



C254 Archaeology West
PADDINGTON NEW YARD
ARCHAEOLOGICAL SITE SPECIFIC WRITTEN SCHEME OF
INVESTIGATION
CRL Document Number: C254-OXF-T1-GMS-CRG03-50006

1. Contractor Document Submittal History:

Revision:	Date:	Prepared by:	Checked by:	Approved by:	Reason for Issue:
5.0	02-04-14	[REDACTED]	[REDACTED]	[REDACTED]	Major revisions throughout to address the impacts of notified C336 construction methods and construction of RBP

3. Acceptance by Crossrail

	Crossrail Review and Acceptance Decal This decal is to be used for submitted documents requiring acceptance by Crossrail.		
<input checked="" type="checkbox"/>	Code 1.	Accepted. Work May Proceed	
<input type="checkbox"/>	Code 2.	Not Accepted. Revise and resubmit. Work may proceed subject to incorporation of changes indicated	
<input type="checkbox"/>	Code 3.	Not Accepted. Revise and resubmit. Work may not proceed	
<input type="checkbox"/>	Code 4.	Received for information only. Receipt is confirmed	
Reviewed/Accepted by: (signature)	[REDACTED]	Print Name:	Date: 8/4/14
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Document History continued

Revision:	Date:	Prepared by:	Checked by:	Approved by:	Reason for Issue:
1.0	13-10-12	[REDACTED]	[REDACTED]	[REDACTED]	For Crossrail review



2.0	29-11-12	[REDACTED]	[REDACTED]	[REDACTED]	For Crossrail review
3.0	12-12-12	[REDACTED]	[REDACTED]	[REDACTED]	Comments on Review Sheet Document Number: C254-OXF-T1-XCS-CRG03-50005 dealt with
4.0	21-02-13	[REDACTED]	[REDACTED]	[REDACTED]	Paddington New Yard Project Manager comments on Rev 3 addressed. The following sections have been altered, changed or added: 1.1.1 – 1.1.3, 2.1.3, 2.1.4, 2.2.3, 6.3.1, 6.7.1, 7.1.1, 7.1.2, 8.2 – 8.4, 8.7.4 – 8.7.6 and Annexes 12 to 14. Section 7.2 is now deleted. Section 11 'Principal Contractor Responsibilities' added.

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1 Executive Summary

1.1.1 This Site Specific Written Scheme of Investigation (SSWSI) applies to Crossrail works at Paddington New Yard, Westbourne Park (PNY, the 'worksite'), located within the City of Westminster, London at National Grid Reference TQ (5)25118 (1)81775. The works, which will provide a new elevated bus deck, a replacement concrete batching plant (RBP), associated structures and other works, have the potential to impact on possible archaeological remains.

1.1.2 The worksite is located immediately to the west of Royal Oak Portal (the point at which Crossrail enters the central tunnelled section) and east of Westbourne Park tube station (Figs 1 and 2). The site is partially occupied by a concrete batching plant in the south-western corner of the site; the remaining part is occupied by Crossrail's C300 contractor. A bus garage occupies the north-western corner.

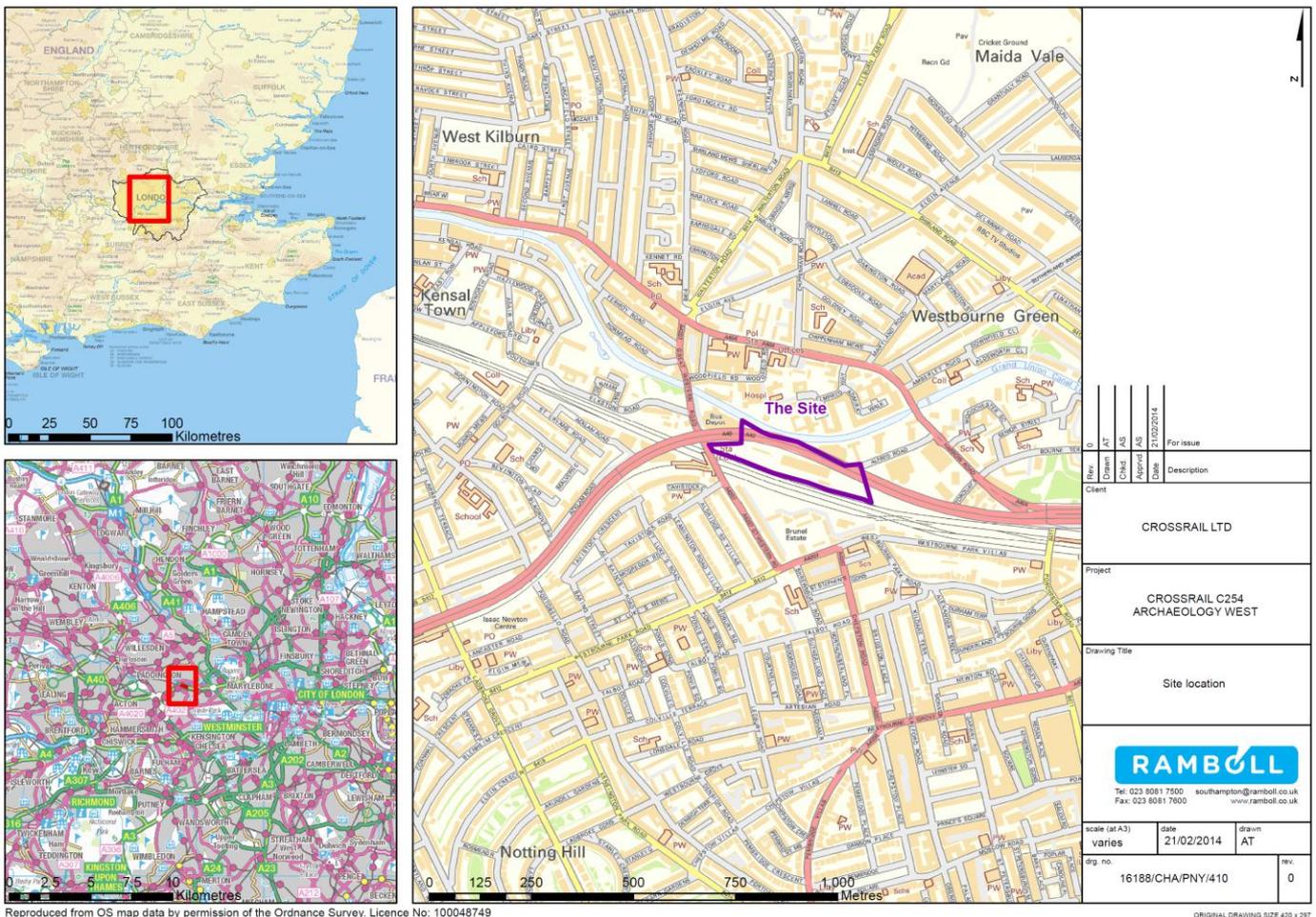


Figure 1: Site location

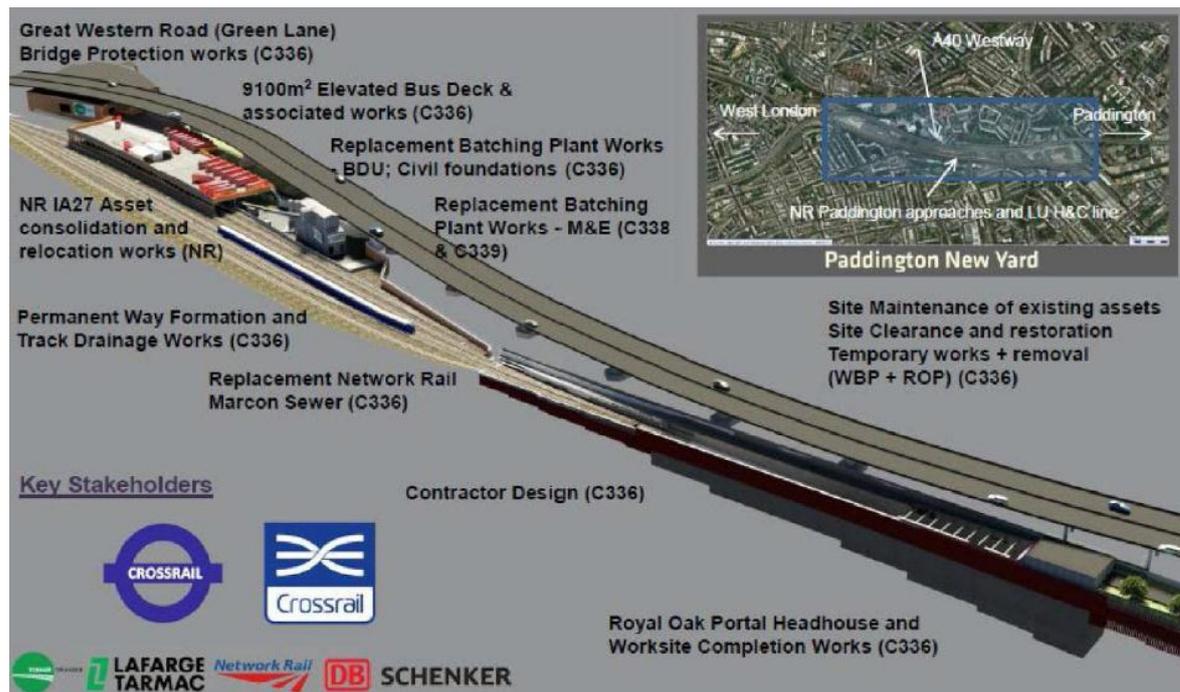


Figure 2: General illustration of proposed works

- 1.1.3 The proposed construction works will be undertaken under contract C336 and will remodel the site to provide a new elevated deck supported on a grid of circular columns resting on pile caps, each supported by four bored piles. The new structure will offer parking for buses as well as refuelling and washing facilities. Access to and from the deck will be via new openings made in the rear wall of the adjacent Westbourne Park bus garage. Its associated works, together with construction of a new concrete batching plant and track formation and drainage works, are detailed in Section 2.1.3.
- 1.1.4 A Detailed Desk Based Assessment of the Westbourne Park and Royal Oak Portal sites (Document reference CR-SD-CT1-EN-SR-00002 Rev 1.0) reviewed the known archaeological and heritage assets of the site as well as available geotechnical and geological data. This desk-based research and subsequent below-ground archaeological observation work by C254 in 2010/2011 has established that the construction and enlargement of the Great Western Railway through this area during the 1830s and later periods is likely to have removed all archaeological deposits dating to earlier than the 19th century, with the exception of geoarchaeological features within the sub-strata of the site.
- 1.1.5 This SSWSI provides a strategy for mitigating impact on surviving sub-surface archaeological remains on the site. It covers impacts deemed to affect the archaeological resource arising from construction of the elevated bus deck, the batching plant and the associated works detailed in Crossrail's Constructability Report (Document Reference C178-CSY-C-RGN-CR076_MS005-50002), in Section 2.1.3 of this report, and in recent correspondence and drawings issues from C336 Costain.
- 1.1.6 This SSWSI addresses the scope, specification, timing and order of works and the deliverables required to successfully integrate 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 arising from the construction of Crossrail is undertaken is set out in the Environmental Minimum Requirements (EMR) for Crossrail (CR/HB/EMR/0001 (fifth draft July 2008)). Accordingly, the nominated undertaker or any contractors will be required to implement certain control measures in relation to archaeology before or during construction work.
- 2.1.2 The strategy for archaeological works on Crossrail 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 Crossrail and provides a general statement of objectives, standards and structure for the planning and implementation of archaeological works.
- 2.1.3 At PNY the proposed construction requires the site to be remodelled to provide an elevated bus deck supported on a grid of circular columns resting on pile caps, themselves each supported by four bored piles. The new structure will offer parking for buses as well as refuelling and washing facilities. Access to and from the deck will be via new openings made in the rear wall of the garage. A replacement concrete batching plant will also be constructed. The list of works, including additional and associated works, that will or may impact on the archaeological resource is provided in Crossrail's Constructability Report (Document Reference C178-CSY-C-RGN-CR076_MS005-50002). There are also a number of other groundworks and temporary works designed by Costain, the contractor appointed to undertake the C336 works, to allow the permanent construction to take place.
- approximately 9000 sq m of elevated bus deck supported on a grid of 900mm diameter circular columns at nominally 12.5m x 13.5m spacing with additional intermediate columns in the rows adjacent to the siding tracks. The columns will be supported on 1.2m thick pile caps generally supported on 4 no 900mm diameter bored piles approximately 30m deep. The deck will be of *in situ* reinforced beam and ribbed slab construction. The northern edge is supported on a line of 750mm diameter piles while the southern edge is integral with a piled reinforced concrete retaining wall. The deck will be constructed in a sequence of up to six phases;
 - ground reduction to allow formation of temporary pile mats and removal of obstructions to piling. Generally C336 advise that the ground will be reduced by c 1100mm. The formation of working platforms (piling mats) in construction Area AD1 requires a number of areas to be reduced in level. The size and location of these working platforms are shown on drawing C336-COS-CIV-SKT-000035. Working Platform 1 enables test piles to be constructed and will measure c. 35m x 35m x 1.1m thickness. Working Platform 2 will be measure c. 10m x 60m x 1.1m thickness and allows high level piles on the northern boundary of the site to be constructed. Working Platform 3 allows the piles and other foundations for the RBP to be constructed and Working Platform 4 and will allow the secant piles for the BDU to be built. These works are programmed to take place very shortly after C336 gain possession of the site

- a mini pile cut off wall installed north of the deck to retain the canal embankment during construction of the ground slab and retaining wall;
- fuel storage tanks located under the deck;
- piled foundations for the RBP aggregate bins store, batching plant and silos;
- a skip elevator pit, a greywater wedge pit, a below-ground stirrer pit and a stormwater wedge pit;
- a bottom discharge hopper unit (BDU) under the deck. This is for the rail delivery of aggregate to the Lafarge Tarmac batching plant. The structure is of secant pile wall construction;
- Ground level access roads and miscellaneous retaining walls;
- Lighting, drainage and power supplies to the refuelling and washing facilities;
- Diversion of the Marcon sewer line, to connect to the Ranelagh sewer. The Marcon sewer is a Network Rail asset and drains the site eastwards to discharge into the Ranelagh sewer. The construction of the Marcon sewer starts to the south of the new Lafarge Tarmac RBP, in order to provide a drainage connection to the plant.
- Construction of Westbourne Park drainage;
- Construction of the Great Western Road sewer across the Network Rail lines west of the Green Lane Bridge. The Great Western Road sewer is a new asset to be built to the west of Green Lane Bridge. This will either be pipe jacked or constructed in trench under the tracks. It terminates in two chambers, and will be built either by C300 in co-ordination with C336, or C336.
- Stabilisation of the Green Lane Bridge north abutment to enable the lowering of the tracks in the vicinity;
- Construction of the track formation and drainage for turnback sidings, CRL eastbound and Marcon sidings;
- Connection of the Network Rail track drainage system into the new Marcon sewer

2.1.4 This SSWSI provides a strategy for mitigating impacts on sub-surface archaeological remains on the site arising from the construction activities listed above. It covers any impacts deemed to affect the known archaeological resource of the site that may be interpreted from the following information provided by Crossrail:

- C178-CSY-C-RGN-CR076_MS005-50002
- C178-CSY-D-DDA-CR076_MS005-01035 Rev P04
- C178-CSY-D-DDA-CR076_MS005-01036 Rev P04
- C178-CSY-D-DDA-CR076_MS005-01037 Rev P04
- C178-CSY-D-DDA-CR076_MS005-01038 Rev P04
- C178-CSY-S-DDA-CR076_MS005-01050 Rev P05
- C178-CSY-S-DDA-CR076_MS005-01051 Rev P05
- C178-CSY-S-DDA-CR076_MS005-01090 Rev P05

- C178-CSY-S-DDA-CR076_MS005-01091 Rev P05
 - C178-CSY-D-DDA-CR076_MS005-01540 Rev P05
 - C178-CSY-D-DDA-CR076_MS005-01541 Rev P04
 - C178-CSY-S-DDB-CR076_MS005-01170 Rev P05
 - C178-CSY-S-DDB-CR076_MS005-01171 Rev P05
 - C178-CSY-S-DDB-CR076_MS005-01172 Rev P05
 - C178-CSY-S-DDB-CR076_MS005-01173 Rev P05
 - C178-CSY-S-DDB-CR076_MS005-01251 Rev P05
 - C178-CSY-S-DDB-CR076_MS005-01252 Rev P05
 - C178-CSY-R5-DDB-CR076_MS005-01270 Rev P03
 - C178-CSY-R5-DDB-CR076_MS005-01285 Rev P03
 - C178-CSY-R5-DDB-CR076_MS005-01286 Rev P03
 - C178-CSY-D-DDA-CR076_MS005-01605 Rev P04
 - C178-CSY-D-DDA-CR076_MS005-01606 Rev P04
 - C178-CSY-D-DDA-CR076_MS005-01607 Rev P04
 - C178-CSY-D-DDA-CR076_MS005-01608 Rev P04
 - C178-CSY-D-DDB-CR076_MS005-01610 Rev P04
 - C178-CSY-D-DDB-CR076_MS005-01611 Rev P04
 - C178-CSY-D-DDB-CR076_MS005-01612 Rev P04
 - C178-CSY-D-DDB-CR076_MS005-01613 Rev P04
 - C178-CSY-S-DDH-CR076_MS005-00138 Rev P01.2
 - C336-COS-CIV-SKT-000035
 - C336-COS-CIV-SKT-000036
 - C336-COS-CIV-SKT-000037
 - Clarke & Associates 3545-100D
 - Clarke & Associates 3545-120D
 - Clarke & Associates 3545-124D
- 2.1.5 Any design changes arising from updates to these drawings will be addressed in future revisions to this SSWSI.
- 2.1.6 For the purposes of construction, the site has been divided into a number of construction areas (see below). Access to each area differs.

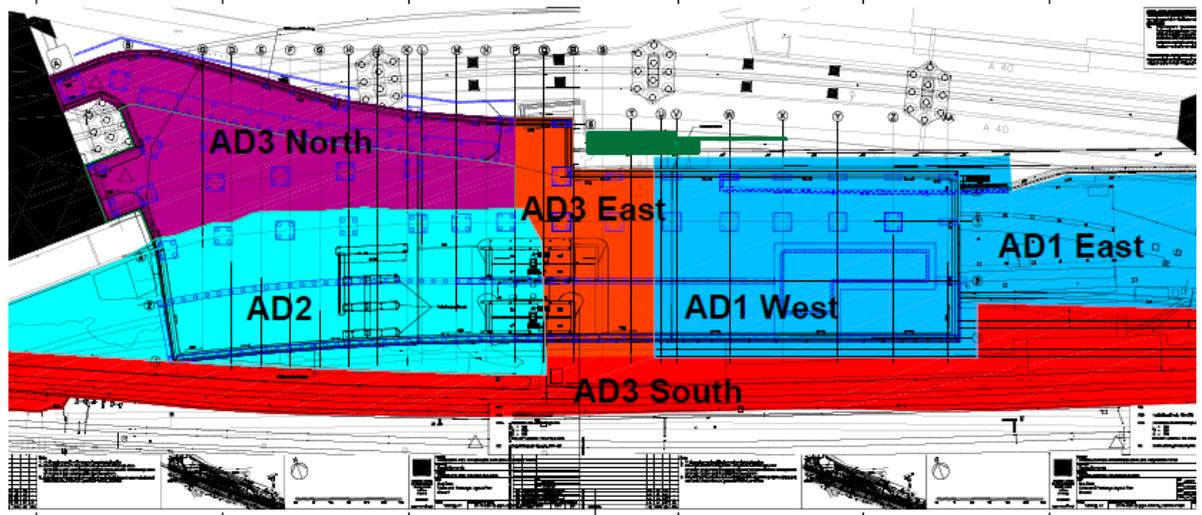


Figure 3: C336 Paddington New Yard working areas

2.2 Site Description

- 2.2.1 The worksite, known as Paddington New Yard, is located immediately to the west of Royal Oak Portal (the point at which Crossrail enters the central tunnelled section) and east of Westbourne Park tube station (Figs 2 and 3). The site is bounded by the Grand Union Canal and the A40 Westway to the north, the Great Western Mainline railway to the south, the Royal Oak Portal worksite to the east and Great Western Road to the west. PNY is centred on Ordnance Survey National Grid Reference at TQ (5)25118 (1)81775. The Westway oversails a bus garage in the north-western corner of the site (Westbourne Park Garage, built in 1981).
- 2.2.2 The site was last used as a goods siding, with the bus garage, a warehouse (Great Western Studios, a former three-storey British Rail lost property office, now demolished), and a concrete batching plant operated by Lafarge Tarmac also occupying the site. The plant, located in the central area of the site, is to be replaced by a new batching plant to the east of the new bus deck.
- 2.2.3 Crossrail contractor C300 is currently demobilising from the parts of the site not occupied by Lafarge Tarmac. Their temporary works included a sprayed concrete lining (SCL) batching plant, a grout batching plant, a narrow gauge railway, precast rings storage, a gantry crane, muckaway conveyors and temporary sidings.

2.3 Summary of Previous Studies

- 2.3.1 Previous studies and documents of specific relevance to this SSWSI relate to the work undertaken by the Museum of London Archaeology (MOLA, formerly MoLAS) in the early stages of the Crossrail Bill process (such as Specialist Technical Reports: Assessment of Archaeology Impacts (Parts 1, 2, and 6) prepared in support of the Environmental Statement 2005 (Crossrail 2005), a detailed desk-based assessment (DDBA) of the site (document CR-SD-CT1-EN-SR-00002 Rev 1.0), previous SSWSIs for Royal Oak and Westbourne Park (document C150-CSY-T1-RGN-CR076_PT001-00005 Rev 5.0 and previous revisions), fieldwork undertaken by C254 Archaeology West in 2010 and 2011

(document C254-OXF-T1-RGN-CRG03-50047) and a summary of utilities and assets undertaken by Crossrail (document C178-CSY-C-RGN-CR076_MS005-50003 Rev 2). Additionally, geotechnical ground investigation works have been completed. The results of these have been reviewed and assessed in order to inform this SSWSI (Section 2.7.2 below).

- 2.3.2 Intrusive trial pit surveys have also been undertaken across the Royal Oak Worksite West area. Advanced works Package WEP-S-008 comprised the excavation of trial pits targeted to identify the location and depth of utilities, cable routes and other subsurface hazards including the former GWR engine sheds of Brunel's railway, on and around the Network Rail Great Western Mainline between CH 0m 45c and 1m 20m. Several of these intrusive trial pits (S3/03, S3/04, S3/11, S3/12 and S3/13) were selected for monitoring as an archaeological watching brief in order to identify and record any subsurface archaeological deposits (Crossrail (Scott Wilson), 2009, *Westbourne Park GI Report, WEB-S-0008C*).
- 2.3.3 North-to-south aligned Trench S3/03 was situated between the northern side of Marcon Line 2 and the centre of Relief Line 4. This recorded multiple east-west aligned brick wall foundations, typically constructed from red brick, bonded by a cream sandy mortar and surviving to varying depths. A number of the walls appeared to be internal elements of the engine shed and were capped by dark blue-grey coping stones or purple engineering bricks. Red brick and concrete floor levels were also identified at depth of c 121.45 and 121.35 m TD.
- 2.3.4 Trench S3/04 revealed two north-south aligned concrete foundations at a depth of c 121.88m TD. Located on the southern side of the Marcon Line these foundations fell outside of the engine shed and it is unclear what structure they may relate to. Made ground was recorded to the limit of excavation at 1.50m b.g.l. (c.121.10m TD).
- 2.3.5 North-to-south aligned Trench S3/11 revealed multiple east-west aligned brick wall foundations recorded between the northern side of Marcon Line 2 and the northern side of Relief Line 4. The brick foundations were typically constructed from red brick, bonded by a cream sandy mortar, capped or faced with purple engineering bricks and surviving to varying depths below the existing track level. Again a number of the walls appeared to be internal elements of the engine shed inspection pits or troughing. Brick and concrete floor levels were also recorded of c 121.52 and 121.67m TD.
- 2.3.6 Test trench S3/12 was aligned east-to-west across the 'open' western end of the 1860s main engine shed, but proved to be negative, revealing only modern railway ballast.
- 2.3.7 East-to-west aligned Trench S3/13 was situated between the Marcon Lines 1 and 2 and partially uncovered a single concrete foundation which ran the entire 30m length of the southern side of the trench at a depth of c 121.15m TD. Made ground was recorded to the limit of excavation at 1.50m b.g.l. (c.121.10m TD) where London Clay was exposed.
- 2.3.8 The fieldwork undertaken by C254 Archaeology West in 2010 and 2011 (document C254-OXF-T1-RGN-CRG03-50047) recorded a continuation of existing rails seen and recorded as part of the non-listed built heritage survey (C150-T1-RGN-CR076_PT001-005). These were located in a position against the northern side of the former Great Western Studios building. Rail 7004 was seen to extend for approximately 2m, was slightly curved in plan and lay about 400mm below the surface. The rail itself was made of steel and displayed a bullhead 'I' shaped profile ie not Brunel's wide gauge rail. The rail was bolted to underlying transverse wooden sleepers (7005 and 7013). A layer of black ashy stone ballast (7000) was associated with the remains, all of which were clearly truncated by the concrete

column bases for the studios. Several layers of material were used to level the ground for the tracks (7008 and 7010-7012). A surface of rectangular granite setts (7002) had been laid at the same level as the rails and may therefore have been of contemporary date. An overlying Tarmac surface (7001) sealed both. The track is likely to be the former Portobello Junction line which passed to the north of the original Westbourne Park depot.

- 2.3.9 The summary of utilities and assets undertaken by Crossrail (document C178-CSY-C-RGN-CR076_MS005-50003 Rev 2) identified that a turntable was partially exposed during the construction of Network Rail's UTX Crossing 8 (pictured below, Fig 4). The reproduced image shows a substantial, curved brick wall to a depth of c.700mm, over which a capping course survived. This report says that the turntables have an approximate depth of 3m, although how this is known is not verified. This turntable has subsequently been catalogued by C254 as Structure 14.



Figure 4: Part of the 1882 turntable (Structure 14) exposed during utility works

- 2.3.10 Finally, non-listed built heritage assets were assessed by Scott Wilson during or before 2009. Recording was also undertaken in 2010 by MoLA in advance of demolition, and the results summarised in *Westbourne Park and Royal Oak Portal Site-Specific Archaeological Written Scheme of Investigation* (document C150-CSY-T1-RGN-CR076_PT001-00005) and *Westbourne Park, Non-Listed Built Heritage Recording*.

3 Geology and Topography

- 3.1.1 Information on the geology and topography of PNY has been summarised from the DDBA (document CR-SD-CT1-EN-SR-00002) and previous summaries in *Westbourne Park and Royal Oak Portal Site-Specific Archaeological Written Scheme of Investigation* (document C150-CSY-T1-RGN-CR076_PT001-00005).
- 3.1.2 The PNY site is located on London Clay, within a cutting constructed in the 19th century for the Great Western Railway (GWR). This formed a terraced land parcel located between the Grand Union Canal and the mainline to Paddington Station. The upper terrace slopes from c 129m ATM adjacent to the Grand Union Canal, to between c 128m and 125m ATM at the top of the new concrete retaining wall as it extends west to east across the site. The lower terrace is relatively flat, sloping gently from c 123m ATM at the

base of the concrete retaining wall of the railway cutting to c 122.6m TD at the existing track level of the Network Rail mainline.

3.1.3 Geotechnical and geo-environmental conditions within the Royal Oak Worksite West were investigated as part of geotechnical ground investigations Works Package 17B undertaken between February and June 2009. The upper terrace of the site, immediately east of the former Great Western Studios (GWS) was investigated by five cable percussion boreholes (ROP6–9 and ROP6A), five window samples (WS114–118) and two test pits (TP350 and TP 351).

3.1.4 The stratigraphic sequence in this area is summarised below in Table 1.

Stratum	Elevation at top, m TD	Thickness, m
Made Ground	128.38 to 125.95	1.0 to 3.05
Alluvium ¹	126.48 to 125.94	0.30 to 1.05
Organic Alluvium ²	125.64	0.30
Reworked London Clay ³	125.71 to 124.38	0.40 to 1.40
London Clay	125.78 to 122.98	Not proven

Notes: ¹ Window Samples WS114-116 only

² Window Sample WS116 only

³ Only identified in boreholes ROP6a and ROP8

Table 1: Stratigraphic summary for the upper terrace east of the GWS

3.1.5 The area of the site within the GWR cutting and immediately north of the mainline railway was investigated by two cable percussion boreholes (ROP12 and ROP14), three rotary boreholes (ROP13R, ROP15R and ROP16P) and five window samples (WS113 and WS120-WS123).

3.1.6 The stratigraphic sequence for the area within the GWR cutting is summarised in Table 2 below:

Stratum	Elevation at top, m TD	Thickness, m
Made Ground	122.74 to 122.54	0.80 to 1.80
Alluvium	126.48 to 125.94	0.30 to 1.05
Organic Alluvium (Borehole ROP15R and window samples WS114-4 only)	121.45 to 126.48	0.05 to 1.05
London Clay	121.90 to 120.78	Not proven

Table 2. Stratigraphic summary of the Lafarge Tarmac depot and First Group bus facility (within the GWR cutting)

3.1.7 The ground investigations confirmed the natural slope of the underlying London Clay southward. The investigation also confirmed that the site has been subjected to significant truncation relating to the excavation of the GWR cutting, construction of railway buildings and track layout and more recently the A40 Westway although the depth of truncation and made ground was noted as variable.

- 3.1.8 Three window samples (WS114–116) located outside the GWR cutting on the upper terrace of the site (area around Murphy's Yard) identified a firm brown/brown mottled orange clay alluvial deposit (0.30–1.05m thick), overlain by between 1.00 and 1.90m of made ground. In WS116 the brown alluvial deposit sealed a grey mottled black, organic alluvium 0.30m thick which overlay the London Clay.
- 3.1.9 Within the GWR cutting borehole (ROP15R) identified a light brown/blue grey clay alluvial deposit (0.05m thick) sealed by 1.15m of made ground. The alluvial deposit sealed the London Clay.
- 3.1.10 The paleoenvironmental and geoarchaeological potential of these below-ground deposits was demonstrated in 2010 when several relict courses of the river Westbourne were identified to the east within the Royal Oak East worksite. It is possible that the alluvial deposit identified in borehole ROP15R is part of another former watercourse, or a flood plain deposit.

3.2 Archaeological and Historical Development of the Site

- 3.2.1 A summary of the archaeological and historical development of the site is set out below and draws on the information provided in the documents listed in Section 2.3.1 and additional research undertaken during the preparation of this SSWSI.
- 3.2.2 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. There is a limited archaeological record for the area on the Greater London Sites and Monuments Record list (GLSMR), reviewed in detail in document CR-SD-CT1-EN-SR-00002.
- 3.2.3 The landscape of the site and its environs during the prehistoric period would have been dominated by the valley of the river Westbourne which would have provided a landscape ideal for hunter-gatherer activity and occupation. Isolated finds of Palaeolithic axes (c. 450,000-12,000 BC) have been recovered from the gravel deposits of the area, and an assemblage of flintwork, including Levallois flakes and cores and a *Bos* tooth, were recovered from clay and gravel deposits beside the former course of the Westbourne in Hyde Park in 1925. Little evidence remains of early farming and land use dating to the later prehistoric period, and what has been recovered is piecemeal in nature.
- 3.2.4 The work undertaken by C254 at Royal Oak Portal revealed a swathe of early deposits filling a topographical hollow. These were recognised as Pleistocene sediments (deposits relating to the most recent sequence of glaciations between 12,000 and 2.5 million years before present). Four thousand fragments of bone were retrieved from the deposits. The pieces large enough to be identified proved to be mainly Bison and Reindeer remains - some gnawed by carnivores, possibly bear or wolf. The sediments have been dated to c 70-80 thousand years before present by OSL dating which places them in the early Devensian period. Analysis of pollen samples from the site indicate the landscape is likely to be on of a treeless, grassed open tundra.
- 3.2.5 The Roman city of *Londinium* lay approximately 6km to the east of the site. The city was served by a series of Roman roads, two of which are in the vicinity of the site. Bayswater Road is aligned on Roman Stane Street, approaching London from Chichester (Roman *Noviomagus Reginorum*) in the south-west. The area is located to the north west of the Roman road *Via Trinobantia* (Oxford Street) which ran to the Roman town of Silchester (Roman *Calleva Atrebatum*). Previous archaeological field work and research has

determined that there are no known Roman known archaeological remains in the area and no known deposits in the immediate locality of the site.

- 3.2.6 Rural settlement around London survived the demise of Roman control of Britain in the 5th century and, gradually, villages such as Paddington and Lillestone to the north-east developed. The land of Hyde Park and surrounding regions, including the Westbourne River, formed the Saxon agricultural lands of Eia, which was bequeathed by Geoffrey de Mandeville to Westminster Abbey in 1086. The medieval village of Westbourne Green was situated approximately 500m to the north-east of the construction area. Westbourne Park was formerly located through the study area.
- 3.2.7 Land use in the area changed dramatically in the post-medieval period, with economic factors during the Tudor period leading to a population explosion in London. Urbanisation extended out from the City, particularly after the Great Fire of 1666. During the 16th and 17th centuries Paddington was still a small settlement centred around a village green. In 1756 Marylebone Road was constructed to connect Islington to Paddington and this gave rise to increased housing, commercialism and industrialisation of the area. The area was first impacted upon by transportation requirements as a result of an expanding population. The Grand Union Canal was constructed through the area in 1801 and Great Western Railway terminus at Paddington was completed in 1840. A historic map regression exercise indicates, however, that the area of the site comprised open fields until the mid-19th century, and it is therefore unlikely that occupation extends to the site. This fact is demonstrated by a survey drawn by Gutch in 1836 (Fig 5)).



Figure 5: Detail from George Gutch survey 1836

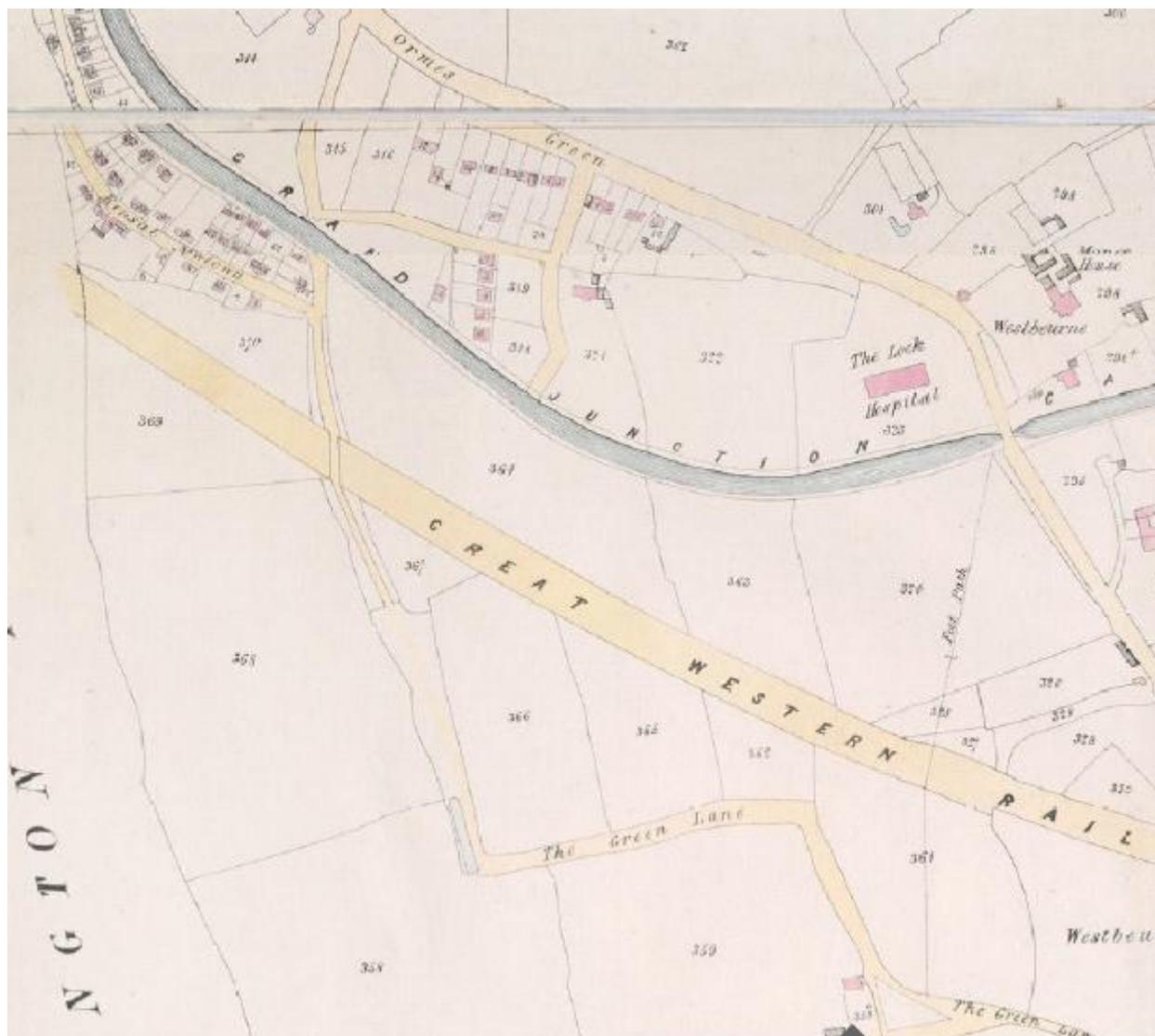


Figure 6: George Oakley Lewis lithograph 1842

- 3.2.8 Further construction across the study area resulted from increased urbanism. The Victorian Ranelagh Sewer, a brick structure which crosses the mainline beneath Ranelagh Bridge, took the former Westbourne River underground and was commissioned as part of the Metropolitan Board of Works improvements to the area in the 1870s.
- 3.2.9 Stanford's Map of 1862 (part pictured below) shows the area to have become rapidly urbanised, almost certainly a product of the arrival of the Great Western Railway. The GWR transformed the land use of the Paddington New Yard site, leading to extensive truncation caused by the excavation of the railway cutting which effectively terraced the site into two levels. The first railway line through this area, constructed by GWR's engineer, Isambard Kingdom Brunel, was operational by summer 1838 and linked Maidenhead to a temporary terminus to the west of the newly constructed Bishop's Road Bridge. This line ran within the later railway corridor seen on Stanford's map of 1862. The temporary GWR station operated between 1838 and 1853 and was constructed primarily from timber, although the roofs were carried by iron columns. The terminus, somewhat haphazardly conceived, was intended to be a purely temporary affair before the

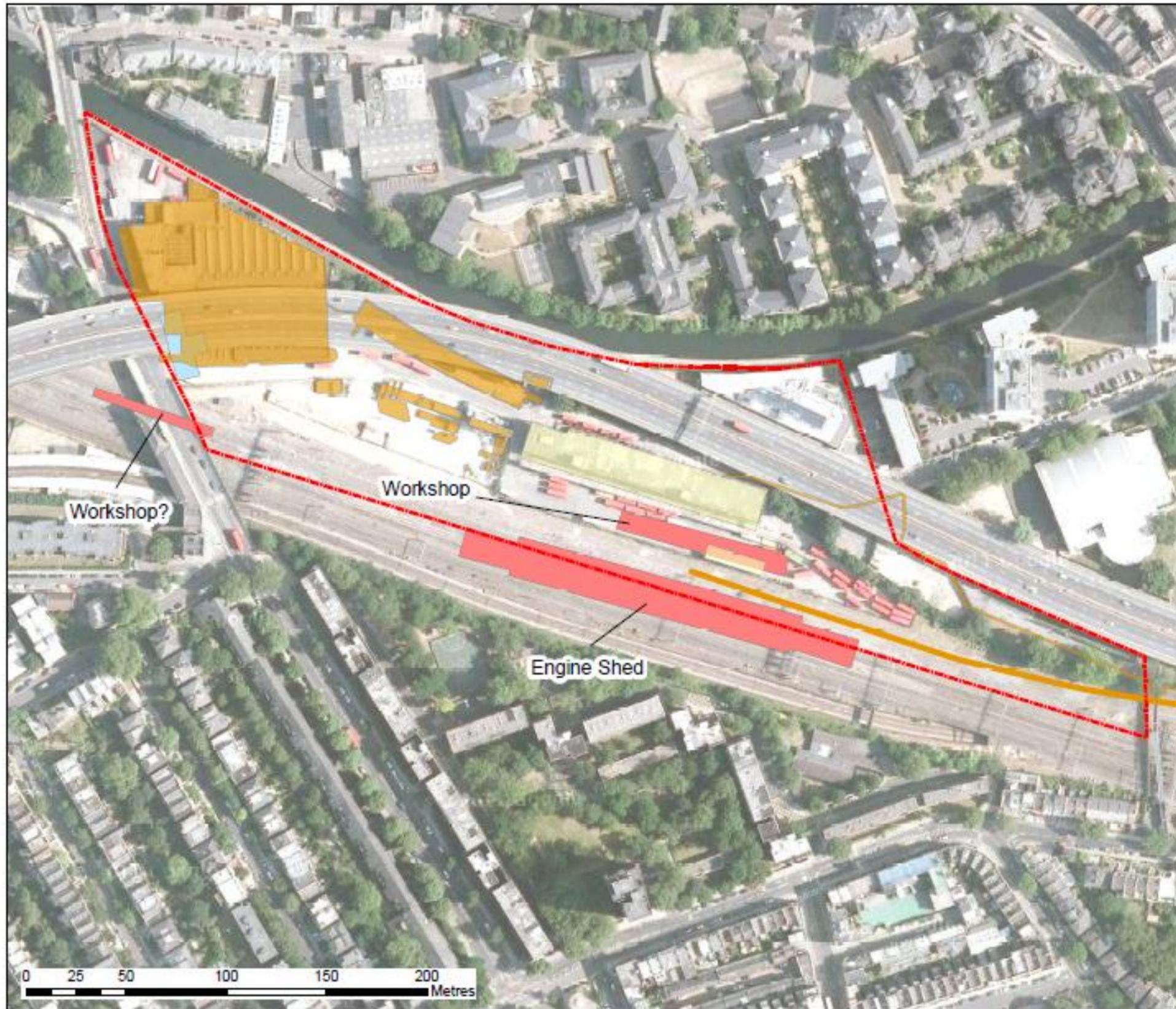
completion of the more permanent station to the east of the bridge in 1854. Its engine shed, with an octagonal building designed by Daniel Gooch and housing a turntable and eight 'roads' (apparently with sunken working pits), stood to the west of carriage sheds and offices, which themselves were separated from Bishop's Road Bridge by the arrival and departure platforms (Brindle 2004, 20).

- 3.2.10 After the opening of the existing Paddington Station east of Bishops Bridge Road, the area of the earlier terminus became the station's goods depot, the new terminus having replaced the short-lived goods shed to the east of the bridge. Stanford's map indicates three sets of tracks in the western part of the Royal Oak East worksite, running eastwards past Lord's Hill Bridge and Ranelagh Bridge and terminating at the goods depot and the new Paddington station.
- 3.2.11 With the opening of the new station, Brunel and Gooch moved the whole locomotive department from the old octagonal engine shed (which had become subsumed by the new goods depot) to Westbourne Park. Engines were now housed in a 663ft long rectangular, brick-built shed (Structure 1) constructed to accommodate Brunel's 7-foot wide broad-gauge rails (later converted to Stephenson's narrow gauge. Lengths of this broad-gauge rail were found at Westbourne Park during construction works in 2010, and were seen to be of the Brunel-designed type, which he designed specifically for use on the London-Bristol line, and which differed from Barlow's later bridge-rail design by featuring a vertical rather than curved base to the profile's height. These early rails were of wrought-iron). The engine shed housed four tracks spanned with a simple roof of tied wrought iron trusses (the contract was signed in 1852).
- 3.2.12 Four tracks ran through the building, the GWR mainline passing to the south of the engine shed. Stanford's map shows this engine shed together with a workshop located to the north of the tracks, both constructed within the cutting. The engine department workshops (Structure 2), of one storey and eleven bays long, housed smiths, fitters, coppersmiths and a carpenter and are shown in plan and elevation on page 134 of Brindle (2004). At either end were two-storey wings, one of offices (which Gooch himself used in the early days of the yard), the other for a storeroom and enginemens' sleeping quarters above.



Figure 7: Stanford 1862

3.2.13 In 1861 a new shed was built to accommodate narrow-gauge engines (Structure 3), Brunel having effectively lost the gauge wars after the Gauge Act of 1846 was passed. This was erected to the west of the workshops and originally housed three tracks. In 1873 a further three tracks were added. This building became known as the narrow-gauge shed (the earlier shed becoming, logically, the broad-gauge shed). Another, smaller workshop was located at the western boundary of the site below the Green Lane Bridge (Structure 4). The western part of the site (now occupied by the bus depot) was in the 1860s occupied by the Westbourne Schools (Structure 5). To the south of the GWR mainline (and therefore outside this study area) lay the topically-named Crimea Goods Yard. Originally, this housed additional workshops and a coal stage. On the 1869-1880 1:2500 Ordnance Survey maps a travelling crane is also shown in this area.



Key	
	Site boundary
	Existing Maroon sewer
	Existing buildings
	Demolished buildings
	1862 Westbourne Schools
	1862 Rail buildings

Client	
Crossrail Ltd	
Project Title	
Paddington New Yard	
Project Number	
16188	
Figure Title	
Existing and 1862 historic buildings	
<small>Tel: 023 8081 7500 southampton@ramboll.co.uk Fax: 023 8081 7600 www.ramboll.co.uk</small>	
Date	Prepared by
24 August 2012	JG
Drawing No.	Revision
16188/CHA/500	P01

Figure 8: Historic buildings shown on Stanford's 1862 map

- 3.2.14 The 1872 Ordnance Survey (OS) map (Fig. 9) depicts the site developed further with the addition of the narrow-gauge engine shed (Structure 3) to the north-west of the main (broad gauge) engine shed, in the area now occupied by the Lafarge Tarmac depot. A crane was located to the north of the building (Structure 6). A turntable of 12.8m diameter (42ft, Structure 7) stood to the west of the broad-gauge shed and another (Structure 8) was situated on a track linking the narrow-gauge shed with the workshop. A small, hexagonal building, probably a boiler house (Structure 9), adjoined the southern turntable, which is believed to be the only one on the GWR network powered by steam. An oval-shaped reservoir (Structure 10) occupied the north-eastern corner of the site, presumably to secure a reliable source of water for the locomotives. This was fed (or bled) by a pipe in the north-eastern corner, adjacent to Brindley Street, and may have replaced a smaller version shown on Stanford's 1862 map.
- 3.2.15 By 1872 the northern part of the site was separated from the GWR yards by an access ramp leading to Alfred Road. This was lost with the construction of the Portobello Junction line in later years, but was later reinstated on a different alignment (Structure 11), although both it and its predecessor exited the site opposite Alfred Road, north of which the site remained undeveloped with the exception of the reservoir. To the south of the reservoir a large residential property and gardens (Structure 12) occupied the north-eastern corner of the site. The 1:5,280 1850 Town map of the area does not show Alfred Villa, but this is probably a bias of the mapping since it does not depict individual buildings. The building is first shown on a map of 1869 and by 1915 there is a suggestion from the size that the building may have been extended. It is still shown on the 1938 OS map although there is no definition as the map scale is too small. Alfred Villa was excavated by C254 in 2010, and is highly likely to be the building shown on an original architect's drawing dating to 1853 -1855 on page 47 of Steven Brindle's 2004 volume on Paddington Station. This was the residence of Gooch's deputy. In 1872 the north-western part of the site was still occupied by Westbourne Schools, which had been joined by a new building labelled St. John's Servants' School (Structure 13), as well as a group of presumably residential buildings constructed along the canal.

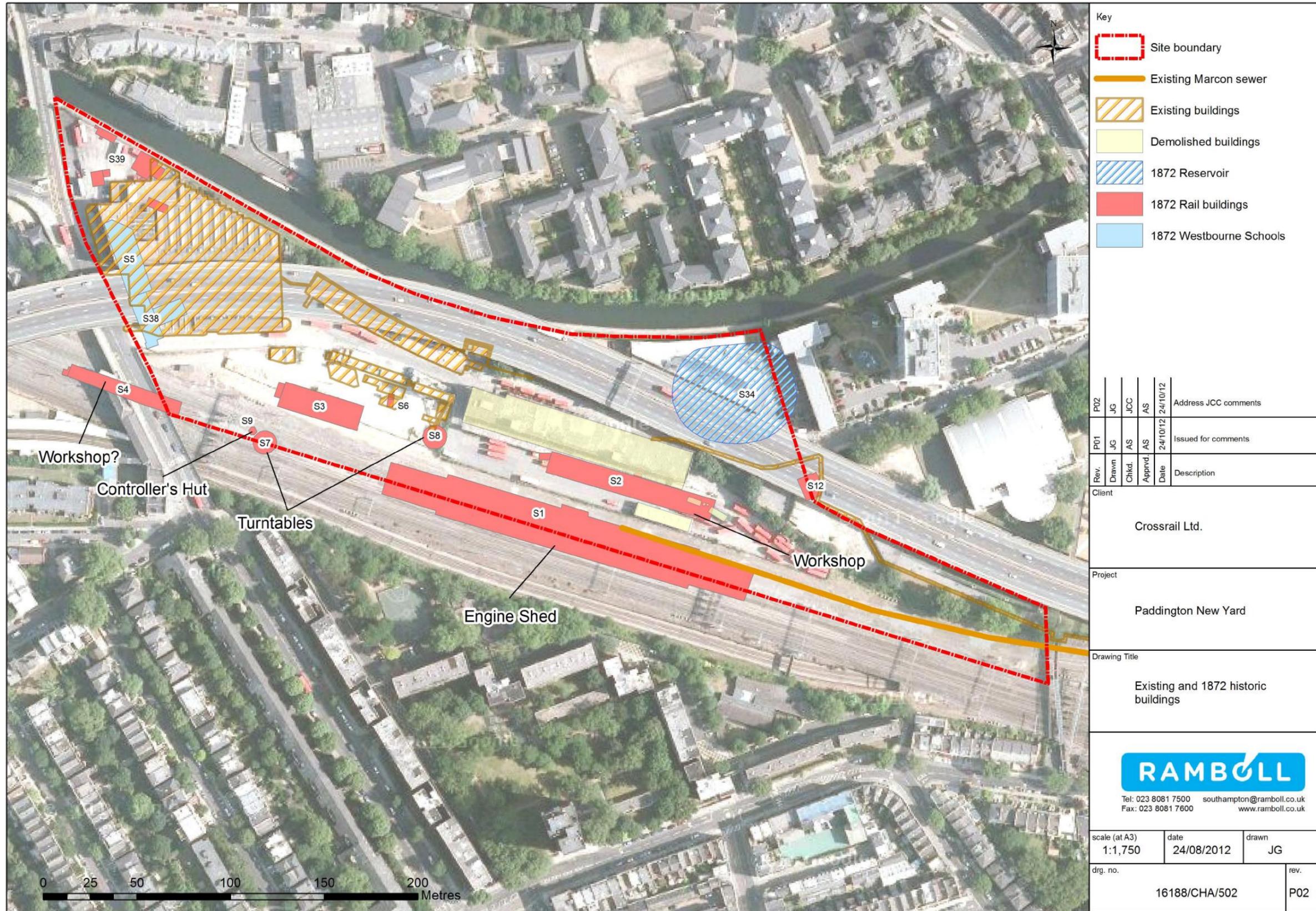


Figure 9: The 1872 Ordnance Survey map

- 3.2.16 By the 1890s the site was known as Paddington New Yard. According to a previous SSWSI (C150-CSY-T1-RGN-CR076_PT001-00005 Rev 5.0) a GWR survey plan dated 1880 depicts a new Sand House and storage tank at the western end of the site adjacent to the Westbourne School. A GWR survey dated 1890 (again, according to a previous SSWSI, C150-CSY-T1-RGN-CR076_PT001-00005 Rev 5.0) and (in parts) 1895 1:1056 Town Plan shows that the GWR cutting had been extended northwards almost to the site boundary with the Grand Union Canal at the western end of the site and up to the triangle that housed the oval-shaped reservoir (now appearing to be reduced in area), rectangular tanks and Alfred Villa at the eastern end.
- 3.2.17 Within the cutting the broad-gauge engine shed inspection pits underneath each road each, apparently, running the length of the shed. The southern turntable and the boiler hut had by this time been removed to make way for additional tracks. A new, 45' turntable (Structure 14) now sat to the west of the narrow-gauge engine shed and a rectangular structure (Structure 15, probably the Sand House mentioned above) sat to the north of the line which looped to the north of this shed (and south of four new sidings terminating at the walls of Westbourne and St. John's Schools). A third much, smaller engine shed (Structure 22) sat to the north-east of the narrow gauge shed, and the workshops had been replaced (or heavily modified) by a fourth rectangular engine shed (Structure 17, later in turn replaced by Alfred Road Warehouse). Several smaller ancillary structures are also shown on 1894-1895 Town Plan. These include small buildings immediately east of Structure 17, possibly including a coal stage or water tank (Structure 18), a footbridge (Structure 19) over the Portobello Junction lines which connected Alfred Villa to Structure 17, a small building (Structure 20) immediately against the south-west corner of the narrow-gauge engine house and another small, rectangular building (Structure 21) to the immediate south-east of the eastern turntable (Structure 8).
- 3.2.18 Additionally, the 1895 Town Plan and OS map shows, in the area now occupied by Tarmac Topmix depot, the narrow gauge engine shed as significantly enlarged, nearly doubling in size to straddle additional three tracks to the north. The eastern turntable also appears to have been enlarged, to 55ft, and the new rectangular engine shed (Structure 22) had been constructed to the north. All of these structures are linked by sidings and three lines of the Portobello Junction branch now pass north of the former locomotive workshops (forming the northernmost limit to track) to the north-west corner of the site where they pass under Great Western Road. The addition of these tracks necessitated the footbridge between Alfred Villas and the former locomotive workshops, which by then had been substantially altered or replaced to form another engine shed (Structure 17) (the bay housing the Superintendent's offices appears to have been retained). The area in the very north-western corner of the site (north of the Westbourne Schools) previously occupied by residential buildings has been appropriated to form a stone yard. The layout of these structures and track layouts is depicted on a GWR plan dated 29th May 1899 (GWR Drawing No. 2515-410-1331, reproduced in C150-CSY-T1-RGN-CR076_PT001-00005 Rev 5.0).
- 3.2.19 The 1895 Town and OS maps (Fig.10) also show two rectangular water tanks (Structure 23) in the north-eastern part of the site, built to the immediate west of the existing reservoir.

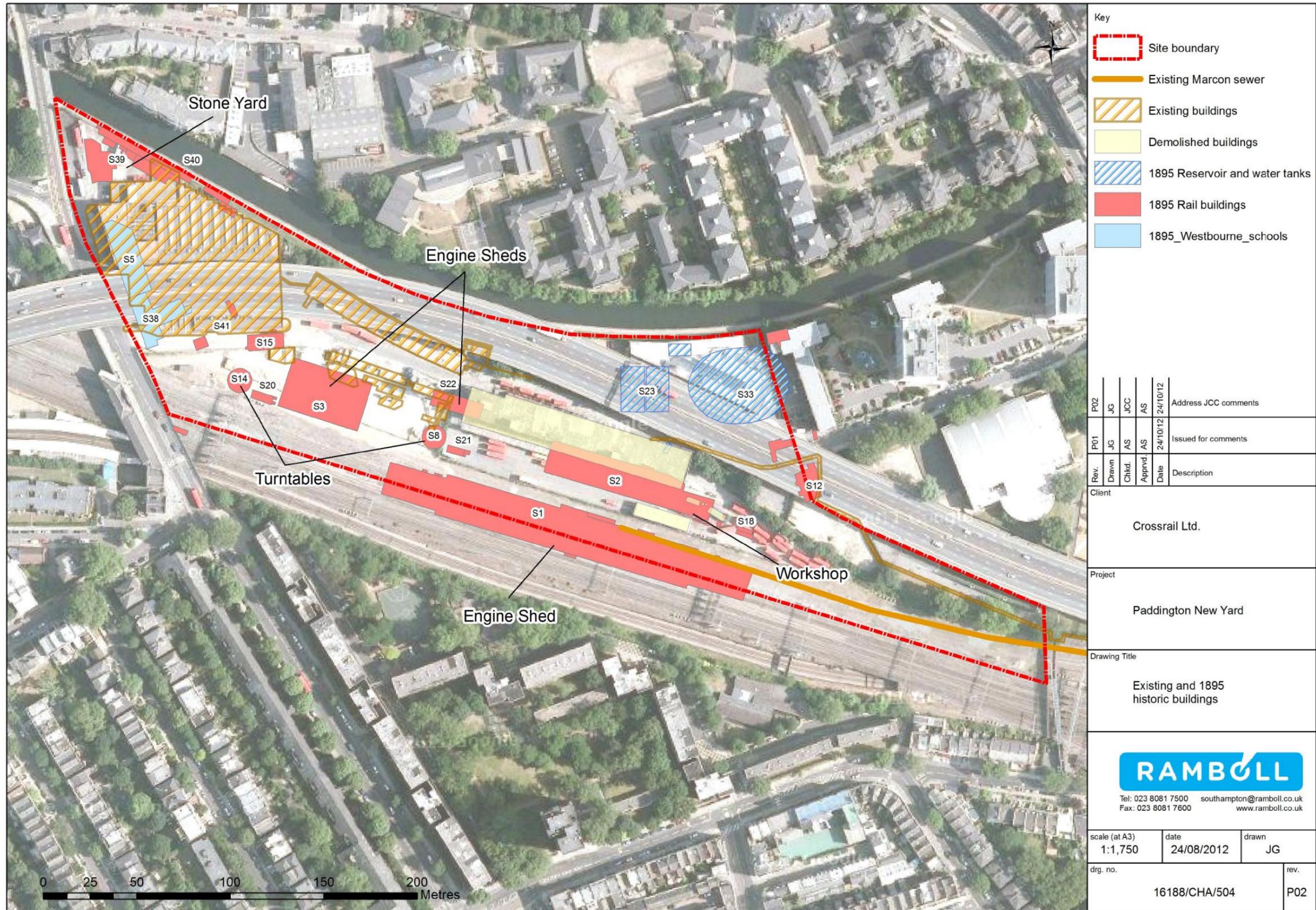
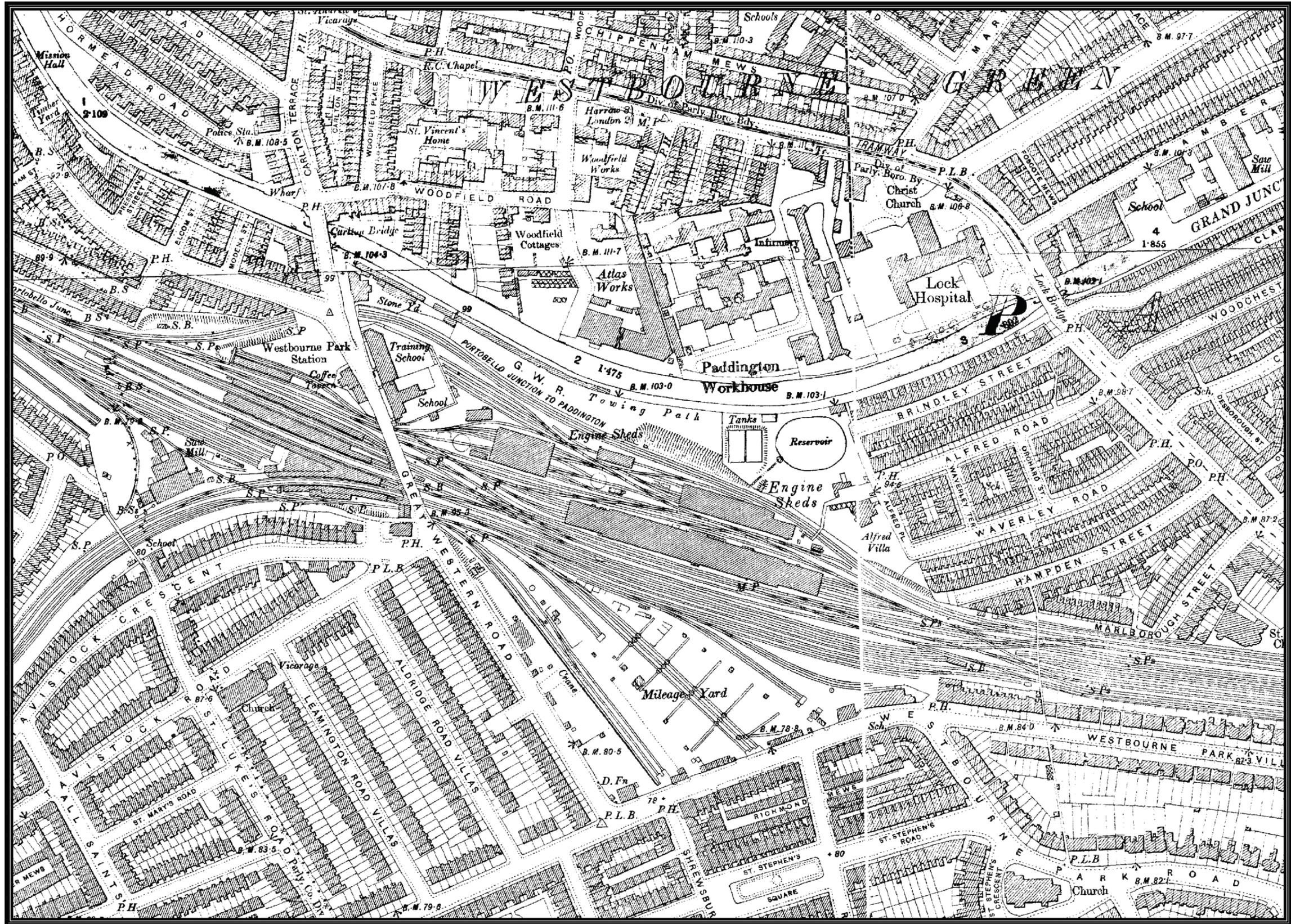


Figure 10: Structures shown on the 1895 Ordnance Survey map



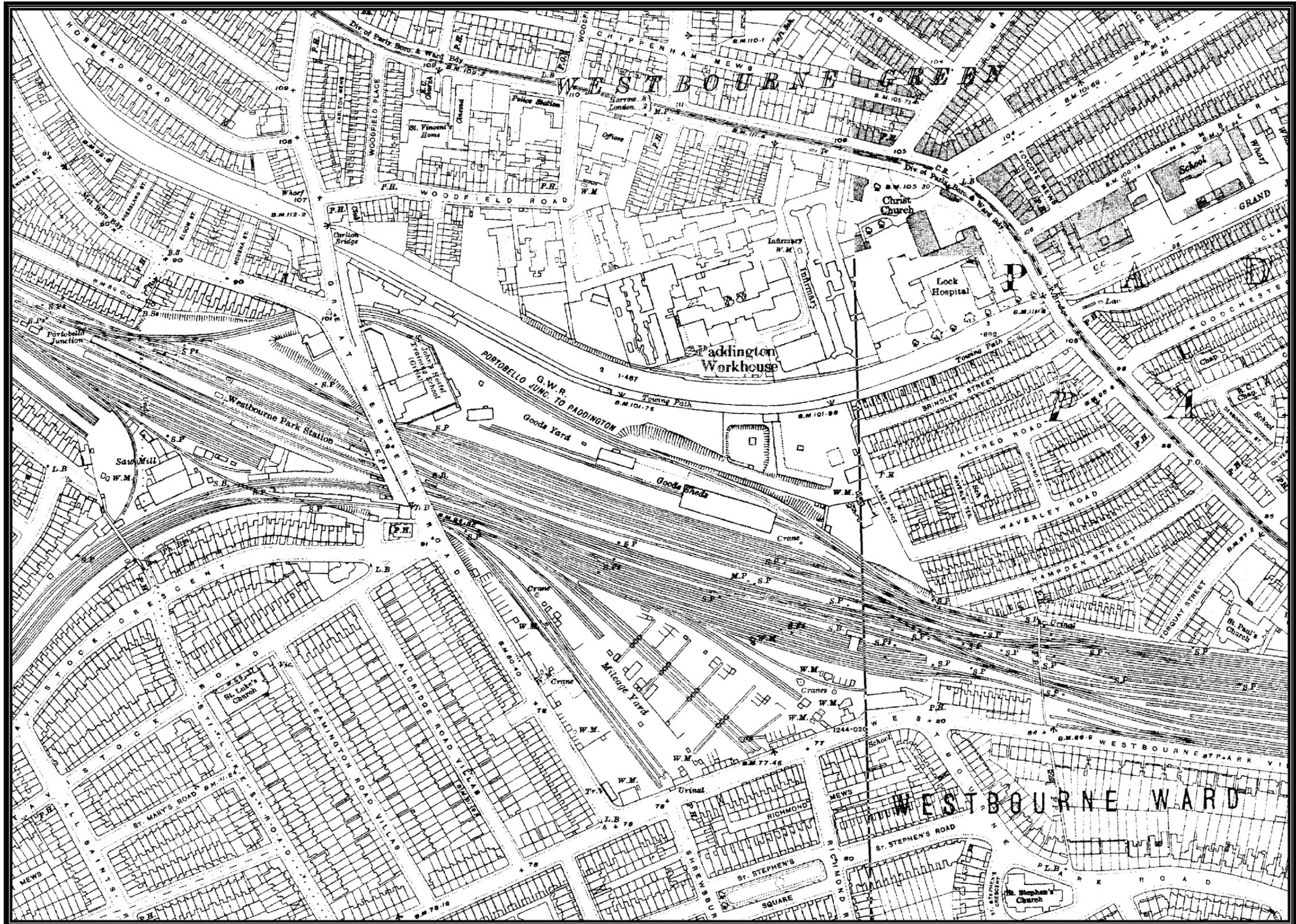
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County: LONDON Scale: 1:2,500 Date: 1896

Figure 11: 1896 Ordnance Survey 1:2500 map



Figure 12: Structures shown on the 1916 Ordnance Survey map



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County: LONDON Scale: 1:2,500 Date: 1915-1916

Figure 13: 1915/1916 1:2500 Ordnance Survey map

- 3.2.20 Between 1906 and the publication of the 1916 Ordnance Survey map the worksite was comprehensively redeveloped to provide a new goods depot for GWR. This followed the relocation of the engine sheds and associated facilities to Old Oak Common, situated several miles further west along the mainline, in 1906. This relocation had much to do with the appointment in 1902 of a new locomotive superintendent, G J Churchward and the decision in 1906 to enlarge Paddington Station. As part of the plans, various of the bridges, including Westbourne Bridge, were replaced with long-span steel girder structures.
- 3.2.21 The 1916 OS map shows that the main and the western engine sheds had been demolished and the two turntables and much of the trackwork removed. The Sand House (Structure 15) was still extant at this time but the engine sheds (Structures 17 and 22) had been converted into goods shed surrounded by a goods yard. Structure 17 has been reduced in size since 1896, the eastern bay having been demolished. This bay was probably the only original part of the 1850s workshops to have survived being altered into an engine shed. It had originally housed Gooch's offices, which presumably became surplus to requirements after the move to Old Oak Common. In the northern part of the site the reservoir had been infilled and buildings comprising the GWR motor works had been constructed in the area (Structure 24).
- 3.2.22 The recently dismantled Great Western Studios building was constructed in 1938. This was formerly known as the Alfred Road Warehouse (Structure 25) and replaced Structure 17 on the site. Alfred Road Warehouse was assessed and recorded by MoLA in 2010 (C150-CSY-T1-RGN-CR076_PT001-00010). The building was described as a three storey, twenty bay, purpose built brick building surmounted by two timber rectangular stair towers, presumably used for roof access. Ground floor was located on a brick plinth which may have been part of the original goods shed or workshop. On top of the plinth were timber platforms and intermittent breeze block structures. First and second floors were mounted on a concrete ring beam. Window openings featured concrete lintels broken up by brick pilasters. A timber canopy was also extant which may have been part of the previous structure. The rear of the building featured a projecting section forming part of a covered vehicle bay, extending further on cantilevered concrete piers. Associated railway tracks also survived. Alfred Road Warehouse formed one of the very last urban railway warehouses. According to the Council for British Archaeology (CBA 2012, 277-278) the Liverpool Shipping Warehouses in Trafford Park, Manchester, built between 1927 and 1932, lay at 'the end of the classical railway warehouse tradition'. Both the Trafford Park and Alfred Road warehouses share one of the innovations in building materials that characterise this phase, that of the use of concrete.
- 3.2.23 The access ramp from Alfred Road into the site from the east was also modified at around 1938 with the brick retaining wall and grass embankment being replaced by a concrete retaining wall immediately north of the Great Western Studios. The 1956 1:2500 Ordnance Survey map depicts a new, curvilinear goods shed and platform (Structure 26) located immediately to the north-west of Alfred Road Warehouse, adjoining to the north the Portobello Junction lines. This survives.
- 3.2.24 Paddington New Yard closed as a goods yard in 1972 and the Alfred Road Warehouse became a British Rail lost property depot until its sale and conversion into the Great Western Studios in 1994. Two remaining sidings were subsequently used to serve the Lafarge Tarmac batching plant.

3.2.25 One final historic structure requires mention. The Marcon Sewer was designed to drain the railway corridor and, presumably, the buildings within Paddington New Yard. The sewer was exposed during construction works at Royal Oak in 2010, and has been temporarily diverted in a number of locations. Where previously exposed it was seen to be constructed from two skins of red unfrosted bricks laid as stretcher courses to form walls. The bricks were bonded with a pale grey mortar was barrel vaulted in profile. Its age of construction is not currently known.

3.3 Historic Asset Gazetteer

3.3.1 The buildings, structures and elements of infrastructure discussed in the preceding sections are listed here, each being given a Structure Number and dates when they are either known to have been constructed and demolished or as they first appear on cartographic sources. A level of significance is given to each entry. This is based upon a system developed by Ramboll for Environmental Impact Assessment, and which draws on guidance provided by DCMS, English Heritage, the Department for Transport, and the Department of Arts, Heritage and the Gaeltacht in Ireland, amongst others. The gazetteer may be revised in the light of new information becoming available.

Structure Number	Description	Earliest known date	Level of Significance
1	Broad-gauge engine shed	1852	Regional
2	Engine department workshops	1852	Regional
3	Narrow-gauge engine shed	1869-1872	Regional
4	Smaller workshop below Green Lane Bridge	1862	Significant Local
5	Westbourne Training School	1862	Local
6	Crane to the north of the narrow-gauge engine shed	1869-1872	Local
7	42' turntable to the west of the broad-gauge engine shed	1869-1872	Regional
8	Turntable to the east of the Structure 3 narrow-gauge engine shed	1869-1872	Regional
9	Structure 7 turntable boiler or control house	1869-1872	Regional
10	Oval-shaped reservoir (1862)	1862	Regional
11	Access ramp down from Alfred Road	1915-1916	Local
12	Locomotive Superintendent's House (Alfred Villa)	1855	Regional
13	Deleted	-	
14	45' turntable to the west of the Structure 3 narrow-gauge	1894	Significant Local

	engine shed		
15	Sand house	1894-1895	Significant Local
16	Deleted	-	
17	Engine shed, replacing Structure 2	1894-1895	Significant Local
18	Several small buildings immediately east of Structure 17 (maybe a coal stage or water tanks)	1894-1895	Local
19	Footbridge over the Portobello Junction lines which connected Alfred Villa to Structure 17	1894-1895	Local
20	A small building immediately against the south-west corner of the Structure 32 narrow-gauge engine house	1894-1895	Local
21	Small building to the immediate south-east of Structure 8 turntable	1894-1895	Local
22	Small, rectangular engine shed to the north of Structure 8 turntable	1894-1895	Significant Local
23	Two rectangular water tanks to the immediate west of the existing reservoir	1894-1895	Local
24	GWR motor works	1955	Local
25	Alfred Road Warehouse (later Great Western Studios)	1938	Local
26	Goods shed and platform/canopy	1955-1956	Not significant
27	Track formations 1838-1854		Regional
28	Track formations 1854-1870		Regional
29	Track formations 1870-1890		Regional
30	Track formations 1890-1906		Local
31	Track formations 1906-2012		Not significant
32	Enlargement of Structure 3 narrow-gauge engine shed	1894-1895	Significant Local
33	Oval-shaped reservoir (from 1895 OS)	1894-1895	Local
34	Oval-shaped reservoir (from	1872	Local

	1872 OS)		
35	Platform/canopy to curvilinear goods shed (Structure 26)	1955-1956	Not significant
36	Small rectangular building to immediate north-east of Structure 26	1955-1956	Not significant
37	Structure (purpose unconfirmed)	1955-1956	Not significant
38	Westbourne School	1869-1872	Local
39	Stone Yard	1872	Local
40	Canal-side buildings	1894-1895	Significant Local
41	Structures against the south and west walls of Westbourne School	1894-1895	Not significant
42	Later structures against the south and west walls of Westbourne School	1915	Local
43	Crane to the south-east of engine department workshops	1915	Local
44	Small building by the oval reservoir S33	1895	Local
45	Marcon Sewer	Not currently known	Local

Table 3: Historic Asset Gazetteer

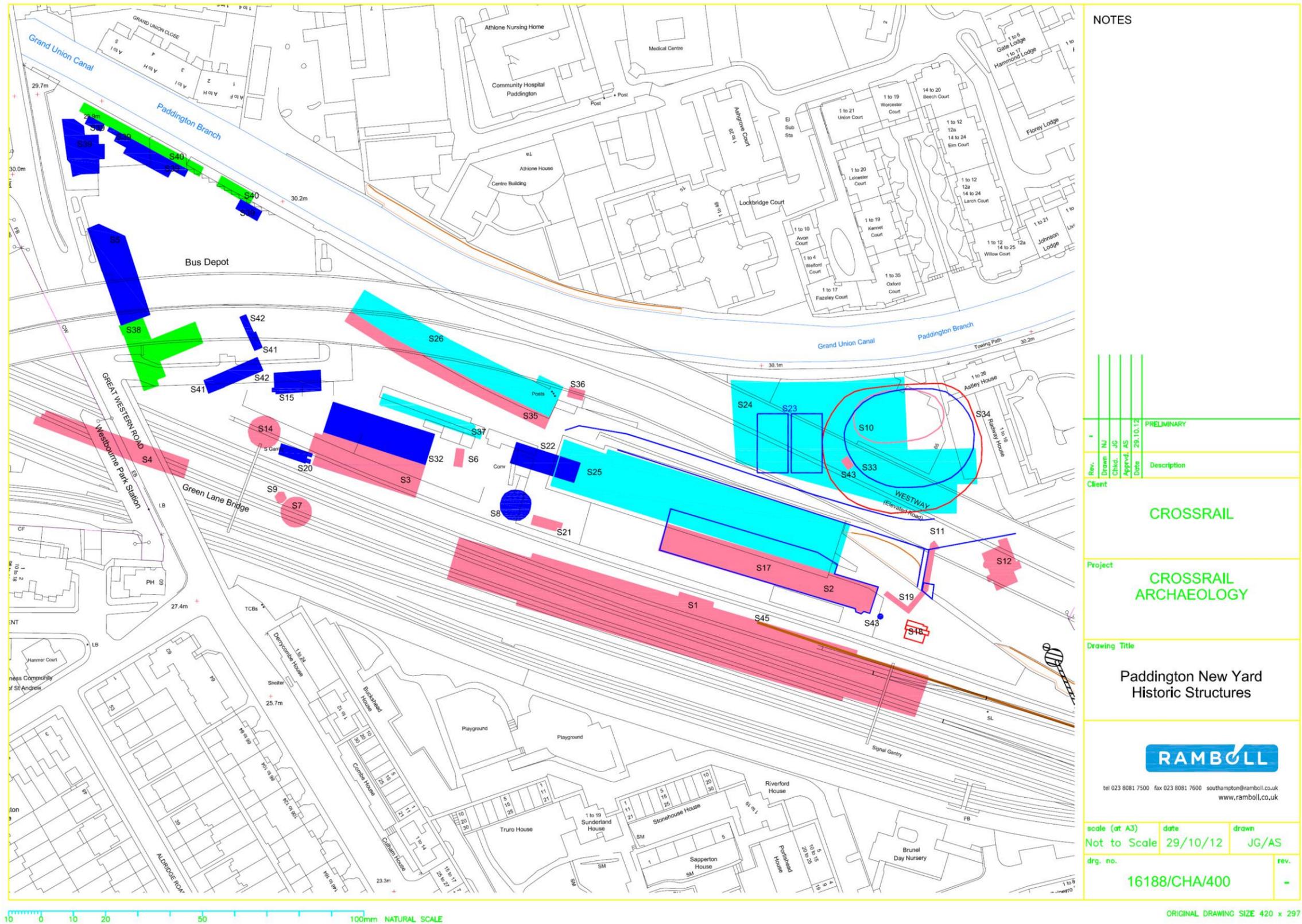


Figure 14: Plan showing the location of known historic assets at Paddington New Yard, overlaid on current Ordnance Survey mapping. Note: the location of these buildings and structures is approximate only

3.4 Deposit Survival

- 3.4.1 The historical development of Paddington New Yard was dominated by the excavation and enlargement of the GWR cutting, exercises which removed most if not all brickearth, terrace gravels and subsurface stratigraphical layers in order to expose the London Clay. The exception to this rule are the geoenvironmental materials surviving in scours (palaeochannels) through the clay, several of which were investigated by C254 at the Royal Oak tunnel portal site.
- 3.4.2 As a consequence, the main archaeological interest is likely to centre on the remains of the railway infrastructure which used the cutting created by the Great Western Railway and which have been shown to overlie the truncated top of London Clay.
- 3.4.3 Ground investigations and other works as described in Section 2.3 have demonstrated the potential for below-ground structures and elements of infrastructure to survive across the site. Wherever these structures have been accidentally exposed they have been shown to lie very close to the normal grade level of the site, in some cases no deeper than 0.4m below ground surface.

4 Construction Impacts

4.1 Summary

- 4.1.1 The proposed works to be undertaken at Paddington New Yard are listed in this SSWSI at Section 2.1. From the documents and drawings listed in Section 2.1, the works which may have an impact sub-surface archaeological remains are:
- Ground reduction to allow formation of temporary pile mats and removal of obstructions to piling. Generally C336 advise that the ground will be reduced by c 1100mm. The formation of working platforms (piling mats) in construction Area AD1 requires a number of areas to be reduced in level. The size and location of these working platforms are shown on drawing C336-COS-CIV-SKT-000035. Working Platform 1 enables test piles to be constructed and will measure c. 35m x 35m x 1.1m thickness. Working Platform 2 will be measure c. 10m x 60m x 1.1m thickness and allows high level piles on the northern boundary of the site to be constructed. Working Platform 3 allows the piles and other foundations for the RBP to be constructed and Working Platform 4 and will allow the secant piles for the BDU to be built. These works are programmed to take place very shortly after C336 gain possession of the site;
 - general site clearance to a depth of 1200mm in an area indicated in drawings C178-CSY-D-DDA-CR076_MS005-10035, C178-CSY-D-DDA-CR076_MS005-10036, C178-CSY-D-DDA-CR076_MS005-10037 and C178-CSY-D-DDA-CR076_MS005-10038 and including removal of all existing above-ground items (including the goods yard platform) and existing stormwater drains and gullies;
 - a grid of 1.2m thick pile caps resting on 4 no 900mm diameter bored piles approximately 30m deep for support of the columns on which the elevated bus deck structure will rest;
 - a line of 750mm diameter piles, each approximately 25m deep supporting the northern edge of the deck;
 - a mini pile cut off wall installed north of this construction to retain the canal embankment during construction of the ground slab and retaining wall;

- construction of the ground slab and the new retaining wall;
 - construction of a below-deck drainage interceptor;
 - construction of fuel storage tanks located under the deck;
 - construction of a bottom discharge hopper unit (BDU) under the deck in secant pile wall construction for delivery of aggregate to the relocated Lafarge Tarmac RBP;
 - construction of piled foundations for the RBP aggregate bins store, batching plant and silos;
 - construction of a skip elevator pit, a grey-water wedge pit, a below-ground stirrer pit and a stormwater wedge pit;
 - construction of ground level access roads and miscellaneous retaining walls;
 - lighting, drainage and power supplies to the refuelling and washing facilities;
 - construction of the Marcon sewer to connect with the Ranelagh Sewer. The Marcon Sewer is a Network Rail asset which drains the site eastwards to discharge into the Ranelagh Sewer and the construction of the whole of this length is part of the C336 contractor's work. The line of the new sewer in the vicinity of the bus deck is along the southern edge. The new sewer will be a concrete pipe of either 600mm or 750mm diameter;
 - construction of Westbourne Park drainage;
 - construction of the Great Western Road sewer, a new asset, beneath the Network Rail lines west of the Green Lane Bridge. This will either be pipe jacked or constructed in trench under the tracks, with two receiving chambers;
 - stabilisation of the Green Lane Bridge north abutment to enable the lowering of the tracks in the vicinity. A scheme has been prepared to strengthen it, involving trenching and the construction of a series of piles and a ground beam. This scheme is being developed further.
 - construction of the track formation and drainage for the turnback sidings, CRL eastbound and Marcon sidings. The total area encompasses 17,000m²; and
 - connection of the Network Rail track drainage system into the new Marcon sewer.
- 4.1.2 The areas where these works will or will potentially impact on sub-surface archaeological remains are shown on Figs 15, 16 and 17.

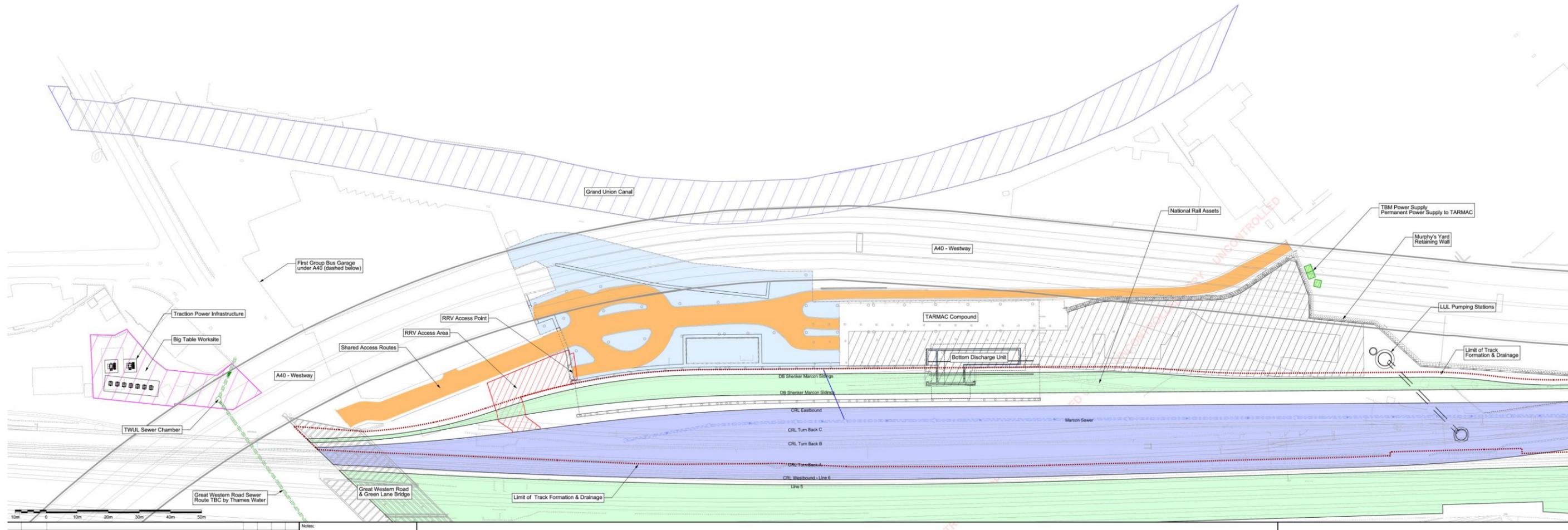


Figure 15: Extract from dwg C178-CSY-S-DDH-CR076_MS005-00138 Rev P01.2, showing proposed layout

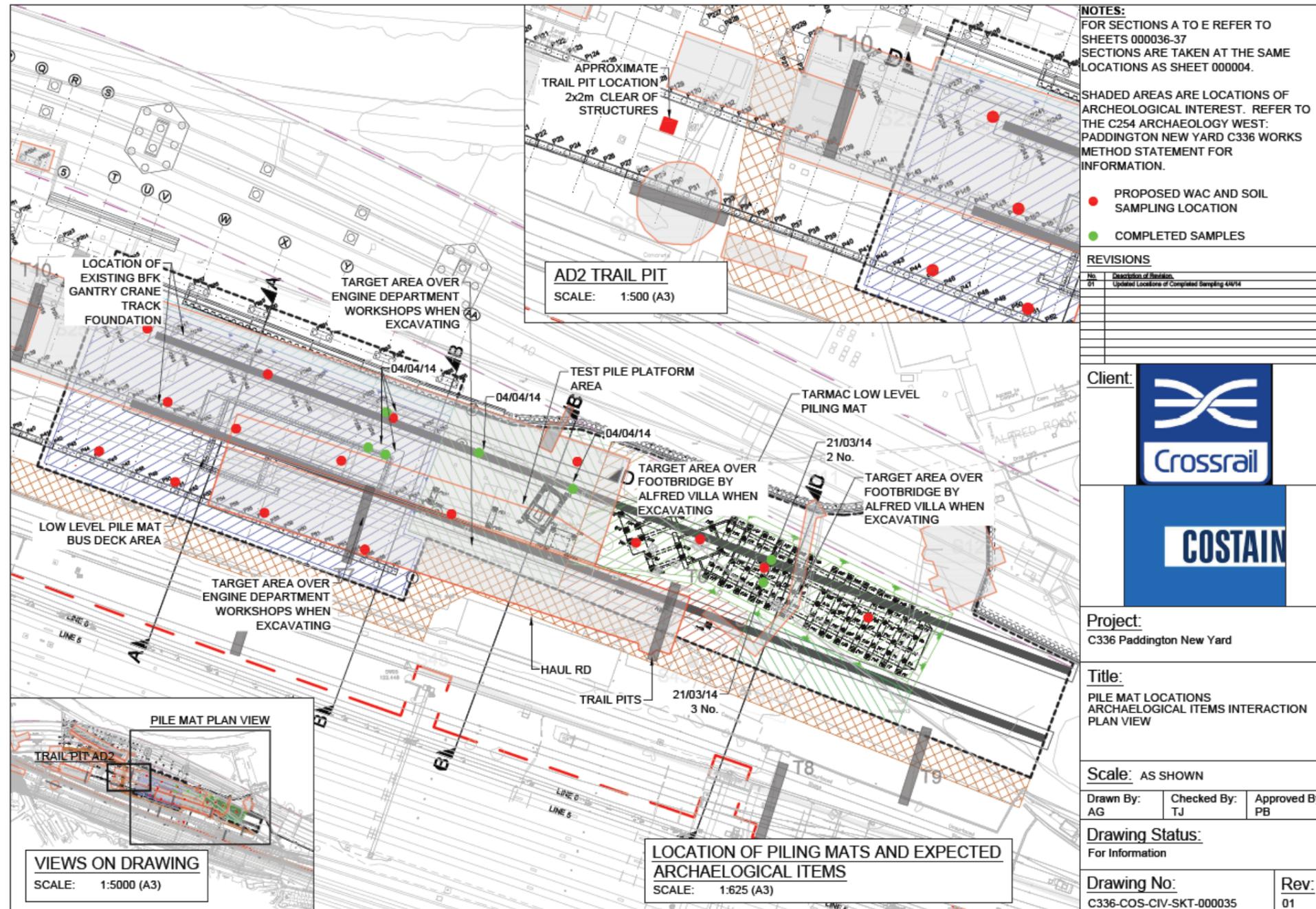
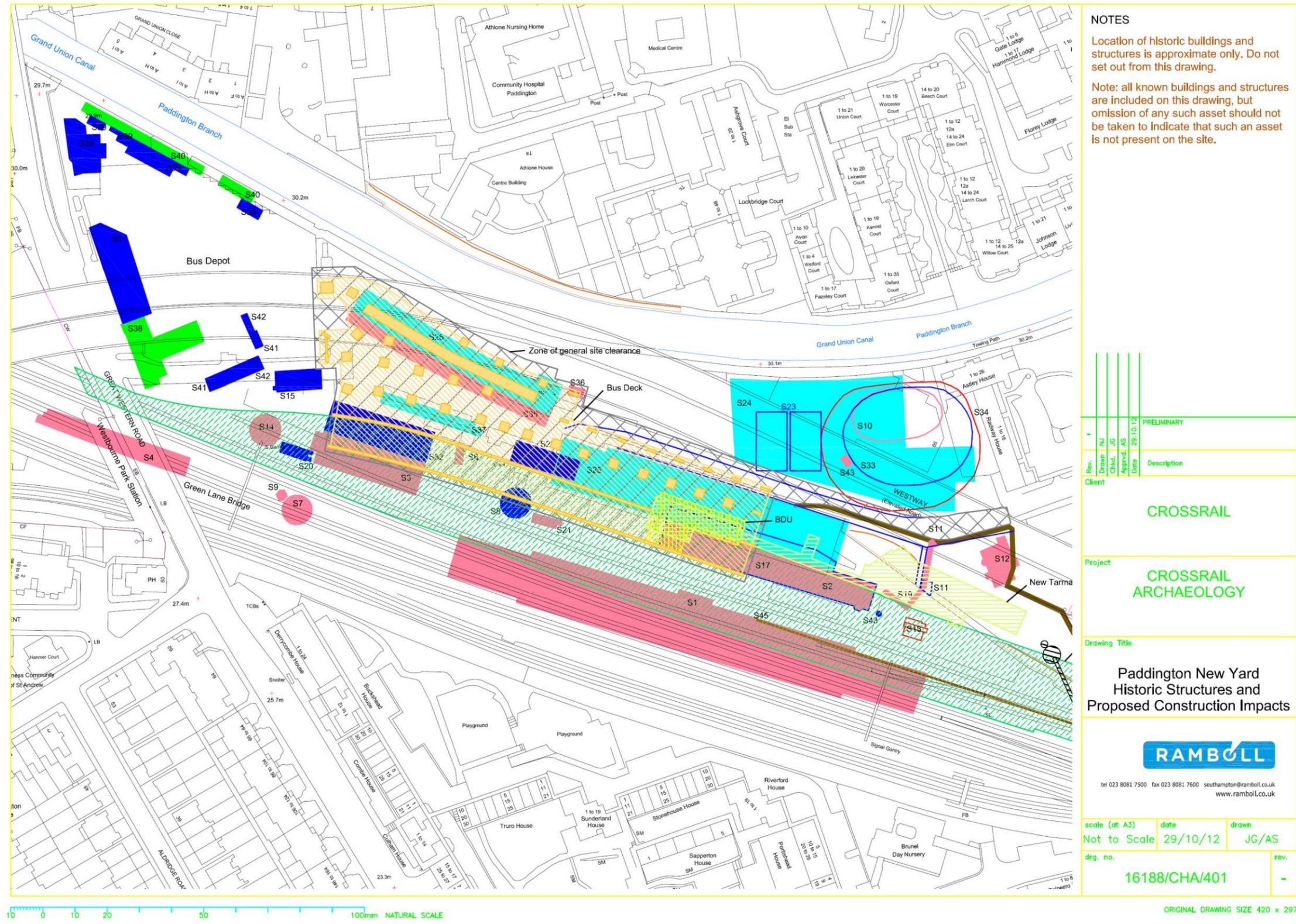


Figure 16: Location of C336 Working Platforms 1 to 4



NOTES

Location of historic buildings and structures is approximate only. Do not set out from this drawing.

Note: all known buildings and structures are included on this drawing, but omission of any such asset should not be taken to indicate that such an asset is not present on the site.

Rev.	Drawn / NU	Check / JC	Appr'd / AS	Date	Description
1				29.10.12	PRELIMINARY

Client
CROSSRAIL

Project
CROSSRAIL ARCHAEOLOGY

Drawing Title
Paddington New Yard Historic Structures and Proposed Construction Impacts



tel 023 8081 7500 fax 023 8081 7600 southampton@ramboll.co.uk
www.ramboll.co.uk

scale (at A3) Not to Scale	date 29/10/12	drawn JG/AS
drg. no. 16188/CHA/401	rev. -	

ORIGINAL DRAWING SIZE 420 x 297

Figure 17: Areas of impact from proposed construction on all known historic assets. Note: the locations of historic structures is approximate only.

5 Archaeological Mitigation - Aims and Objectives

5.1 Research Aims and Objectives

- 5.1.1 Archaeological mitigation of the impacts arising from the works described herein will aim to answer the following aims and objectives.
- 5.1.2 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). Specifically here, archaeological investigation and mitigation within the PNY worksite should 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.
- 5.1.3 The early development of the Great Western Railway is of great interest to historians. At PNY, the facilities conceived and developed by Brunel and Gooch were the full statement of what they had tried, but largely failed, to achieve at Paddington Station. Here they could provide a full-sized engine shed and workshops, unencumbered by the space restrictions which had so hampered their early efforts at Paddington. It is no coincidence that the department workshops had spacious office accommodation nor that Alfred Villas was constructed immediately alongside the workshops – Gooch and his deputy could, for the first time, preside directly over the maintenance of his newly designed locomotives. Understanding the layout and workings of this first of several iterations of locomotive depot is a key part of understanding how the Great Western Railway operated in London in its early days.
- 5.1.4 The overall objective of the archaeological mitigation set out in this SSWSI is to preserve by record any surviving archaeological remains that will be impacted upon by the development. These are taken to include:
- The foundations and other below-ground evidence for the site's engine sheds, workshops, Sand House, turntables and track layouts within the site's GWR cutting, and also the remains of any associated railway infrastructure. Whilst ex-situ lengths of early rail may be expected to be uncovered, it would be of greater interest to find any of the earliest track formations, supporting timbers, transoms or associated ironwork; and
 - Possible geoarchaeological remains cut through or overlain by the London Clay which underlies the site.

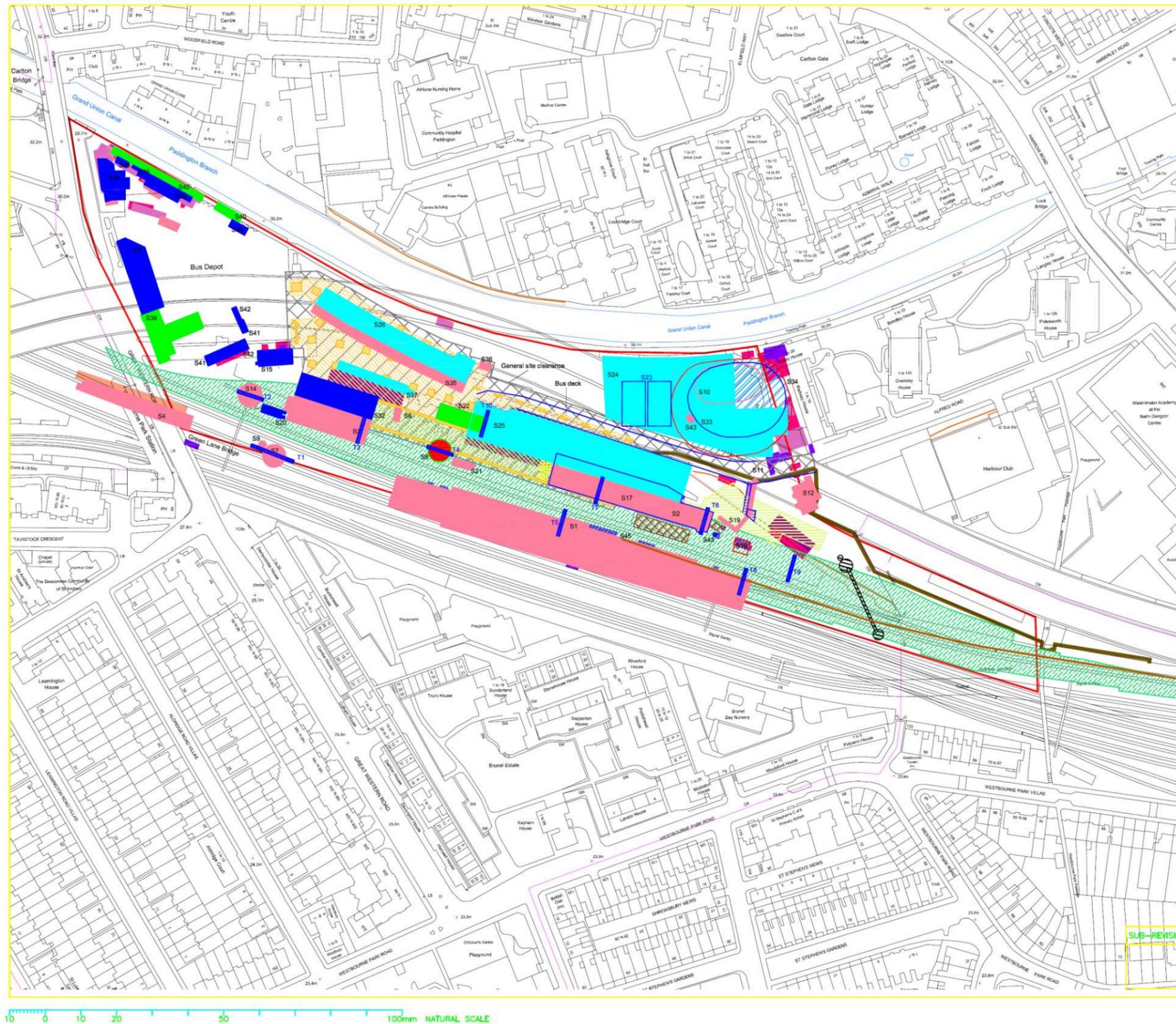
6 Scope of the Investigations

6.1 Archaeological Mitigation

6.1.1 Archaeological mitigation of the impacts arising from the works described herein is staged, and comprises:

- Further desk-based historical research and report on the early and subsequent development of the GWR's infrastructure at Westbourne Park, concentrating on the collation and interpretation of primary archive drawings and documents;
- Targeted trial trench excavations centred on areas of the site where construction impacts coincide with the position of significant heritage assets;
- Archaeological excavation and recording of significant historic assets if they are shown to survive. This comprises opening out of trial trenches to reveal significant structures such as the turntables, before full historic building recording of such structures;
- Strip, map and sample excavation and historic building recording in areas of ground reduction where it coincides with heritage assets;
- Identifying, cataloguing and co-ordinating salvage of historic railway items; and
- General watching brief during enablement and construction activities outside of the areas covered by the mitigation activities listed above.

6.1.2 All fieldwork interventions are specified below and in Section 8. The Event Code to be used during the activities listed above will be confirmed by the Project Archaeologist.



NOTES

Location of historic buildings and structures is approximate only. Do not set out from this drawing.

Note: all known buildings and structures are included on this drawing, but omission of any such asset should not be taken to indicate that such an asset is not present on the site.

Omit T1 which will be undertaken by others. Omit T6 and T7, which are replaced by strip, map and sample excavation mitigation.

Rev.	Drawn	Chkd.	Apprd.	Date	Description
A	NJ	JG	AS	04/04/14	PRELIMINARY
1	NJ	JG	AS	29/10/12	PRELIMINARY

Client
CROSSRAIL LTD

Project
**CROSSRAIL C254
ARCHAEOLOGY WEST**

Drawing Title
**Paddington New Yard
Historic Structures
Impacts and Proposed Trenches**

RAMBOLL
tel 023 8081 7500 fax 023 8081 7500 southampton@ramboll.co.uk
www.ramboll.co.uk

scale (at A3)	date	drawn
Not to Scale	29/10/12	JG/AS
drg. no.	16188/CHA/402	
rev.	A	

ORIGINAL DRAWING SIZE 420 x 297

Figure 18: Location of trial trench excavations (T1 to T10). Note: the locations of historic structures is approximate only. T1 is included for information only and will not be undertaken by Crossrail. T6 and T7 now replaced by mitigation by strip, map and sample excavation.

6.2 Historical Research

- 6.2.1 Further desk-based historical research on the early and subsequent development of the GWR's infrastructure at Westbourne Park, concentrating on the collation and interpretation of primary archive drawings and documents. This work will enable a refined understanding of the nature and extent of the site's development after the construction of the GWR lines through the area, leading to a refinement of the research objectives for the mitigation work and the purpose of intrusive groundwork investigations

6.3 Trial Trench Excavation

- 6.3.1 Archaeological evaluation, comprising trial trench excavation (Fig 18), with full enablement by C336, is required to identify the level of survival (if any) of the significant heritage assets. Specifications for the trial trench excavations, and any further works stemming from these trenches, are provided in Section 8.7 below.

Trial Trench 1 42' turntable to the west of the broad-gauge engine shed (Structure 7) and turntable boiler or control house (Structure 9). **NOTE: This trench lies within Network Rail's Operational Railway area and will not form part of the archaeological response to the works described herein. It is included in this SSWSI solely to inform any archaeological mitigation strategy that Network Rail may prepare in response to their Paddington Approaches works.**

Trial Trench 2 45' turntable to the west of the Structure 3 narrow-gauge engine shed (Structure 14)

Trial Trench 3 Narrow-gauge engine shed (Structures 3 and 32)

Trial Trench 4 Turntable to the east of the Structure 3 narrow-gauge engine shed (Structure 8)

Trial Trench 5 Broad-gauge engine shed (Structure 1). The size and location of this trench must respect a 2m wide easement against Network Rail's Operational Railway area.

Trial Trench 6 Now replaced with strip, map and sample excavation

Trial Trench 7 Now replaced with strip, map and sample excavation

Trial Trench 8 Broad-gauge engine shed (Structure 1). The size and location of this trench must respect a 2m wide easement against Network Rail's Operational Railway area.

Trial Trench 9 General track formations (Structures 27, 28 and 29)

Trial Trench 10 Small, rectangular engine shed to the north of Structure 8 turntable (Structure 22)

- 6.3.2 The purpose of the trial trench excavations is to identify and record the nature and extent of survival of historic structures, in order to inform the need or otherwise for any further mitigation work, as detailed below. In addition, each trench shall accurately record the methods and materials of construction used, and the nature of the backfill of any structures. Particular attention shall be paid

to excavating and recording any buried mechanisms or fittings associated with the structures.

6.4 Mitigation excavation and recording of significant historic assets

6.4.1 Archaeological excavation and recording of significant historic assets should be undertaken where they are shown by trial trenching to survive and will be damaged by construction activities. The excavation and recording will comprise opening out of trial trenches to reveal the extent (or a statistically valid sample area) of important structures (generally, those characterised in Table 1 as being of regional or significant local significance) before full excavation and historic building recording of such structures.

6.5 Strip, map and sample excavation

6.5.1 Where possible, archaeological mitigation in areas where construction comprising general ground reduction, obstruction removal or track formation coincides with known heritage assets will take the form of strip, map and sample excavation. This is characterised as the stripping of areas using a flat-bladed bucket under archaeological supervision and control, followed by the rapid recording of such structures.

6.5.2 The formation of C336 Working Platforms 1, 2, 3 and 4 in construction area AD1 requires the ground to be significantly reduced in level (Fig 16). The necessity of constructing these very shortly after C336 gain possession of the site means that the best method of archaeologically mitigating the impact of these ground reductions is by strip, map and sample excavation.

6.6 Salvage of historic items

6.6.1 It is possible that historic items of significance relating to the use of the site and which could be salvaged for re-use will be revealed during the mitigation works. These should be identified and fully recorded, issued with a catalogue number and brought to the attention of the Project Archaeologist. An appraisal of their significance will also be made.

6.7 General Watching Brief

6.7.1 A general watching brief will be undertaken during enablement and construction activities outside of the areas covered by the mitigation activities listed in Sections 6.3, 6.4 and 6.5 but within other areas where historic assets are known. Particular attention will be paid to areas of deep construction activity, such as excavation for the BDU, in order to capture geoarchaeological evidence, should it exist.

7 Programme

7.1 Introduction

7.1.1 Current programme is as last notified by C336 Costain on 31 March 2014. C336 assume Principal Contractor control of the site on 11 April 2014 and platform construction and piling works in Area AD1 commence 15 April 2014. Archaeological works will commence the same day. C336 gain access to Area AD2 on 31 August 2014. Detailed programming for the archaeological works will be notified to the Archaeological Contractor in one or more supplementary bulletins to this SSWSI issued after C336 commence construction.

7.1.2 The key driver for the programme is track laying by the C610 contractor, scheduled to start in March 2015.

7.1.3 The programme of works provided in the Construction Phase Plan (C336-COS-O1-STP-CR076_SD006-50001 Rev 2.0) is as follows:

D1	C300 Release Phase 1 & 3 & New Tarmac Area	11-Apr-14
D2	Decom. & Remove Exist Tarmac Plant & Handover to C336	31-Aug-14
AD3	C300 Release Remainder of WBP to C336	08-Oct-14
AD4	C300 Demobilised from Royal Oak Portal	23-Jan-15
KD1	BDU and Below Deck Area Handover for Tarmac M&E Works	10-Oct-14
KD2	Complete Green Lane Bridge strengthening	05-Nov-14
KD3	Phase 3 ,4, 5 Southern Edge of Deck Structure Complete	16-Jan-15
KD4A/D	Provide Utility Services to Tarmac Area Connection Points	06-Mar-15
KD5	Bus Deck Structure Complete	08-Jul-15
KD6	Head House M&E Fitout Complete Handover to Systemwide	17-Dec-15
SCD1	Formation Complete for C610 Install of Turnback Sidings	29-Apr-15
SCD2	Deck & Formation Comp for C610 Install of Marcon Sidings	12-May-15
SCD3	Marcon Sewer Completion / Handover asset to Network Rail	03-Jun-15
SCD4	ROP Complete for C610 Install of Track in Tunnels	10-Jun-15
SCD5	Deck & Below Deck Complete. Handover to Systemwide	14-Aug-15
SCD6	Bus Deck Complete Handover to First Centre West	17-Sep-15
CD8	Road Fed Plant Complete & Accessible to Operate	26-May-15

8 Archaeological Contractor Specification and Requirements

8.1 Generic Standards

8.1.1 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
- Archaeology Procedure for Non-Listed Built Heritage Recording, Document No: CR-PN-PRW-EN-PD-00010, 7 July 2009, (APNLB)
- English Heritage *Measured and Drawn: Techniques and practice for the metric survey of historic buildings* (2003);
- English Heritage *Understanding Historic Buildings: A guide to Good recording practice* (2006b); and
- Institute for Archaeologists *Standard and Guidance for the Archaeological Investigation and Recording of Standing Buildings or Structures* (1999 rev 2008)

8.2 Potentially Nationally Important Remains

8.2.1 Please refer to Annex 14.

8.3 Human Remains

8.3.1 Please refer to Annex 12.

8.4 Treasure Act

8.4.1 Please refer to Annex 13.

8.5 Health and Safety

8.5.1 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).

8.5.2 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.

8.5.3 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.

8.5.4 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.

8.6 Location and Ground Elevation of Interventions and Survey Grids

8.6.1 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.

8.6.2 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.

- 8.6.3 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 $10 \text{ mm} \sqrt{k}$: 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.
- 8.6.4 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.
- 8.6.5 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.

8.7 Specification for Archaeological Trial Trench Excavations

- 8.7.1 None of the structures identified by this SSWSI as being historic assets are Listed buildings or structures. As such, non-Listed built heritage recording methods should be used. The recording strategy shall consist of three main elements: a drawn record, a descriptive, written record and a photographic record. As the historic assets were industrial and housed many different functions particular attention shall be paid to evidence of the former use of the buildings and their operations.
- 8.7.2 Any evidence relating to the primary or historic use of the structures shall be recorded and interpreted by the archaeological contractor to inform the overall understanding of the buildings and complex. This would include any evidence of forges, furnaces, power transmission, transport within building (rail tracks) or other mechanical installations and fittings, and residual artefacts, relating to the use of the structures.
- 8.7.3 A sufficient sample of the archaeological structures, features and deposits revealed by trial trench excavation must be sampled/or fully excavated, in order 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.
- 8.7.4 The dimensions of the trial trench excavations, exclusive of any trench support systems or stepping provided by the Principal Contractor to secure safe personnel entry to the excavations, shall normally be 1.8m wide by 15m length, or greater length if required to examine opposing side walls, or shorter length as site constraints determine. Trial trenches shall be excavated to the base of the

historic structures or confirmed construction level, whichever is the higher. Thus, the depth of each trench will vary.

- 8.7.5 The exact position and size of all trenches must be agreed by the Project Archaeologist, the Principal Contractor and the site's Project Manager in advance of their excavation. All relevant trenches shall respect a 2m wide easement against Network Rail's Operational Railway area.
- 8.7.6 Trenches 2 and 4 should expose the opposing side walls of the turntables. Each trial trench shall be excavated to the base of the turntable 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.
- 8.7.7 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.
- 8.7.8 The machine used to remove modern overburden shall reduce the ground level progressively, in spits of 0.20m to 0.5m depth (dependent 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.
- 8.7.9 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).
- 8.7.10 The Archaeological Contractor shall supervise the excavation of each trial trench in such a manner so as to allow a cumulative or continuous section to be recorded.
- 8.7.11 The trial trench excavations 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).
- 8.7.12 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*;

- Planning and section drawing of appropriate structures, single contexts and features (usually at 1:20 scale for plans and 1:10 scale);
- Photographs; and other appropriate drawn and written records;
- Permanent Ground Markers (PGMs), any temporary benchmarks and approved OS benchmarks shall be indicated on the relevant plans.
- 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; and
- Single context planning if appropriate.

8.7.13 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.

8.7.14 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.

8.7.15 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.

8.7.16 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.

8.7.17 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.

8.7.18 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.

8.7.19 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.

8.7.20 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.

8.7.21 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.

8.7.22 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 the provision of such by 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.

8.7.23 The Principal Contractor shall ensure that water is discharged and arisings from trial trench 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.

8.7.24 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).

8.7.25 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.

8.7.26 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.

8.8 Specification for mitigation excavation and recording of significant historic assets

8.8.1 Dependent upon the results of each trial trench, and subject to the site constraints current at the time of work and the agreement of the Project Archaeologist, it may be necessary to enlarge trial trenches to either partially or fully reveal the extent of significant structures (such as, for example, the turntables), before full historic building recording of such structures. This work will aim to expose such machinery, fittings and artefactual, construction or engineering evidence not apparent or only partially resolved in the trial trench excavation. Excavations shall cease when these details are resolved.

8.8.2 Excavation and recording methodology shall be that outlined in the specification for trial trench excavation (above).

8.9 Specification for strip, map and sample excavation

8.9.1 Where possible, archaeological mitigation in areas where construction comprising significant ground reduction, obstruction removal or track formation coincides with known heritage assets will take the form of strip, map and sample excavation. This is characterised as the stripping of areas using a flat-bladed bucket under archaeological supervision and control, followed by the rapid recording of such structures.

8.9.2 The general objectives of archaeological strip, map and sample are to:

- Determine and record the presence/absence, character, extent, date, integrity, state of preservation and importance of any archaeological remains within the impacted area; and
- Explain any temporal, spatial or functional relationships between such remains;

- 8.9.3 Overburden will be removed in a controlled fashion, using a toothless machine bucket under direct and constant archaeological supervision. Machine excavation will temporarily cease at the level where archaeological structures, features or deposits that require recording is reached, and will resume once the recording is complete. Thus, the archaeology contractor may impose constraints on, or require changes to, the Principal Contractor's or sub-contractor's method of working that allow and enable the archaeological investigation to take place alongside construction works. For example, stripped areas that require archaeological mapping and recording should not be tracked over or otherwise disturbed until the mapping and recording is complete.
- 8.9.4 Stripped areas of the site are not to be hand-cleaned except where it is essential to define the edges of discrete features. Once the archaeological horizon (or confirmed construction level, whichever is the higher) has been reached a pre-excavation plan will be made of exposed archaeological features. The specific sampling and recording strategy for excavation of any revealed features is then to be confirmed with the Project Archaeologist.
- 8.9.5 If the nature of the archaeological remains is unclear, or if archaeological remains are extensive or complex, these remains will be hand-excavated to an extent sufficient to determine their form, date and character.

8.10 Salvage of historic items

- 8.10.1 Historic items of significance relating to the use of the site are defined in this instance as objects such as machinery, machine components, architectural fittings, fragments or components, signage, tools, permanent and temporary way fixtures and fittings, and any other general railway paraphernalia which can be reasonably salvaged and for which it may be reasonably supposed would be accepted by a heritage body.
- 8.10.2 Salvage items should be identified, catalogued in a gazetteer and brought to the attention of the Project Archaeologist whose responsibility it shall be to arrange storage, removal from the site and final deposition.
- 8.10.3 The approach to salvage will necessarily have to strike a balance between the interest and significance of the heritage features and the practicalities of reusing/retaining them. In general, the most significant items may also be those which would be logistically the most challenging to remove, store and re-use. Conversely, there may be items which, although they are of lower significance, should be salvaged because they can be removed and stored with little difficulty.

8.10.4 The clear aim should be to incorporate items into new buildings or structures at the new Crossrail or Lafarge Tarmac facilities. Any items will clearly have a relationship with Paddington New Yard and would have the potential to form a valuable link between the past and future. Their heritage interest would inevitably be reduced once removed from the site and reused elsewhere. Most items will be of a relatively limited intrinsic significance but as part of this site would have a meaning and heritage value. Other items may not have the potential for reuse in their original function but could be incorporated into the development as interpreted artefacts for display at the site, either internally or externally.

8.10.5 Some items may have the potential for being accessioned by a railway museum or heritage railway, while other items which would not warrant deposition as a formal artefact within a museum could be donated to, and regarded as a valuable memento by, a railway museum, heritage railway or a former employee.

8.11 Specification for the General Watching Brief

8.11.1 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.

8.11.2 The Archaeological Contractor shall undertake the general watching brief during enablement and construction works in areas not previously archaeologically mitigated by the trial trench excavations, mitigation excavations or strip, map and sample excavations listed above. 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.

8.11.3 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.

8.11.4 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.

- 8.11.5 The core team shall undertake the observation and any required investigation such as they may reasonably be able to undertake.
- 8.11.6 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.
- 8.11.7 The Archaeological Contractor's core and support teams shall be advised where necessary by specialists, as appropriate and as agreed with the Project Archaeologist.
- 8.11.8 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.
- 8.11.9 A representative sample of archaeological remains should be recorded to an appropriate English Heritage historic building recording standard, subject to the constraints imposed by a general watching brief. 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.
- 8.11.10 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.

8.11.11 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).

8.11.12 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.

8.12 Archaeological Science and Finds

8.12.1 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.

8.12.2 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).

8.12.3 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.

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

8.12.5 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.

9 Archaeological Contractor Deliverables

9.1 Archaeological Contractor's Method Statement

9.1.1 The Archaeological Contractor shall provide a detailed Archaeological Method Statement (AMS) for the works, for the Project Archaeologist's approval. The AMS 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 AMS 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.

9.2 Site Archives

- 9.2.1 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.
- 9.2.2 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.
- 9.2.3 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.
- 9.2.4 The site archive shall be deposited with a museum to be confirmed by the Project Archaeologist.

9.3 Digital Data

- 9.3.1 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).
- 9.3.2 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.
- 9.3.3 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.
- 9.3.4 Final reports, site plans and other illustrations shall be prepared in accordance with the Employer's Information Management standards and procedures.
- 9.3.5 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).
- 9.3.6 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.
- 9.3.7 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.
- 9.3.8 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.

9.3.9 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.

9.3.10 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.

9.3.11 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.

9.4 Interim Statement

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

9.4.2 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.

9.4.3 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.

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

9.4.5 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.

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

9.4.7 The following shall appear in the footer or header of each Interim Statement: © CRL Ltd, 2012

9.4.8 Copies of the Interim Statement shall be provided by the Project Archaeologist to Diane Abrams (GLAAS) and the City of Westminster for comment.

9.5 Survey Report

9.5.1 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.

- 9.5.2 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.

9.6 Fieldwork Report

- 9.6.1 The trial trench excavation, mitigation excavation, and strip, map and sample excavation 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). A separate general watching brief report should also be prepared within six weeks of the completion of the watching brief fieldwork. The reports 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

Non-technical summary

1. Introduction
2. Planning background
3. Previous work(s) relevant to archaeology of site (DBA, DDBA, surveys etc)
4. Geology and topography of site
5. Research objectives and aims
6. Methodology of site-based and off-site work
7. Results and observations including quantitative report, stratigraphic report (including any constraints on site).
8. Assessment of results against original expectations (using criteria for assessing national importance *i.e.* period, relative completeness, condition, rarity, and group value) and review of evaluation strategy
9. Statement of potential of archaeology
10. Conclusions and recommendations for appropriate mitigation strategy
11. Publication and dissemination proposals (in addition to fieldwork report)
12. Archive deposition
13. Bibliography
14. Acknowledgements

Appendices

1. Index of archaeological archive
2. Summary of SSWSI
3. Greater London Historic Environment Record form

4. OASIS record form
 5. Registers
 6. Site matrices
 7. A3 plans and other drawings for illustration
- 9.6.2 The 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 reports shall utilise information collected during archaeological fieldwork and from any other appropriate sources agreed with the Project Archaeologist.
- 9.6.3 The 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.
- 9.6.4 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.
- 9.6.5 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), and a trench summary table indicating depths of all major stratigraphic units, and their boundaries. Photographs shall be included where appropriate.
- 9.6.6 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.
- 9.6.7 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.

- 9.6.8 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.
- 9.6.9 Copies of the reports shall be provided by the Project Archaeologist to Diane Abrams (English Heritage) and the City of Westminster for comment.
- 9.6.10 The following shall appear in the footer or header of each Fieldwork Report:
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9.7 GLHER Summary Sheet

- 9.7.1 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 reports as outlined above.

9.8 Summary Report

- 9.8.1 A short annual summary of the works shall be prepared by the Archaeological Contractor for submission to the Project Archaeologist for subsequent publication within *London Archaeologist* Round-Up or other publication outlet specified by the Project Archaeologist.

9.9 Post Excavation Assessment

- 9.9.1 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.
- 9.9.2 The Archaeological Contractor shall provide details with their Method Statement of its current post-excavation assessment procedures.

10 Site Monitoring and Progress Reports

- 10.1.1 The GLAAS officer shall be informed in writing at least one week in advance of commencement of fieldwork.
- 10.1.2 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. Arrangements for GLAAS monitoring of the archaeological works will be made during and following the above consultation.
- 10.1.3 Periodic updates on the progress of the Crossrail archaeology programme shall be submitted to the external consultees by the Project Archaeologist. The

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

- 10.1.4 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 and/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.

11 Principal Contractor Responsibilities

- 11.1.1 During all archaeological events described in this SSWSI the responsibilities of the Archaeological Contractor will be for the archaeological works only. All other provisions will be responsibility of the Principal Contractor. These provisions may include, but are not limited to:

- Pre-excavation demolition of standing structures, basement floor slabs, modern overburden, obstructions and other materials as may be required (to be removed under the direction of the Archaeological Contractor);
- Setting out;
- A safe and secure site with safe access routes from compound or offices to the working areas;
- Work area fencing and signage;
- Service disconnection or isolation;
- Temporary services provision as required;
- Dewatering;
- Clearly delineated working areas for the Archaeological Contractor, without any adjacent demolition or construction activities taking place which impede archaeological work;
- Explosive Ordnance Engineer in attendance (where required). Measures to deal with contaminated ground as necessary;
- Spoil storage areas, to be provided as near to the excavation areas as possible;
- Temporary works to access and support excavations where personnel access for the investigation is required;
- Excavation plant, plant operators and banking;
- Attendance;
- Power, lighting and water (if required);
- Welfare facilities, temporary office space, complete with furniture and storage for small plant and tools;
- Other temporary works as may be required to safely undertake the works specified.

12 Personnel Requirements

- 12.1.1 The Archaeological Contractor shall provide experienced project personnel 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.
- 12.1.2 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 or post-contract appointment process.
- 12.1.3 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.
- 12.1.4 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.
- 12.1.5 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.
- 12.1.6 The Archaeological Contractor's project team shall be staffed by technician grades with minimum six months experience in appropriate aspects of excavation and recording.
- 12.1.7 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).
- 12.1.8 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.

13 References and Glossary of Terms

Brindle, S, 2004, *Paddington Station: Its history and architecture*, English Heritage

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

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

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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

Palmer, M., Newell, M. and Sissons, M., 2012, Industrial Archaeology: A Handbook, CAN Practical Handbook No. 21, Council for British Archaeology 2012

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

14 Definitions/Abbreviations/Acronyms

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

ATD	Above Tunnel Datum = Ordnance Datum plus 100m	Tunnel	Datum.
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

15 Annex 1 Site Information

15.1.1 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.

16 Annex 2 Health and Safety Requirements

16.1.1 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.

16.1.2 The Designer's Risk Assessment to accompany this SSWSI is presented below:



Designer's Risk Assessment

Gifford - GMS

Project Summary

Job Name:

Job Number:

Project Director: Project Manager:

Status:

Entries

Design Element	Task/Project	Date Created	Created By
Paddington New Yard	-	18/11/2012	Andy Shelley

Hazard	At Risk	Initial Assessment			Revised Assessment		
		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 injury.	<ul style="list-style-type: none"> ✓ Construction Operatives ✓ Users 	Likely	High	Attend all inductions. No lone working. Use PPE. Operatives to familiarise themselves with all WSI and Risk Assessments generated by this work.	Unlikely	High	<ul style="list-style-type: none"> ✓ H & S Plan Low
Striking live services during the course of archaeological mitigation works causes injury.	<ul style="list-style-type: none"> ✓ 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	<ul style="list-style-type: none"> ✓ H & S Plan Low
Trial trench excavations destabilise nearby structures, causing collapse and injury.	<ul style="list-style-type: none"> ✓ Construction Operatives ✓ Users 	Likely	High	All trenching to be undertaken only after nearby buildings have been demolished to ground level.	Unlikely	High	<ul style="list-style-type: none"> ✓ H & S Plan Low
Adjacent plant causing injury during trial trench excavations, mitigation excavations, strip, map and sample excavations and general watching briefs	<ul style="list-style-type: none"> ✓ 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	<ul style="list-style-type: none"> ✓ H & S Plan Low
Vehicle movements causes injury whilst undertaking archaeological works.	<ul style="list-style-type: none"> ✓ Construction Operatives ✓ Users 	Likely	High	Use designated routes. Attend inductions. Be accompanied. Use of PPE.	Unlikely	High	<ul style="list-style-type: none"> ✓ H & S Plan Low
Encountering contaminated land causes injury.	<ul style="list-style-type: none"> ✓ Construction Operatives ✓ Users 	Likely	High	Principal Contractor to supply all relevant information in advance of works. 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	<ul style="list-style-type: none"> ✓ H & S Plan Low
Trial Trench excavations collapse causing injury	<ul style="list-style-type: none"> ✓ 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 arrangements, 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	<ul style="list-style-type: none"> ✓ H & S Plan No residual risk.
Slips, trips and falls during archaeological attendance causing injury	<ul style="list-style-type: none"> ✓ 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	<ul style="list-style-type: none"> ✓ H & S Plan Low

17 Annex 3 Personal Protective Equipment (PPE)

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

- Orange rail-compliant high visibility vest and trousers;
- 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

18 Annex 4 Labelling of Hazardous Substances, Contaminated Land

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

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

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

20 Annex 6 CRL and work on Network Rail Land

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

21 Annex 7 Environmental Protection Requirements

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

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

22.1.1 Current programme is as last notified by C336 Costain on 31 March 2014. C336 assume Principal Contractor control of the site on 11 April 2014 and platform construction and piling works in Area AD1 commence 15 April 2014. Archaeological works will commence the same day. C336 gain access to Area AD2 on 31 August 2014. Detailed programming for the archaeological works will be notified to the Archaeological Contractor in one or more supplementary bulletins to this SSWSI issued after C336 commence construction.

22.1.2 The programme of works provided in the Construction Phase Plan (C336-COS-O1-STP-CR076_SD006-50001 Rev 2.0) is as follows:

D1	C300 Release Phase 1 & 3 & New Tarmac Area	11-Apr-14
D2	Decom. & Remove Exist Tarmac Plant & Handover to C336	31-Aug-14
AD3	C300 Release Remainder of WBP to C336	08-Oct-14
AD4	C300 Demobilised from Royal Oak Portal	23-Jan-15
KD1	BDU and Below Deck Area Handover for Tarmac M&E Works	10-Oct-14
KD2	Complete Green Lane Bridge strengthening	05-Nov-14
KD3	Phase 3 ,4, 5 Southern Edge of Deck Structure Complete	16-Jan-15
KD4A/D	Provide Utility Services to Tarmac Area Connection Points	06-Mar-15
KD5	Bus Deck Structure Complete	08-Jul-15
KD6	Head House M&E Fitout Complete Handover to Systemwide	17-Dec-15
SCD1	Formation Complete for C610 Install of Turnback Sidings	29-Apr-15
SCD2	Deck & Formation Comp for C610 Install of Marcon Sidings	12-May-15
SCD3	Marcon Sewer Completion / Handover asset to Network Rail	03-Jun-15
SCD4	ROP Complete for C610 Install of Track in Tunnels	10-Jun-15
SCD5	Deck & Below Deck Complete. Handover to Systemwide	14-Aug-15
SCD6	Bus Deck Complete Handover to First Centre West	17-Sep-15
CD8	Road Fed Plant Complete & Accessible to Operate	26-May-15

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

23.1.1 The Archaeological Contractor is likely to require (this will be confirmed in the Archaeological Contractor's AMS) the Principal Contractor to provide the following services/enabling 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 six staff;
- Excavation of trial trenches to dimensions provided in Section 8, using plant fitted with 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 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.
- Explosive Ordnance Engineer in attendance (where required).
- Banking and attendance;
- Other temporary works as may be required to safely undertake the works specified.

24 Annex 10 Security Requirements

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

25 Annex 11 Need for screening or other protective works

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

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

26.1.1 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.

26.1.2 It is not expected that human remains will be present at PNY. Therefore, the archaeological contractor should immediately notify the Principal Contractor and Project Archaeologist on discovering human remains.

26.1.3 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.

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

27.1.1 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.

27.1.2 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.

27.1.3 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.

27.1.4 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.

27.1.5 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.

28 Annex 14 Procedure for notification of major unexpected discoveries

28.1.1 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 immediately notify the Project Archaeologist and thereafter, once given approval by the Project Archaeologist to proceed, undertake works in accordance with the Environmental Requirements (Archaeology) section of the C254 Works Information. They shall adhere to the procedures set out in the Generic SSWSI.

28.1.2 The Archaeological Contractor shall submit details of their procedure for excavating and recording such remains in their Archaeology Method Statement.

28.1.3 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.