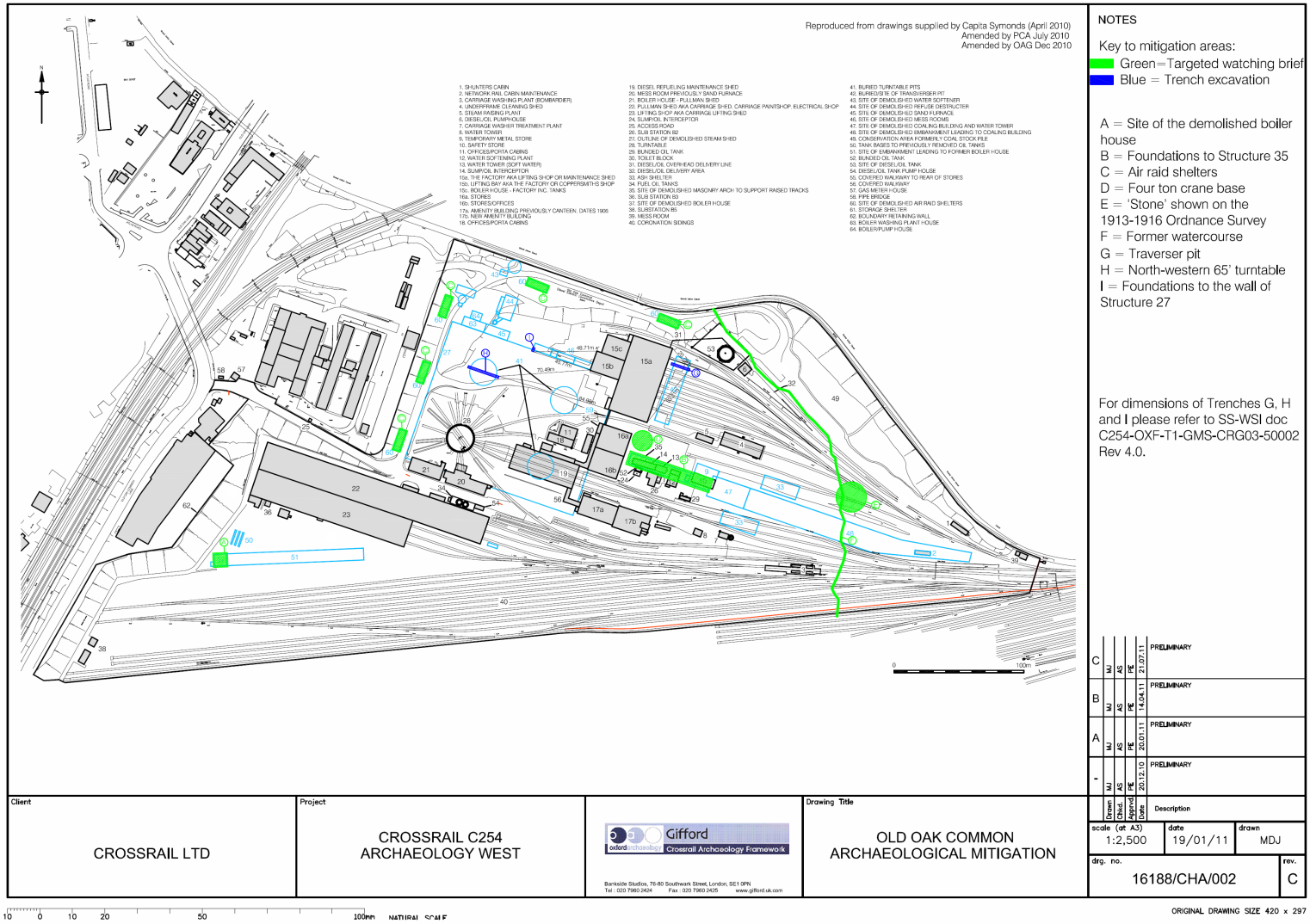

Figure 4: Location of heritage assets (items) requiring mitigation

4 Archaeological Mitigation - Aims and Objectives

4.1 Research Aims

4.1.1 Archaeological mitigation of the impacts arising from C160 and C300 works (see Section 3.2) will be required to answer the following aims and objectives.

4.1.2 Selected research themes derived from *A Research Framework for London Archaeology 2002* (Nixon et al, 2003) are included in the Assessment of Archaeology Impacts Technical Report (Crossrail 2005). Archaeological investigation and mitigation within the Crossrail OOC TMD worksites could provide evidence relating to early railway construction. This evidence would have the potential to contribute to the following research themes:

- Understanding the reasons for evolution of the road systems, street layouts, river crossings and ferries, and their importance as engines of development and change.
- Examining the concept of core/periphery for different periods in London's past, as a means of understanding how evolving settlement patterns reflect the need for sustainable, beneficial relationships between a settlement and its environs, a city and its hinterland.
- 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.

4.1.3 For landscape development (*e.g.* land construction) through assessment of the soil stratigraphy. This would have the potential to contribute to the following research themes:

- Examining the concept of core / periphery for different periods in London's past, as a means of understanding a settlement and its environs, a city and its hinterland;
- Contributing to our understanding of the creation of the London suburbs; and
- Defining levels of landscape change due either to environment and climate or human interaction.

4.1.4 In addition, archaeological fieldwork relating to the use of the site during WWII would meet the need, noted in *Modern Military Matters* (Schofield, J., 2004), to understand what 'Measures were put in place during World War II to ensure the functioning of the railway system. Structures included hardened signal boxes, railway control centres and related air raid shelters. Little is known of this subject.' Schofield notes that 'Research through archives and in particular local and national records may provide information about this. Information may also appear in the local defence schemes. Some official histories and archives held by GPO or BT, or the National Archives may assist with a wireless communications study. There is some urgency, particularly for recording railway buildings which are disappearing very rapidly due to rail improvements.'

4.2 Objectives of the Investigation

4.2.1 The overall objectives of the investigation described in this document are to establish the character, nature, date, extent and state of preservation of any surviving archaeological remains (heritage assets) that will be impacted upon by the development. This will generally comprise buried non-listed built heritage.

4.2.2 Specifically, the mitigation proposed has the potential to recover evidence relating to the original 65' turntables which were housed in the Engine Shed, the construction method and materials used to found the walls and columns of the Engine Shed and Stores, the use of the site during WWII, the nature and extent of survival of the traverser pit, the nature of the stone marked on early OS maps, the survival of the four-ton crane which was sited outside the Stores and the construction method and materials used to found the raised track of the coaling stage and former boiler house. Additionally, evidence may be recovered for the development of the watercourse which formerly crossed the site.

4.2.3 Finally, it is an objective to assess and analyse the data collected from documentary work and the archaeological investigations undertaken in connection with this project in order to prepare a publication in accordance with the generic SSWSI (CR-PN-LWS-EN-SY-00001).

5 Scope of the Investigations

5.1 Archaeological Mitigation

5.1.1 Archaeological mitigation of the impacts arising from the Crossrail's C160 and C300 packages comprises preservation by record through a targeted watching brief and trench excavation. Targeted watching briefs and trench excavation are specified below and in Section 7.

5.2 Targeted Watching Brief

5.2.1 Archaeological mitigation in the form of preservation by record, comprising a targeted watching brief (Figure 5), is required whilst any groundworks associated with construction which may impact on heritage assets takes place at the following locations:

Item A Site of the demolished boiler house (Structure 37, during X2234 construction).

Item B The foundations of the raised track structure to the west of the coaling stage (Structure 35, during X2234 and C300 construction);

Item C The demolished air raid shelters (Structures 60, during X2234 construction);

Item D 'Four ton crane base' shown on the 1913 to 1916 Ordnance Survey at the external north-eastern corner of Structure 16 (during C300 and X2234 construction);

Item E The 'Stone' shown on the 1913 to 1916 Ordnance Survey, and located between tracks at the east end of the site (during C300 and X2234 construction);

Item F The former north-to-south aligned watercourse (during X2234 construction).

5.2.2 The purpose of a targeted watching brief at each of these locations is:

Item A To identify and record the plan of the structure and the construction methods and materials used.

Item B To identify and record the construction methods and materials used.

Item C To identify and record the construction methods and materials used, and to record and recover any items relating to their WWII use.

Item D To identify and record the construction methods and materials used;

Item E To identify and record the nature and survival of this item, should any part of it survive. Is it a parish/district boundary marker?

Item F To record the nature and position of the former watercourse and any antecedents (including palaeochannels).

5.3 Trial Trench Excavation

5.3.1 Archaeological mitigation in the form of preservation by record, comprising trial trench excavation by C254, with enablement by the Principal Contractor, is required at the following locations (Figure 4). Specifications for the trial trench excavations, and any further works stemming from these trenches, are provided in Section 7.11 below.

Item G The traverser pit to the east of the Lifting Shop (Structure 42, during C300 and X2234 construction);

Item H The former north-western 65' turntable (Structure 41, during X2234 construction).

Item I The foundations to the wall of the Engine Shed (Structure 27, during X2234 construction)

5.3.2 The purpose of the trial trench excavations are to:

Item G To identify and record the nature and survival of the traverser pit, and the construction methods and materials used.

Item H Evaluate and record the construction methods and materials used, to record any surviving engineering fixtures and fittings and to record and recover any important items used as backfill.

Item I To identify and record the construction methods and materials used.

5.3.3 The Event Code to be used for Items A to I will be confirmed by the Project Archaeologist.

6 Programme

6.1 Introduction

6.1.1 Site-specific mitigation measures are presented using the following phasing (see also Annex 8):

- Critical phase - advanced archaeological works which need to be undertaken prior to the Enabling Works (this may apply to very significant archaeological remains where complex mitigation is required and where early site access is required)
- Phase 1 - archaeological works to be undertaken commensurate with the programme of Enabling Works
- Phase 2 - archaeological works to be undertaken commensurate with the Main Works
- Phase 3 - archaeological works to be undertaken after the Main Works phase (*e.g.* post-excavation assessment, analysis, publication and dissemination).

Critical Phase

None.

Phase 1

None.

Phase 2

C300 – Targeted Watching Brief (if construction depths require it – design details awaited) – Items B, D, E and G (see Table 1).

X2234 - Targeted Watching Brief – Items A, B, C, D, E and F (see Table 1)

Trial trench excavation – Items G, H and I (see Table 1)

Phase 3

See requirements in Section 8.

6.2 Programme

6.2.1 The site enablement and construction work is divided into three phases – Areas 1 to 3. Demolitions has been completed in Areas 2 and 3 under C277. Area 1 demolition works commence in 2014.

6.2.2 Area 2 concrete segment yard works (C300) will commence in July 2011 and operation will cease in December 2013 (see OOC Site Phasing Plan CRL1-XRL-G-DDA-CR074-00004 v2). In addition, Contract C610 (System-wide fit out) will occupy the site from July 2014 (see OOC Site Phasing Plan CRL1-XRL-G-DDA-CR074-00006 v5).

6.2.3 Main construction works to Areas 1 to 3 (C160) commence in January 2014 under Contract X2234 - Rolling Stock and Depot Services. The contractor will develop the C160 outline depot design reviewed here to detailed design stage and then construct the depot (and provide the rolling stock). Possession is progressive and dependent on C610 system-wide site vacation.

7 Archaeological Contractor (C254) Specification and Requirements

7.1 Generic Standards

7.1.1 The archaeological mitigation works and scope of any archaeological scientific methods shall be designed and undertaken in accordance with the Generic SSWSI and relevant best practise guidance (and any subsequent revisions) *i.e*:

- Crossrail standards and specifications;
- Institute for Archaeologists – Standard and Guidance for archaeological field evaluation, 2008 (revised);
- Institute for Archaeologists – Standard and Guidance for archaeological excavation, 2008 (revised);
- Institute for Archaeologists – Standard and Guidance for an archaeological watching brief, 2008 (revised);
- Museum of London collections and archive policies and guidance; English Heritage – Geoarchaeology, 2007;
- English Heritage - Archaeological Science at PPG16 interventions: Best Practice Guidance for Curators and Commissioning Archaeologists, 2003;
- GLAAS Archaeological Guidance Papers 1999;Corporation of London archaeology guidance – Planning Advice Note 3, 2004;
- Museum of London Archaeology Service site recording manual (MOLAS 1994); and
- English Heritage – Understanding Historic Buildings – A guide to good recording practice, 2006

7.2 Potentially Nationally Important Remains

7.2.1 Where unexpected, potentially nationally-important archaeological remains (as defined in the Crossrail Environmental Minimum Requirements and Generic SSWSI) are identified during the works, the Archaeological Contractor shall undertake works in accordance with the Environmental Requirements (Archaeology) section of the C254 Works Information and shall adhere to the procedures set out in the Generic SSWSI.

7.2.2 The Archaeological Contractor shall submit details of their procedure for excavating and recording potentially nationally-important remains in the Archaeological Contractor's Method Statement.

7.2.3 In the event of the discovery of unexpected, potentially nationally important archaeological remains, this SSWSI will be updated to incorporate any additional specific primary fieldwork event aims.

7.3 Human Remains

7.3.1 Certain aspects of the normal legal procedure for the removal of human remains (and associated monuments) from burial grounds has been modified by Schedule 15 to the Crossrail Act 2008. However for other aspects, normal legislation applies.

7.3.2 Where human remains are identified, all subsequent works must be undertaken in accordance with relevant legislative and environmental health requirements as set out in the Environmental Requirements (archaeology) section of the relevant package Works Information.

7.3.3 The Archaeological Contractor shall confirm how the requirements set out in the SSWSI will be implemented as part of their procedure for excavating and recording human remains in the Archaeological Contractor's Method Statement. This should incorporate best practice guidance e.g. Council for the Care of Churches (1999) and English Heritage (2002 and 2002a), as set out in Annex 10.

7.3.4 Should human remains be discovered, the Archaeological Contractor shall notify the Project Archaeologist immediately so that these procedures can be implemented. This notification may be initially made personally or by telephone but shall be confirmed in writing within 24 hours of discovery.

7.3.5 On discovery of human remains the Principal Contractor will be required to cease all works at that location until further instruction is provided by the Project Archaeologist. The Archaeological Contractor shall undertake an initial *in situ* observation and assessment of the remains and shall advise the Project Archaeologist of the course of action required.

7.3.6 Lifting of human skeletal remains shall be kept to the minimum compatible with an adequate evaluation or excavation. Notwithstanding this, the Archaeological Contractor shall ensure that all burials are planned/photographed *in situ* and that appropriate samples have been recovered prior to any lifting.

7.3.7 Visible grave goods and other obvious artefacts, shall be recorded and lifted before the end of the working day to avoid the risk of vandalism and theft. Where this is not feasible or appropriate, the Archaeological Contractor shall ensure, on liaison with the

Project Archaeologist that adequate site security is provided by the Principal Contractor. As a minimum, this will require a 24-hour comprehensive security regime until sensitive remains have been recorded and lifted.

7.3.8 As a result of the discovery of unexpected, potentially nationally important archaeological remains, the SS-SSWSI will be updated by the Project Archaeologist to incorporate any additional specific primary fieldwork event aims.

7.4 Treasure Act

7.4.1 The Treasure Act 1996 defines 'Treasure' as:

- Any object at least 300 years old when found which is: not a coin, but has metallic content of which at least 10% is precious metal; or
- One of at least two coins with at least 10% precious metal content;
- One of at least 10 coins;
- Any object at least 200 years old designated as treasure by the Secretary of State;
- Any object which would have been 'Treasure Trove';
- Any object found with any of the above.

The Treasure (Designation) Order 2002 extends the definition of treasure to include:

- Finds of at least two base metal objects (other than coins) of prehistoric date; and
- Any object (other than a coin) of prehistoric date with any precious metal content.

7.4.2 All finds falling within the definitions of treasure shall be reported immediately to the Project Archaeologist and all subsequent works must be undertaken in accordance with the relevant legislative requirements as set out in the Environmental Requirements (archaeology) section of the relevant package Works Information and Annex 11.

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

7.4.4 Subject to the Provisions of the Treasure Act 1996, all material that is defined as Treasure is vested in the franchisee or, if none, the Crown.

7.4.5 With respect to Treasure finds, a reward may be payable to the finder, the landowner and/or the occupier. The Crown usually offers finds to a museum.

7.5 Health and Safety

7.5.1 The Archaeological Contractor shall undertake the works in accordance with the Employer's Health and Safety requirements, the Principal Contractor's Health and Safety Plan and the Designers Risk Assessment. Where specific health and safety

constraints or requirements for the Archaeological Contractor's method of work are required, these shall be set out in this section and detailed in the Archaeological Contractor's Method Statement (in the Health and Safety Plan).

7.5.2 No ground intervention or other survey shall be made without approval of the Archaeological Contractor's Health and Safety Plan, Method Statement and Risk Assessment by the CDM co-ordinator.

7.5.3 Hand excavation or other remote sensing method may be required prior to any mechanical excavation in the first instance to locate any known or suspected below ground hazards. The Archaeological Contractor's Method Statement and Risk Assessment shall take account of any design information (including the Designer's and Principal Contractor's Risk Assessment) pertaining to above ground hazards such as buildings and other structures or public rights of way and below ground hazards such as services, utilities and infrastructure and shall contain a site specific Risk Assessment for unknown below ground hazards such as contaminants including unexploded ordnance. All appropriate mitigation measures shall be in place prior to commencement of any ground intervention or other survey.

7.5.4 Trial trench excavation method and earthworks support design shall conform to Health and Safety legislation and safety standards as well as incorporating current engineering best practice, where appropriate.

7.6 Location and Ground Elevation of Interventions and Survey Grids

7.6.1 The spatial extent of the investigation(s) shall be set out in accordance with the setting out co-ordinates supplied by the Project Archaeologist. All spatial setting out and recording shall be in accordance with The London Survey Grid Standard (formerly Crossrail Survey Grid). See Crossrail standard CR-STD-010.

7.6.2 Interventions shall be located to a horizontal accuracy of +/-500mm in relation to the detail illustrated in the contract drawing(s). The corner points of each excavation or the centre point of each soil core location shall be set out with a Total Station Theodolite or other suitable automated equipment referenced from approved Permanent Ground Marker (PGM) data supplied to the Archaeological Contractor by the Project Archaeologist. The positions of the trenches and survey points shall be verified by the Archaeological Contractor taking additional check measurements to additional known-location points of detail.

7.6.3 Surface heights shall be recorded and related to PGMs or approved Ordnance Survey Bench Marks (OSBM). The full descriptions and locations of PGMs and OSBMs known to the Employer will be supplied to the Archaeological Contractor by the Project Archaeologist. Levelling accuracy between OSBMs/PGMs and site TBMs shall be within 10 mm$\sqrt{k}$: where 'k' is the total distance levelled in kilometres. Each TBM shall be levelled as part of a closed loop starting and finishing on approved OSBMs or Crossrail PGMs. Where more than one TBM is required per site the Archaeological Contractor shall establish the TBMs as part of the same closed loop.

7.6.4 The Archaeological Contractor shall include details of their surveying methodology within their Method Statement (see Section 8), including the setting out of the grid and

how they intend to provide the project grid co-ordinates to the Project Archaeologist with the Survey Report.

7.6.5 The Archaeological Contractor shall ensure that all trench or excavation limits, and significant archaeology detail are surveyed 'as dug' in relation to the project grid before leaving the site. Ground level height data shall be recorded for each intervention. Survey methodology and a detailed survey record shall be provided to the Project Archaeologist within the Survey Report.

7.7 Specification for the Watching Brief

7.7.1 Scope of Watching Brief

7.7.2 A Watching brief, as defined in the Generic SSWSI, is a programme of archaeological monitoring (*i.e.* observation, investigation and recording) which is carried out by a suitably qualified archaeologist during site investigations (*e.g.* geotechnical test pits, boreholes and utilities trial trenches) and construction works. The purpose of a watching brief is to identify the potential of any archaeological remains that are uncovered in the course of the works and record them appropriately (as far as is reasonably practicable). The watching brief shall result in the preparation of an ordered archive which will be incorporated into the post-excavation works and into publication of the project results.

7.7.3 The Archaeological Contractor shall undertake the watching brief during enablement and construction works in areas listed in Section 3.2 of this SSWSI. This shall include any activities (including those associated with site set-up and demolition) undertaken by the Principal Contractor that involve the removal of modern material, made ground and topsoil and subsoils.

7.7.4 Two classes of watching brief are set out in the Generic SSWSI:

- A general watching brief shall comprise observation and recording of the *Principal Contractor's* works without constraint on their working methods.
- A targeted watching brief shall comprise observation and recording of the Principal Contractor's works with specific operations carried out under the supervision of the Archaeological Contractor. Under targeted watching brief, the Archaeological Contractor may impose constraints on, or require changes to, the Principal Contractors' or his sub-contractor's method of working to enable the archaeological investigation to take place alongside construction works.

7.7.5 A targeted watching brief shall be used for areas of known occasional, dispersed features which are either not considered to be of sufficient significance to warrant archaeological investigation in advance of construction, or where access prior to construction has not been possible and where, as a result, there is a possibility of unexpected discoveries

7.7.6 Except in cases where unexpected, potentially nationally important, archaeological remains are discovered, the targeted watching brief shall be designed and

implemented so as to avoid adverse impact on the construction programme, wherever practicable.

7.7.7 The Principal Contractor shall make allowance in their activity programme for the completion of targeted watching briefs as set out in this SSWSI.

7.8 Scope of Targeted Watching Brief - Constraints on Principal Contractor's Methodology

7.8.1 In areas where the need for a targeted watching brief has been identified in Section 5 above, the Principal Contractor will remove soils and structures under the supervision of the Archaeological Contractor. The Archaeological Contractor may request the use of toothless machine buckets for this operation in order to prevent unnecessary damage to archaeological remains. The Principal Contractor will limit tracking of vehicles and plant within these areas whilst archaeological recording takes place and/or as instructed by the Project Archaeologist. The Principal Contractor will facilitate recording by the Archaeological Contractor through use of agreed plant, a site share agreement and careful liaison between the Archaeological Contractor's supervising archaeologist and the Principal Contractor's site supervisor.

7.8.2 Specification for Watching Brief

7.8.3 The Works to be carried out by the Archaeological Contractor shall consist of:

- Targeted watching brief by a core team of archaeologists.

7.8.4 The Archaeological Contractor's core team shall consist of the Archaeological Contractor's key person (the field director) and other appropriately experienced archaeologists commensurate with the scale and nature of the Principal Contractor's works.

7.8.5 The core team shall undertake the observation and any required investigation such as they may reasonably be able to undertake.

7.8.6 The Archaeological Contractor's support team shall consist of additional experienced archaeologists. The size of the support team shall be commensurate with the scale and programme of the Principal Contractor's works..

7.8.7 The Archaeological Contractor's core and support teams shall be advised where necessary by specialists, as appropriate and as agreed with the Project Archaeologist.

7.8.8 The Archaeological Contractor shall record the following observations on a daily basis. The record shall consist of, as a minimum:

- The Event Code and chainage/location of the area observed;
- The date(s) of the observation;
- Personnel employed on site;
- A description of the construction works observed;

- The works (sub) contractor and personnel undertaking and supervising the construction activity;
- Depths and extents of excavation works observed;
- Measure of confidence that any archaeological remains would have been observed and reasons;
- The areas and horizons (both those containing archaeological remains and those which do not) unaffected by construction activity (with special reference to archaeological sites identified for preservation in situ);
- The reasons why any particular area of the works was not observed, and noting those areas not subject to disturbance from construction;
- Location and description of any archaeological remains; and
- Location and description of any modern remains.

7.9 Investigation Undertaken during Watching Brief

7.9.1 An appropriate sample of archaeological remains of importance should be recorded to an appropriate English Heritage historic building recording standard. The level of finds recovery shall be determined by the Archaeological Contractor in liaison with the Project Archaeologist (and as discussed with the relevant local authority and English Heritage if relevant). Any specific variations from this specification shall be indicated in the Archaeological Contractor's Method Statement.

7.9.2 Heights for all structures and deposits shall be related to approved Permanent Ground Markers (PGMs) or approved Ordnance Survey Bench Marks (OSBM), where reasonably accessible. Levelling accuracy between OSBMs/PGMs and site Temporary Bench Marks (TBMs) shall be within 10 mm□k: where 'k' is the total distance levelled in kilometres. Each TBM shall be levelled as part of a closed loop starting and finishing on approved OSBMs or URL PGMs. Where more than one TBM is required per site, the *Archaeological Contractor* shall establish the TBMs as part of the same closed loop. The *Archaeological Contractor* shall prepare a record of their surveying methodology for inclusion in the archive.

7.10 Recording Standards

7.10.1 The archaeological remains shall be recorded to best practice standards, recognising the special circumstances of a watching brief which demand flexibility in order to achieve archaeological objectives and requirements within the construction environment.

7.10.2 The recording is to include as a minimum:

- The written record of individual context descriptions on appropriate pro-forma.
- The drawn record shall normally include, plans and section drawings of appropriate features, structures and individual contexts (1:50 1:20 or 1:10).

Isolated archaeological remains (artefacts) may be spot located in plan and a height provided where possible. Deposits which are regular in plan (pits and ditches) may be located though co-ordinates, annotated with dimensions, and may be recorded digitally.

- Other appropriate drawn and written records shall also be produced (for environmental sampling *etc*).

7.10.3 The photographic record shall consist of monochrome prints/negatives and colour transparencies. A 35mm format (film or digital) SLR camera is acceptable for all site photography. The Archaeological Contractor shall maintain a minimum of two 35mm SLR cameras on site at all times during working hours. The photographic record shall include photographs and transparencies of archaeological features, appropriate groups of features, structures, and quaternary deposits. Each photograph and transparency shall clearly show details of the above. Each photograph and transparency shall include an appropriate graduated scale, a north arrow, and a header board detailing (as a minimum) the event code and context/feature number. In addition, the *Archaeological Contractor* shall take appropriate record photographs to illustrate work in progress.

7.11 Specification for Archaeological Trial Trench Excavation

7.11.1 A sufficient sample of the archaeological features and deposits revealed by trial trench excavation must be sampled/or fully excavated to allow the resolution of the aims and objectives of the work. Structures, features or finds which might reasonably be considered to merit preservation *in situ* shall not be unduly damaged.

7.11.2 The objectives of the trial trench excavations, as set out in Section 4 of the SSWSI, have been established in consultation with the project's statutory consultees.

7.11.3 The dimensions of Trial Trench Excavation G in plan, exclusive of any trench support systems or stepping employed to remove or shore overlying modern demolition material deposits and thus secure personnel entry to the excavation, shall be 15m by 1.8m or greater length if required to examine opposing side walls. The trial trench shall be excavated to the base of the traverser pit and expose opposing walls .

7.11.4 Dependent upon the results of Trial Trench Excavation G and subject to the agreement of the Project Archaeologist, it may be necessary to expose more of the traverser pit in order, for example, to expose machinery, construction or engineering evidence not apparent in the trial trench excavation. This additional work should take the form of a strip, map and sample record, and should aim to expose only enough of the remaining structure to resolve questions remaining unanswered by the trial trench work.

7.11.5 The dimensions of Trial Trench Excavation H in plan, exclusive of any trench support systems or stepping employed to remove or shore overlying modern demolition material deposits and thus secure personnel entry to the excavation, shall be 25m x 1.8m or greater length if required to examine opposing side walls. The trial trench shall be excavated to the base of the turntable and expose opposing walls, and should aim to align across the diameter of the turntable and the axis of the main operating road (as shown on historic plans) in order to record the pivot, track edges and locking plates.

7.11.6 Dependent upon the results of Trial Trench Excavation H and subject to the agreement of the Project Archaeologist, it may be necessary to expose more of the buried turntable in order, for example, to elucidate construction or engineering evidence not apparent in the trial trench excavation, or, subject to the agreement of the Project Archaeologist, to expose the turntable in its entirety, after being emptied, for the purposes of photographic recording. This work should take the form of an archaeological excavation which should aim to expose only enough of the remaining turntable to resolve questions remaining unanswered by the trial trench work.

7.11.7 The dimensions of Trial Trench Excavation I in plan, exclusive of any trench support systems or stepping employed to remove or shore overlying modern demolition material deposits and thus secure personnel entry to the excavation, shall be 3m by 1.8m or greater length if required to examine both edges of the wall foundation. The trench shall be excavated to the base of the foundation.

7.11.8 Machining using a range of toothed and toothless buckets, any breaking out, temporary works and any required hand investigation to address below ground hazards shall be carried out by the Principal Contractor under supervision by the Archaeological Contractor in accordance with their approved Method Statement and Risk Assessment. The Principal Contractor shall cease work when archaeological evidence is revealed and allow the Archaeological Contractor to undertake investigation, as appropriate.

7.11.9 The machine used to remove modern overburden shall reduce the ground level progressively, in spits of 0.20m to 0.5m depth (dependant on specific site conditions), moving along the length of the trench or area. The Archaeological Contractor's supervising archaeologist shall use their professional judgement to determine the appropriate depth of each spit and will advise the Principal Contractor accordingly. Any variations to the excavation methodology shall be at the discretion of the supervising archaeologist and recorded in writing for inclusion in the final report to the Project Archaeologist.

7.11.10 Each spit shall be examined carefully to assist the recovery of any archaeologically significant artefacts and thus to determine when to cease machining. The archaeological level shall be cleaned in plan by the Principal Contractor using a wide blade ditching bucket (*ie* toothless bucket) or similar (if applicable).

7.11.11 The Archaeological Contractor shall supervise the excavation of each trial pit in such a manner so as to allow a cumulative or continuous section to be recorded.

7.11.12 The Archaeological Contractor's excavation, sampling and recording policy shall be included in the Archaeological Contractor's Method Statement. This is to include, as a minimum:

- The recording of individual contexts on appropriate *pro formas*;
- Excavation plans at 1:50 scale; planning and section drawing of appropriate single contexts and features (usually at 1:20 scale for plans and 1:10 scale for inhumations and sections);
- Photographs; and other appropriate drawn and written records; and
- Permanent Ground Markers (PGMs), any temporary benchmarks and approved OS benchmarks shall be indicated on the relevant plans.

7.11.13 The Archaeological Contractor's survey and recording policy shall meet the following requirements:

- All levels shall be recorded to London Grid standards and reduced to OS datum;
- The test trench location shall be electronically surveyed with reference to the London Grid and Crossrail PGMs upon the completion of fieldwork by the Archaeological Contractor;
- The locations of the trial trench shall be plotted on appropriate scale plans related to the London Grid and labelled with six figure eastings and northings; and
- The electronic survey record shall be retained with the project archive.

7.11.14 The Archaeological Contractor shall identify any temporary works and dewatering requirements associated with the archaeological investigation in the Archaeological Contractor's Method Statement and shall agree the detailed arrangements for such with the Principal Contractor. The Archaeological Contractor will be required to undertake works in accordance with the Principal Contractor's arrangements for matters such as off site-spoil disposal or storage, on-site facilities and services. Relevant requirements shall be incorporated in the Archaeological Contractor's Method Statement.

7.12 Recording Systems

7.12.1 The test trench excavation shall be recorded by the Archaeological Contractor to the standards of current best practice. The recording systems adopted during the investigations must be fully compatible with those published by the Museum of London Archaeology Service (MoLAS 1994 3rd ED) and Museum of London (MoL 1998).

7.12.2 The recording is to include, as a minimum:

- At least one representative section at (1:10 or 1:20 scale) from ground level to the base of the excavation;
- The written record of individual context descriptions on appropriate pro-forma;
- Plans at appropriate scales (1:10 or 1:20);
- Single context planning if appropriate; and
- Photographs and other appropriate drawn and written records.

7.12.3 Other sections, including the half-sections of individual layers or features shall be drawn as appropriate to 1:10 or 1:20.

7.12.4 Site plans shall identify both London Grid and OS co-ordinates. A 'site location plan', indicating site north shall be prepared at 1:1,250 scale. Individual 'trench plans' or 'excavation area plans' at 1:200 (or 1:100) scale shall be prepared which show the location of archaeology investigated in relation to the investigation area.

7.12.5 Section drawings shall be located on the relevant plan and both London Grid and OS co-ordinates recorded. The locations of the OSBM or PGM bench markers used and any site TBM shall also be indicated.

7.12.6 A record of the full extent in plan of all archaeological structures and deposits as revealed in the investigation shall be made; these plans shall be on polyester based drawing film, and be at a scale of 1:10 or 1:20 unless otherwise agreed with the Project Archaeologist. 'Single context planning' shall be used on deeply stratified sites. Drawing information shall be digitised for eventual CAD applications. The GLHER will accept Autocad DXF or DWG format of extent of site and location of major features with the completed Sites and Monuments Report Form.

7.12.7 A 'Harris matrix' stratification diagram shall be employed to record stratigraphic relationships (Harris 1993). This record shall be compiled and fully checked by the *Archaeological Contractor* during the course of the excavations. Spot dating shall be incorporated onto this diagram during the course of excavations.

7.12.8 Recording of the structural evidence will vary according to the level of survival of the structure. Detailed drawings of important features revealed in investigations may be required in accordance with the aims and objectives of the investigation.

7.12.9 The Archaeological Contractor shall agree the appropriate level of recording and analysis for below-ground structures with the Project Archaeologist, in accordance with the Crossrail procedure for non-listed built heritage recording (Document CR-PN-PRW-EN-PD-00010). The Archaeological Contractor shall revise the *Archaeological Contractor*'s Method Statement to reflect any additional requirements for built heritage recording if this is required.

7.12.10 The photographic record shall consist of monochrome prints/negatives and colour transparencies. A 35mm format SLR camera (film or digital) is acceptable for all site photography. The Archaeological Contractor shall maintain a minimum of two 35mm SLR cameras on site at all times during working hours. The photographic record shall include photographs and transparencies of archaeological features and structures. Each photograph and transparency shall clearly show details of the above, and may require the use of artificial lighting to achieve suitable definition. Each photograph and transparency shall include an appropriate graduated scale, a north arrow, and a header board detailing (as a minimum) the project event code and context/feature number. In addition, the Archaeological Contractor shall take appropriate record photographs to illustrate work in progress.

7.12.11 The transparencies shall be mounted in suitable frames for long-term curation in preparation for deposition with the archive. Digital photography and video recording may be appropriate in some circumstances and the Archaeological Contractor shall set out proposals for such recording in the Archaeological Contractor's Method Statement for approval by the Project Archaeologist.

7.12.12 Where appropriate a photogrammetric record or laser scan record shall be made of complex structures, features and horizons, liable to be damaged in the course of the investigation, such as buildings or parts of buildings. Appropriate technical specification and scales shall be specified in the Archaeological Contractor's Method Statement.

7.13 Specific Requirements for the Excavation of Trial Trenches

7.13.1 The Principal Contractor shall ensure that water is discharged and arisings from archaeological excavations are stored in accordance with the Principal Contractor's environmental protection requirements (as set out in the package Works Information and their Environmental Management Plan) and any relevant consents for the worksite.

7.13.2 Should any material be excavated that is deemed to be contaminated or potentially contaminated it shall be investigated, controlled (*e.g.* placed separately from clean material) and removed from the site by the Principal Contractor in accordance with the Principal Contractor's environmental protection requirements (as set out in their Environmental Management Plan).

7.13.3 The Archaeological Contractor shall ensure, in liaison with the Project Archaeologist, that adequate protection is provided for any archaeological remains. Any specific archaeological requirements relating to backfilling shall be included by the Archaeological Contractor in their Method Statement.

7.13.4 The trenches, should it be necessary, shall be pumped dry by the Principal Contractor and any necessary protection measures for archaeological remains (in addition to those for below ground infrastructure, services or utilities) shall be completed prior to backfilling. Backfilling and reinstatement shall be undertaken by the Principal Contractor as specified in the package works information and in accordance with the approved Archaeological Contractors Method Statement or other instruction from the Project Archaeologist and/or Project Manager. Generally, all backfill material shall consist of non-toxic, uncontaminated, non-putrescible, natural and inert material which shall be compacted and (if necessary) tested (dynamic compaction test or other) in accordance with a specification provided by the Project Manager. Surface conditions shall be reinstated to the required standard.

7.13.5 In order to protect any waterlogged remains during the works, the Archaeological Contractor may identify a requirement for trial excavations to be allowed to refill with water overnight. In such cases, the Archaeological Contractor shall request approval from the Project Manager and shall ensure that any hazards to staff or third parties are minimised.

7.14 Archaeological Science and Finds

7.14.1 The strategy for sampling any archaeological and palaeo-environmental deposits and structures (which can include soils, timbers, pollen, diatoms, animal bone, human bone etc.) will be developed by the Project Archaeologist in consultation with English Heritage Regional Science Advisor and the Archaeology Contractor. On-site work and off-site analysis of the processed samples and remains will be undertaken by the Archaeological Contractor's environmental archaeologist as specified in the Archaeological Contractor's Method Statement. It is to be noted that it is unlikely that any deposits requiring such sampling will be encountered during the works listed in Section 5, with the exception, possibly, of Item F (the former north-to-south aligned watercourse).

7.14.2 The finds retrieval policies of the appropriate recipient museum will be adopted. In accordance with the collection and retention strategy set out in SSWSI, all finds (artefacts and ecofacts) visible during excavation shall be collected and processed by the *Archaeological Contractor.* In some cases, sampling may be the most appropriate

strategy. Finds shall be appropriately packaged and stored under optimum conditions, as detailed in the RESCUE/UKIC publication First Aid for Finds (Watkinson and Neal 1998).

7.14.3 Assessment of finds assemblages shall include x-radiography of all iron objects (after initial screening to exclude obviously recent debris) and, where appropriate, non-ferrous artefacts (including all coins). Where necessary, active stabilisation/consolidation shall be carried out to ensure long-term survival of the material but with due consideration to possible future investigations.

7.14.4 Once assessed, all material shall be packed and stored in optimum conditions, as described in *First Aid for Finds* (Watkinson and Neal 1998).

7.14.5 Any animal bone assemblages, or sub-samples of them, shall be assessed by the Archaeological Contractor's specialist with reference to English Heritage guidance (English Heritage 2002). Again, it should prove unlikely that any animal bone deposits will be encountered during the works listed in Section 5.

8 Archaeological Contractor Deliverables

8.1 Archaeological Contractor's Method Statement

8.1.1 The Archaeological Contractor shall provide a detailed Method Statement for the works for the Project Archaeologist's approval. The Method Statement shall be prepared in association with the Principal Contractor, taking account of their Environmental Management Plan and other relevant site information provided by them and requirements for the works set out in the Works Information (*e.g.* relating to health and safety, security, engineering design requirements and attendances). The Method Statement shall include, as appropriate:

- A resource plan and programme and CVs;
- The Archaeological Contractor's IT capability and proposed IT plan (including specific survey methods for on-site recording of stratigraphic profiles and sub-surface topographic modelling;
- The Archaeological Contractor's approach to Archaeological Science;
- The methods for survey and setting out works;
- The methods to address the specific event types required (TWB, GWB, trial trenching etc);
- The safe method of working whilst excavating trenches or pits including any temporary works required;
- The method for disposing of water from trenches and test pits in waterlogged ground;
- Site management plan to include requirements/responsibilities of the Principal Contractor and any other requirements;

- The retention and disposal policies for samples and artefacts recovered during the work;
- The method for excavating and recording inhumations and cremations in compliance with the generic Crossrail standards for Human Remains (see Section 7.1);
- The method for preparation of the required reports, archive and all associated deliverables;
- The procedures for assessment of potential for analysis (post excavation assessment), analysis and publication proposals;
- The method for preparation of the digital dataset, digital drawings, and digital report deliverables;
- The Archaeological Contractor's methods and approach for undertaking the site based works and off site processes to completion.
- The Health and Safety Plan and Site-Specific Risk Assessment (including unexploded ordnance);
- Details of the Archaeological Contractor's Quality Assurance Plan;
- The procedures for on- and off- site security and emergency response plan (including environmental incidents);
- The method for complying with project generic and site specific environmental and consent requirements; and
- The Archaeological Contractor's requirements and specification for services and facilities and attendances required to be supplied by the Principal Contractor or the Employer.

8.2 Site Archives

8.2.1 The site archive shall be organised to be compatible with other archaeological archives in London any specific requirements of the receiving museum. This requirement for archival compatibility includes computerised databases.

8.2.2 For London archives, individual descriptions of all archaeological strata and features excavated or exposed shall be entered onto prepared pro-forma recording sheets which include the same fields of entry on the recording sheets of Museum of London Archaeology. Sample recording sheets, sample registers, finds recording sheets, registered finds catalogues and photographic record cards shall also follow the Museum of London Archaeology equivalents.

8.2.3 Archives shall be prepared to conform with current best practise (*e.g.* Brown and Duncan 2007; Institute of Field Archaeologists 2008f) The archive shall cover all finds, samples and records (drawn, written, photographic and electronic) collected and produced during the works. The archive shall be indexed and internally consistent. The

Archaeological Contractor shall complete the site archive and submit to the Project Archaeologist within eight weeks of completion of a fieldwork event.

8.2.4 The site archive shall be deposited with a museum to be confirmed by the Project Archaeologist.

8.3 Digital Data

8.3.1 The Archaeological Contractor shall produce a digital data archive of all primary field data produced during the works in accordance with ADS guidelines (Richards and Robinson 2001).

8.3.2 The Archaeological Contractor shall prepare and provide field and laboratory data, evaluation or excavation trench and phasing plans showing archaeological features recorded, and report text in digital form, as well as in paper form. Consideration should be given to recording electronic plans during fieldwork.

8.3.3 The digital archive for each fieldwork event shall be copied to CD-R or DVD (recordable laser disc) and submitted to the Project Archaeologist for archiving in the Employer's document management system.

8.3.4 Final reports, site plans and other illustrations shall be prepared in accordance with the Employer's Information Management standards and procedures.

8.3.5 All data files submitted shall be scanned by a virus detection programme updated to the most current version. The disk label shall clearly indicate:

- Confirmation that this check has been carried out (including details of the virus checking programme name and version used) and that the submission is virus free.
- Fieldwork event name and code.
- Supplier company name, date and QA details (as a minimum, the name, position and signature of the approver).

8.3.6 Prior to commencing the works, the Archaeological Contractor shall submit an example hard copy and data output of each of the data formats required (*i.e.* data, graphic, CAD and text) produced by their current software, for approval by the Project Archaeologist. The Archaeological Contractor shall inform the Project Archaeologist of any changes or upgrades made to approved software prior to processing any works data. The sample disk shall include data from a previous real job or jobs.

8.3.7 A sequential numbering of data issues shall be rigorously adhered to so that no data versions are submitted out of sequence. The organisation of the data prior to submission shall be the responsibility of the Archaeological Contractor. The Archaeological Contractor shall ensure that data originating from different sources within the Archaeological Contractor's organisation is compatible with the project requirements. The Archaeological Contractor shall nominate one person to the Project Archaeologist who is the main point of contact for matters relating to the digital data submissions.

8.3.8 Where errors or inconsistencies are noted in the data, by either the Project Archaeologist or Archaeological Contractor they shall be corrected by the Archaeological Contractor and a corrected data file issued to the Project Archaeologist. When a change or addition is made to the data within an issue, a complete data group shall be re-issued, not just the changed fields. This may not require complete replacement of the whole data set which includes other previous issues.

8.3.9 Where any changes are made to a data record between digital data submissions, the Archaeological Contractor shall record the date of the change and the name of the person carrying out the change. The Archaeological Contractor shall ensure that each data amendment is carried out correctly.

8.3.10 The Archaeological Contractor shall make two identical copies of the digital archive. The first copy shall be retained by the Archaeological Contractor until the expiry of the Contract maintenance period. The second copy shall be issued to the Project Archaeologist.

8.3.11 A digital archive for each Crossrail site (incorporating individual event archives) shall be submitted to a regional or national data archive as agreed with the service provider by the Employer.

8.4 Interim Statement

8.4.1 Within seven days of completion of a fieldwork event the Archaeological Contractor shall submit an Interim Statement to the Project Archaeologist.

8.4.2 The Interim Statement shall be brief, and the information contained commensurate with the timescale for production. The report shall not duplicate effort to be utilised at a later date and shall draw on the data gathered during the initial assessment undertaken during fieldwork.

8.4.3 A site plan indicating all as-dug investigations shall be provided. Key stratigraphic profiles and topographic templates of the major stratigraphic units shall be provided.

8.4.4 The Interim Statement including illustrations shall be submitted as a single PDF file to the Project Archaeologist. CAD drawing files shall also be submitted.

8.4.5 The Interim Statement text shall be submitted in hard copy and as an MS Word document in accordance with the Employer's information management standards and procedures.

8.4.6 The Interim Statement shall include an approved report title sheet and QA page (to be supplied by the Employer).

8.4.7 The following shall appear in the footer or header of each Interim Statement: © CRL Ltd, 2011

8.4.8 Copies of the Interim Statement shall be provided by the Project Archaeologist to Robert Whytehead (GLAAS) and the London Borough of Hammersmith and Fulham for comment.

8.5 Survey Report

8.5.1 The Archaeological Contractor shall provide a written and graphic survey report for the works upon completion of fieldwork. Evidence shall be provided for check measurements and results of levelling for establishment of TBMs. The survey report shall be submitted by the Archaeological Contractor to the Project Archaeologist within two weeks of the completion of fieldwork.

8.5.2 The Archaeological Contractor shall prepare and submit 'as excavated' site area outlines and levels in accordance with Crossrail standard CRS-SDT-05. Each drawing shall identify the relevant event code and sub-site division, if applicable.

8.6 Fieldwork Report

8.6.1 The trial trench excavation report and watching brief report shall be prepared by the Archaeological Contractor within six weeks of the completion of the fieldwork (unless this is varied by the Project Archaeologist). The Fieldwork Report shall follow the standard structure set out in GLAAS standards and guidance for archaeological fieldwork, City of London Planning Advice Note 3 and IFA standards, as appropriate, *i.e.*:

Contents list

8.6.2 The Fieldwork Reports shall provide an illustrated factual statement and statement of importance with associated assessment of potential for further fieldwork and/or analysis of the archive. The Fieldwork Reports shall utilise information collected during archaeological fieldwork and from any other appropriate sources agreed with the Project Archaeologist.

8.6.3 The Fieldwork Reports shall include sections detailing the background to the project, any previous relevant research and investigation, location and topography/geology, a description of the methodology employed and the techniques adopted. Where relevant, these sections shall include location plans with scale and grid co-ordinates.

8.6.4 Each component of the works (*e.g.* stratigraphic/structural, artefactual and environmental/economic) shall be supported by a statement setting out:

- A quantification of the resource (tabulated and cross referenced as appropriate);
- Provisional dating and evidence for residuality and intrusiveness;
- The range of material, including sampling and/or taphonomic biases; and
- The condition of the material, including preservation bias.

8.6.5 The stratigraphic statement shall include: a description of the geomorphology and sedimentation record of the survey area, a description of the fieldwork results (brief context descriptions supported by plans and sections as necessary, with levels related to Ordnance Datum), a trench summary table indicating depths of all major stratigraphic units, and their boundaries. Photographs shall be included where appropriate.

8.6.6 The Archaeological Contractor shall produce a subsurface model(s) and profiles to illustrate the extent, character and depth of the major stratigraphic topology identified. The model shall be correlated with previous works within the survey area in order to inform the mitigation design. The processing software and presentation format of the data shall be included in the Archaeological Contractor's Method Statement for approval by the Project Archaeologist.

8.6.7 The assessment of results and statement of potential shall include the Archaeological Contractor's conclusions based on the recorded data, *e.g.* the monument/site class represented, site/feature function and relevant parallels. The statement shall also comment on the potential of the data to address the projects' research themes. As appropriate, comment shall be made on the site as a whole and the individual components (e.g. artefactual, palaeo-environmental, economic). The statement shall utilise the criteria laid down by the Secretary of State for Culture, Media and Sport Criteria for Scheduling in order to establish importance.

8.6.8 In reporting the results of the works, the accuracy of the original expectations and the appropriateness of the methods adopted shall be assessed by the Archaeological Contractor in order to illustrate what level of confidence can be placed on the information. The Project Archaeologist will use that information as the basis for developing any further mitigation strategy and/or further analysis and publication.

8.6.9 The report shall be illustrated with a site location plan, survey location plans as appropriate (to include archaeological interpretation of results), and individual trench and area plans identifying archaeological features exposed and investigated.

8.6.10 When submitted at evaluation stage, the report shall set out an outline recommendation for mitigation. This may include preservation in situ and/or further investigation and recording of the remains and/or watching brief. The development of a detailed mitigation strategy shall be progressed by the Project Archaeologist in liaison with the Project Manager's engineering design team, the Archaeological Contractor, and the English Heritage Regional Science Advisor (and other statutory authority), as appropriate.

8.6.11 Copies of the Fieldwork Report shall be provided by the Project Archaeologist to Robert Whytehead (English Heritage) and the London Borough of Hammersmith and Fulham for comment.

8.6.12 The following shall appear in the footer or header of each Fieldwork Report:

8.7 GLHER Summary Sheet

8.7.1 The Archaeological Contractor shall complete a GLHER Summary Sheet for the works (*i.e.* one per fieldwork event). The Summary Sheet shall be included in the Fieldwork Report as outlined in Section 8.6.

8.8 Summary Report

8.8.1 A short summary report of no more than 500 words (the Summary Report) for the works shall be prepared by the Archaeological Contractor for submission to the Project Archaeologist for subsequent publication within *London Archaeologist* or another local (county) journal or publication outlet specified by the Project Archaeologist.

8.8.2 The Archaeological Contractor shall submit the draft Summary Report to the Project Archaeologist for approval within 8 weeks of the completion date of the fieldwork event. The Archaeological Contractor shall allow two weeks in the programme of works for the Project Archaeologist to provide comments. The Archaeological Contractor shall include any amendments required by the Project Archaeologist in the final Summary Report which shall be submitted within one week of receiving the Project Archaeologist's comments on the draft report.

8.8.3 The Summary Report shall be submitted as an MS Word document in accordance with the Employer's information management standards and procedures.

8.9 Post Excavation Assessment

8.9.1 If instructed by the Project Archaeologist, the Archaeological Contractor shall undertake a post-excavation assessment of the site archive and submit a report of their findings to the Project Archaeologist for approval. Assessment of potential for analysis shall be undertaken in accordance with English Heritage guidelines.

8.9.2 The Archaeological Contractor shall provide details of its current post-excavation assessment procedures with their Method Statement.

9 Site Monitoring and Progress Reports

9.1.1 Prior to commencing the works the Archaeological Contractor shall agree a programme of weekly written progress reports and periodic progress meetings with the Project Archaeologist an/or Project Manager and shall be represented at such meetings to the satisfaction of the Project Archaeologist. The Archaeological Contractor shall provide information describing progress on-site to date, the processing of samples and artefacts and feedback from any initial assessment.

9.1.2 The London Borough of Hammersmith and Fulham and Robert Whytehead (GLAAS) will be informed in writing by the Project Archaeologist at least one week in advance of commencement of fieldwork. GLAAS have been kept informed of the methodology and objectives of the works listed in Section 5.

9.1.3 Periodic updates on the progress of Crossrail's archaeological programme shall be submitted to the external consultees by the Project Archaeologist. The Archaeological

Contractor shall provide information to the Project Archaeologist as requested to inform this reporting.

9.1.4 The Project Archaeologist shall arrange and convene monitoring site visits by the external consultees, as appropriate. There shall be no unauthorised access to the works in any other circumstances. Any visits to the works shall be in accordance with the Principal Contractor's health and safety, site access and security requirements.

9.1.5 The Archaeological Contractor may propose that excavation be carried out as an extension to trial trench excavation works, if the scope of such work is readily incorporated into the SSWSI. The detailed method for this work shall be agreed between the Archaeological Contractor and the Project Archaeologist at a site meeting and subsequently in writing between the Project Archaeologist and the relevant external consultees.

10 Personnel Requirements

10.1.1 The Archaeological Contractor shall provide project personnel of experience as described below. The personnel shall be approved by the Project Archaeologist. Approval may be withdrawn by the Employer at their discretion and in accordance with the contract conditions.

10.1.2 The Archaeological Contractor shall submit CVs of all proposed personnel including any specialists, but excluding site technician grades, to the Project Archaeologist for approval if this has not already been done as part of the pre-qualification process.

10.1.3 The works shall be managed, directed and staffed by appropriately qualified and experienced personnel. The Archaeological Contractor's Key Person shall possess at least ten years relevant experience.

10.1.4 The excavation, sampling and recording of the works shall be directed in the field by a Fieldwork Director who is a Member of the Institute of Field Archaeologists (MIFA) The Fieldwork Director shall be on site throughout the fieldwork stages.

10.1.5 The Archaeological Contractor's project team shall include an environmental archaeologist suitably qualified in archaeological science and geoarchaeological sediment description methods, and on-site sample processing and assessment techniques.

10.1.6 The Archaeological Contractor's project team shall be staffed by technician grades with minimum six months experience in appropriate aspects of excavation and recording.

10.1.7 Specialist historic building recording staff employed on any aspect of the works, including post-excavation assessment or analysis of any kind including the writing of reports, shall be suitably qualified and shall be supervised by personnel with a minimum of ten years of relevant experience in their field (this may be inclusive of post-graduate studies).

10.1.8 Specialist staff shall be available, normally at 24 hours notice, for the duration of the works to provide advice on any specialist tasks to be undertaken.

11 References and Glossary of Terms

Crossrail. 2005. Assessment of Archaeological Impacts, Technical Report. Part 5 of 6, Western Route Section, Document Number. 1E0318-C1E00-00001, February 2005.

Crossrail, 2008c, Archaeology Generic Written Scheme of Investigation, Document Number CR-PN-LWS-EN-SY-00001

Crossrail. 2008. *Procedure for non-listed built heritage recording*. Document number CR-PN-PRW-EN-PD-00010

Crossrail, 2008. Archaeology Specification for Evaluation & Mitigation (Document CR-PN-LWS-EN-SP-00001)

Nixon, T, McAdam, E, Tomber, R, and Swain, H, 2003, A Research Framework for London Archaeology 2002, Museum of London Archaeology Service

Oxford Archaeology/Gifford, Archaeology Method Statement, Crossrail document C254-OXF-W-GMS-CRG03-00004 Rev 4.0

Schofield, J., 2004, *Modern Military Matters,* CBA

Pre-Construct Archaeology, *Old Oak Common Worksites: Archaeological Detailed Desk-Based Assessment: Non-Listed Built Heritage*, Crossrail document C150-CSY-T1-RGN-CR076_PT001-00011 Rev 4.0

12 Definitions/Abbreviations/Acronyms

The following is a list of the most commonly used definitions, abbreviations and acronyms within CRL SSWSIs:

ATD	Above Tunnel Datum. Tunnel Datum = Ordnance Datum plus 100m
BP	Before Present
c.	Circa
CDI	Common Design Item
CDM	Construction (Design and Management) Regulations
CICP	Crossrail Integrated Construction Programme
CLRL	Cross London Rail Links Ltd
CPFR	Crossrail Project Functional Requirements
dB	Decibel
dB(A)	Decibel (ambient)
DDA	Disability Discrimination Act

DfT	Department for Transport
DLR	Docklands Light Railway
Dom Doc	Lotus Domino Document Manager (software programme)
EMP	Environmental Management Plan
EMR	Environmental Minimum Requirements
ES	Environmental Statement
EWMA	Enabling Works Managing Agent
GLHER	Greater London Historic Environment Record
HF	Human Factors
HMRI	Her Majesty's Railway Inspectorate
IDC	Inter-Discipline Design Check
IDR	Inter-Discipline Design Review
IRD	Initial Reference Design
km	kilometre
km/h	kilometres per hour
LB	London Borough
LFEPA	London Fire and Emergency Planning Authority
LLAU	Limit of Land to be Acquired or Used
LMP	Lorry Management Plans
LoD	Limit of Deviation
LU	London Underground Ltd
m	metre
M&E	Mechanical and Electrical
MDC	Multi-Disciplinary Consultant
MDC4	Multi-Disciplinary Consultant 4, Halcrow
NLL	North London Line
NR	Network Rail
O&M	Operations and Maintenance
OHLE	Overhead Line Equipment
OSD	Over Site Development
RM	Requirements Management
RMP	Requirements Management Plan

RSPG	Railway Safety Principles and Guidance
SI	Systems Integration/Site Investigation
SRA	Strategic Rail Authority
SRC	Systems and Rolling Stock Consultants
SRS	Systems Requirements Specification
TBM	Tunnel Boring Machine
TfL	Transport for London
TOC	Train Operating Company
VE	Value Engineering
VM	Value Management

13 Annex 1 Site Information

13.1.1 For Services and Utilities, Extinguishments of Rights of Way, Surface Water Control, Protective Fencing, Credit Boards, Care in Executing the Site Operations and Parking of Vehicles please refer to C254 Works Information Volumes 1 and 2 or the Principal Contractor's Method Statements or Construction Phase Plans.

14 Annex 2 Health and Safety Requirements

14.1.1 For CDM requirements, Archaeological Contractor's Risk Assessments and Health and Safety Plans, Archaeological Contractor's Safety Audits, Safety Inspections, Reporting of Accidents, please refer to Package Work Order C254 Works Information Volumes 1 and 2. The Designer's Risk Assessment to accompany this SSWSI is presented below:

Designer's Risk Assessment

Gifford - GMS

Project Summary

Job Name:	Crossrail Archaeology		
Job Number:	16188		
Project Director:	Simon Price	**Project Manager:**	Andy Shelley
Status:	Approved		

Entries

Design Element	Task/Project	Date Created	Created By
Old oak common archaeological works	-	27/01/2011	Ed Crammond

		Initial Assessment			Revised Assessment		
Hazard	**At Risk**	**Probability**	**Severity**	**Mitigation**	**Probability**	**Severity**	**Residual Risk**
Lack of understanding of the site and its hazards, and the purpose and design of the archaeological works, causes personal injury.	✔ Construction Operatives ✔ Users	Likely	High	Attend all inductions. No lone working. Use PPE. Operatives to familiarise themselves with all WSIs and Risk Assessments generated by this work.	Unlikely	High	✔ H & S Plan Low.
Encountering contaminated land causes personal injury. Principla Contractor needs to supply all relevant information in advance of works.	✔ Construction Operatives ✔ Users	Likely	High	Use PPE at all times. Attend site inductions. Familiarise oneself with the mitigation measures in place to deal with known contaminated land. No lone working.	Unlikely	High	✔ H & S Plan Low
Striking live services during the course of watching brief and trial trench excavation works causes personal injury. The location of TWB, GWB and trial trench excavation areas have been chosen for archaeological reasons.	✔ Construction Operatives ✔ Users	Likely	High	All archaeological work will be undertaken under the supervision of the Principal Contractor and will require a Permit to Dig to be issued. The archaeological contractor should confirm with the Principal Contractor in advance of works that there are no live services in areas they are to investigate. The Principal Contractor should ensure that there are no live services in areas requiring archaeological investigation.	Unlikely	High	✔ H & S Plan Low.
Trial trench excavations							

destabilise nearby structures, causing collapse and personal injury.	✔ Construction Operatives ✔ Users	Likely	High	All trenching to be undertaken only after nearby buildings have been demolished to ground level.	Unlikely	High	✔ H & S Plan Low
Entering air raid shelters or traverser pit requires entering a confined space, causing personal injury. Research has not answered whether these remain, and if they do whether they are still void or have been backfilled.		Likely	High	No confined spaces, as to be defined by Principal Contractor, shall be entered at any time by non-confined space trained operatives. Any confined space trained operatives shall operate under Principal Contractor supervision/control at all times, using appropriate PPE.	Unlikely	High	✔ H & S Plan Low
Slips, trips and falls during archaeological attendance causing personal injury	✔ Construction Operatives ✔ Users	Likely	High	Use PPE at all times as specified by PC. Use designated routes only. Attend site inductions. Be aware at all times. Use ladders installed by Principal Contractor to gain access/egress to trenches. Familiarise oneself with Site First Aiders and First Aid Stations. No lone working.	Unlikely	High	✔ H & S Plan Low.
Adjacent plant causing personal injury during watching briefs/trench excavations	✔ Construction Operatives ✔ Users	Likely	High	Use of PPE. Use designated routes only. Attend site inductions. Be aware at all times. All plant to be operated by certified PC operatives.	Unlikely	High	✔ H & S Plan Low
Vehicle movements causes personal injury whilst undertaking archaeological works.	✔ Construction Operatives ✔ Users	Likely	High	Use designated routes. Attend inductions. Be accompanied. Use of PPE.	Unlikely	High	✔ H & S Plan Low
Trial Trench Excavation collapse causing personal injury	✔ Construction Operatives ✔ Users	Likely	High	All trenches to be dug only to safe working depth. Greater depths to be achieved using trench shoring systems installed, maintained and certified by trained and certified operatives, or by stepping or battering arrangments, all to be approved for use and installed by Principal Contractor. GI works indicate London Clay and therefore a low probability of collapse within shallow trenches.Archaeological contractor to familiarise themselves with the results of GI logs, available from the Principal Contractor.	Unlikely	High	✔ H & S Plan No residual risk.

Designers Risk Assessment (CDM) - Completion and Approval

Approved By: [signature] **Approved Date:** 31/1/11

15 Annex 3 Personal Protective Equipment (PPE)

15.1.1 PPE must conform to Network Rail worksite specifications and consist of:

- High visibility vest (orange);
- Hard hat;
- Gloves;
- Safety glasses;
- Laced boots with ankle support, steel insoles and toe caps (rigger boots are not permitted on Crossrail sites);
- Protective disposable contamination suits for work on rail sites or other identified contaminated areas

16 Annex 4 Labelling of Hazardous Substances, Contaminated Land

16.1.1 Please refer to Package Work Order C254 Works Information Volumes 1 and 2.

17 Annex 5 CRL Health and Safety Management System, CRL Drugs and Alcohol Policy

17.1.1 Please refer to Package Work Order C254 Works Information Volumes 1 and 2.

18 Annex 6 CRL and work on Network Rail Land

18.1.1 Please refer to Package Work Order C254 Works Information Volumes 1 and 2.

19 Annex 7 Environmental Protection Requirements

19.1.1 Please refer to Package Work Order C254 Works Information Volumes 1 and 2 and Principal Contractor's Method Statements and Environmental Plan.

20 Annex 8 Programme and Order of Work for Implementation of Works and Integration with Other Activities

20.1.1 An outline programme and order of work is provided, and will be updated following confirmation of Construction Programme Dates. The current outline programme for works is:

- C300 Concrete Segment Factory – construction and operation of a temporary segment casting facility from July 2011 to July 2014; and

- C160 Permanent Depot – outline depot design substantially complete. Contract X2234 - Rolling Stock and Depot Services will develop the outline depot design to detailed design stage and then construct the depot (and provide the rolling stock)

21 Annex 9 Enabling and Temporary Works Design Requirements, Attendances and Implementation

21.1.1 Contract C254 Archaeology West will require the Principal Contractor to provide the following services/enablement during the excavation of the trial trench excavations and/or targeted watching briefs:

- Any temporary power, task and safety lighting facilities required;
- All below-ground and surface services to be disconnected prior to works commencing;
- All information on known contaminated ground risks, and measures to mitigate the risks stemming from encountering contaminated ground;
- Office, light tool storage and welfare facilities for up to four staff;
- Excavation of trial trenches to dimensions provided in Section 7.11, using plant fitted with both toothed and flat-bladed buckets (up to 1.8m in width). Excavations to proceed in 0.25m spits under direction of supervising archaeologist;
- Any concrete breaking required to enable excavations to proceed;
- All spoil management, leaving clear working areas around each trench;
- Provision, installation and maintenance of temporary earthwork support for excavations requiring shoring, or provision of plant and operatives to step or batter trenches if required;
- Dewatering of trial trench excavations (if required);
- Provision of Confined Space Working emergency escape equipment (if required);
- Backfilling of any excavations (if required);
- Provision, installation and maintenance of edge protection and trench access and egress equipment.
- A safe site with safe access routes from compound to the working areas. Delineated working areas for different site activities and contractors.
- Parking facilities (if practicable);
- Explosive Ordnance Engineer in attendance (where required).
- Attendance;
- Other temporary works as may be required to safely undertake the works specified.

22 Annex 10 Security Requirements

22.1.1 Please refer to Package Work Order C254 Works Information Vols 1 and 2.

23 Annex 11 Need for screening or other protective works

23.1.1 Please refer to Package Work Order C254 Works Information Vols 1 and 2.

24 Annex 12 Procedure for Notification of the Discovery of Human Remains

24.1.1 Please refer to Section 7.3.

25 Annex 13 Procedure for notification of the material falling under the Treasure Act 1996

25.1.1 Please refer to Section 7.4.

26 Annex 14 Procedure for notification of major unexpected discoveries

26.1.1 Please refer to Section 7.2.