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Old Oak North

Infrastructure Advisor - Stage 4 Report
Old Oak North, Preliminary Infrastructure Cost Report

Old Oak and Park Royal Development Corporation

Project number: 60567089
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07 September 2018

Old Oak North

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Executive Summary

AECOM has been commissioned by Old Oak and Park Royal Development Corporation (OPDC) to advise on the strategic infrastructure needed to enable the next 15 years of development in Old Oak North.

This report summarises the cost of the key items of infrastructure that will be required to support the proposed development of Old Oak North. Details of the estimated delivery costs and the assumptions behind these costs have also been provided.

A summary of the costs included in this report is provided below.

Table 1. Summary of construction and budgetary costs for strategic infrastructure improvements for the 15 year Business Case

Infrastructure Description	Construction Costs	Budgetary Costs
Structures		
Park Bridge (Ref: S01)	**£16,397,473**	**£35,024,756**
Park Road Underpass (Ref: S02)	**£15,113,871**	**£31,361,282**
Laundry Bridge (Ref: S08)	**£12,821,062**	**£26,603,704**
Old Oak Bridge (Ref S09)	**£10,015,294**	**£20,781,735**
Harlesden Bridge (Ref: S07)	**£15,179,806**	**£31,498,097**
Green Bridge (Ref: S10)	**£16,409,583**	**£34,049,885**
Canal Bridge (Ref: N/A)	**£7,610,008**	**£13,876,134**
Powerday Underpass (Ref: N/A)	**£15,113,871**	**£31,361,282**
Commuted Sums	**N/A**	**£4,800,000**
Hythe Road Underpass Improvements (Ref: S05)	**£6,633,274**	**£13,764,004**
Hythe Road Viaduct & Station Enabling Works	**N/A**	**£143,000,000**
Willesden Junction Station Improvements	**£16,031,113**	**£33,264,559**
Retaining Walls to Support Rail Line Embankments	**£6,809,863**	**£14,130,466**
	Budgetary Cost Sub-TOTAL	**£433,515,944**
Streets		
Associated Roads – Primary Streets, Secondary Streets and Service Streets	**£36,346,259**	**£61,497,870**
Retaining Walls to Support Primary Streets	**£8,801,833**	**£14,892,701**
Commuted Sums	**N/A**	**£35,000,000**
Site Wide Earthworks (Cut / Fill)	**N/A**	**£34,218,550**
Site Clearance, Demolition and Decontamination for Park Road	**N/A**	**£5,950,000**
	Budgetary Cost Sub-TOTAL	**£151,559,122**
Decentralised Energy		
Western Energy Centre: Groundworks / Structural Construction	**£5,895,000**	**£9,974,340**
Western Energy Centre: Thermal Generation and Fit-out	**£6,613,000**	**£11,189,196**
Eastern Energy Centre: Groundworks / Structural Construction	**£1,302,000**	**£2,202,984**
Eastern Energy Centre: Thermal Generation and Fit-out	**£2,493,000**	**£4,218,156**
District Heating Pipework	**£5,322,000**	**£9,004,824**
	Budgetary Cost Sub-TOTAL	**£36,589,500**

Infrastructure Description		Construction Costs	Budgetary Costs
Electrical Power			
	UKPN Connection Fee (15MVA) at Atlas Road	**N/A**	**£2,300,000**
	11kV Cable Circuits - Atlas Road to Old Oak North Sub Station	**£1,325,000**	**£2,241,900**
	Distribution Network (Ducting and Cables: Western Wedge & CG)	**£3,500,000**	**£5,922,000**
	Old Oak North Sub-Station Building and Fit-out	**£900,000**	**£1,522,800**
	HS2 Settlement Fee for Additional 14MVA Capacity	**£4,000,000**	**£6,768,000**
		Budgetary Cost Sub-TOTAL	**£18,754,700**
Gas			
	Reinforce the existing gas network on the eastern side of the site	**£1,522,500**	**£2,576,070**
	Extend medium pressure gas supply to Old Oak North Energy Centre	**£1,015,000**	**£1,717,380**
	Extend medium pressure gas supply to Scrubs Lane Energy Centre	**£203,000**	**£343,476**
		Budgetary Cost Sub-TOTAL	**£4,636,926**
Potable Water			
	New 250 mm dia main from 30" No4 in Old Oak Lane to centre of site	**£0**	**£0**
	New 200 mm dia main from 21" in Scrubs Lane to centre of site	**£0**	**£0**
	New 150 mm dia main from 21" in Scrubs Lane to centre of site	**£0**	**£0**
	New 250 mm dia main from 30" No4 in Old Oak Lane to centre of site	**£0**	**£0**
	New 150 mm dia main from 21" in Scrubs Lane to centre of site and connect to new main in centre of Site 8	**£0**	**£0**
	Offsite reinforcement works	**£0**	**£0**
		Budgetary Cost Sub-TOTAL	**£0**
Foul and Surface Water Drainage			
	Tokyngton and Stonebridge Flood Alleviation Scheme	**£0**	**£0**
	Strategic sustainable urban drainage systems within areas of Public Open Space to attenuate runoff from adopted roads	**£1,827,000**	**£3,091,284**
	New outfalls to the Grand Union Canal and Improvements to the canal to improve conveyance capacity	**£2,030,000**	**£3,434,760**
	Sewerage system extension and capacity expansion	**£1,725,500**	**£2,919,546**
		Budgetary Cost Sub-TOTAL	**£9,445,590**
Telecommunications			
	Telecommunications network in Old Oak Common (phased to match development timing)	**N/A**	**£2,640,000**
		Budgetary Cost Sub-TOTAL	**£2,640,000**
Social Infrastructure			
	Community & Sports Facilities (1No. 2,600m² in 2026)	**£11,801,405**	**£15,946,649**
	Green Infrastructure (Allowance for Parks and Open Spaces)	**£3,400,250**	**£4,594,588**
	Health Facilities (1No. 1,088m² in 2024, expanded to 1,564m² in 2038)	**£3,174,920**	**£4,290,111**
	Primary School (840 places 4FE, 5,800m² (0.58 Ha) site size)	**£14,210,000**	**£19,201,263**
	Super Nursery (120 places, 2,000m² site size, 800m² floorspace)	**£905,380**	**£1,223,395**
	Birchwood Nature Reserve	**£1,500,000**	**£2,026,875**
		Budgetary Cost Sub-TOTAL	**£47,282,879**

Infrastructure Description	Construction Costs	Budgetary Costs
Offsite Highway Improvements		
High level assumptions for cycle hire; Legible London wayfinding and signage; nominal allowance for additional bus infrastructure at Overground stations. (50% of original costs allowance)	**£2,635,568**	**N/A**
Junction Victoria Rd, Old Oak Common Lane, Old Oak Lane & Atlas Rd - increase capacity	**£2,658,460**	**£5,516,304**
New bus routes and bus infrastructure including bus stops, bus stands, welfare and maintenance facilities, bus gates, bus priority measures and bus-only routes (50% of original costs allowance)	**£9,990,640**	**£16,904,163**
Scrubs Lane Interventions identified within the Scrubs Lane Direction of travel	**£13,398,000**	**£27,800,850**
	Budgetary Cost Sub-TOTAL	**£50,221,317**
Additional Items		
Hythe Road Station	**N/A**	**£30,000,000**
Demolition - all sites except Powerday	**£33,495,000**	**£41,265,840**
Demolition - Powerday	**£829,055**	**£1,021,396**
Decontamination Costs - Powerday	**N/A**	**£996,300**
Automated Waste Collection System (AWCS)	**£14,210,000**	**£24,043,320**
Sitewide Utility Diversions	**£10,150,000**	**£21,061,250**
Stamford Brook Sewer Diversion	**£2,489,850**	**£4,212,826**
Canal & River Trust – Air Rights	**£1,000,000**	**£1,000,000**
	Budgetary Cost Sub-TOTAL	**£123,600,932**
	Preliminary Infrastructure Budgetary Cost TOTAL	**£878,246,911**

In addition to specific assumptions described in each section of this report, the budgetary costs shown above include the following allowances:

- Cost estimates prepared before August 2018 have been increased by 3% per annum to account for inflation.
- The following allowances have been added to the construction cost estimates for each asset, to account for risk, contingency, fees, survey costs and maintenance:

Element Interface	Professional Fees, Maintenance & Survey Costs	Optimism Bias
Rail Related	25%	66%
Transport / Utilities	17.5%	44%
Social Infrastructure	17.5%	15%

Note the costs shown in the main body of this report are considered construction cost estimates only. For budgetary purposes, early stage estimates should include allowances for the items listed above (e.g. incl. Optimism Bias), which have been added to the construction costs to provide the budgetary costs shown in Table 1. A breakdown of these costs is provided in Appendix A of this report.

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Acronyms

Acronym	Description
CRT	Canal and River Trust
DfT	Department for Transport
DMRB	Design Manual for Roads and Bridges
HS2	High Speed Two Limited
LBHF	London Borough of Hammersmith and Fulham
LPG	Low Pressure Gas
MfS	Manual for Streets
MfS2	Manual for Streets 2

Acronym	Description
MPG	Medium Pressure Gas
NMU	Non-Motorised User
OPDC	Old Oak and Park Royal Development Corporation (the Client)
PRS	Pressure Reducing Station
SuDS	Sustainable Urban Drainage System
TfL	Transport for London
UKPN	UK Power Networks

1. Introduction

AECOM has been commissioned by Old Oak and Park Royal Development Corporation (OPDC) to advise on the strategic infrastructure needed to enable the next 15 years of development in Old Oak North.

This report summarises the cost of the key items of infrastructure that will be required to support the proposed development of Old Oak North. Details of the estimated delivery costs and the assumptions behind these costs have also been provided.

Basis of Assessment

1.1 Following the issue of their Stage 1 Report in November 2017, the AECOM Masterplanning Team developed a series of Masterplan Options for the redevelopment of Old Oak North. An evaluation of these options was undertaken in early 2018 and Option 6 was identified as the preferred option, which includes the provision of a new 2 track viaduct that will be constructed to support the West London Line, providing improved connectivity below and allowing the development of a new high level station. A further iteration of Option 6 was prepared in March 2018, which has formed the basis of the Business Case being prepared by OPDC. (Refer to Appendix B).

1.2 In our role as Infrastructure Advisor, OPDC has commissioned AECOM to assess the infrastructure provisions for Old Oak North, which have been based upon the March iteration of Masterplan Option 6.

1.3 AECOM has been instructed to make no allowance in the current cost plan for improvements to the strategic infrastructure that would be required to support development beyond 2033. Costs that would typically be paid by a Developer for buildings and the associated on-plot infrastructure have also been excluded from this estimate, as these have been reported separately.

1.4 It is anticipated the Early Activation Sites that are located at Oaklands South and adjacent to Scrubs Lane will be connected to the existing services and highway infrastructure. As the cost of any infrastructure improvements required to support these developments will be paid by the Developer, these costs have not been included in this report.

1.5 The assumed development capacity for each site identified in Masterplan Option 6 has been taken from revision V4.0 of the Development Trajectory, which was received from OPDC on 17 April 2018. This assumed development capacity has informed assumptions around utility demands.

Basis of Costs

1.6 This report has been prepared to identify and provide outline costs for the key infrastructure assets and improvements to the existing infrastructure that will be required to support the proposed development of Old Oak North. The costs identified within this report are preliminary budget costs reflecting the early stage of the Masterplanning assessment. These cost estimates will be refined as the design of the new infrastructure is developed and additional detail becomes available.

1.7 Costs quoted in the following sections of this report are the anticipated direct construction costs derived from an analysis of schemes of a similar type, size and complexity; generally speaking, benchmark rates have been used for the purpose of pricing of the works. Where the use of benchmark rates has not been possible, provisional sums have been used to cost items of work; an element of approximate estimating and notional pricing has been used to build-up the provisional sum allowance.

1.8 The construction costs detailed in the following sections of this report have been increased by the allowances shown below to provide budgetary costs for the proposed improvements to the strategic infrastructure:

- Cost estimates prepared before August 2018 have been increased by 3% per annum to account for inflation.
- The following allowances have been added to the construction cost estimates for each asset, to account for risk, contingency, fees, survey costs and maintenance:

Element Interface	Professional Fees, Maintenance & Survey Costs	Optimism Bias
Rail Related	25%	66%
Transport / Utilities	17.5%	44%
Social Infrastructure	17.5%	15%

Structure of this Report

1.9 This report addresses each of the below infrastructure utilities in turn, with a section dedicated to each:

- Section 2: Streets and Structures
- Section 3: Decentralised Energy
- Section 4: Electrical Power
- Section 5: Gas
- Section 6: Potable Water
- Section 7: Foul and Surface Water Drainage
- Section 8: Telecommunications
- Section 9: Social Infrastructure
- Section 10: Offsite Highway Improvements
- Section 11: Additional Items
- Section 12: Assumptions

1.10 Note that smart technology is not included in this assessment.

2. Streets and Structures

Overview

2.1 This section defines the form of the streets and structures proposed to enable Non-Motorised Users (NMU), buses, service vehicles and vehicular traffic to gain access to the Old Oak North development.

Existing Transport Network

2.2 The Old Oak site is situated in the locality of significant highways, as the A40 extends close to the southern boundary of the site, whilst the A219 Scrubs Lane and Old Oak Common Lane extend along the eastern and western boundaries respectively. The site is dissected by the Grand Union Canal (Paddington Branch) and by a series of major transport links, including the Great Western Main Line, West Coast Main Line, London Overground (North and West London lines) and the London Underground Bakerloo line and there is therefore limited permeability in an east-west direction across the site.

2.3 The existing transport network will be expanded through the planned development of a new station in 2026, which will link the proposed High Speed 2 (HS2) rail line, the Elizabeth Line (Crossrail) and the Great West Mainline. There are also plans to carry out upgrade works to the existing Willesden Junction station, which is a current interchange between the North London and West London Overground lines and the Bakerloo Underground line. The current masterplan for Old Oak North includes the provision of a new high level rail station on the West London Line at the Hythe Road Viaduct. Construction of the new and improved rail facilities is expected to create a new desire line for pedestrians and public transport between Willesden Junction and the new railway stations via the Old Oak North development.

Proposed Highway Network

2.4 The masterplan for Old Oak North (shown in Figure 1 below and Appendix B) identifies opportunities for improving the permeability of the area through the provision of a network of streets.

2.4.1 Park Road forms a primary street which extends from the Oaklands South development (in the southwest corner), through the Old Oak North development, tying in with the existing A219 Scrubs Lane to the south of the West Coast Mainline overbridge (in the Northeast corner).

The proposed alignment of Park Road will require the provision of new structures to allow the highway to cross the Grand Union Canal (Park Bridge), pass beneath the West London Overground line (Park Road Underpass) and cross the Southern (freight) line (Laundry Bridge) to connect with the A219 Scrubs Lane via a new signal controlled junction.

The Park Road highway corridor is currently proposed to be approximately 865m in length and 20m wide.

2.4.2 Old Oak Street forms a primary street that extends in a north / south direction from a proposed junction with Park Road (to the north), beneath the proposed Hythe Road station viaduct and then connects with the Old Oak Bridge to cross the Grand Union Canal, the Crossrail Depot and connect into the HS2 Old Oak Common station.

The Old Oak Street highway corridor from the junction with Park Road, south to the junction with Hythe Road is currently proposed to be approximately 242m in length and 25m wide.

The Old Oak Street highway corridor between the two Hythe Road junctions is currently proposed to be approximately 122m in length and 20m wide.

The Old Oak Street highway corridor from the Hythe Road junction, south to Old Oak Bridge is currently proposed to be approximately 125m in length and 27m wide.

2.4.3 Hythe Road forms a primary street which runs in an east west direction from Park Road to the existing Hythe Road Underpass. This road is essentially two separate links, separated by Old Oak Street.

The western section of the Hythe Road highway corridor from Park Road to Old Oak Street is currently proposed to be approximately 214m in length and 20m wide.

The eastern section of the Hythe Road highway corridor from Old Oak Street to the existing Hythe Road Underpass is currently proposed to be approximately 251m in length and 20m wide.

2.5 A number of secondary streets will be created off these primary streets to access the individual plots within the Old Oak North development. The current masterplan assumes that approximately 827m of secondary streets will be included.

2.6 A number of streets will be created within the proposed development plots to allow service vehicles (refuse, emergency, etc.) to access the new buildings. The current masterplan assumes that approximately 514m of servicing streets will be developed.

2.7 The current expectation is that the primary streets will be adopted by the London Borough of Hammersmith and Fulham. In addition LBHF have expressed an interest in also adopting the secondary street network; however this will need to be dealt with on a case-by-case basis between land-owner/developer and LBHF during the planning phase.

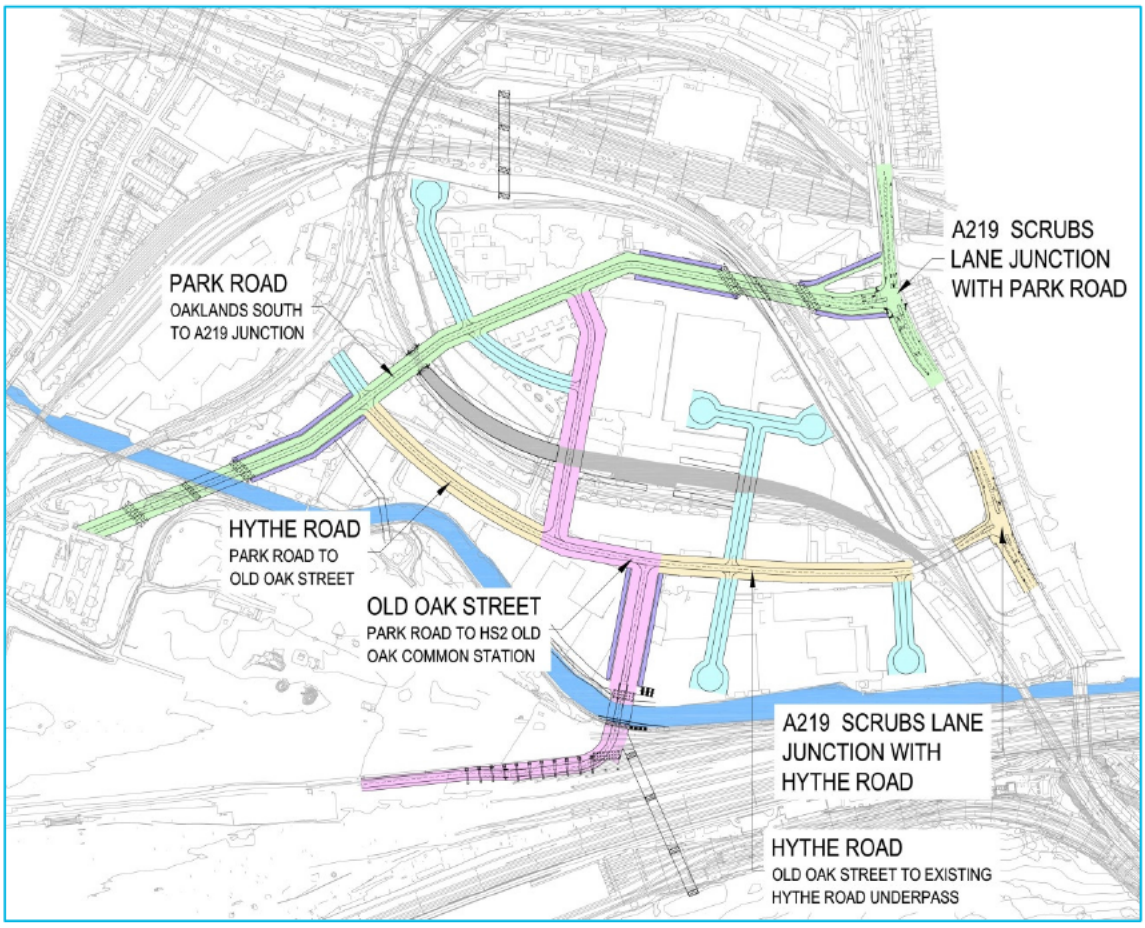

Figure 1: Old Oak North Proposed Street Network (Park Road – Green, Old Oak Street – Pink, Hythe Road – Yellow and Secondary Streets – Blue)

Proposed Costs

2.8 Construction costs have been developed for the streets and highway structures, which are included in Table 2. Each structure and road has been assigned a unique reference number, which is listed in Table 2, and Drawing Reference OOC-ACM-HWY-XX-DR-CE-00001 is provided within Appendix B to illustrate the location of each of the structures and roads.

2.9 The requirements associated with each asset, and the assumptions and exclusions that have been used to develop cost estimates, are described in detail in the following sections.

Table 2: Summary of strategic infrastructure construction costs for the 15 year Business Case

Infrastructure Description	CAPEX Cost
Structures	
Park Bridge (Ref: S01)	**£16,397,473**
Park Road Underpass (Ref: S02)	**£15,113,871**
Laundry Bridge (Ref: S08)	**£12,821,062**
Old Oak Bridge (Ref S09)	**£10,015,294**
Harlesden Bridge (Ref: S07)	**£15,179,806**
Green Bridge (Ref: S10)	**£16,409,583**
Canal Bridge (Ref: N/A)	**£7,610,008**
Powerday Underpass (Ref: N/A)	**£15,113,871**
Commuted Sums	**£4,800,000#**
Hythe Road Underpass Improvements (Ref: S05)	**£6,633,274**
Hythe Road Viaduct & Station Enabling Works	**£143,000,000#†**
Willesden Junction Station Improvements	**£16,031,113**
Retaining Walls to Support Rail Line Embankments	**£6,809,863**
Streets	
Associated Roads – Primary Streets, Secondary Streets and Service Streets	**£36,346,259**
Retaining Walls to Support Primary Streets	**£8,801,833**
Commuted Sums	**£35,000,000#**
Site Wide Earthworks (Cut / Fill)	**£34,218,550#**
Site Clearance, Demolition and Decontamination for Park Road	**£5,950#**

CAPEX Costs suffixed with a **#** denote a Total Cost Estimate rather than a Construction Cost estimate.

CAPEX Costs suffixed with a **†** denote a cost that has been provided to AECOM by an outside source (i.e. OPDC or one of their other consultants).

Street Geometry

2.10 Preliminary design drawings have been prepared to establish the horizontal and vertical geometry of streets and structures that are proposed to be extended through the Old Oak site (refer to Appendix B). These drawings have been used to inform the masterplan by defining the extent of the land that will be occupied by the network of streets, and by establishing the variation in levels of proposed streets that extend through the site.

2.11 The highway design drawings have also been prepared to inform the Cost Plan that supports the Old Oak Business Case, by defining the variation in length and width of proposed streets, establishing likely bulk earthworks quantities, and verifying the horizontal and vertical geometry of new structures and retaining walls.

Design Standards

2.12 The geometry of proposed streets that extend through the Old Oak site have been designed to comply with the requirements of Manual for Streets (MfS) and Manual for Streets 2 (MfS2), which was published by the Chartered Institution of Highways and Transportation in 2010.

2.13 This design standard has been used in preference to the Design Manual for Roads and Bridges (DMRB) as the highways that extend through Old Oak will accommodate high volumes of pedestrians and cyclists, and it will therefore be necessary to create a low speed, attractive urban environment rather than a strategic highway network.

2.14 The horizontal and vertical highway alignment has been designed in accordance with MfS and MfS2. The design speed for the carriageway is 50kph (31mph), however the formal speed limit for the road will be 20mph (either as a 20mph speed limit or a 20mph zone) in line with OPDC's Local Plan policy.

2.15 The vertical highway corridors have been designed not to exceed a gradient of 5%/1:20 without a suitable alternative NMU route being provided.

Horizontal Street Geometry

2.16 The cross sectional width of the highway corridors that will form the primary streets has been taken from the current masterplan. The overall width of the highway corridor has been designed to provide sufficient space to accommodate high volumes of pedestrians and cyclists, in addition to Sustainable Urban Drainage Systems (SuDS), soft landscaping and a carriageway that will be utilised by buses, taxis, service vehicles and private vehicles. The carriageway width has been assigned a width of 6.5m throughout, with the exception of Old Oak Street where it widens to 7.3m on the approach ramp to the HS2 Old Oak Common station. The remainder of the highway corridor given to pedestrians, cyclists, planting, SuDS and other highway furniture (bus shelters, active frontages, bins/benches etc).

2.17 The Masterplan proposals for the highway corridors have developed from the original 'Scenario A and B' described the in September 2017 'Preliminary Infrastructure Cost Report'. The highway corridors now vary in width;

- 20m wide for Park Road, the east/west section of Old Oak Street and both the eastern and western sections of Hythe Road,
- 25m wide for Old Oak Street between Park Road and Hythe Road, and
- 27m wide for Old Oak Street between Hythe Road and Old Oak Bridge.

2.18 The proposed sections of Old Oak Street between Hythe Road and Old Oak Bridge have been designed with an overall width of 27m in order to provide opportunities for active frontage, in accordance with the TfL Guidance on the width of highway flow streets that is indicated in Figure 2. It will not be practical to provide active frontage or verges that incorporate trees where the streets extend over bridges and through underpasses. This approach also complies with the requirements of the Walking, Cycling and Public Realm Study, prepared by 5th Studio and Alan Baxter Integrated Design to support the Local Plan.

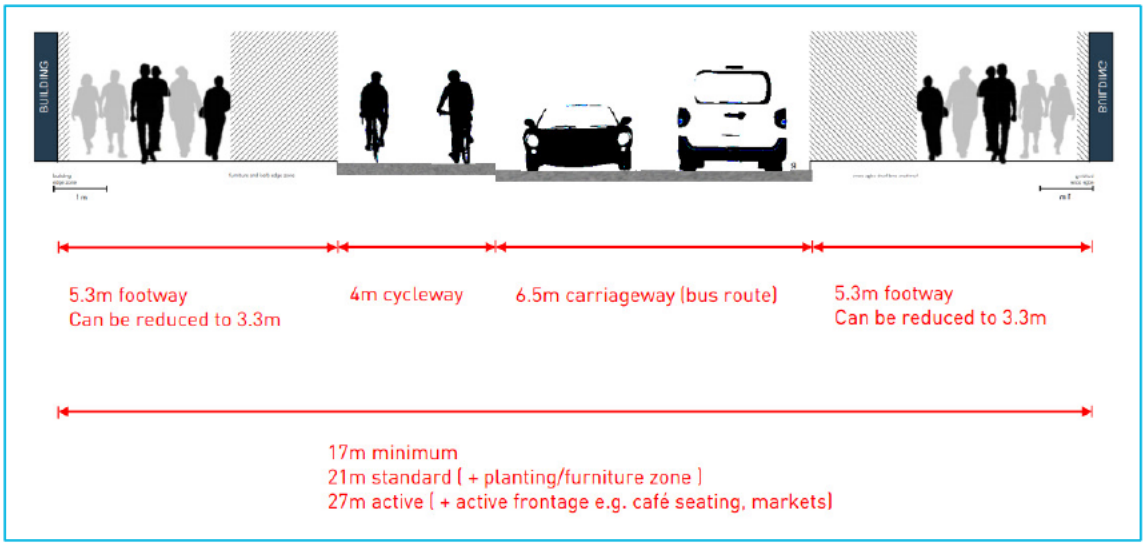

Figure 2: TfL Guidance on the Minimum Width of High Flow Streets

2.19 A number of secondary streets are included throughout the site to provide vehicular access to individual plots. These have been allocated a highway corridor width of 18m with a carriageway width of 6.5m to allow service and emergency vehicle access. Where these side streets end in a cul-de-sac arrangement, a turning circle has been included, which has been designed to allow a large refuse vehicle to turn around without requiring a reversing manoeuvre.

2.20 A number of secondary streets for service vehicle access only are included to allow for plot servicing. These have been allocated a carriageway width of 6.0m.

2.21 The horizontal alignment of the proposed streets has generally been designed to incorporate straight sections across structures in order to simplify their construction. Horizontal curves have been designed to provide a radius of at least 44m, which Table 8.1 in MfS2 indicates is the minimum recommended curve radius for streets with a design speed of 50kph. Minimum radius horizontal curves have been selected in order to encourage reduced vehicle speeds and to avoid creating awkward plot boundaries.

2.22 The exact allocation of the highway corridor between all users will be informed and assured through preparation of a strategic transport model, analysis of this model and further design development work. The delivered highway corridor shall be of suitable width to accommodate the predicted traffic, pedestrian and cycle flows through the Old Oak North development site and allow for the inclusion of highway furniture as required (such as bus stops).

Vertical Street Geometry

2.23 The streets that extend through the Old Oak site are frequently required to traverse a series of major transport links, including the Great Western Main Line, West Coast Main Line, London Overground Lines and the Grand Union Canal.

2.24 The vertical geometry of the streets has been designed to provide adequate clearance to existing railway lines and the Grand Union Canal, whilst also providing sufficient space to accommodate the depth of the supporting structure, which is defined in the Old Oak Structures Database. Streets that extend over the Grand Union Canal have been designed to provide a minimum vertical clearance of 2.75m and 3m to the canal towpath and the canal water level, respectively. Streets that pass over railways have been designed to provide a minimum vertical clearance of 6m above the surveyed rail level (with the exception of Old Oak Bridge), whilst new streets that extend below rail lines have been designed to provide a minimum vertical clearance of 5.7m within underpasses.

2.25 The alignment of proposed streets has generally been designed to enable the maximum longitudinal gradient to be restricted to 5% in order to comply with the requirements of Disability Discrimination Act and ensure that the streets may be easily negotiated by pedestrians and cyclists. Escalators and lifts have been proposed where site constraints introduce a requirement for streets to provide a gradient of greater than 5%, such as the Harlesden Bridge Non-Motorised User Link that extends through the northern part of the Old Oak site. The introduction of escalators and lifts along pedestrians and cycle routes will require careful consideration, as they will be required to be integrated within railway stations or commercial buildings to ensure that they are adequately operated and maintained.

2.26 On approach to the Park Bridge, Park Road Underpass, Laundry Bridge and Old Oak Bridge, the primary street network will need to be supported by a number of highway retaining walls. In order to provide a construction cost estimate we have assumed that these walls will be formed of reinforced in-situ concrete, however existing ground conditions may make it necessary to adopt a different method such as piled or earth retained.

Junctions

2.27 A number of new signal controlled junctions will be required at key locations as part of the Old Oak North development. The benefit in choosing signal controlled method is to enable pedestrians and cycle movements to be prioritised and to provide opportunities for Selective Vehicular Detection to be employed to provide buses with priority over private vehicles in order to optimise journey times.

2.27.1 A signal controlled junction will be developed at the eastern end of Park Road where it connects with the existing A219 Scrubs Lane.

2.27.2 Three signal controlled junctions between the proposed development primary streets have been included in the cost estimate. The locations for these are currently assumed to be at the Park Road junction with Old Oak Street and the two Old Oak Street junctions with Hythe Road

2.27.3 The existing A219 Scrubs Lane mini roundabout will be upgraded to a signal controlled junction to enable improved control of highway users, to cater for the anticipated traffic flows generated by the development.

2.28 The cost plan includes an allowance for signalised junctions to be provided at key intersections in the primary street network. However, further work will be required to establish the size and location of these junctions once turning flows have been verified and junction modelling calculations have been produced.

Streets Summary

2.29 From the have undertaken to-date we have estimated a construction cost of £36,346,259 to deliver the primary, secondary and on-plot service streets.

2.30 From the have undertaken to-date we have estimated a construction cost of £8,801,833 to deliver retaining walls to support the primary street network on approach to the key structures.

Proposed Structures

2.31 The current masterplan includes four significant highway structures to enable the highway corridor to cross a series of major transport links, including the Crossrail Depot, the Grand Union Canal, London Overground Lines and southern (freight lines).

2.32 Three NMU structures have been proposed which cross a series of major transport links, including the HS2 Old Oak Common station, the Great Western Main Line, the West Coast Main Line and the Grand Union Canal. The location of the key structures is illustrated within Appendix B.

2.33 A number of additional structures are also included as part of the strategic infrastructure requirements.

2.34 The following provides an overview of the key structures. Technical Notes have been prepared for each of the structures, which provide a more detailed assessment of the constraints, option(s) for structural form and risks.

Park Bridge (Ref S01)

2.35 The horizontal alignment of Park Bridge is based upon the site plan for the Oaklands South development, which results in the structure passing over the northern corner of the Crossrail Depot site. The bridge is proposed to have a total length of approximately 118m to allow it to pass over the Crossrail Depot and the Grand Union Canal, as illustrated in Figure 3. The bridge is proposed to have a width of 20m in order to accommodate all modes of transport, and to provide consistency with the information contained within the consented Oaklands South planning application.

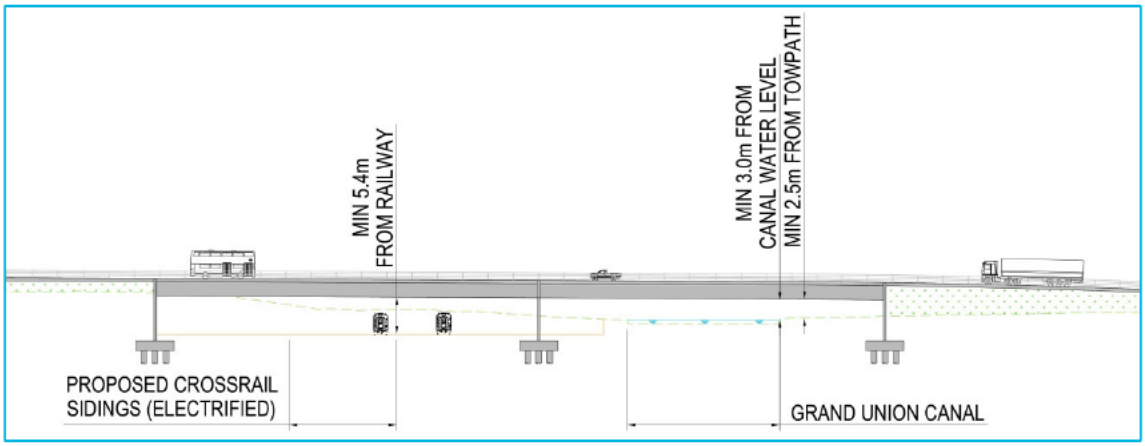

Figure 3: Park Bridge

2.36 The bridge is assumed to have two equal 59m long spans, assuming that abutments are constructed on the northern side of the Grand Union Canal and the western side of the Crossrail Depot, and that an intermediate pier is constructed within the Depot site. Discussions have been held with Crossrail, TfL and Bombardier (who will maintain and operate the Depot) on gaining third party approval for both the over-sailing of the Depot and positioning of the intermediate pier.

2.37 The current conceptual design for the bridge has included a requirement to not preclude the Crossrail Depot rail lines to be extended by 44m (to accommodate 11 carriage trains) into consideration. The requirement to not preclude the Depot extension has formed the main height constraint for the bridge soffit.

2.38 The superstructure for this bridge is expected to comprise four pairs of braced steel girders acting compositely with a reinforced concrete deck. The substructure will comprise an intermediate solid leaf pier and bank seat abutments. The intermediate leaf pier will be supported on a 29m x 7.2m x 1.5m pile cap with three rows of 11No. 20m long x 900mm diameter piles. The bank seat abutments are supported on a reinforced earth retaining wall, with a 29m x 7.2m x 1.5m settlement control slab with three rows of 11No. 15m long x 900mm diameter piles.

2.39 To enable a future Depot extension, a retaining wall is required to lower the ground level under the bridge to Crossrail Depot level. The retaining wall is assumed to be of reinforced concrete pile construction. This retaining wall will tie into approach works to the east and west of the bridge comprising of 20m wide by 50m long reinforced earth wall retaining walls. The retaining wall height is likely to vary from 4.0m to 1.0m from existing ground level to proposed bridge level, assuming that the base of the retaining walls is constructed to existing ground level.

2.40 The construction costs for Park Bridge have been estimated at £16,397,473.

Park Road Underpass (Ref S02)

2.41 The Park Road Underpass forms a key element of the primary street connections that extends in an east-west direction through the Old Oak North site, as it enables all modes of transport to pass below the West London Line, as illustrated in Figure 4 below.

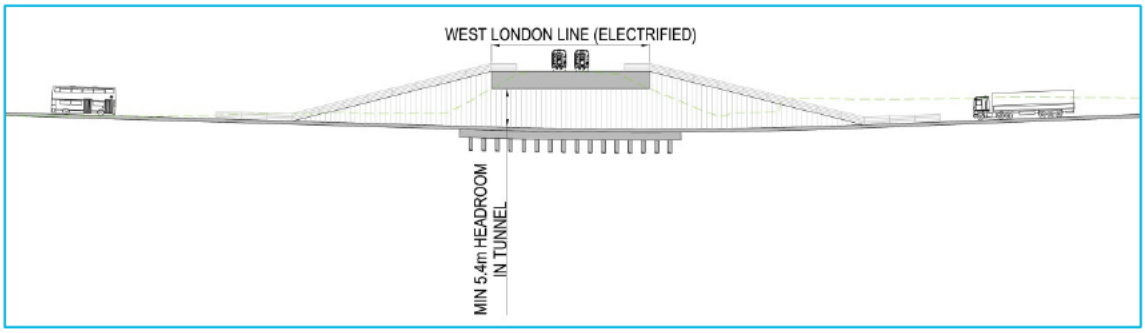

Figure 4: Park Road Underpass

2.42 The horizontal alignment of the underpass is broadly compatible with the location that is proposed in the Local Plan and it enables development plots to be created on either side of Park Road. The underpass is proposed to have a total length of 50m to allow it to pass below the full width of the existing railway embankment. The underpass is also proposed to have a width of 20m in order to accommodate all modes of transport.

2.43 The underpass will be constructed below an operational railway and it is therefore likely to be necessary to utilise a reinforced concrete structure that is installed using tunnel jacking techniques.

2.44 Approach works to the east of the underpass include the construction of a 20m wide by 96m long ramp supported by reinforced earth retaining walls on either side. The retaining wall heights are likely to vary between 6.8m and1.0m from existing ground level to proposed underpass level, assuming that the top of the retaining walls is constructed at existing ground level.

2.45 The construction costs for the Park Road Underpass have been estimated at £15,113,871.

Laundry Bridge (S08)

2.46 The horizontal alignment of the Laundry Bridge has been designed to enable the section of new road on the western side of the structure to avoid existing buildings within the Cargiant site, in order to allow this section of Park Road to be constructed during the first phase of development. The bridge is proposed to have a total length of 65m to allow it to span across the Southern railway line and the Powerday access road, as illustrated in Figure 5. The bridge is also proposed to have a width of 20m in order to accommodate all modes of transport.

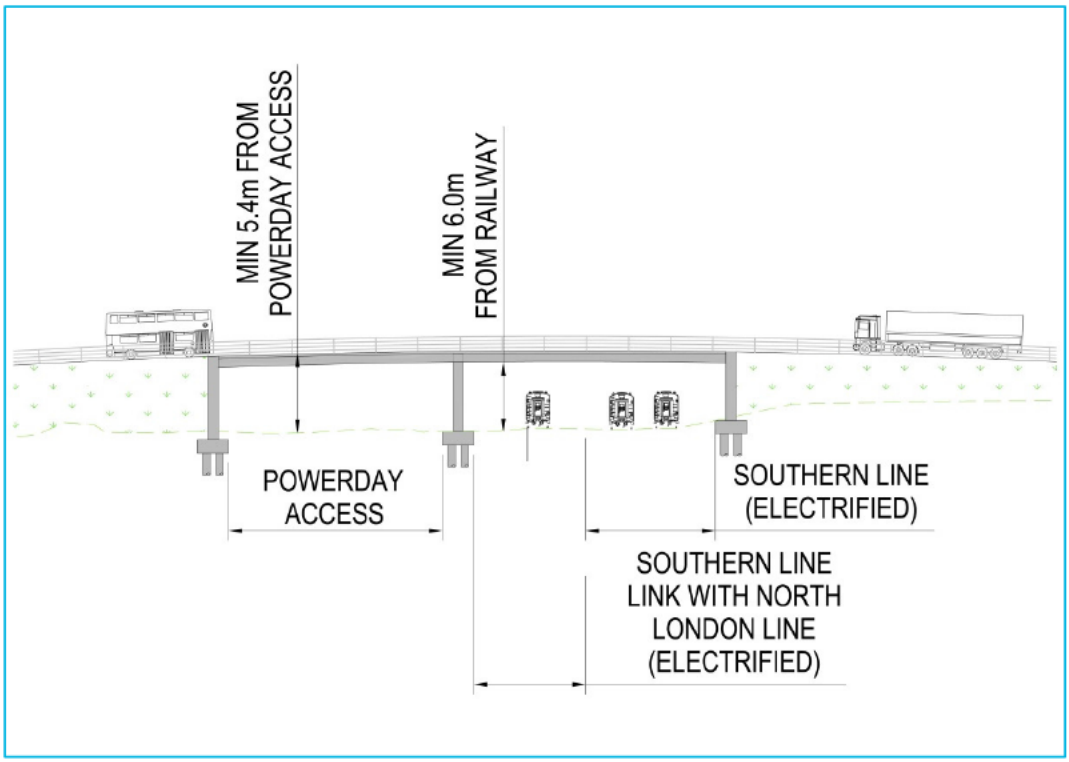

Figure 5: Laundry Bridge

2.47 The bridge is assumed to have two spans assuming that an intermediate pier is located between the Powerday access road and the railway. This arrangement would provide approximate span lengths of 30m over the Powerday access road and 42m over the railway.

2.48 The superstructure for this bridge is expected to comprise four pairs of braced steel girders acting compositely with a reinforced concrete deck. The substructure will comprise an intermediate solid leaf pier and bank seat abutments. The intermediate leaf pier is supported on a 29m x 7.2m x 1.5m pile cap with three rows of 11No. 20m long x 900mm diameter piles. The bank seat abutments are supported on a reinforced earth retaining wall, with a 29m x 7.2m x 1.5m settlement control slab with three rows of 11No. 15m long x 900mm diameter piles.

2.49 Approach works to west of bridge comprise a 20m wide by 135m long ramp supported by reinforced earth retaining walls on either side. The height of the retaining walls on the western side of the structure is likely to vary from 8.5m to 1.0m, assuming that the base of retaining walls is constructed at existing ground level.

2.50 The construction costs for Laundry Bridge have been estimated at £12,821,062.

Old Oak Bridge (Ref S09)

2.51 Old Oak Bridge will provide a key connection across the Grand Union Canal and Crossrail Depot from Old Oak North into the HS2 Old Oak Common Station as shown on Figure 6.

2.52 The horizontal alignment of the Old Oak Bridge is designed to align with the western end of the HS2 station box. The bridge is also proposed to have a minimum width of 23m in order to accommodate all modes of transport and to provide sufficient capacity to accommodate the high pedestrian and cycle flows that are anticipated at this location.

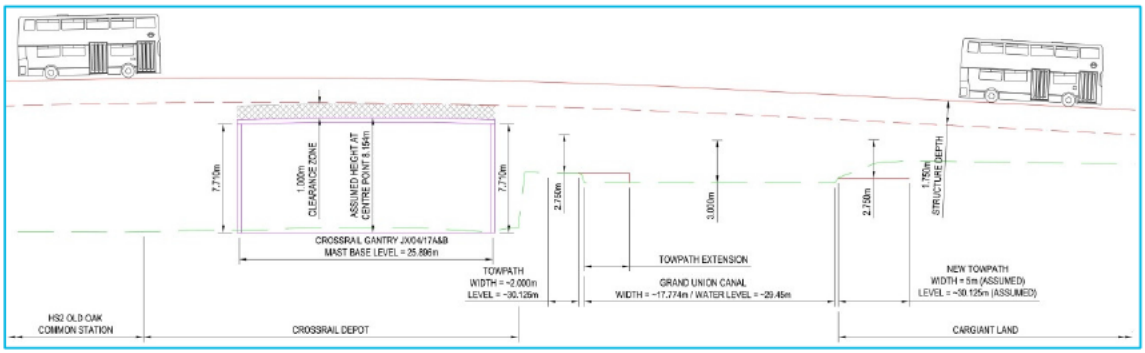

Figure 6: Old Oak Bridge

2.53 The bridge is assumed to span from the north side of the Grand Union Canal to the northern side of the HS2 Station Box with an intermediate pier within the Grand Union Canal southern towpath. The two spans of the bridge are 30m and 35m, over the Grand Union Canal and the Crossrail Depot respectively. The superstructure is expected to comprise four pairs of braced steel girders acting compositely with a reinforced concrete deck. The substructure is considered to comprise of intermediate and southern column pier and a northern bankseat abutment. The intermediate column pier is supported on a pilecap 21.0m x 4.8m x 1.5m with three rows of 12No. 20m long x 600mm diameter piles. The southern column pier is supported on a pilecap 26.4m x 8.4m x 1.5m with three rows of 9No. 20m long x 1200mm diameter piles. The northern bankseat is supported on a reinforced earth retaining wall with a settlement control slab 20.4m x 8.4m x 1.5m with three rows of 7No. 20m long x 1200mm diameter piles.

2.54 A 230m long by 5.3m wide elevated pedestrian link connects Old Oak Bridge to the HS2 Station Concourse. This is assumed to consist of steel box girder construction supported upon steel or concrete columns every 13.5m. The concept design for this link is currently being undertaken by WSP as part of their design contract with HS2.

2.55 Approach works to the north of Old Oak Bridge comprise a 27m wide by 118m long ramp supported by reinforced earth retaining walls on either side. The height of the retaining walls varies from 7m to 1m, assuming the base of the retaining walls is constructed at existing ground level.

2.56 Approach works to the west of Old Oak Bridge comprise a concrete viaduct adjacent to the bridge transitioning into reinforced earth retaining walls. The concrete viaduct is approximately 100m long broken into 12.5m spans with precast T-beams supported upon reinforced concrete portal abutments. The portal abutments are located partly upon the HS2 Station Box, with the portal abutment leg located adjacent to the HS2 Station Box supported on a pilecap 3.0m x 3.0m x 1.5m with 4No. 12m long x 600mm diameter piles. The reinforced earth retaining walls support a cross section 13.8m wide by approximately 130m long.

2.57 The costs detailed within this cost report do not include for the Elevated Pedestrian Link which will connect the Old Oak Bridge with the concourse level of the HS2 Old Oak Common station. This link, which will cater for both pedestrians and cyclists, is currently being developed by WSP under their RIBA 3 appointment to design the station.

2.58 The construction costs for Old Oak Bridge have been estimated at £10,015,294.

Harlesden Bridge (Ref S07)

2.59 Harlesden Bridge will provide a non-motorised user route from Old Oak North to Willesden Junction Station as part of a north south route through the Old Oak development area, as shown on Figure 7.

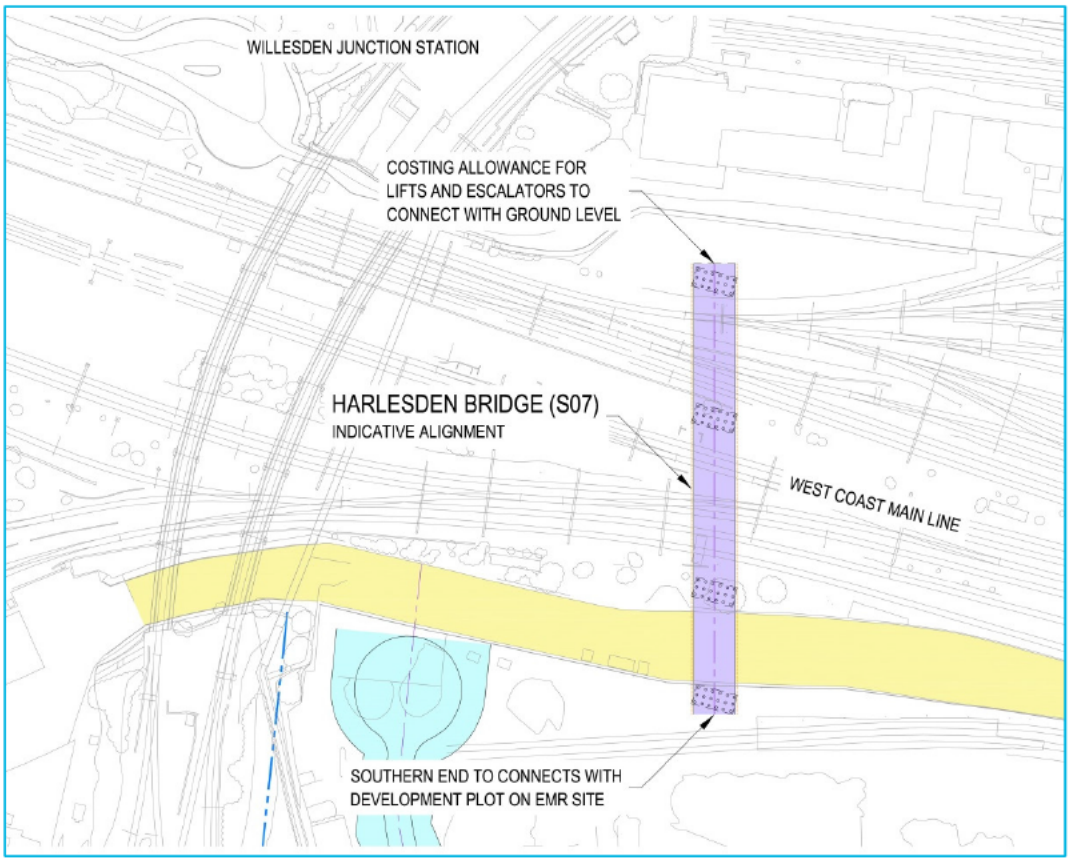

Figure 7: Harlesden Bridge

2.60 The bridge is proposed to have a width of 12m in order to accommodate pedestrians and cyclists. The total length of the structure is estimated to be 140m to allow it to span across the West Coast Mainlines, Southern Lines, the Powerday Access Track and the London Overground Rail Operations Limited Depot Access Road. The bridge is assumed to have four spans assuming intermediate piers can be constructed between tracks with an offset of at least 4.5m from the nearest rail. Third party approval will be required to gain consent for the intermediate piers to be installed in these locations.

2.61 The superstructure of the bridge is anticipated to be of streel truss construction with 4m high warren trusses along each edge of the bridge. The substructure is assumed to be reinforced concrete piers supported by a pilecap 16m x 4.8m x 1.5m with two rows of 8No. 20m long x 900mm diameter piles.

2.62 The southern end of the bridge will land within the Belvedere area within the EMR site, which will incorporate a level change to the adjacent section of Park Road. This minimises the approach ramp required on the southern side of the bridge.

2.63 The landing philosophy for the northern end of the bridge is not currently determined however, an allowance for a 100m long, 12m wide steel ramp structure has been included.

2.64 The construction costs for the Harlesden Bridge have been estimated at £15,179,806.

Green Bridge (Ref S10)

2.65 The Green Bridge will provide a non-motorised user route from Old Oak North to Wormwood Scrubs as part of a north south route through the Old Oak development area. The bridge will connect the southeast corner of the Old Oak Bridge to Wormwood Scrubs as shown on Figure 8.

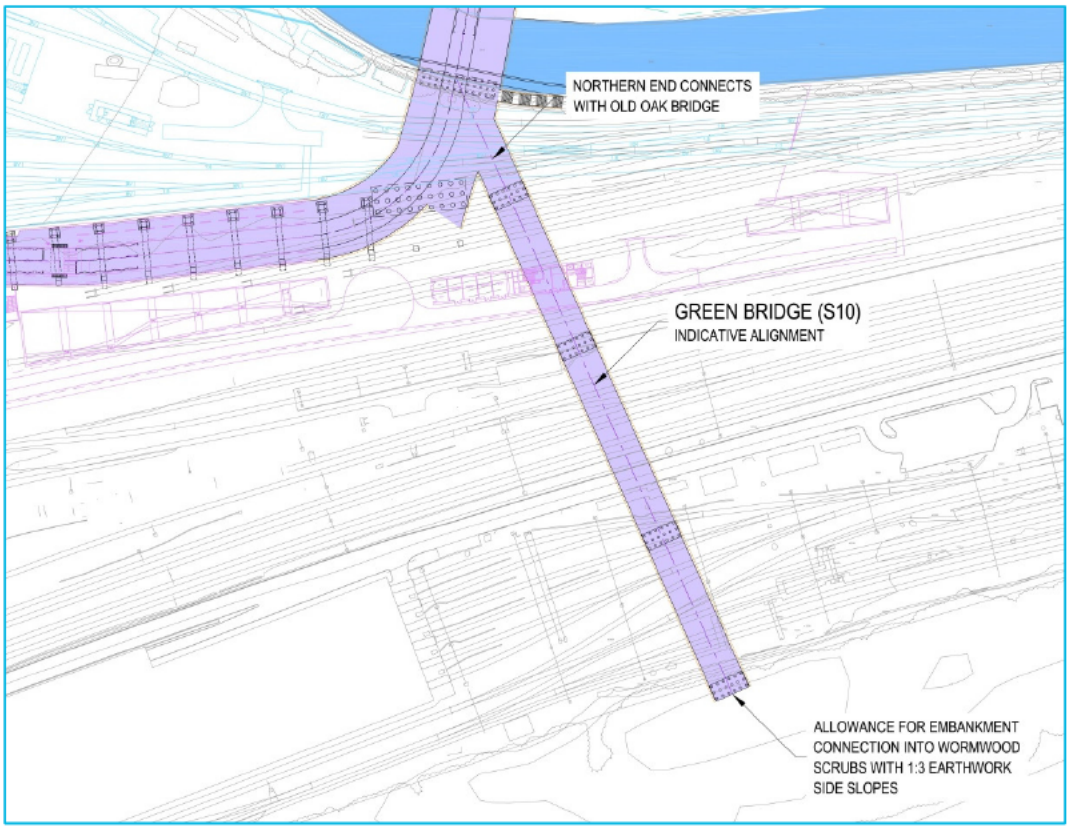

Figure 8: Green Bridge

2.66 The bridge is proposed to have a width of 12m in order to accommodate pedestrians and cyclists. The total width of the structure is proposed to be 155m to allow it to span across the HS2 Station Box, the Great Western Main Line and Network Rail operational sidings. The bridge is assumed to have three spans of approximately 50m, assuming intermediate piers are constructed between the redesigned Great Western Main Lines. Third party approval will be required to gain consent for the intermediate piers to be installed in these locations.

2.67 A significant level difference will exist at the southern end of the structure and it will therefore be necessary to construct an extensive landform within Wormwood Scrubs that incorporates ramps to enable cyclists and pedestrians to gain access to the bridge. An allowance has been included in the current construction cost estimate for the provision of a 300m long, 12m wide landform with a maximum height of 15m and 1:3 slide slopes.

2.68 The superstructure for this bridge is considered to consist of a central warren truss 4.5m high with both edge parapets formed from 2.1m deep plate girders. The substructure is considered to consist of a reinforced concrete hammerhead pier supported by a 10.0m x 4.8m x 1.5m with three rows of 6No. 20m x long 600mm diameter piles.

2.69 The construction costs for the Green Bridge have been estimated at £16,409,583.

Canal Bridge (Ref: N/A)

2.70 The Canal Bridge crosses the Grand Union Canal to provide a connection between two areas of parkland to the north and south of the canals shown in Figure 9.

2.71 The bridge is anticipated to comprise a single 35m long span, 6m wide with a 40m long elevated viaduct on the north side of the canal tying into a 30m long approach ramp. The superstructure is assumed to be of warren truss constructed with 4m high steel trusses on both sides of the bridge, supported on reinforced concrete abutments.

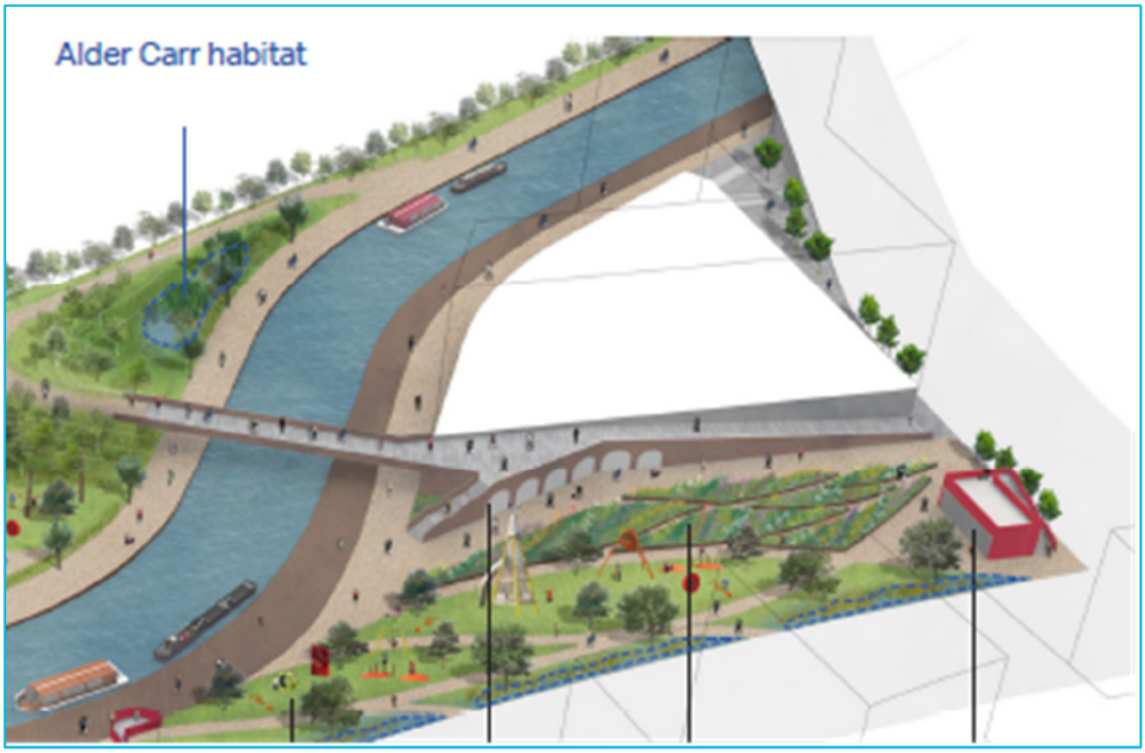

Figure 9: Canal Bridge

2.72 The construction costs for the Canal Bridge have been estimated at £7,610,008.

Powerday Underpass

2.73 An allowance to construct an underpass between the Cargiant West (Plot 15) site and Powerday beneath the North London Line embankment has been included. At this time, no design work has been undertaken on this underpass and therefore the construction cost estimate of £15,113,871 has been taken from the Park Road Underpass.

2.74 The anticipated delivery timeframe for the Powerday site and this structure is post 2050 and therefore falls outside the 15 year business case window. We have allowed no commuted sums for this structure.

Hythe Road Underpass Improvements (Ref S05)

2.75 The existing Hythe Road Underpass to the west of the A219 Scrubs Lane currently provides the only vehicular access into the Old Oak North site. This access includes a gradient of approximately 10% off the A219 Scrubs Lane and has a signed headroom restriction of 4.7m (15'6"). In addition, the provision for non-motorised users is considered poor due to both a narrow pedestrian tunnel running to the north of the underpass and a non DDA compliant gradient from the A219 Scrubs Lane to the tunnel.

Figure 10: Existing Vehicle Underpass at Hythe Road (looking east)

2.76 An initial assessment has been undertaken to verify whether the level of the carriageway on Hythe Road can be reduced to either provide compliant headroom beneath the existing EMR/Powerday access track and rail line bridges, or reduce the current sag curve to enable a more relaxed carriageway vertical profile. In terms of reducing the levels to provide compliant headroom, this has been discounted due to the impact this would have on the already steep gradient off the A219 Scrubs Lane into the underpass.

2.77 The assessment has also considered whether the width of the existing pedestrian underpass to the north can be increased, however there are a number of existing utilities located behind the side walls of the pedestrian tunnel to make this approach un-desirable.

2.78 A financial allowance of £6,633,274 has been included within the cost plan for some intervention/improvement works to be undertaken at this location.

Hythe Road Viaduct & Station Enabling Works

2.79 The masterplan includes proposals for a new viaduct to be constructed to enable the West London Line to be horizontally and vertically realigned, to improve connectivity below the railway. The new Hythe Road Overground Station is also proposed to be constructed in this location.

2.80 In February 2018 TfL carried out a high-level costing exercise of the viaduct and station. This exercise estimated that to deliver a two-track viaduct that could support a future station would cost £143M. This estimate was based on providing a viaduct design sufficient to support construction of the station at a later date on -pre-installed foundations.

2.81 The estimated costs were supplied by TfL in an email provided to OPDC on 21 February 2018. No supporting information on how the costs were developed was included. A full copy of the email from TfL can be found in Appendix C. At this time, we have made no allowance for commuted sums relating to the Hythe Road Viaduct & Enabling works.

Willesden Junction Station Improvements

2.82 Improvement works to the existing Willesden Junction Station are required to enable development in Old Oak North.

2.83 The £15,700,000 initial cost for delivering the Willesden Junction Station Improvements is taken from costing work undertaken by Atkins / WestonWilliams+Parners as part of their GRIP 2 study. The costing was supplied to AECOM in September 2017 and quotes the station works for the Dual option at £15.7M. A copy of this costing work is included in Appendix A.

2.84 This estimate of £15.7M has been increased to £16,031,113 to allow for inflation.

2.85 The scope of this work to be undertaken as part of the station improvements is currently undefined and therefore no allowance for any commuted sums has been included.

Retaining Walls to Support Rail Line Embankments

2.86 Two retaining walls to support existing rail line embankments have been included within the cost plan.

2.87 The first of these retaining walls is located to the rear (western edge) of the Cargiant Plot 15, supporting the North London Line embankment. This retaining wall allows for the area of Plot 15 to be increased for redevelopment. The cost for installing this infrastructure is based on a reinforced in-situ concrete retaining wall being constructed at this location.

2.88 The second of these retaining walls is located to the western edge of the EMR site, supporting the West London Line embankment. This retaining wall allows for the development area on the EMR site to be increased. The cost for installing this infrastructure is based on a reinforced in-situ concrete retaining wall being constructed at this location.

2.89 As noted in Section 2.39, as part of the non-preclusion of the 44m Crossrail Depot extension, a retaining wall will be required beneath the proposed Park Bridge, separating the Crossrail land from the Oaklands North land due to the difference in level between the two sites. We have included an allowance for construction of a reinforced in-situ concrete retaining wall in this location.

2.90 The construction costs for these retaining walls have been estimated at £6,809,863.

Commuted Sums

Bridges & Underpasses

2.91 In order to estimate the value of commuted sums that are likely to be requested by the adopting authority for the new bridge and underpass structures that will be constructed in the Old Oak North site we have used the following assumptions:

- Bridges priced at £750,000 per structure.
- Underpasses priced at £300,000 per structure.

2.92 There are six bridges and one underpass within the current Masterplan giving an estimated commuted sum of £4.8M.

2.93 We have not made any allowance for commuted sums for the retaining walls to support the existing rail line embankments.

Highways

2.94 In order to estimate the value of commuted sums that are likely to be requested by the adopting authority for the new highways infrastructure constructed within the Old Oak North site we have used the following assumptions:

- Blacktop carriageway priced at £509m² for a 60 year design life.

- Blacktop footway priced at £325m². This sum is also used for the cycle and verge/SuDs provision for a 60 year design life.
- Lighting columns priced at £7,230 per column for a 60 year design life.
- Signal controlled junctions priced at £432,000 for a 60 year design life.
- Highway retaining walls priced at £100 linear meter.

2.95 There is approximately 15,368m² of primary street carriageway which at £509m² will attract a commuted sum of £7,822,312.

2.96 There is approximately 29,774m² of primary street footway corridor (for NMU and verge/SuDS provision) which at £325m² will attract a commuted sum of £9,676,550.

2.97 The primary street network is approximately 2,120m in length. A street lighting column every 30m at £7,230 per column has been allowed for, attracting a commuted sum of £510,920.

2.98 The current assumption is that five new signal controlled junctions will be delivered as part of the Old Oak North development (2No. on A219 Scrubs Lane and 3No. in Old Oak North). A commuted sum of £432,000 for each junction has been allowed for giving a total commuted sum of £2,160,000.

2.99 There is approximately 981 linear meters of highway retaining walls on the primary street network which at £100 linear meter will attract a commuted sum of £98,100.

2.100 There is approximately 3,372m² of maintenance footways along the front faces of the highway retaining walls which at £325m² will attract a commuted sum of £1,095,900.

2.101 The adopted highways infrastructure commuted sums allowed for equates to a total of £21,363,782.

2.102 We have rounded up the total in the cost spreadsheet within Appendix A to **£35,000,000**. This is to take account of additional elements that may attached a commuted sum that we cannot yet estimate, such as traffic signs, pedestrian crossings, trees, landscaping, enhanced SuDS solutions, safety features etc or the Secondary Street network being placed up for adoption.

Site Wide Earthworks (Cut / Fill)

2.103 We have undertaken an initial cut/fill analysis of the Old Oak North development sites based on finished floor levels provided by the Masterplanning Team in their March Iteration of Option 6. The sites have a net cut requirement of 459,374m³. Previous estimation work has assumed a 90/10 split between uncontaminated and contaminated material to be disposed, giving a cost of £29,859,250.

2.104 This net cut requirement for the plots is then added to the cut/fill requirement for the site roads and park (February Option 6), giving a net cut requirement of 526,439m³. Using the 90/10 split gives a cost estimate of £34,218,550.

2.105 To enable a cost estimate to be derived, we have allowed for the cost of material to be taken off site to be £50m³ for inert/non-hazardous material and £200m³ for hazardous material. We have assumed these costs take material bulking into account and that transportation is by road.

2.106 Based upon the above assumptions, we have estimated a construction cost estimate of £34,218,550 for the site wide earthworks.

Site Clearance, Demolition and Decontamination for Park Road

2.107 The cost for carrying out site clearance of the area for the Park Road, including demolition and decontamination has been estimated at £350m². This cost estimate is consistent with that used for the same activities for the individual development plots.

2.108 As the area of Park Road is approximately 17,000m² based on an 850m long highway corridor, 20m wide, this provides a construction cost estimate of £5,950,000 for site clearance activities.

3. Decentralised Energy

Overview

3.1 This section summarises the proposed decentralised energy strategy (including the decentralised energy network and supporting energy centres) for the purposes of defining costs to be included in the Old Oak Business Case.

3.2 AECOM's Stage 3 Infrastructure report (March 2018) set out the anticipated decentralised energy strategy for the scheme. In line with current and anticipated London Plan policy and the draft Regulation 19 Local Plan policy, the report set out the intention to deliver a district energy network served by a number of low carbon heat sources. The anticipated geographical spread of development for the first 15 years dictates that two separate energy centres are required to serve the development- an Eastern Energy Centre serving development along Scrubs Lane, and a Western Energy Centre serving Old Oak North and the Oaklands site, via the proposed Park Bridge. These could later be interconnected for further resilience and operational flexibility, subject to delivery of Laundry Bridge.

3.3 The Stage 3 report identified four key opportunities for low carbon heat sources for further investigation. These included a potential Energy from Waste facility, sewer heat recovery, canal heat extraction and aquifer heat extraction via open-loop boreholes. It was recommended that, in order to safeguard flexibility and resilience in the strategy, the network and energy centres should be designed with the ability to access all of these sources. However, it was recommended that a district heat network be proposed with sewer heat recovery as the prime and preferred heat source in the Western Energy Centre, and aquifer heat extraction in the Eastern Energy Centre.

3.4 The recent Stage 4 report further developed the proposed strategy. This included continued engagement with both Thames Water and potential sewer heat recovery technology providers to assess the technical feasibility, commercial viability and deliverability of heat recovery from local sewer assets. Feedback from energy service providers confirmed that there was market interest in adopting, owning, operating and managing district heating networks in the London area and that potential energy services providers would be interested in engaging with the competitive procurement of a district heat network in Old Oak North.

Heat Loads and Proposed Strategy

3.5 To ensure an economic approach to plant provision, a phased plant installation strategy is proposed and summarised in Table 3. Note that the capacity shown is cumulative capacity. The capacity schedule is based on the V4.0 Trajectory (received from OPDC on 17 April 2018). Phasing of the plant installation will be subject to the trajectory of development build-out.

Table 3: Energy centre plant schedule

Plant	Unit	Capacity				
		2022	2024	2026	2033 *	2037 †
Western Energy Centre						
Gas boilers	MW	6	6	10	18	20
Sewer heat recovery heat pumps	MW	3	3	3	3	3
Thermal storage	m^3	150	150	150	150	150
Eastern Energy Centre						
Gas boilers	MW	-	4	4	4	4
Borehole heat extraction	MW	-	0.8	0.8	0.8	0.8
Thermal storage	m^3	-	50	50	50	50

* Year 15

† Note that, as per the V4.0 Trajectory, full development build-out is not achieved until 2037

Proposed Costs

3.6 Phased costs have been developed for the proposed district heat scheme. See Table 4 below. A full breakdown of the costs is provided in Section 4.2 of AECOM's Old Oak Decentralised Energy Stage 4 Report[1].

Table 4: Phased capital construction costs for energy centres and networks

CAPEX, £,000s	HIF Period	Post-HIF Period	Total
Western Energy Centre			
Energy Centre construction	5,895	0	5,895
Energy Centre fitout	4,316	2,297	6,613
Heat Network	2,164	2,329	4,493
Western Energy Centre Sub-total	12,374	4,627	17,001
Eastern Energy Centre			
Energy Centre construction	0	1,302	1,302
Energy Centre fitout	0	2,493	2,493
Heat Network	0	829	829
Eastern Energy Centre Sub-total	**0**	**4,624**	**4,624**
Total Site Wide	**12,374**	**9,251**	**21,625**

3.7 The above costs have been developed on the basis of the following assumptions and exclusions:

- Costs include:
  - Energy centre construction which is assumed to be integrated into the building design for a development plot.
  - Energy centre fitout, including boilers, heat pumps, thermal stores, ventilation systems, circulation pumps, lighting, security systems, controls
  - Flues
  - Gas mains connections within the energy centres (other gas mains costs, e.g. for routing and upgrades to gas networks, are discussed in more detail in Section 5 of this report)
  - Water treatment, pressurisation and expansion tanks
  - Controls and BMS
  - Energy centre electrical auxiliaries
  - Primary district heating distribution network
  - Heat substation on edge of each development plot
- In addition to the general exclusions, these costs exclude:
  - Secondary side pipework
  - Tertiary side pipework, distribution and services

3.8 Costs quoted are the anticipated direct construction costs derived from an analysis of schemes of a similar type, size and complexity; generally speaking, costs have been built up by AECOM based on benchmark rates applied to the anticipated plant capacities, network lengths or energy centre space requirements. Costs for the more novel equipment associated with sewer heat recovery have been developed based on capital cost estimates provided by sewer heat recovery technology provider Sharc Energy Systems.

[1] Old Oak Decentralised Energy Stage 4 Report. 17th August 2018

Energy Centre Requirements

3.9 The proposed energy centre locations identified below are shown in red in drawing OOC-ACM-UTL-XX-SK-UT-05005, shown in Appendix D.

3.10 The Western Energy Centre would be developed first, in order to serve early phase development in the Western Wedge development area. Provision of space for the Eastern Energy Centre will be safeguarded in the masterplan, in order to ensure Eastern Wedge development along Scrubs Lane can be served by local energy resources. The two energy centres will be connected via district heating pipework once the new enabling highway and bridge infrastructure is in place.

3.11 The Western Energy Centre will be much larger, in order to respond to the larger loads expected in the Western Wedge. The peak demand at the Western Energy Centre is expected to be c.17.4 MW at full build out. C.20 MW of boiler plant will be provided (including backup boiler capacity).

3.12 The Eastern Energy Centre will be smaller due to the smaller scale of development planned in this area. The peak demand at the Eastern Energy Centre is expected to be c.2.7 MW at full build out. C.4 MW of boiler plant will be provided (including backup boiler capacity).

3.13 AECOM recommends two low carbon technologies to support the Business Case: sewer heat recovery (as the preferred heat source in the Western Energy Centre in Plot 15a); and aquifer heat extraction (in the Eastern Energy Centre located on Scrubs Lane). Careful sizing of low carbon plant capacities, and the use of appropriately-sized thermal storage, means the majority of the annual heat requirement can be served by low-carbon technologies. The Western Energy Centre has been located and will be designed to also have the ability to source heat from the canal or from an aquifer borehole, should it not prove possible to bring forward sewer heat recovery.

Western Energy Centre

3.14 An energy centre will be required to provide thermal services to the development planned in Old Oak North. Should the Park Bridge be provided early, this energy centre should also serve the Early Activation phase of development in Oaklands.

3.15 This energy centre is proposed to be located in Plot 15a of Old Oak North, and would require;

- up to 2,500 m2 of floor area for the energy centre, including some double height space for c.6 m height storage vessels. Access to the energy centre at Ground level.
- vehicular access for plant delivery/replacement.
- flue release at high level (preferably at the top of a tall building), since gas boilers will be required for standby and peaking generation
- power services to operate the energy centre (including heat pumps, network distribution pumps, ventilation, security features, control systems, lighting, etc.)
- either medium pressure gas mains services to operate gas boiler plant (expected to be the primary backup/peaking plant), or low pressure gas mains services with onsite gas booster units to serve gas boiler plant
- reserve ancillary space for access to the canal and for canal heat extraction infrastructure installation
- reserve ancillary space for aquifer borehole access and plant maintenance; and,
- reserve ancillary space for access to the sewer and for sewer heat recovery infrastructure installation. This includes separation tanks that are fed under gravity from the sewer main. These tanks therefore need to be at a lower level than the sewer main.

Eastern Energy Centre

3.16 An energy centre will be required to provide thermal services to the Early Activation development planned in Scrubs Lane and Willesden Junction, and later Phase 1 and Phase 2 development in Scrubs Lane.

3.17 This energy centre would require;

- up to 1,000 m2 of floor area for the energy centre, including some double height space for c.6 m height storage vessels. Access to the energy centre at Ground level.
- vehicular access for plant delivery/replacement.
- flue release at high level (preferably at the top of a tall building), since gas boilers will be required for standby and peaking generation
- power services to operate the energy centre (including heat pumps, network distribution pumps, ventilation, security features, control systems, lighting, etc.)
- medium pressure gas mains services to operate gas boiler plant (expected to be the primary backup/peaking plant), or low pressure gas mains services with onsite gas booster units to serve gas boiler plant; and
- require ancillary space for aquifer borehole access and plant maintenance

Network Routing

3.18 Energy will be distributed to customer buildings via a network of Primary district heating pipework carrying hot water. Two parallel pipes will be provided as part of the Primary network:

- 'Flow' pipework, operating at 70℃ (which flows 'away' from the energy centres)
- 'Return' pipework, operating at 40℃ (which returns 'back' to the energy centres)

3.19 The proposed Primary network route is shown in Appendix D. The proposed route will utilise Park Road as the main axis for the strategic heat network. This will allow the network to utilise key new structures, including Park Bridge, Park Road Underpass and Laundry Bridge to cross the site's major physical barriers. Table 5 summarises the expected capacity requirements that should be safeguarded in the key structures proposed around the site. Further penetration of the site will utilise roads including Scrubs Lane, Hythe Road and Old Oak Street in order to route the network to customer plots and buildings.

Table 5: Pipework capacity in key structures

Structure	Pipework capacity, MW	Pipe internal diameter, mm	Pre-insulated pipe outer diameter (Series 2 insulation), mm
Park Bridge	2.6	125	250
Park Road Underpass	18.6	300	500
Laundry Bridge	3.5	150	280

3.20 Phasing of the network will be subject to the trajectory of development build-out. The current V4.0 Trajectory has been used to outline the route shown in Appendix D. The initial phase of the network (to be funded by HIF monies) will be along Park Road, as this will be delivered as part of the Western Wedge phase of development. Connections to Oaklands to the south of the canal will also be delivered as part of the HIF phase of the Primary network delivery.

4. Electrical Power

Overview

4.1 This section summarises the electricity strategy (including the distribution network and supporting substations) for the purposes of defining costs to be included in the Old Oak Business Case.

4.2 The current strategy is based on the development trajectory set out in Masterplan Option 6, March 2018 for Old Oak North. The proposed strategy recommends the construction of a new 11kV switching station, provisionally designated as Old Oak North substation, supplied from the new Atlas Road Substation. All plots, except those designated as early activation sites, will be supplied with electricity from Old Oak North Substation through 11kV ring circuits.

Load Forecast

Basis for Load Forecast

Commercial Space

4.3 Commercial space (which includes retail, hospitality, offices, light industry, hotels, schools, community centre, GP surgery, nursery, cinema, leisure and SG_CHP) in this load forecast uses 85W per sqm of commercial gross internal area.

Residential Units

4.4 The load forecast for residential units (which includes C3_Residential ancillary, C3_Residential_Car Park andC3_Residential_Circulation) is based on an after diversity maximum demand (ADMD) of 2.1kVA per residential unit.

Energy/District Heating

4.5 The electric load forecast for the energy/district heating scheme is as provided by the AECOM Energy team in an email received on 05-04-18.

4.6 The estimated electrical loads are as follows:

Table 6: Energy / District Heating Electrical Load Forecasts

MW Power	2018	2022	2026	2033	2048
East Energy Centre	0	0.6	0.7	0.8	1.0
West Energy Centre	0	2.6	2.8	3.2	3.5

Electric Vehicle Charging

4.7 For electric vehicle (EV) charging, two categories of EV charging have been assumed:

- Residential charging facilities: It has been assumed that all residential parking spaces are equipped with 7kW charging facilities. It is further assumed that 20% of residential units will have parking spaces. In addition, it has been assumed that of the residential parking spaces available 5% will be visitors' spaces which will be equipped with medium rate chargers, rated at 25kW each. Based on these assumptions the forecast maximum demand for residential EV charging has been estimated as being circa. 4MW. It considered that this load can be accommodated within the 2.1kVA demand for each residential unit; since various Smart Grid or demand management techniques could be used to limit and/or reschedule the charging to limit the maximum demand.
- Non-residential charging facilities: Non-residential charging facilities are assumed to include charging points at bus stands, taxi stands, on-street parking and any other facilities for users such as private hire vehicles, delivery vans, etc. An assessment has been made of the likely electrical demand arising for non-residential EV charging, as set out in a separate report. This found that the estimated load is c. 1MW which it is considered can be accommodated within the demand forecast for non-residential property.

Electrical Demand Forecast

4.8 The Masterplan Option 6 proposes that approx. 7,500 residential units and approx. 105,000m2 of commercial property be developed over the period from 2022 – 2037. This excludes the 'Early Activation' sites which are being brought forward for development earlier than 2022 with some already in development.

4.9 The estimated electrical demand for the development of Old Oak North as set out in Masterplan Option 6 is 29MW. This figure includes provision for the electrical supplies necessary for the energy centres and electric vehicle charging associated with residential properties.

Electrical Demand Development Profile

4.10 This section considers the timing of the load development at the Old Oak North substation.

4.11 The electrical load for a property is committed at the time the connection offer for that property is accepted. This will typically be before the start of construction and therefore for the purpose of the profile it has been assumed that the forecast demand will occur at the start of construction. This results in the cumulative load profile shown in Figure 11.

4.12 However, in practice the full demand will not be realised for each individual development until the end of construction. Figure 12 below shows the forecast development of electrical demand over time for the Old Oak North development in the two instances:

- The blue line shows the forecast demand for Old Oak North on the assumption that the full demand is required at the start of construction
- The green grey line shows the demand if power is only required at the forecast completion of construction

4.13 In reality, the demand will build up somewhere between these two graphs since some of the plots will be a phased development, with load building up during the construction period as occupancy units are completed and handed over.

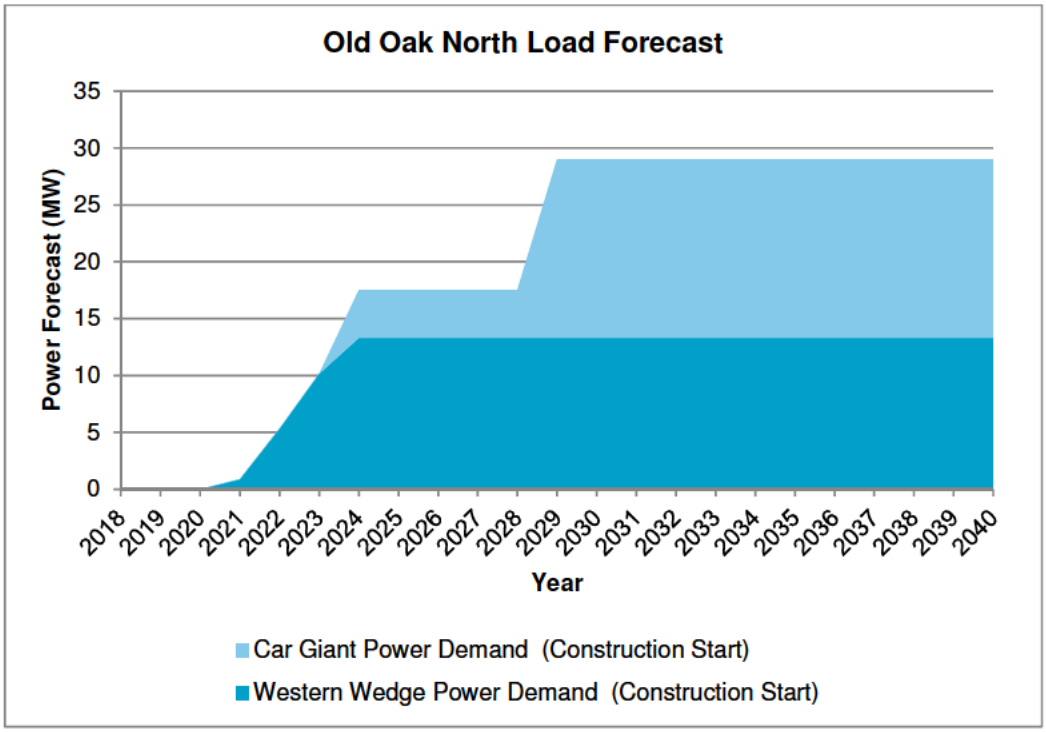

Figure 11: Old Oak North Electrical Demand Profile by Area

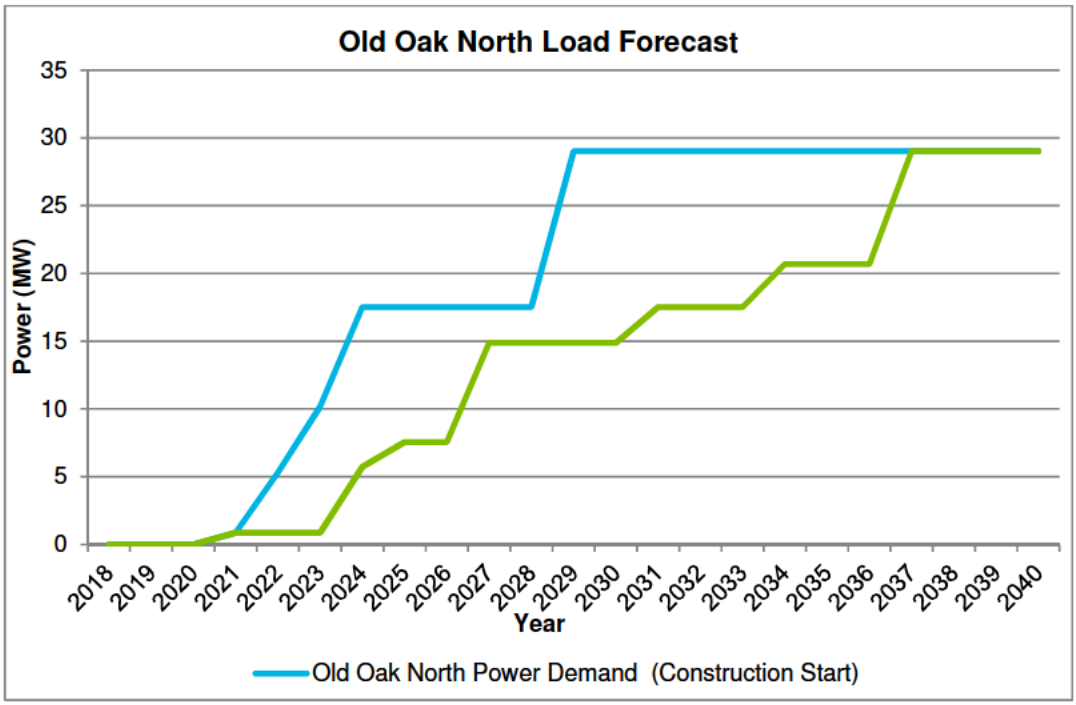

Figure 12: Old Oak North Electrical Demand Profile - Construction Start vs Construction End

Electrical Infrastructure Strategy

4.14 The following outlines the preferred strategy for providing electrical power to the Old Oak North development area:

4.14.1 Early activation sites on the eastern and western edges of the development coming forward for development in 2018-2021 are to source electricity supplies directly from UKPN or SSE (ahead of construction of Old Oak North Substation).

4.14.2 A Connection Offer has been received from UKPN for a 15MW supply at Atlas Road to supply Old Oak North.

4.14.3 An agreement is to be negotiated with HS2 to secure an additional capacity at Atlas Road that will not be used by HS2. It has been assumed that there is likely to be adequate capacity at Atlas Road to supply Old Oak North, the HS2 operational railway infrastructure and associated development in Old Oak South.

4.14.4 A formal procurement process will be run to select a DNO/IDNO to own and operate the electrical infrastructure for the Old Oak North development.

4.14.5 As there is sufficient capacity at Atlas Road, there is no requirement for a further Primary Substation to serve Old Oak North. Therefore, it will only be necessary to establish an 11kV switching station within the Old Oak North Development, designated as Old Oak North Substation. This is required to limit the number of cables that have to cross on either the existing bridge or the proposed new Park Road Bridge.

4.14.6 An 11kV distribution infrastructure will be provided to serve the Old Oak North development, with an 11kV supply provided to each plot.

4.14.7 11kV distribution infrastructure is to be arranged on ring circuits, installed in pre-installed ducts in roads, pavements and other public spaces as appropriate.

4.14.8 All infrastructure is to be designed to an adoptable standard; currently this is assumed to be the UKPN standards.

4.14.9 Low voltage supplies to public space facilities, such as street lighting, signage, communications services etc. are to be provided from on-plot substations.

4.14.10 Infrastructure is to be designed to accommodate future SMART network technologies through the telecommunications infrastructure.

Old Oak North Substation

4.15 The Old Oak North Substation (OON Substation) is to be the primary point of supply for the Old Oak North development area.

4.15.1 OON Substation will be an 11kV switching station supplied from the UKPN HS2 Atlas Road Substation. This supply will have an initial capacity of 15MVA, which it is planned will be increased by a further 14MVA to be negotiated with HS2 to utilise spare capacity which is not expected to be taken up by HS2.

4.15.2 The substation is currently planned to be located on Plot 15-00-BX located to the west of Park Road.

4.15.3 OON Substation is to be designed to the UKPN standards. Since it is only a switchroom, it is possible for the substation to be built over but it must still have good road transport links to allow access for maintenance and equipment delivery and have sufficient access for all incoming and outgoing cables.

Electrical Distribution

4.16 The concept design provides for an 11kV distribution infrastructure to serve the Old Oak North development, with an 11kV supply provided to each plot. The key requirements for the 11kV distribution are:

- 11kV distribution infrastructure to be arranged on ring circuits, installed in pre-installed ducts in roads, pavements and other public spaces as appropriate.
- The rings have been identified so as to generally align with the development trajectory. The rings serving the main Car Giant area have been kept separate from the rings serving the Western Wedge and other development plots.

4.17 The following drawing showing this concept design arrangement can be found in Appendix D.

- OOC-ACM-UTL-XX-SK-UT-05008 P01 - Western Wedge 11kV Infrastructure

Electric Vehicle Charging Infrastructure

4.18 A separate study has been carried out into the potential impact of the change to electric vehicles and the associated battery charging infrastructure. In summary the findings of this study can be summarised as:

- The total forecast demand for both residential and non-residential EV charging for the OON development will be c. 5MW.
- This demand can be accommodated within the current load forecast for the development of 29MW and additional dedicated infrastructure does not need to be provided to service EV charging. This can be achieved by the implementation of various load management techniques including smart charging and smart grids, energy storage and V2G technologies and potentially time of use tariffs.
- The current market model suggests that EV charging facilities are provided by suppliers who typically build, finance, own and operate the facilities. There is no need for forward investment by OPDC to accommodate this.

Estimated Costs

4.19 The costs of each of the main infrastructure items have been estimated and recorded in Table 7.

Table 7: Phased capital costs for electrical infrastructure

Item	Cost Period	Capital Cost, 2018 £,000s
UKPN Connection Fee (15MVA) at Atlas Rd	2018-2019	2,300
HS2 - Settlement Fee for additional 10MVA capacity	2018-2019	4,000
11kV Cable Circuits – Atlas Rd – OON S/S	2021	1,325
Old Oak North Substation Building	2020	300
OON S/S Fit -out	2021	600
DISTRIBUTION NETWORK		
Ducting in Road - Western Wedge	2020-2021	600
11kV cables - Western Wedge	2021	900
Ducting in Road - Car Giant	2023 - ONGOING	800
11kV cables - Car Giant	2023 - ONGOING	1200

4.20 The following should be noted in respect of the above estimates:

- A Connection Offer for a 15MVA supply at Atlas Road has been received from UKPN. OPDC may need to come to a commercial arrangement with HS2 at some time in the future as part of shared capacity negotiations. Budget provision has been included for this reason and includes a share of the Connection Fee paid by HS2 and a share of the capital costs of the construction of Atlas Rd Substation.
- The budget for the 11kV cables from Atlas Road to Old Oak North Substation allows cables rated to transfer 30MVA. The budget is based on unit rates for ducting and cabling used for estimating electrical infrastructure costs.
- The budget provided for the Old Oak North Substation is only for the construction of the 11kV switchroom. It does not allow for the construction of a suitable structure to facilitate over-building. The budget is based on the estimated construction cost of a 300m^2 single storey building with cable basement equipped with a 22 panel 11kV switchboard to UKPN specifications.
- The phasing of the installation of the 11kV cables still needs to be confirmed.
- On-plot infrastructure including final distribution substations are not included. These are the responsibility of the developers of each plot.
- Public area infrastructure, such as street furniture, street lighting, etc.is not provided in these budget estimates.
- Contractor mark ups excluded.
- Optimism Bias has been applied to all of the costs except for the UKPN Connection Fee for which a quotation has been received.
- VAT excluded.

5. Gas

Overview

5.1 This section summarises the current gas strategy, to support the catering facilities and supply of heat to the development plots via the proposed energy centre, for the purposes of defining costs to be included in the Old Oak Business Case.

Gas Demand

5.2 The demand calculations prepared in 2017 identified that a peak gas demand of approximately 75MW was likely to be generated by the proposed development in Old Oak North based upon the Scenario B Masterplan. Updated calculations have been prepared during Stage 4 based upon the current masterplan, which have identified that the peak gas demand has reduced to approximately 44MW due to a reduction in the quantum of development proposed in Old Oak North. These calculations have been determined based on the following assumptions:

- The gas demand will follow the delivery start dates detailed in the OPDC Development Trajectory Version 4.0 (received from OPDC on 17 April 2018).
- The peak load for the space heating and hot water provided by the energy centres will coincide with the maximum demand resulting for the catering facilities.
- The heat will be generated at the energy centres using gas boilers with an efficiency of 86%.
- Gas boilers will provide 100% of the space heating and hot water demand.
- The proportion of retail/leisure that requires catering is 30%.
- The benchmark demand for catering is 800 W/m2.
- A contingency of 20% has been included within the demand calculations.

Gas Network

Existing Supply Networks

5.3 National Grid (Gas) Asset Location Plans confirm that there is an existing gas holder located approximately 1 km east of Scrubs Lane, and to the south of St Mary's Cemetery. There are currently medium pressure gas mains running along the:

- A40, to the south and west of the Old Oak area;
- Southern end of Scrubs Lane, to the south and east of the Old Oak area, near the Hammersmith Hospital; and
- High Street, to the north of Willesden Junction.

5.4 A Pressure Reducing Station (PRS) is located to the north of the Scrubs Lane / Barlby Road junction, to the east of Hammersmith Hospital. Low-pressure gas mains then extend along a number of routes, including:

- Up the full length of Scrubs Lane, to meet the A404 in Willesden Junction;
- Beneath the Hythe Road underpass into the existing Car Giant site in Old Oak North;
- Along the A4000, which changes from Wales Farm Road near the A40 to Victoria Road and Old Oak Lane, before becoming Station Road in the Willesden Junction area;
- Along Atlas Road; and
- Along the northern-most section of Old Oak Common Lane near the proposed Oaklands South development.

Proposed New Supply Networks

5.5 The assessment undertaken during Stage 4 has focused on the planned redevelopment of Old Oak North, however, initial consultations with Cadent have indicated that the outline strategy proposed during Stage 2 is likely to remain valid. The Stage 2 analysis confirmed that the low pressure gas main below Scrubs Lane will need to be upgraded to a medium pressure gas main, or supplemented with a new low pressure main to act as a primary connection point to supply the site.

5.6 We have assumed that in order to provide a resilient gas supply to the Old Oak North a new medium pressure cross connection will extend through the site from the new main in Scrubs Lane to the existing main in the A40 near North Acton. The new mains will need to be laid through the Park Bridge, Laundry Bridge and the Park Road Underpass.

5.7 The Eastern Energy Centre will be serviced by the upgraded gas infrastructure in Scrubs Lane, and the Western Energy Centre, will be serviced by the proposed cross connection through Park Road. A distribution network, required to serve the proposed Old Oak North development will extend from the new cross connection to serve the development plots. (Note: The costs for the provision of low pressure gas supplies to the commercial units are **not** included in the cost estimates provided for the Business Case, as it is assumed that these will be paid by the Developer).

Proposed Costs

5.8 Consultation is currently ongoing with Cadent regarding the improvements that will be required to their existing infrastructure in order to supply the increased gas demand for Old Oak North. We have therefore included the estimated construction costs that were prepared in 2017, which have been uplifted to allow for inflation and are based upon the assumption that new medium pressure gas supplies will be provided to the site to supply the proposed redevelopment. These are shown in Table 8 below.

Table 8: Estimated construction costs for gas

Infrastructure Description	Estimated Cost
Reinforce the existing gas network on the eastern side of the site	£1,522,500
Extend medium pressure gas supply to Old Oak North Energy Centre	£1,015,000
Extend medium pressure gas supply to Scrubs Lane Energy Centre	£203,000
Site-Wide Total	**£2,740,500**

5.9 The above costs have been developed on the basis of the following assumptions and exclusions:

- Costs include:
  - Upgrade low pressure main on Scrubs Lane to a medium pressure main
  - Routing the new medium pressure gas mains across the bridge linking the Scrubs Lane Central and Scrubs Lane South areas
  - Routing the new medium pressure gas mains across the new Laundry Lane Bridge
  - Routing the new medium pressure gas mains under the new Park Road Underpass
  - Routing the new medium pressure gas mains across the Genesis Bridge
- In addition to the general exclusions listed, these costs exclude:
  - Low pressure networks to individual plots for commercial units

5.10 Routing the new medium pressure gas mains across the bridge linking the Scrubs Lane Central and Scrubs Lane North areas.

6. Potable Water

Overview

6.1 This section summarises the potable water strategy for supplying the proposed development in Old Oak North for the purposes of defining costs to be included in the Old Oak Business Case.

Water Demand

6.2 The previous Stage 3 calculations indicated that the Old Oak Scenario B development would generate a total water demand of approximately 4000 m^3/day. Updated calculations prepared during Stage 4, show that the water demand for Old Oak North is likely be in the region of 2750 m^3/day. These calculations have been determined based on the following assumptions:

- Water demand for new residential homes is 125 litres per head per day, and the average household size in the UK is 2.3 people.
- Water demand for new office premises is 750 litres per 100m2 per day.

Water Network

6.3 Thames Water has indicated that there are short term challenges relating to network capacity, and long term challenges associated with water resource capacity that require resolution in order to generate a sustainable development at Old Oak.

6.4 The Stage 4 works focused primarily on the Old Oak North development, however consultations with Thames Water have indicated that the outline strategy proposed during Stage 2 remains valid. The Stage 2 analysis confirmed that the two existing water mains in Scrubs Lane (21" and 16" Cast Iron (CI) pipes mains) require a new cross connection, which will enable a new supply to be provided to the site via the 30" CI main in Old Oak Lane.

6.5 The cross connection, a new 400mm main will extended from the 30" CI pipe in Old Oak Lane to the 16" CI pipe in Scrubs Lane below the new Park Road. The new mains will need to be laid through the Park Bridge and Laundry Bridge and the Park Road Underpass.

6.6 Distribution mains, required to serve the proposed Old Oak North development will extend from the new 400mm mains to serve the development plots.

Proposed Costs

6.7 In April 2018 Thames Water introduced new charging arrangements for new connections.

6.8 In line with their new charging arrangements, Thames Water will be financing strategic improvements to the water supply infrastructure in OON and the distribution mains to the development plots. Their investment will be recovered via connection charges.

6.9 The previous cost plan included an allowance of £7.9M for strategic improvements to the water supply infrastructure. This allowance has now been removed from this report, as this investment is now to be paid by Thames Water.

6.10 It is also understood that Thames Water will finance a proportion of the cost of any new strategic water mains that may need to be installed within the site via an income offset payment. We have assumed that the contribution paid by Thames Water will be sufficient to cover the cost of installing the new watermains beneath the main movement corridors. The allowance of £3.26M included in the previous version of the cost plan for installation of the new water supply infrastructure has therefore been removed.

6.11 Costs for the provision of distribution mains to the development plots has not been included in the estimates provided for the Business Case, as this is not considered to be strategic infrastructure and it is assumed that these costs will be paid by the Developer.

7. Foul & Surface Water Drainage

Overview

7.1 This section summarises the foul and surface water drainage strategy that has been developed to support the proposed redevelopment of Old Oak North for the purposes of defining costs to be included in the Old Oak Business Case.

Existing Sewer Networks

7.2 Following discussions with Thames Water it is understood that there are five strategic combined sewers in the Old Oak area:

- The Stamford Brook Sewer (Mainline East Branch) flows in a south-westerly direction from the centre of the Site, across Wormwood Scrubs Park and along Old Oak Lane;
- The Stamford Brook Sewer Diversion flows in a southerly direction along the A4000, which is situated in the northwest corner of the Site, before turning east and flowing across the Site adjacent to the Grand Union Canal (on the north bank of the canal) and ultimately discharging to the Wood Lane Sewer;
- The Middle Level Sewer No 2 Brent Valley Section flows in an easterly direction below Tubbs Road and the A404, which are situated directly to the north of the Willesden Junction part of the site;
- The Wood Lane Sewer flows in a south easterly direction below Scrubs Lane; and
- The Middle Level Sewer No 1. Main Line flows in an easterly directions to the south of the Great Western Railway Line.

7.3 These sewers are understood to have limited capacity to accept wastewater and surface water runoff from the proposed redevelopment of Old Oak North.

Foul and Surface Water Drainage Strategy

7.4 The Stage 2 report indicated that the Old Oak development will cause the peak foul discharge to the existing combined sewer network to be increased significantly and that the existing network of combined sewers have no residual capacity to accommodate the increased flow. This report also highlighted the potential for significant volumes of surface water to accumulate within the Old Oak site.

7.5 Consultations with Thames Water indicate that in order to create capacity within the existing combined sewer network to accommodate the increased foul effluent it will be necessary to provide Sustainable Drainage Systems (SuDS) to enable the peak discharge generated during rainfall events with a return period of up to 1 in 100 years plus 40% climate change to be restricted to greenfield rates. This approach is also required to mitigate the existing risk of surface water flooding.

7.6 The Stage 4 works have focused primarily on the management of surface water runoff within Old Oak North to provide increased capacity within the existing public sewers, to accept foul effluent from the development.

7.7 The current solution has been based upon the assumption that surface water runoff from the development plots will be attenuated at source and discharged into a carrier drainage network at the appropriate greenfield runoff rate.

7.8 SuDS will be provided within and adjacent to the main movement corridors to attenuate runoff from the paved surfaces, which will be discharged into a highway drainage network and ultimately into the public combined sewer system.

7.9 Foul effluent from the development plots will be discharged directly to a new foul drainage network that will be constructed below the main movement corridors. This network will be connected to the public sewerage system. No attenuation of foul effluent is currently proposed.

7.10 The Stamford Brook Sewer, is a large 1219x813mm brick combined sewer that currently runs directly through the Old Oak North site, along Hythe Road. It is proposed that the sewer is diverted to follow the northern bank of the Grand Union Canal, maintaining a 5m easement from the canal wall, this is due to a number of factors including; level constraints, conflicts with development plots on the masterplan layout and to facilitate a connection for the energy centre's heat recovery apparatus.

7.11 A foul water drainage network will allow each of the development plots to drain into the Stamford Brook Sewer diversion or other existing combined sewers.

7.12 The surface water drainage networks, foul sewers and highway drains will discharge into the Stamford Brook Sewer or other existing combined sewers.

Estimated Costs

7.13 Following a meeting with Thames Water on 12 March 2018, it is understood that the cost of any off site reinforcement, which may be required to facilitate the proposed development will be financed by the Company and their investment recovered via the infrastructure charge applied to each property connected to the asset.

7.14 The cost plan issued in September 2017 included an allowance of £171,738 for a contribution towards the cost of the Tokyngton and Stonebridge Flood Alleviation Scheme. This cost has now been removed, as it is assumed that Thames Water will finance this scheme under their new charging arrangements, implemented from 1 April 2018.

7.15 Estimated costs have been developed for the foul and surface water drainage improvements that are expected to be required to support the first 15 years of development in Old Oak North. See Table 9 below.

Table 9: Estimated costs for foul and surface water drainage

Infrastructure Description	Estimated Cost
Strategic sustainable urban drainage systems within areas of Public Open Space to attenuate runoff from adopted roads	1,827,000
New outfalls to the Grand Union Canal and improvements to the canal to improve conveyance capacity	2,030,000
Sewerage system extension and capacity expansion	1,725,500
Total	**5,582,500**

7.16 The above costs have been developed on the basis of the following assumptions and exclusions:

- Costs include:
  - The provision of a limited number of strategic Sustainable Drainage Systems within areas of Public Open Space; and
  - The installation of outfalls to the Grand Union Canal and construction of measures to improve the conveyance capacity of the canal.
- These costs exclude:
  - Sustainable Drainage Systems that are provided on plot;
  - Installation of new surface water and foul drainage networks required to accommodate flows from development parcels; and
  - New connections to combined sewers.

8. Telecommunications

Overview

8.1 This section summarises the required telecommunications strategy for the purposes of defining costs to be included in the Old Oak Business Case.

Proposed Costs

8.2 The telecommunications strategy for Old Oak North has identified that a new open access duct network comprising 8 No. ducts and the associated draw chambers should be installed on either side of the principal and secondary movement corridors. The following costs have been allowed for the installation of this new infrastructure, which is it assumed will be installed with the new road construction:

Table 10: Estimated costs for telecommunications

Description	Estimated Length	Budget for Network Installation
Park Road – Northern Boundary of Oaklands South to Scrubs Lane	865m	£1,038,000
Old Oak Street – Park Road to Old Oak Bridge	489m	£586,000
Hythe Road West – Park Road to Old Oak Street	214m	£256,800
HS2 Station to Grand Union Street	251m	£301,200
Total	**1,819m**	**£2,182,800**

8.3 We have increased the length of telecoms ducting infrastructure to 2,200m to allow for connections into the on-plots at strategic points through the development. This has increased the budgetary cost to £2,640,000.

9. Social Infrastructure

Overview

9.1 This section summarises the required Social Infrastructure strategy for the purposes of defining costs to be included in the Old Oak Business Case.

Proposed Costs

9.2 The allowances shown in Table 12 for the provision of social infrastructure in Old Oak North, are based upon the capital costs included in the Preliminary Infrastructure Cost Report issued on 8 September 2017, which have been inflated to represent August 2018 costs.

Table 11: Phased capital costs for Social Infrastructure

Infrastructure Description	CAPEX Costs
Community and Sports Facilities comprising a 2,600m^2 on site community hub and a 3,700m^2 sports centre.	£11,801,405
Green Infrastructure	£3,400,250
Heath Facilities	£3,174,920
Onsite 4 FE Primary School	£14,210,000
Site-Wide Total	**£32,586,575**

9.3 The construction costs provided for the healthcare provision assume a basic community medical facility, such as a Doctor's Surgery or Dentist. We have also assumed that any specialist equipment required within the facility will be provided by the operator/NHS.

9.4 We have included an allowance of £905,380 for the construction of a super nursery for 120 pre-school children. This allowance is for the cost of the building only, as we have assumed that any specialist equipment required within the facility will be provided by the operator.

9.5 We have included an allowance of £1,500,000 for improvements to Birchwood Nature Reserve, which could be used for educational purposes to complement the facilities at the proposed primary school.

10. Offsite Highway Improvements

Overview

10.1 This section summarises the required Offsite Highway Improvements for the purposes of defining costs to be included in the Old Oak Business Case.

10.2 Offsite highway improvements are likely to be required to enable the capacity of the highway network that surrounds the Old Oak site to be increased to accommodate vehicular and non-motorised traffic generated by the Old Oak development.

10.3 The Cost Plan includes a range of measures that are identified within the Infrastructure Asset Database. However, additional contingency should be allowed for further improvements, which may be identified when transport modelling work is undertaken.

10.4 At this time no detailed work has been undertaken to assess the scale or nature of offsite highway improvement works which will be required to support the Old Oak North development. As advised by OPDC, we have carried over the previous construction cost estimate of £28,682,668 to allow for the following:

- High level assumptions for cycle hire; Legible London wayfinding and signage; nominal allowance for additional bus infrastructure at Overground stations. (50% of original costs allowance) - £2,635,568.
  - This was removed from the cost plan following the meeting on 3rd May with OPDC and Deloitte.
- Junction Victoria Rd, Old Oak Common Lane, Old Oak Lane & Atlas Rd - increase capacity - £2,658,460.
- New bus routes and bus infrastructure including bus stops, bus stands, welfare and maintenance facilities, bus gates, bus priority measures and bus-only routes (50% of original costs allowance) - £9,990,640.
- Scrubs Lane Interventions identified within the Scrubs Lane Direction of travel - £13,398,000.

11. Additional Items

Overview

11.1 This section summarises the required Additional Items of strategic infrastructure that may need to be delivered for the purposes of defining costs to be included in the Old Oak Business Case.

Hythe Road Station

11.2 In February 2018 TfL carried out a high-level costing exercise. This exercise estimated that to deliver a new station built upon the pre-prepared foundations constructed as part of the two-track viaduct would cost £30M. This estimate was based on providing a viaduct design sufficient to support construction of the station at a later date on the pre-prepared foundations.

11.3 The estimated costs were supplied by TfL in an email provided to OPDC on 21 February 2018. No supporting information on how the costs were developed was included and a full copy of the email from TfL can be found in Appendix C.

Demolition - all sites except Powerday

11.4 An allowance of £41,265,840 has been included to carry out the demolition of the existing sites so that earthworks may be undertaken to prepare a developable plot. The estimated costs have been derived using an average rate of £295m^2 of site area.

Demolition – Powerday

11.5 An allowance of £1,021,396 has been included to allow for the demolition of the existing Powerday building(s) to enable the site to be redeveloped.

11.6 The anticipated delivery timeframe for the Powerday site is post 2050 and therefore falls outside the 15 year business case window.

Decontamination Costs – Powerday

11.7 The PBA prepared report entitled 'Old Oak Development Infrastructure Funding Study, Ground Contamination, Rev 03' (dated September 2014) estimated decontamination of the Powerday site to be between £302,000 (Low), £556,000 (Medium) and £810,000 (High). We have taken the highest estimate (£810k) and uplifted by 23% to allow for inflation from September 2014 to give an estimate of £996,300.

11.8 The anticipated delivery timeframe for the Powerday site is post 2050 and therefore falls outside the 15 year business case window.

Automated Waste Collection System (AWCS)

11.9 An initial waste collection study has been undertaken to define the main options available for waste collection for the Old Oak North development. This study identified three options available and provided an estimated cost for each to deliver:

- A conventional waste collection system at £500,000
- An underground waste collection system at £3,200,000
- An automated waste collection system at £14,000,000

11.10 For this costing exercise it has been agreed to include the costs for the automated waste collection system at £14,000,000 into the Business Case.

Sitewide Utility Diversions

11.11 At this time, no work has been undertaken to identify the existing utilities within the Old Oak North development area which will require diverting or stopping-up to facilitate delivery of the strategic infrastructure or new development plots. Detailed negotiations with Statutory Undertakers will need to be undertaken to understand how continuity of services to existing areas are maintained while at the same time, space cleared for development works to be undertaken.

11.12 An initial budgetary estimate of £10,000,000 has been included to undertake diversions of the existing utilities across the Old Oak North development site.

Stamford Brook Sewer Diversion

11.13 The existing Stamford Brook Sewer is a large 1219x813mm brick combined sewer that currently runs directly through the Old Oak North site, below the existing Hythe Road.

11.14 The current foul water strategy proposes that the Stamford Brook Sewer is diverted. This is due to a number of factors including; level constraints, conflicts with development plots on the masterplan layout and to facilitate a connection for the energy centre heat recovery apparatus. Consultation with Thames Water has indicated that they will not contribute financially to the construction cost of any sewer diversions.

11.15 Following discussions with the Masterplanning Team, a high-level cost estimate has been prepared and included in the cost plan based on the sewer alignment being diverted to the northern bank of the Grand Union Canal. The sewer diversion is assumed to comprise a 990m length of 1800mmØ pipe at an average depth of 3m, including manholes, connections etc.

11.16 The construction costs for the Stamford Brook sewer diversion have been estimated at £2,489,850.

CRT- Air Rights

11.17 OPDC have instructed that a contingency sum of £1M is to be included within the cost plan to allow for additional contributions to the Canal & River Trust (CRT) that we cannot yet quantify. The three bridges that are currently planned to cross the Grand Union Canal (Park Bridge, Old Oak Bridge and the Canal Bridge) already include a £1M contribution to CRT, however there are concerns that CRT may request additional contributions for each of the utilities that are also crossing the canal attached to the bridges.

12. Assumptions

12.1 The costs shown in this report and included in Appendix A are based upon the following assumptions:

- We have made no allowance for phasing or the timing of the infrastructure improvements, as these will need to be agreed with the Statutory Undertakers and OPDC.
- The costs for bulk earthworks assume that the surplus excavated material will be removed off site at the following rates:
  - Inert/Non Hazardous - £50/m3
  - Contaminated material - £200/m3
- As a geo-environmental assessment of the existing ground has not been undertaken, we have assumed that 10% of the surplus excavated material is likely to be classified as contaminated.
- Any earthworks associated with piling, foundations, installation of new services and the provision of SuDS is assumed to be included within the on plot costs.
- No allowances have been included for infrastructure that would be delivered as part of the anticipating future potential phase (Old Oak South).
- No allowance has been included relating to land purchase.
- With the exception of the designs for the Old Oak Bridge and Park Bridge, we have not held any consultation with the main Stakeholders (Network Rail, the Canal & River Trust, the adopting Highway Authority or TfL) to understand any requirements they may place on the structural and highway elements. We understand that OPDC have begun initial discussions with these stakeholders to discuss the principals of the scheme.
- We have assumed that the costs provided by TfL for the new viaduct to support the West London Line include an allowance for removal of the existing rail embankment to current ground level.
- We have assumed that any SuDS required within the development parcels to reduce the peak rate of surface water discharge to greenfield runoff rates will be include in the on plot costs.
- We have made no allowance for commuted sums in relation to the Hythe Road Viaduct & Enabling Works.
- We have made no allowance for commuted sums in relation to the secondary street network being adopted by LBHF.
- The commuted sum items costs have been taken from the costs agreed with the London Borough of Brent and TfL for the Brent Cross scheme.
- We have made no allowance for any works relating to the redevelopment of the Powerday site.
- We have made no allowance for any works relating to the existing EMR/Powerday access track conversion into a public highway.
- We have made no allowance for any temporary works that may be required for construction of any of the preliminary infrastructure elements.

Appendix A Cost Spreadsheet

REF		Location	Estimated Construction Period Start	Completion	Total Construction Cost (£)	Allowance for Professional Fees, Maintenance and Survey Costs 25% Rail Related 17.5% Elsewhere %	£	Optimism Bias 66% Rail Related 44% Transport/Utilities 15% Social Infrastructure %	£	July 2018 Total Cost (Excluding Inflation) (£) 878,246,911
1.00	**Streets & Structures**									
1.01	Park Bridge (Ref: S01)	Land north of Oaklands and CG West	Dec 2021	Dec 2022	16,397,473	0.25	4,099,368	0.66	13,527,915	35,024,756
1.02	Park Rd Underpass (Ref: S02)	EMR, H&F Triangle and CG West	Oct 2021	Feb 2023	15,113,871	0.25	3,778,468	0.66	12,468,944	31,361,282
1.03	Harlesden Bridge (Ref: S07)	EMR	Jan 2023	Jul 2024	15,179,806	0.25	3,794,952	0.66	12,523,340	31,498,097
1.04	Laundry Bridge (Ref: S08)	EMR and Cumberland Business Park	Jan 2023	Dec 2025	12,821,062	0.25	3,205,266	0.66	10,577,376	26,603,704
1.05	Green Bridge (Ref: S10)	CG West	Jan 2026	Dec 2027	16,409,583	0.25	4,102,396	0.66	13,537,906	34,049,885
1.06	Old Oak Bridge (Ref: S09)	CG East	May 2023	Jan 2025	10,015,294	0.25	2,503,824	0.66	8,262,618	20,781,735
1.07	Powerday Underpass (Ref: N/A)	CG West	Jan 2050	Dec 2052	15,113,871	0.25	3,778,468	0.66	12,468,944	31,361,282
1.08	Hythe Road Underpass Improvements (Ref: S05)	CG East	Jun 2023	Dec 2024	6,633,274	0.25	1,658,319	0.66	5,472,451	13,764,044
1.09	Hythe Road Viaduct & Station Enabling Works (Ref: S04)	CG East	Apr 2023	Dec 2025						143,000,000
1.10	Associated Roads (Primary, Secondary & Plot Service Streets)	All	Mar 2021	Jun 2022	36,346,259	0.175	6,360,595	0.44	18,791,016	61,497,870
1.11	Willesden Junction Station Improvements	N/A	Jan 2021	Dec 2025	16,031,113	0.25	4,007,778	0.66	13,225,668	33,264,559
1.12	Retaining Walls to Support the Highways	All	Mar 2021	Dec 2026	8,801,833	0.175	1,540,321	0.44	4,550,548	14,892,701
1.13	Retaining Walls to Support Rail Line Embankments		Jan 2023	Dec 2025	6,809,863	0.25	1,702,466	0.66	5,618,137	14,130,466
1.15	Cut / Fill (Option 6)	All	Oct 2019	Dec 2028						34,218,550
1.16	Commuted Sums (Highways)		Jan 2022	Dec 2026						35,000,000
1.17	Commuted Sums (Bridges)		Jan 2022	Dec 2026						4,800,000
1.18	Site Clearance, Demolition and Decontamination for Park Road	EMR, H&F Triangle and CG West	Oct 2019	Dec 2024						5,950,000
1.19	Canal Bridge (Ref: N/A)	CG West	Dec 2021	Dec 2022	7,610,008	0.175	1,331,751	0.44	3,934,374	13,876,134
2.00	**Decentralised Energy**									
2.01	Western Energy Centre: Groundworks / Structural Construction	CG West	Oct 2021	Mar 2023	5,895,000	0.175	1,031,625	0.44	3,047,715	9,974,340
2.02	Western Energy Centre: Thermal Generation and Fit-out	CG West	Mar 2023	Jun 2023	6,613,000	0.175	1,157,275	0.44	3,418,921	11,189,196
2.03	Western Energy Centre: District Heating Pipework	CG West	Oct 2021	Dec 2032	4,493,000	0.175	786,275	0.44	2,322,881	7,602,156
2.04	Eastern Energy Centre: Groundworks / Structural Construction	Cumberland Business Park	Jan 2022	Dec 2024	1,302,000	0.175	227,850	0.44	673,134	2,202,984
2.05	Eastern Energy Centre: Thermal Generation and Fit-out	Cumberland Business Park	Jan 2022	Dec 2024	2,493,000	0.175	436,275	0.44	1,288,881	4,218,156
2.06	Eastern Energy Centre: District Heating Pipework	Cumberland Business Park	Jan 2022	Dec 2032	829,000	0.175	145,075	0.44	428,593	1,402,668
3.00	**Electrical Power**									
3.01	UKPN Connection Fee (15MVA) at Atlas Road	CG West	Jan 2019	Dec 2020						2,300,000
3.02	11kV Cable Circuits - Atlas Road to Old Oak North Sub Station	CG West	Jul 2020	Jan 2021	1,325,000	0.175	231,875	0.44	685,025	2,241,900
3.03	Distribution Network (Ducting and Cables: Western Wedge & CG)	All	Jul 2020	Dec 2026	3,500,000	0.175	612,500	0.44	1,809,500	5,922,000
3.04	Old Oak North Sub-Station Building and Fit-out	CG West	Jul 2020	Aug 2021	900,000	0.175	157,500	0.44	465,300	1,522,800
3.05	HS2 Settlement Fee for Additional 14MVA Capacity	N/A	Jul 2020	Aug 2021	4,000,000	0.175	700,000	0.44	2,068,000	6,768,000
4.00	**Gas**									
4.01	Reinforce the existing gas network on the eastern side of the site	N/A	Jan 2020	Dec 2024	1,522,500	0.175	266,438	0.44	787,133	2,576,070
4.02	Extend medium pressure gas supply to Old Oak North Energy Centre	CG East and CG West	Jun 2022	Dec 2023	1,015,000	0.175	177,625	0.44	524,755	1,717,380
4.03	Extend medium pressure gas supply to Scrubs Lane Energy Centre	CG East and CG West	Jun 2022	Dec 2023	203,000	0.175	35,525	0.44	104,951	343,476
5.00	**Potable Water**									
5.01	New 250 mm dia main from 30" No4 in Old Oak Lane to centre of site	N/A			0	0.175	0	0.44	0	0
5.02	New 200 mm dia main from 21" in Scrubs Lane to centre of site	N/A			0	0.175	0	0.44	0	0
5.03	New 150 mm dia main from 21" in Scrubs Lane to centre of site	N/A			0	0.175	0	0.44	0	0
5.04	New 250 mm dia main from 30" No4 in Old Oak Lane to centre of site	N/A			0	0.175	0	0.44	0	0

REF		Location	Estimated Construction Period		Total Construction Cost (£)	Allowance for Professional Fees, Maintenance and Survey Costs 25% Rail Related 17.5% Elsewhere		Optimism Bias 66% Rail Related 44% Transport/Utilities 15% Social Infrastructure		July 2018 Total Cost (Excluding Inflation) (£)
			Start	Completion		%	£	%	£	878,246,911
5.05	New 150 mm dia main from 21" in Scrubs Lane to centre of site and connect to new main in centre of Site 8	N/A			0	0.175	0	0.44	0	0
5.06	Offsite reinforcement works	N/A			0	0.175	0	0.44	0	0
6.00	**Foul and Surface Water Drainage**									
6.01	Tokyngton and Stonebridge Flood Alleviation Scheme	All			0	0.175	0	0.44	0	0
6.02	Strategic sustainable urban drainage systems within areas of Public Open Space to attenuate runoff from adopted roads	All	Jan 2023	Dec 2026	1,827,000	0.175	319,725	0.44	944,559	3,091,284
6.03	New outfalls to the Grand Union Canal and Improvements to the canal to improve conveyance capacity	All	Jan 2023	Dec 2024	2,030,000	0.175	355,250	0.44	1,049,510	3,434,760
6.04	Sewerage system extension and capacity expansion	All	Jan 2023	Dec 2024	1,725,500	0.175	301,963	0.44	892,084	2,919,546
7.00	**Telecommunications**									
7.01	Telecommunications network in Old Oak Common (phased to match development timing)	All	Mar 2021	Dec 2026						2,640,000
8.00	**Social Infrastructure**									
8.01	Community & Sports Facilities (1No. 2,600m² in 2026)	All	Jan 2022	Dec 2026	11,801,405	0.175	2,065,246	0.15	2,079,998	15,946,649
8.02	Green Infrastructure (Allowance for Parks and Open Spaces)	All	Jan 2022	Dec 2026	3,400,250	0.175	595,044	0.15	599,294	4,594,588
8.03	Health Facilities (1No. 1,088m² in 2024, expanded to 1,564m² in 2038)	CG East	Jan 2022	Dec 2038	3,174,920	0.175	555,611	0.15	559,580	4,290,111
8.04	Primary School (840 places 4FE, 5,800m² (0.58 Ha) site size)	CG East	Jan 2028	Dec 2030	14,210,000	0.175	2,486,750	0.15	2,504,513	19,201,263
8.05	Super Nursery (120 places, 2,000m² site size, 800m² floorspace)	CG East	Jan 2028	Dec 2030	905,380	0.175	158,442	0.15	159,573	1,223,395
8.06	Birchwood Nature Reserve	CG West	Dec 2021	Dec 2022	1,500,000	0.175	262,500	0.15	264,375	2,026,875
9.00	**Offsite Highway Improvements**									
9.01	High level assumptions for cycle hire; Legible London wayfinding and signage; nominal allowance for additional bus infrastructure at Overground stations. (50% of original costs allowance)	N/A			2,635,568	0.175	461,224	0.44	1,362,588	0
9.02	Junction Victoria Rd, Old Oak Common Lane, Old Oak Lane & Atlas Rd - increase capacity	N/A	Jan 2022	Dec 2024	2,658,460	0.250	664,615	0.66	2,193,229	5,516,304
9.03	New bus routes and bus infrastructure including bus stops, bus stands, welfare and maintenance facilities, bus gates, bus priority measures and bus-only routes (50% of original costs allowance)	N/A	Jan 2022	Dec 2024	9,990,640	0.175	1,748,362	0.44	5,165,161	16,904,163
9.04	Scrubs Lane Interventions identified within the Scrubs Lane Direction of travel	N/A	Jan 2022	Dec 2024	13,398,000	0.250	3,349,500	0.66	11,053,350	27,800,850
10.00	**Additional Items**									
10.01	Hythe Road Station	CG East	Jan 2026	Dec 2027						30,000,000
10.02	Demolition - all sites except Powerday	All	Oct 2019	Dec 2024	33,495,000	0.120	4,019,400	0.10	3,751,440	41,265,840
10.03	Demolition - Powerday	All	Jan 2050	Dec 2052	829,055	0.120	99,487	0.10	92,854	1,021,396
10.04	Decontamination Costs - Powerday	Powerday	Jan 2050	Dec 2052						996,300
10.05	Automated Waste Collection System (AWCS)	All	Jan 2020	Dec 2024	14,210,000	0.175	2,486,750	0.44	7,346,570	24,043,320
10.06	Sitewide Utility Diversions	All	Jan 2020	Dec 2028	10,150,000	0.250	2,537,500	0.66	8,373,750	21,061,250
10.07	Stamford Brook Sewer Diversion	CG East and CG West	Jan 2022	Dec 2024	2,489,850	0.175	435,724	0.44	1,287,252	4,212,826
10.08	CRT- Air Rights	N/A	Jan 2022	Dec 2024	1,000,000				1,000,000	1,000,000

Appendix B Strategic Infrastructure GA

ISO A1 594mm x 841mm | Approved: BM | Checked: BM | Designer: NT | Project Management Initials:

HIGHWAY RETAINING WALLS
HRW.1 APPROX. 137m LONG
HRW.2 APPROX. 130m LONG
HRW.3 APPROX. 30m LONG
HRW.4 APPROX. 48m LONG
HRW.5 APPROX. 49m LONG
HRW.6 APPROX. 28m LONG
HRW.7 APPROX. 79m LONG
HRW.8 APPROX. 100m LONG
HRW.9 APPROX. 87m LONG
HRW.10 APPROX. 67m LONG
HRW.11 APPROX. 113m LONG
HRW.12 APPROX. 113m LONG
ALL INCLUDE A 4m WIDE MAINTENANCE STRIP TO THE FRONT FACE OF THE WALL

CUTLINE B

PARK ROAD
PARK ROAD UNDERPASS TO LAUNDRY BRIDGE APPROX. 328m LONG x 20m WIDE

SIGNAL CONTROLLED JUNCTION IN ABEYANCE
TRANSPORT MODELLING REQUIRED TO DETERMINE JUNCTION TYPE AND SIZE

RETAINING WALL
SUPPORTING THE WEST LONDON LINE EMBANKMENT TO INCREASE THE EMR PLOT AREA
APPROX. 174m LONG

SECONDARY STREET
APPROX. 147m LONG x 18m WIDE

EMR/POWERDAY ACCESS TRACK
ACCESS ONTO POWERDAY ACCESS TRACK TO BE RE-ALIGNED TO ALLOW FOR LAUNDRY BRIDGE INTERMEDIATE PIER

A219 SCRUBS LANE JUNCTION WITH PARK ROAD
REFER TO TECHNICAL NOTE: OOC-ACM-HWY-XX-TN-CE-01014. JUNCTION SHOWN BASED ON OPTION 1 FROM THE TECHNICAL NOTE

OLD OAK NORTH EASTERN ENERGY CENTRE

PARK ROAD UNDERPASS (S02)
REFER TO TECHNICAL NOTE: OOC-ACM-HWY-XX-TN-CE-01006

LAUNDRY BRIDGE (S08)
REFER TO TECHNICAL NOTE: OOC-ACM-HWY-XX-TN-CE-01007

PARK ROAD
LAUNDRY BRIDGE TO A219 JUNCTION APPROX. 81m LONG x 20m WIDE

OLD OAK NORTH SUB-STATION

SECONDARY STREET
APPROX. 106m LONG x 18m WIDE. REFER NOTE 8

OLD OAK STREET
JUNCTION WITH HYTHE ROAD TO JUNCTION WITH PARK ROAD
APPROX. 242m LONG x 25m WIDE

RETAINING WALL
SUPPORTING THE NORTH LONDON LINE EMBANKMENT TO INCREASE THE CARGIANT PLOT AREA
APPROX. 155m LONG

OLD OAK NORTH WESTERN ENERGY CENTRE

SECONDARY STREET
APPROX. 43m LONG x 18m WIDE

REFER NOTE 11

REFER NOTE 7

SECONDARY STREET
APPROX. 139m LONG x 18m WIDE

HIGHWAY RETAINING WALL
POTENTIAL REQUIREMENT SHOULD THE SECONDARY STREET REQUIRE A VEHICULAR CONNECTION TO THE EMR/POWERDAY ACCESS TRACK. ACCESS TRACK WILL REQUIRE LOWERING BY APPROX 1.1m

A219 SCRUBS LANE

CUTLINE A

HYTHE ROAD VIADUCT AND STATION
DESIGN, CONSENTS AND COSTING BY OTHERS

REFER NOTE 11

REFER NOTE 7

NORTH KENSINGTON GATE DEVELOPMENT

EMR/POWERDAY ACCESS TRACK

PARK ROAD
PARK BRIDGE TO PARK ROAD UNDERPASS APPROX. 203m LONG x 20m WIDE

HYTHE ROAD
PARK ROAD TO OLD OAK STREET APPROX. 214m LONG x 20m WIDE

A219 SCRUBS LANE JUNCTION WITH HYTHE ROAD
REFER TO TECHNICAL NOTE: OOC-ACM-HWY-XX-TN-CE-01016. JUNCTION SHOWN BASED ON OPTION 2 FROM THE TECHNICAL NOTE

PARK BRIDGE (S01)
REFER TO TECHNICAL NOTE: OOC-ACM-HWY-XX-TN-CE-01008

OLD OAK STREET
BETWEEN HYTHE ROAD JUNCTIONS APPROX. 122m LONG x 20m WIDE

SIGNAL CONTROLLED JUNCTION IN ABEYANCE
TRANSPORT MODELLING REQUIRED TO DETERMINE JUNCTION TYPE AND SIZE

SECONDARY STREET
APPROX. 130m LONG x 18m WIDE

CROSSRAIL DEPOT
NON-PRECLUSION OF 44m DEPOT TRACK EXTENSION AND RE-ALIGNMENT OF ACCESS TRACK BELOW PARK BRIDGE

CANAL BRIDGE
NO DESIGN DEVELOPMENT UNDERTAKEN

SIGNAL CONTROLLED JUNCTION IN ABEYANCE
TRANSPORT MODELLING REQUIRED TO DETERMINE JUNCTION TYPE AND SIZE

HRW.11

MITRE YARD DEVELOPMENT

HYTHE ROAD UNDERPASS IMPROVEMENTS (S05)

OLD OAK STREET
OLD OAK BRIDGE TO JUNCTION WITH HYTHE ROAD APPROX. 125m LONG x 27m WIDE

HYTHE ROAD
OLD OAK STREET TO EXISTING HYTHE ROAD UNDERPASS
APPROX. 251m LONG x 20m WIDE

SECONDARY STREET
APPROX. 114m LONG x 18m WIDE

SECONDARY STREET
APPROX. 92m LONG x 18m WIDE

HRW.12

REFER NOTE 7

STAMFORD BROOK
APPROX. 990m LONG SEWER DIVERSION, 1800mmØ PIPE, AVERAGE DEPTH OF 3m

REFER NOTE 7

MITRE YARD DEVELOPMENT

GRAND UNION CANAL

OLD OAK BRIDGE (S09)
REFER TO PRELIMINARY DESIGN REPORT: OOC-ACM-S09-XX-RP-ZZ-01011
FURTHER DEVELOPMENT WORK BEING UNDERTAKEN BY HS2/WSP AS PART OF THE OLD OAK COMMON STATION RIBA 3 DESIGN STAGE

GREEN BRIDGE (S10)
TECHNICAL NOTE [T.B.C.]

HIGH LEVEL NMU CONNECTION
UNDER DEVELOPMENT BY HS2/WSP AS PART OF THE OLD OAK COMMON STATION RIBA 3 DESIGN STAGE

GRAND UNION CANAL

NETWORK RAIL RRV
ALLOWANCE TO RETAIN THE EXISTING ROAD/RAIL VEHICLE ACCESS POINT

RETAINING WALL
NON-PROCLUSION OF RETAINING WALL TO ALLOW CROSSRAIL DEPOT EXTENSION

PARK ROAD
OAKLAND SOUTH TO PARK BRIDGE APPROX. 48m LONG x 20m WIDE

OAKLANDS SOUTH DEVELOPMENT

PARK ROAD
TIE-IN LEVEL WITH OAKLANDS SOUTH AT 36.874m

CUTLINE A

HARLESDEN BRIDGE (S07)
INDICATIVE ALIGNMENT. REFER TO TECHNICAL NOTE: OOC-ACM-S07-XX-TN-SE-00001. SOUTHERN END TO CONNECT WITH DEVELOPMENT PLOT ON EMR SITE. NORTHERN END CONNECTION IN ABEYANCE.

REFER NOTE 7

CUTLINE B

KEY
- PROPOSED EXTENT OF PARK ROAD HIGHWAY CORRIDOR
- PROPOSED EXTENT OF OLD OAK STREET HIGHWAY CORRIDOR
- PROPOSED EXTENT OF HYTHE ROAD HIGHWAY CORRIDOR
- PROPOSED EXTENT OF SECONDARY AND ACCESS STREETS HIGHWAY CORRIDOR
- PROPOSED EXTENT OF STRUCTURES
- APPROXIMATE FOOTPRINT FOR HYTHE ROAD VIADUCT (3 TRACK)
- APPROXIMATE EXTENT FOR RAIL EMBANKMENT RETAINING WALL
- APPROXIMATE EXTENT FOR HIGHWAY RETAINING WALL AND MAINTENANCE ACCESS STRIP
- APPROXIMATE STAMFORD BROOK SEWER REALIGNMENT
- HS2 OLD OAK COMMON STATION RIBA 2 DESIGN
- CROSSRAIL DEPOT TRACK LAYOUT

0 25 50 75 100 125m
SCALE 1:1250

Last saved by: NEIL.TIMS(2018-08-31) Last Plotted: 2018-08-31
Filename: Y:\60495203 - OLD OAK COMMON\06A CAD\01-WIP\CE01_01-DRAWINGS\OPDC-ACM-HWY-XXXX DRAWINGS\OOC-ACM-HWY-XX-DR-CE-00001 P03.DWG

AECOM

PROJECT
Old Oak Common

CLIENT
Old Oak and Park Royal Development Corporation

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1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, ENGINEERS,SERVICES AND SPECIALIST DRAWINGS AND SPECIFICATION.
2. ANY DISCREPANCIES IN DIMENSIONS OR DETAILS ON OR BETWEEN THESE DRAWINGS SHOULD BE DRAWN TO THE ATTENTION OF THE ARCHITECT AND/OR THE ENGINEER FOR CLARIFICATION.
3. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.
4. DO NOT SCALE THIS DRAWING.
5. THIS SKETCH IS PREPARED AS FOR THE PURPOSE OF INFORMING THE ANALYSIS OF HIF COST OPTIONS.
6. THE CONCEPT DESIGN SHOWN ON THIS DRAWING IS BASED ON THE MASTERPLAN OPTION 6 (MARCH ITERATION). RECEIVED 19.06.2018.
7. TURNING CIRCLE SIZES BASED ON A REQUIREMENT TO TURN A DENNIS-EAGLE EURO 5I PHOENIX 2 DUO RECYCLER AT 11.220m LONG X 2.530m WIDE WITHOUT A REVERSING MANOEUVRE. THIS IS CONSIDERED A WORST CASE BASED ON THE VEHICLE BEING ONE OF THE LARGEST IN THE VEHICLE TRACKING LIBRARY.
8. SECONDARY STREET WILL REQUIRE A METHOD OF CONTROL TO RESTRICT PRIVATE VEHICLES FROM 'RAT-RUNNING' FROM PARK ROAD TO OLD OAK STREET WITHOUT USING THE SIGNAL CONTROLLED JUNCTION TO THE NORTH.
9. METHOD OF CONTROL TO RESTRICT PRIVATE VEHICLES FROMTRAVELLING FROM THE EAST TO THE WEST OF THE SITE WILL BE REQUIRED AT STRATEGIC POINTS ON THE PRIMARY ROAD NETWORK. LOCATION AND METHOD TO BE DETERMINED BY THE TRANSPORT MODEL.
10. ALL JUNCTIONS SHOWN ARE INDICATIVE IN SIZE AND TYPE. THESE ARE TO BE DEVELOPED FURTHER THROUGH THE NEXT PHASE OF DESIGN AND FOLLOWING COMPLETION OF THE TRANSPORT MODEL.
11. PLOT SERVICE STREETS ONLY. NO ACCESS FOR PRIVATE VEHICLES.

ISSUE/REVISION

P03	31.08.2018	THIRD ISSUE
P02	31.07.2018	SECOND ISSUE
P01	23.07.2018	FIRST ISSUE
I/R	DATE	DESCRIPTION

KEY PLAN

PROJECT NUMBER
60567089

SHEET TITLE
OLD OAK NORTH STRATEGIC INFRASTRUCTURE GENERAL ARRANGEMENT

SHEET NUMBER
OOC-ACM-HWY-XX-DR-CE-00001

Appendix C TfL Estimated Costs

Tims, Neil

From: Ellis, Sam
Sent: 22 February 2018 13:33
To: Tims, Neil
Cc: Smith, David A (Basingstoke); Milliner, Bryn; Dunn, Simon; Wilcock, Paul (London)
Subject: FW: Hythe Road station and viaduct assumptions

Neil,

See below, TfL have advise a revised cost for the 2 track RAIL VIADUCT in Option 6. Can you include this in the updated Infra cost plans?

Thanks

Sam

+44-(0)7824-503-305

From: Alexandra Reitman [mailto:alexandra.reitman@opdc.london.gov.uk]
Sent: 22 February 2018 13:12
To: Venables, Tom; Ellis, Sam
Cc: Rose, Jonathan; 'Marshall, Tom J (UK - London)'; gm@maccreanorlavington.com
Subject: Hythe Road station and viaduct assumptions

Hi - TfL have given an indication of costs and impacts of doing a 2-track version of the hythe road station and viaduct. The full response is below, but could you please include the costs set out in option 2 / stage 1 (£143m) for the purposes of appraising the viability of the two track viaduct with enabling works for a station in the future.

Could you also incorporate in your plans, the indicative version of the narrower two track option into the plans instead of the wider three track option in plans going forward?

Thanks,
Alex

From: "Michael Mulhern" <michael.mulhern@opdc.london.gov.uk>
Date: Wednesday, 21 February 2018 at 17:42:53
To: "Porter Chris" <ChrisPorter@TfL.gov.uk>
Cc: "Peter O'Dowd" <Peter.ODowd@opdc.london.gov.uk>, "Clare Woodcock" <Clare.Woodcock@opdc.london.gov.uk>, "Blades Nick (ST)" <Nick.Blades@TfL.gov.uk>, "Alexandra Reitman" <alexandra.reitman@opdc.london.gov.uk>
Subject: Re: Old Oak

Chris thanks very much.
Really helpful.
We will feed this information into the work we are progressing.
Thanks
Mick

Sent from Email+ secured by MobileIron

From: "Porter Chris" <ChrisPorter@TfL.gov.uk>
Date: Wednesday, 21 February 2018 at 16:55:44
To: "Michael Mulhern" <michael.mulhern@opdc.london.gov.uk>
Cc: "Peter O'Dowd" <Peter.ODowd@opdc.london.gov.uk>, "Clare Woodcock" <Clare.Woodcock@opdc.london.gov.uk>, "Blades Nick (ST)" <Nick.Blades@TfL.gov.uk>
Subject: RE: Old Oak

Hi Mick,

Please below for responses to the questions posed by both yourself and Clare. As discussed over the phone, this information is high level only and further work would be required to develop and investigate further in the event that a two track viaduct is taken forward.

Please let me know if you have any questions.

Regards

Chris

High-Level Cost Estimate

- Option 1 - A single stage construction proposal for the basic viaduct structure with no specific provision for a station.

  Value - £142m

- Option 2 – A design for a viaduct supporting a future station. In this case the station would be partly supported on the viaduct structure and the viaduct foundations would be designed in order to make future provision for such a structure. The station would then be completed months or years later on the pre prepared foundations.

  £143m – Stage 1
  £30m – Stage 2

  Total in 2 phases = £172m

- Option 3 – Viaduct and station built in one operation. This assumes the same construction activities as Option 2, but with the construction carried out in a sequential manner. Without the additional platform, the scheme delivers less trains per hour and results in less capacity. This option also severs a link between services coming from the south and HS2. The study TfL commissioned was for interchange to HS2 and therefore we had to maximise interconnections.

Value - £166m

All are in outturn prices, include risk and assume delivery in 2023. Land costs are excluded. For comparison, the cost for three track viaduct and station was **£197m**.

Area required for the viaduct

From a high level review, taking only the land directly under the viaduct (i.e. not including any accesses or protective zones which would likely be the same regardless of the size of the viaduct) the twin track station and viaduct would need around 6200sq m between chainages 330 and 650. The equivalent area required for the original scheme between the same chainages would need about 8200sq m. this would result in a reduction of about 2000sq m. The exact area 'released' through having a smaller viaduct would depend on the precise alignment of the viaduct, but would likely be spread along its length.

Cost and timescales for redoing the GRIP3 design

Given the previous work that has been undertaken, our ballpark estimate is that the cost would likely be between £1.5m and £2m depending on who developed the design, and would take about 12 months. This is based on the following:

Consultant Designer Cost: £1.1m. You could assume a 20% deduction if it was agreed they would use the previous work, but this is hard to calculate accurately/predict how happy NR would be with this.

If others were to take forward the design, we would be happy to share all drawings, but wouldn't be able to take any liability for that further design being based upon it, which could potentially cause issues when getting it signed off.

Network Rail Cost: £300K-£500K (our agreement was around £250K with one NR route but we have authority to sign off designs as Project Engineer which Car Giant/Arup (for example) won't be able to do, therefore they would have to pay for additional Network Rail engineers to complete the first review before it goes to the Asset Managers. This also includes cost to complete surveys on the track/other NR assets which they may have to redo. As Car Giant are an external party (rather than a third-party rail partner as we are) Network Rail may also insist on extra oversight i.e. more time for Project Manager/Sponsor. This doesn't include them paying Arup or another consultant to act as Project Manager.

It would likely take 12 months from start of design to Network Rail Sign-Off (three routes involved).

Provision for future delivery of a station

As set out in our letter of 26 January, in the event that a viaduct is taken forward as the preferred solution (with either two or three tracks) our strong view is that the opportunity to enable future delivery of Hythe Road station should be protected and therefore, as a minimum, passive provision for Hythe Road Station should be made within its design and construction. As set out above, we do not believe that the cost of providing this is significant.

From: Michael Mulhern [mailto:michael.mulhern@opdc.london.gov.uk]
Sent: 09 February 2018 14:31
To: Porter Chris
Cc: Peter O'Dowd; Woodcock Clare (OPDC London)
Subject: Old Oak

Chris

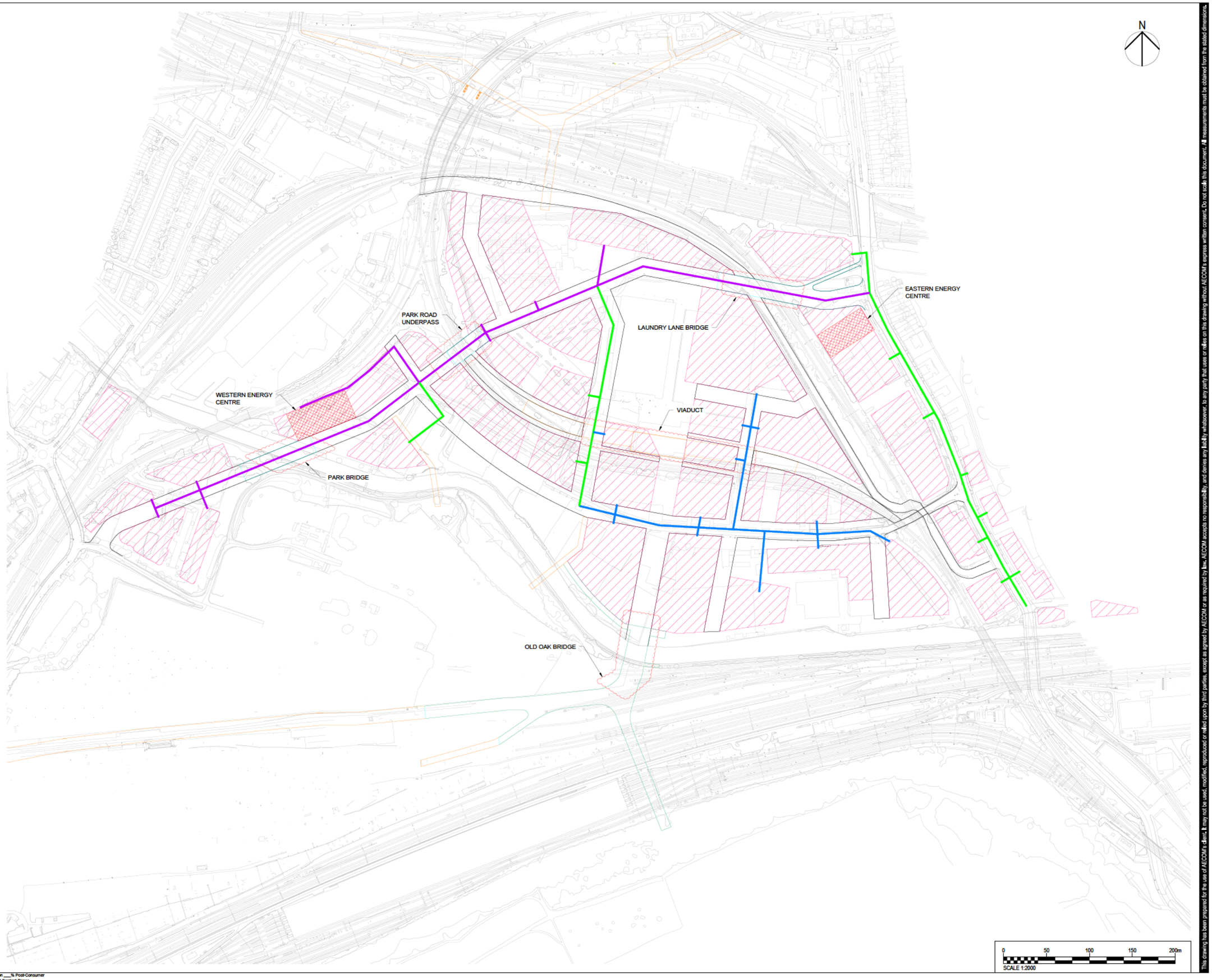
Thanks for the chat it was very informative and it would be useful to get some of the things we discussed in writing:

- Could you provide us with the prices for both the 3 track and the 2 track viaduct options. We will need this information to be able to plug into our viability modelling that we are progressing at the moment. The sooner you could provide this the better.
- Could you confirm TfL's position if a 2 track viaduct was proposed
- We are assuming that a 2 track viaduct option would need to be designed in a way that would not preclude delivery of a station in the future, which you believe should be easily achievable.
- Could you provide some indication of the timescale and cost involved in progressing a GRIP3 for a two track viaduct

Have a good weekend

Michael Mulhern
Director of Planning
Old Oak and Park Royal Development Corporation
Office address: 169 Union Street, London SE1 0LL
Postal address: City Hall, The Queen's Walk, London SE1 2AA
E: michael.mulhern@opdc.london.gov.uk
T: 020 7983 6535 | M: 07584 556 903 | General Enquiries: 020 7983 5732
Website | Twitter | YouTube | Instagram | Facebook | e-newsletters| Blogs, Events & Activities

Appendix D Utilities



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PROJECT

Old Oak Common

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KEY

- PROPOSED DEVELOPMENT PLOT
- PROPOSED DISTRICT HEATING 2018 - 2022 (HIF)
- PROPOSED DISTRICT HEATING 2023 - 2028
- PROPOSED DISTRICT HEATING 2029 - 2033
- PROPOSED ENERGY CENTRE

THIS SKETCH IS A WORK IN PROGRESS AND IS SUBJECT TO FURTHER REVISIONS

ISSUE/REVISION

I/R	DATE	DESCRIPTION
P04	14.08.2018	PIPEWORK UPDATED
P03	04.07.2018	HIF ROUTE EXTENDED
P02	28.06.2018	MASTERPLAN UPDATED
P01	15.05.2018	FIRST ISSUE

KEY PLAN

PROJECT NUMBER

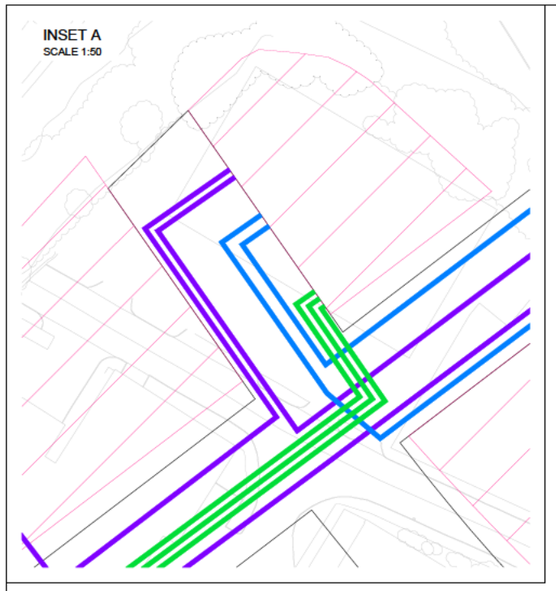
60495203

SHEET TITLE

PROPOSED DISTRICT HEATING LAYOUT MASTERPLAN OPTION 6

SHEET NUMBER

OOC-ACM-UTL-XX-SK-UT-05005



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KEY

- PROPOSED DEVELOPMENT PLOT
- 11kV RING CIRCUIT 1
- 11kV RING CIRCUIT 2
- 11kV ROUTE 1

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ISSUE/REVISION

I/R	DATE	DESCRIPTION
P01	29.06.2018	FIRST ISSUE

KEY PLAN

PROJECT NUMBER

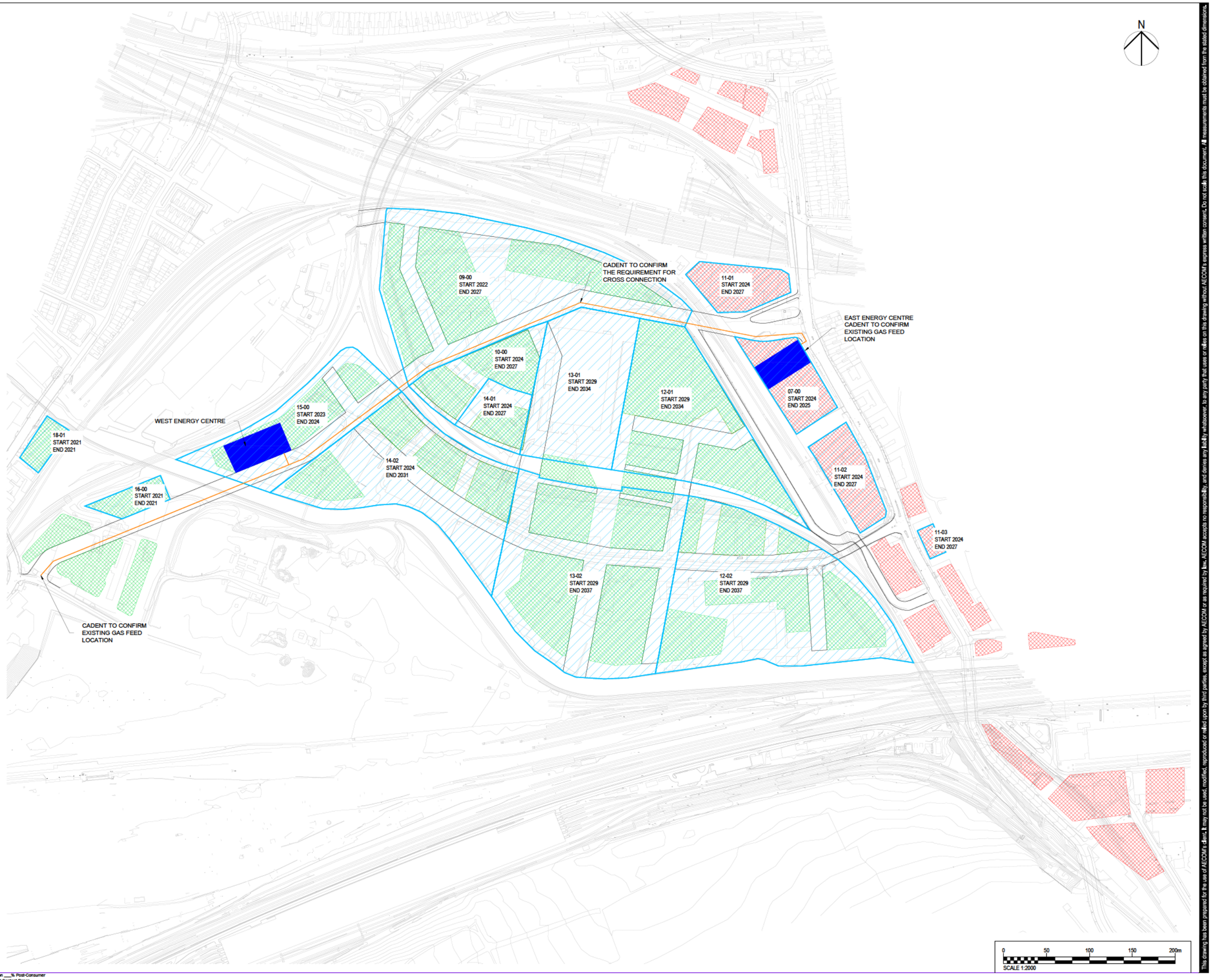
60495203

SHEET TITLE

PROPOSED 11kV ELECTRICITY ROUTES TO SERVE THE WESTERN WEDGE

SHEET NUMBER

OOC-ACM-UTL-XX-SK-UT-05008



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5. TO BE READ IN CONJUNCTION WITH 'Gas Calcs for Old Oak North (Aligned to V4.0 Trajectory)_2018-06-19'

KEY

- PROPOSED STRATEGIC GAS ROUTE
- DEVELOPMENT PLOTS SERVED BY EAST ENERGY CENTRE
- DEVELOPMENT PLOTS SERVED BY WEST ENERGY CENTRE
- ENERGY CENTRE
- DEVELOPMENT TRAJECTORY SITE

THIS SKETCH IS A WORK IN PROGRESS AND IS SUBJECT TO FURTHER REVISIONS

ISSUE/REVISION

I/R	DATE	DESCRIPTION
P01	26.06.2018	FIRST ISSUE

KEY PLAN

PROJECT NUMBER

60495203

SHEET TITLE

PROPOSED ENERGY CENTRES WITH STRATEGIC GAS CONNECTION

SHEET NUMBER

OOC-ACM-UTL-XX-SK-CE-05017

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