

Transport for London
**Upper Lee Valley Transport
Modelling and Bus Priority Study**
BPN01 – Bus Performance and
Challenges: Short and Medium Term
Requirements

Final | 2 November 2017

This report takes into account the particular
instructions and requirements of our client

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1 Introduction

1.1 Background

The Upper Lee Valley Opportunity Area (hereafter referred to as the ULV) covers an area around the River Lea of approximately 3,880 hectares. The ULV includes the London Boroughs of Enfield, Haringey, Waltham Forest and Hackney in the North London sub-region.

The Opportunity Area has substantial potential for unlocking housing and employment for London over the next 20-30 years. The Opportunity Area Planning Framework (OAPF) previously published by the Greater London Authority (GLA) in 2013 identified the potential for 20,000 new homes and 15,000 new jobs to be delivered within the ULV by 2031.

Population growth estimates have increased significantly since the OAPF was first published in 2013, with further opportunities arising primarily because of the proposed Crossrail 2 scheme which will serve the ULV. This will provide improved connectivity and high frequency public transport access into Central London and beyond. As a result of the increased population growth projections and the new Crossrail 2 scheme, TfL now estimates that up to 50,000 new homes and 20,000 new jobs could be delivered in the ULV. In addition, since the OAPF publication, several transport investments are committed and schemes have already been implemented, including improvements to rail, cycling and highways.

TfL has appointed Arup to undertake strategic transport modelling to support an update to the previous Transport Study for the OAPF and assess options for associated bus priority investment in the area in the short, medium and long term. Alongside this, Arup will identify which corridors are more likely to need enhanced frequencies or new links to support growth in the ULV.

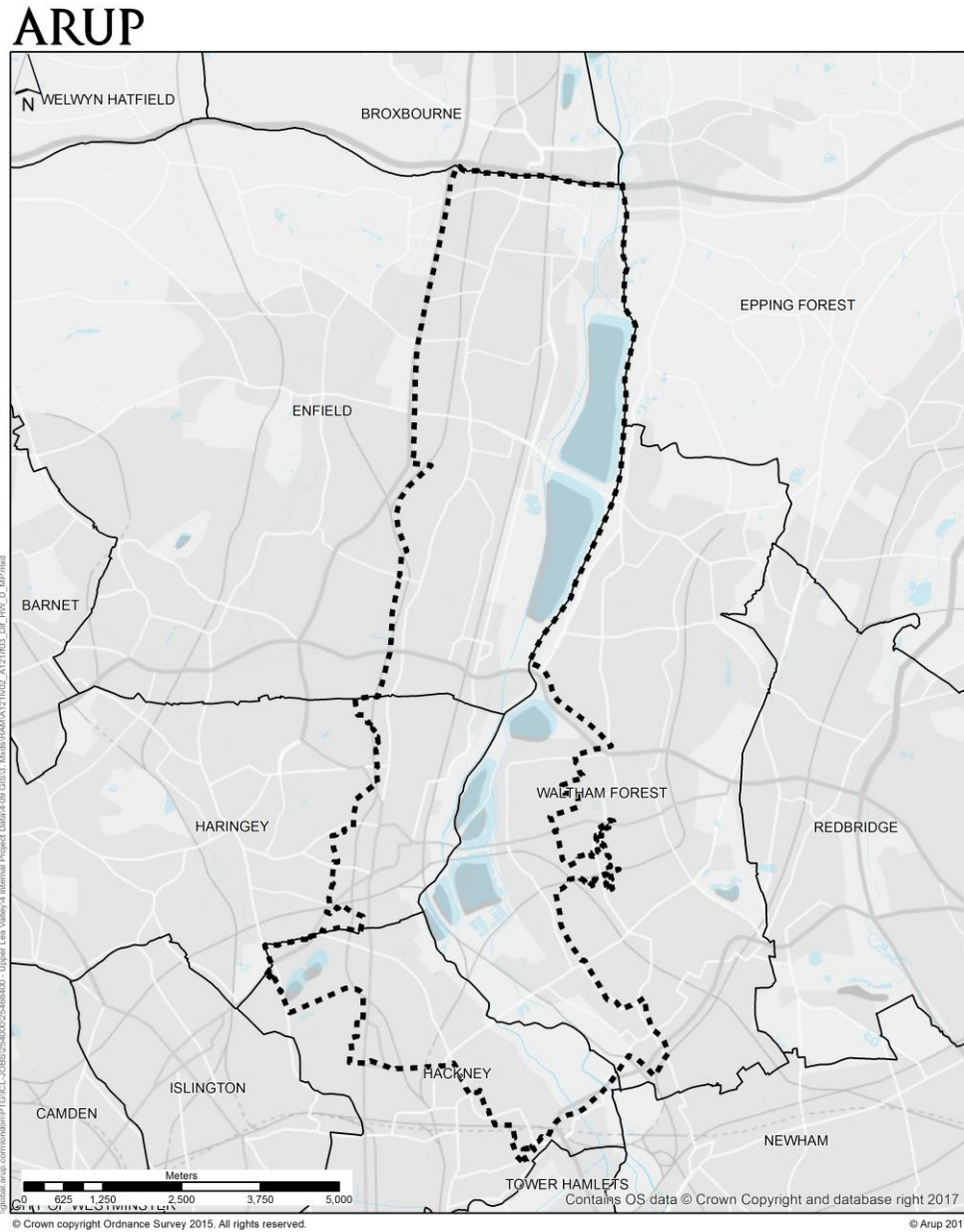
This report is the first interim deliverable of the Bus Priority Study for Transport for London (TfL) and focuses on reviewing planning policies and demand growth, evaluating the bus network within the study area and determining short to medium term changes and improvements. Study Area



The ULV study area includes the London Boroughs of Enfield, Haringey, Waltham Forest and Hackney. The study area is roughly bound by:

- the M25 to the north,
- the River Lea and Lee Navigation to the east,
- the Queen Elizabeth Olympic Park (Stratford) to the south, and
- the A10 Great Cambridge Road to the west.

Figure 1 shows the boundaries of the study area.

Figure 1 ULV study area



 Upper Lee Valley Boundary
 Borough Boundaries

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Future growth will put pressure on the rail and underground network in the ULV and the bus network will play a key role in providing local connectivity, enabling local communities to access jobs and supporting sustainable growth in North London. Sections of the bus network in and around the ULV are already operating close to capacity and significant improvements will need to take place to help deliver the housing and employment targets.

1.2 Aims of the Study

This report focuses on:

- A policy and demand growth review, identifying potential development-related bus opportunities;
- Performance analysis for the highest and lowest performing bus routes; and
- Analysis of existing data with a summary of opportunities, challenges and potential enhancements required in the short and medium term.

1.3 Structure of report

This report is organised as follows:

- **Section 1, Introduction** - the remainder of this section provides a brief context of the study and the goals established to guide the work.
- **Section 2, Existing Demand** – outlines the existing bus network within the study area (e.g. frequency, coverage) and documents the current levels of usage.
- **Section 3, Existing Performance Review** – evaluates bus routes within the study area based on various performance metrics and identifies the highest and lowest performing bus routes.
- **Section 4, Planning Context and Growth** - summarises current planning policies and priorities, and recommendations to support growth.
- **Section 5, Bus Priority Areas** – documents the short-term bus priority and improvements already identified by TfL, as well as short to medium-term changes and improvements based on the analysis conducted.
- **Section 6, Conclusions** – presents the results of this study and outlines the next steps of the project.

Following on from this study, the next deliverables, will report the medium and long term analysis and considerations, building up to the final report. The next deliverables will cover:

- Bus performance and challenges - the long-term requirements;
- Mitigation measures; and
- Scheme prioritisation.

2 Existing Demand

2.1 Data Sources

Analysis of the current bus demand within the ULV study area was based on multiple datasets as summarised in **Table 1**.

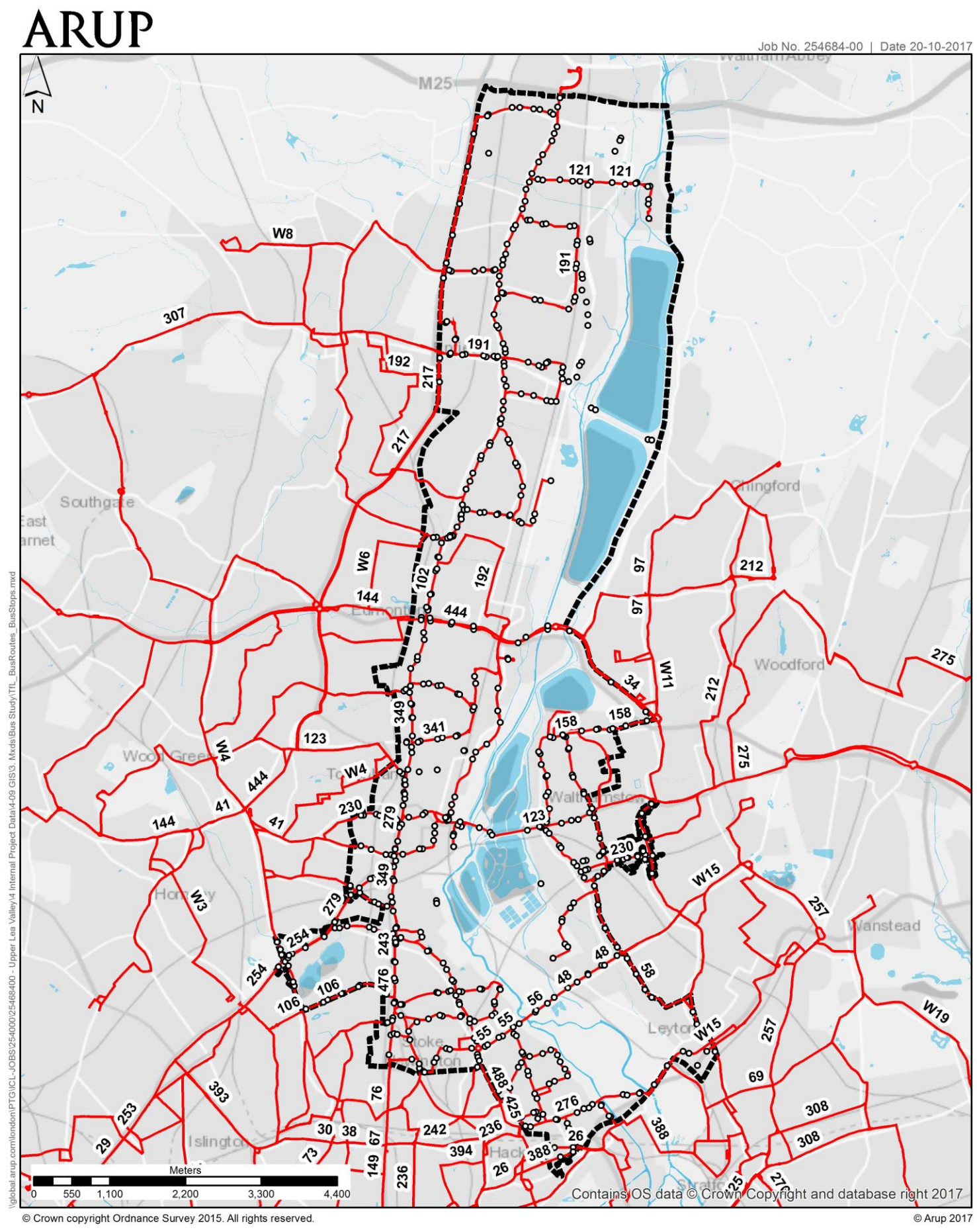
Table 1 Summary of data sources




Data	Description	Data Received
TfL Bus Origin and Destination Surveys (BODs)	TfL dataset providing indication of bus journey Origins and Destinations	28 th April 2017
TfL Bus Route Frequency	TfL dataset reporting operational bus route frequencies	12 th April 2017
TfL Electronic Ticket Machine Factors	TfL dataset providing indication of factors used to convert data to/ from ETM	10 th May 2017
TfL Boarding Profiles	TfL dataset showing boarding profile for selected bus routes	10 th May 2017
TfL Inference Rates	TfL dataset showing relationship between origin and destinations	28 th April 2017
TfL Routes / Bus Stops Map	GIS dataset showing bus routes and bus stop locations	Open Source/ TfL
TfL London Buses Quality of Service Indicators: Route Result for London Buses Services	TfL report on bus route performance matrices	TfL QSI Quarter 1 2017-18 report
TfL Public Transport Accessibility Level	Benchmark of the level of public transport access	Open Source

2.2 Routes and Frequencies

A total of 75 day-service bus routes serve the ULV study area (**Figure 2** and **Figure 3**). The current bus routes have good road network coverage with high frequency bus services on all major corridors of the ULV study area. High frequency bus routes have weekday peak frequency of five or more services per hour. The radial routes (A10 and A1101) and orbital route (A406 North Circular) have a mixture of high and low frequency bus routes.

Figure 2 High frequency bus routes within ULV study area

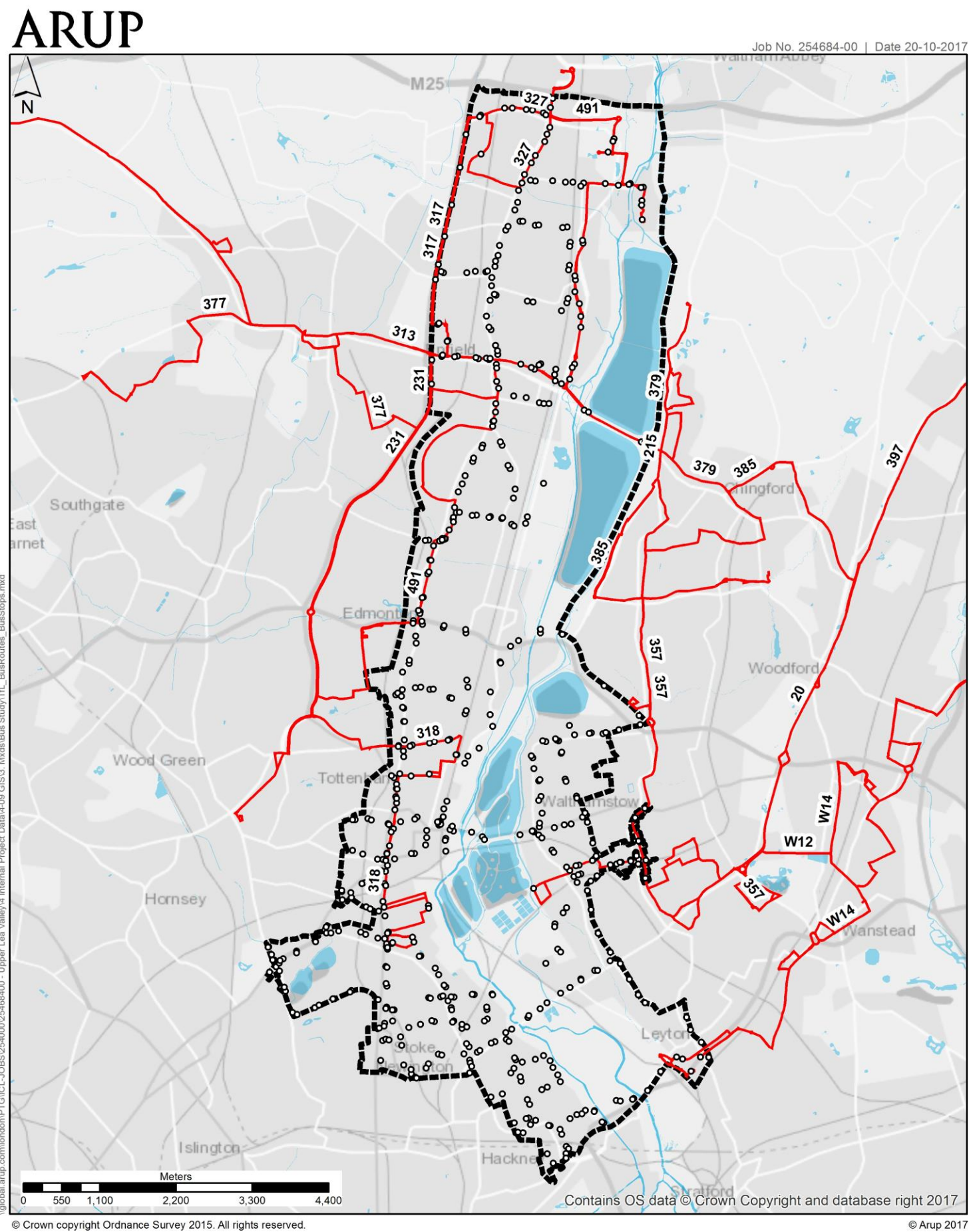


-  Upper Lee Valley Boundary
-  Bus Stops within Upper Lea Valley
-  High Frequency TfL Bus Route

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Based on TfL route results for London Buses Services (Q3, 2016/17)
 High frequency - weekday peak frequencies of 5 or more buses per hour
 Low frequency - weekday peak frequencies of 4 or less buses per hour

Figure 3 Low frequency bus routes within ULV study area



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-  Upper Lee Valley Boundary
-  Bus Stops within Upper Lee Valley
-  Low Frequency TfL Bus Route

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Based on TfL route results for London Buses Services (Q3, 2016/17)
 High frequency - weekday peak frequencies of 5 or more buses per hour
 Low frequency - weekday peak frequencies of 4 or less buses per hour

Figure 4 Public Transport Accessibility Level of Upper Lee Valley (source: OAPF)

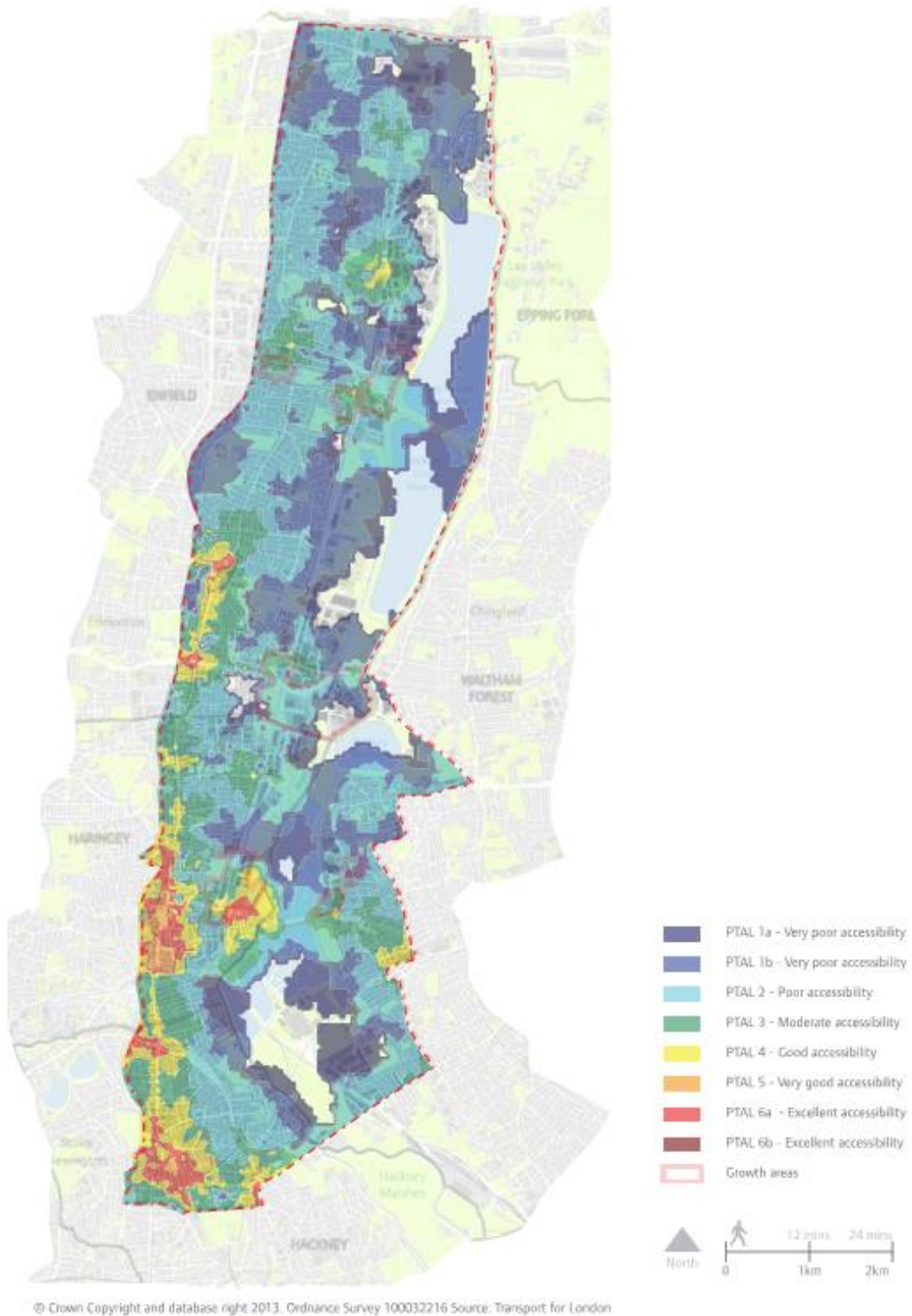


Figure 4 illustrates the Public Transport Accessibility Level (PTAL) for the ULV study area in 2012. PTAL is an industry standard measure of the accessibility in London. PTAL accounts for the type and frequency of public transport serving a location, the distance and walking time to access the services and the waiting time. PTAL is measured in categories ranging between 0 and 6b, with 0-2 indicating poor accessibility and 6 illustrating the area has excellent access to public transport.

The current locations of high PTAL scores coincide with areas of higher population and employment density; the south and west of the ULV have high PTAL scores, whereas the east and north have low PTAL scores. The PTAL map therefore suggests that currently in the ULV there exists a strong relationship between public transport and the housing and employment density.

Appendix A1 summarises the frequency of bus routes, direction, type of vehicle (double deck or single deck) and the borough it serves. Within the ULV study area, LB Hackney is served by 33 bus routes, whilst the boroughs of Enfield, Haringey and Waltham Forest are served by 27 to 28 routes.

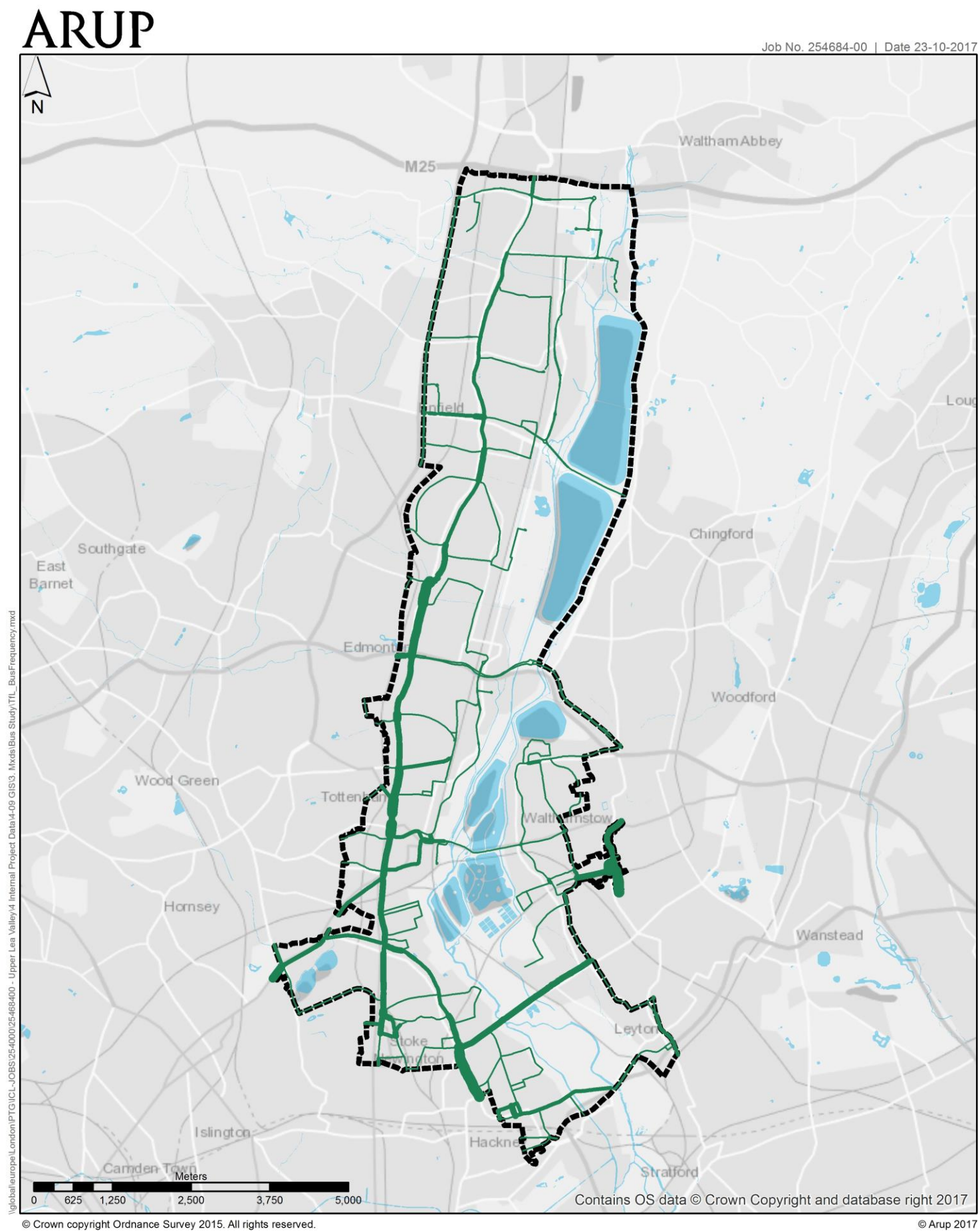
In terms of frequency, 75% (56 out of 75) day-service buses in the ULV study area are high frequency while 25% (19 out of 75) are low frequency.¹ Route 38 between Clapton and Victoria has the highest frequency at 18 buses per hour (bph).

The 72% (54 out of 75) day-service buses in the ULV study area are double deck vehicles and 28% (21 out of 75) are single deck vehicles. Single deck vehicles may be used on these routes due to low bridges. However, if that is not the case, and if demand is proven significant, then these routes could be converted to double deck operation to provide more capacity.

Figure 5 illustrates the weekday peak period bus service frequency within the ULV study area.

¹ According to TfL's *London Buses Quality of Service Indicators Route Result for London Buses Services* (First Quarter 2017/18), high frequency services are routes that have weekday peak frequencies of five or more buses per hour (i.e. a service frequency of 12 minutes or more frequent). Low frequency services are routes with a weekday peak frequency of four buses per hour or less (i.e. service interval of every 15 minutes or less frequently).

Figure 5 Bus frequency



- Bus Frequencies (buses per hour)**
- 1 - 30 bph
 - 31 - 60 bph
 - 61 - 90 bph
 - 91 - 120 bph
 - 121 - 200 bph
 - ⬜ Upper Lee Valley Boundary

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It is evident from the above that, of the sections within the ULV, the busiest North South corridor is along the A1010/ A10 while the busiest East West corridor is the A104 Lee Bridge Road.

The A1010/A10 corridor at Hertford Road / Fore Street / Tottenham High Road is the busiest north-south bus corridor in ULV study area. The busiest segment of this corridor is on Tottenham High Road /A10 between Phillip Lane and West Green Road / Broad Lane, which accommodates approximately 134 bph in both directions during the weekday peak period.²

The busiest east-west corridor is the A104, Lee Bridge Road, with approximately 52 bph in both directions.³ With the Lee Navigation presenting a geographical constraint, buses are limited to only three other east-west corridors in the ULV: the A503, North Circular Road and A110. However, unlike Lee Bridge Road (A104), these other three bus corridors show significantly less frequency of service in both directions. The A110 (Lee Valley Road) is served by only one route with approximately 6 bph in both directions while the A503 (Ferry Lane) and A406 North Circular Road have approximately 22 – 26 bph in both directions.

High frequency bus corridors converge on the major bus stations in the ULV area. The three major bus stations within the ULV study area are:

- **Walthamstow Central bus station** is one of the busiest bus stations in the ULV and has a total of six bus stands. There are 17 bus routes stopping at the station of which nine are terminating routes (20, 34, 48, 58, 69, 215, 257, 675, and W11) and eight are passing through (97, 212, 239, 275, 357, W12, W15, and W19). Buses can access the station through Selbourne Road and High Street. **Appendix B1** shows the bus routes serving Walthamstow Central bus station.
- **Edmonton Green bus station** is situated adjacent to the Edmonton Green Shopping Centre and east of Edmonton Green Roundabout (A1010 Green Road (Hertford Road) / Church Road / The Broadway). There are 12 bus routes stopping at the station, seven of which are terminating routes (102, 144, 149, 191, 259, 616, and W6) and five are passing through (192, 279, 349, 491, and W8). **Appendix B2** shows the bus routes serving Edmonton Green bus station.
- **Tottenham Hale Bus Station** is located east of the A503 Ferry Lane and Broad Lane junction and was recently renovated with new bus stands and public amenity space. The bus station is adjacent to Tottenham Hale London Underground station and Tottenham Hale rail station, connecting to central London, the West End, the City of London, Stratford, Stansted Airport and Cambridge. Six bus routes serve the bus station, of which three are terminating routes (41, 76, 192) and three are passing through (123, 230, W4). **Appendix B3** shows the buses serving Tottenham Hale bus station.

² TfL Bus Routes 79, 49, 243, 259, 279, 318, 349, 476, W4

³ TfL Bus Routes 48, 55, 56

Table 2 and **Table 3** provide detailed indication of the service span by route and a summary of the ULV bus route service spans respectively.

Service spans – also known as hours of operation or operating hours - are the hours of the day and days of the week in which the buses run.

The highlighted green cells shown in **Table 2** indicate that the bus service is operating during that particular period of the day and day of the week. For example, bus route 20 runs approximately from 6:00 to 23:00 on the weekdays, 5:00 to 23:00 on the Saturday, and 6:00 to 23:00 on the Sunday.

Table 2 shows that routes in the ULV run regularly on weekdays and weekends. Service span is one of the key elements influencing the attractiveness of public transport. A bus route with a longer span of service will generally be able to accommodate a wider variety of users and trip purposes than a route with a shorter span of service. Service span also has direct cost implications for TfL and requires careful consideration. The appropriate service spans are determined by the community's demand and the business case (ratio of benefit to cost).

The information in **Table 2** shows that most of the buses run between 05:00 and 24:00 on weekdays. In fact there are only seven routes that run limited services and do not operate on Sundays: 34, 327, 385, 616, 617, 629, 675. Routes in the 600-series are school routes and only operate during weekday school times.

Seven routes operate a 24-hour service on weekdays, Saturdays and Sundays: routes 69, 76, 102, 149, 242, 243, and 341. Two routes operate a 24-hour service on Saturday and Sunday only: routes 307 and W7.

Table 3 summarises the services spans of all bus routes serving the ULV study area. Each highlighted cell shows the level of busyness, red indicates that majority of the bus routes within ULV study area are operating during that hour while green indicates that minimal number of bus routes are operating during that hour of day (and day of the week). It is evident that majority of the bus routes are servicing on the weekday between 6:00 and 8:00 (A.M. peak period), and between 14:00 and 16:00 (P.M. peak period).

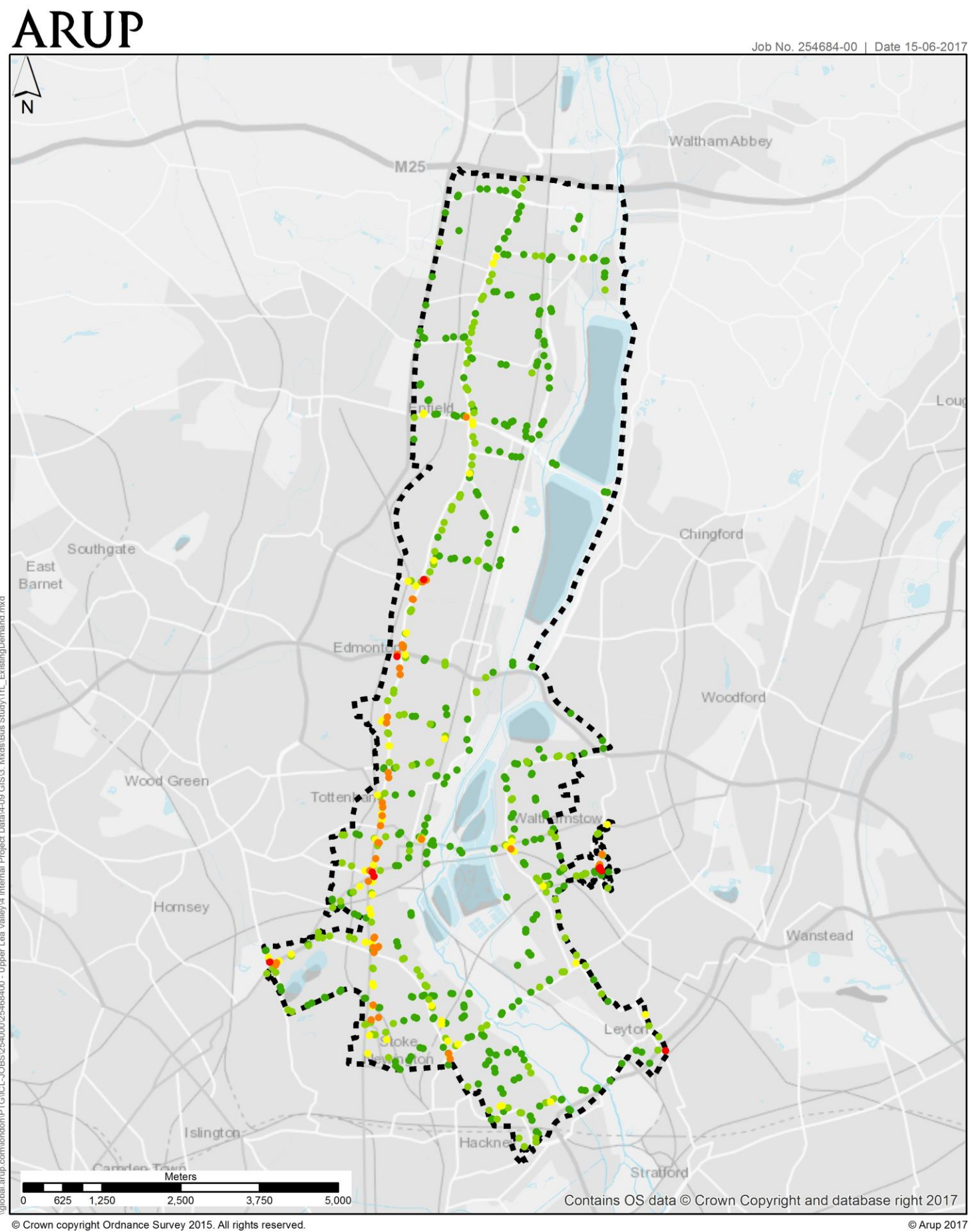
2.3 Demand Patterns

Figure 6, Figure 7 and Figure 8 show the typical weekday, Saturday and Sunday total passenger demand (boarding and alighting based on BODs data) at all bus stops in the ULV study area. The analysis shows that the most significant trip demand occurs at the following bus stops:

- Walthamstow Central Station (Stop AP) with 18,260 passengers;
- Seven Sisters Station (Stop D) with 14,884 passengers;
- Seven Sisters Station (Stop K) with 14,514 passengers;
- Edmonton Green Bus Station (Stop G) with 12,125 passengers;
- Leyton Station (Stop B) with 10,744 passengers;
- Walthamstow Bus Station (Station Stop) with 10,545 passengers;
- Walthamstow Bus Station (Stop A) with 9,657 passengers;
- Angel Corner / Silver Street Station (Stop A) with 8,122 passengers;
- Manor House Station / Woodberry Grove (Stop A) with 8,091 passengers; and
- Walthamstow Bus Station (Stop D) with 7,903 passengers.

Large numbers of passengers boarding and alighting require bus routes to have a longer dwell time, which has a potential impact on the overall journey time performance of the route.

Figure 6 Typical weekday passenger demand

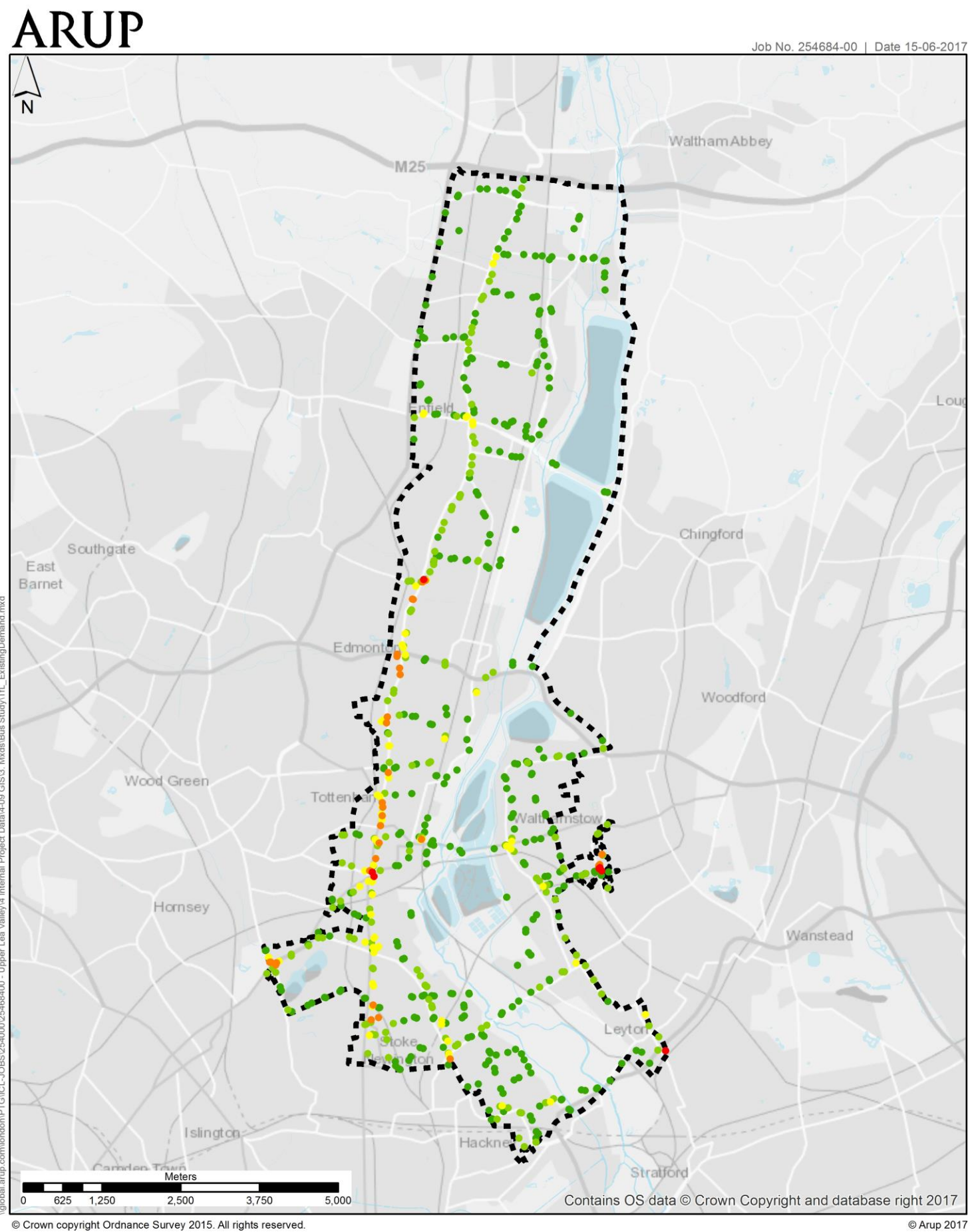


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- Typical Weekday Passenger Demand**
- Upper Lee Valley Boundary
 - 0 - 700
 - 701 - 2,000
 - 2,001 - 4,000
 - 4,001 - 8,000
 - 8,001 - 18,500

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Figure 7 Typical Saturday passenger demand

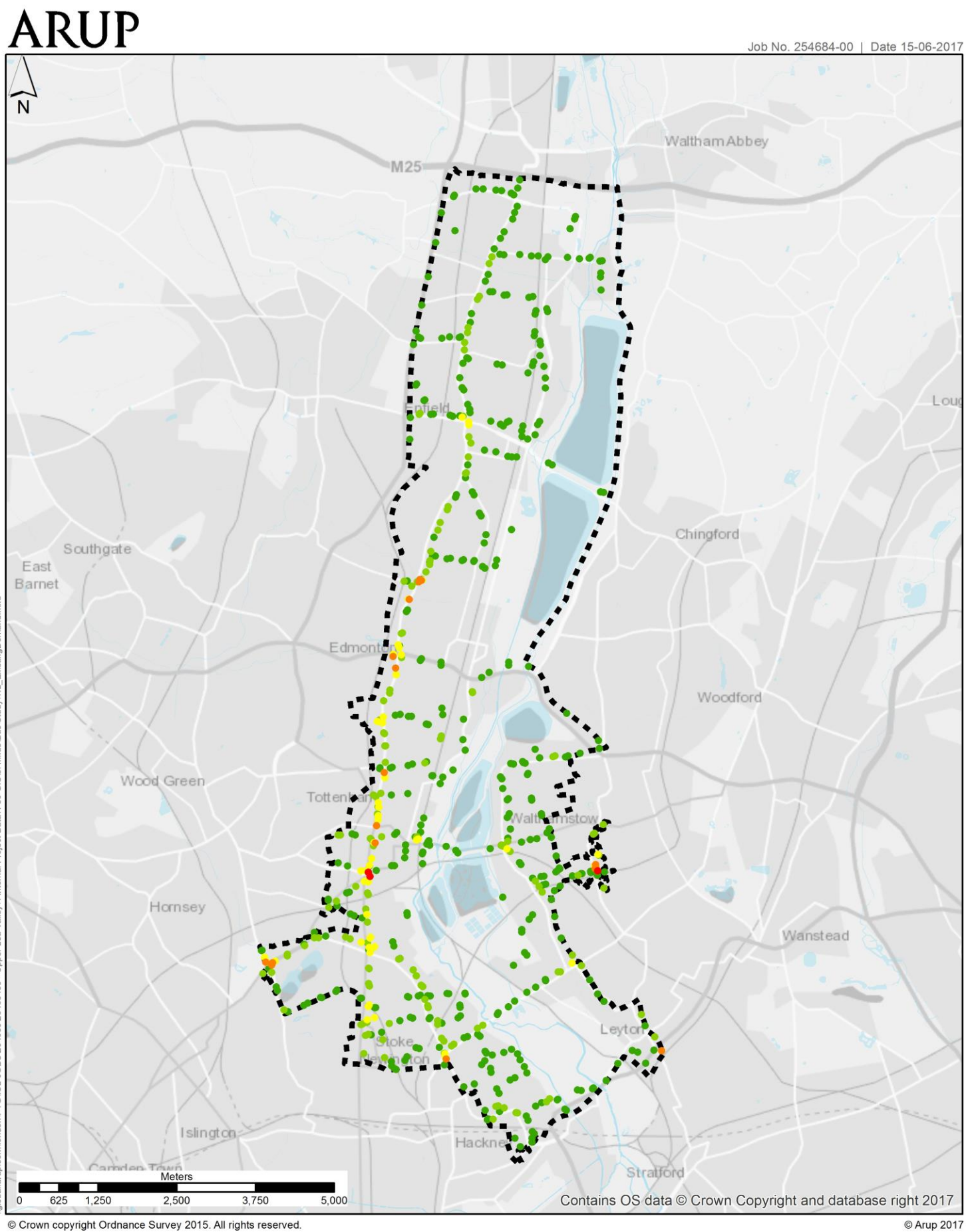


- Typical Saturday Passenger Demand
- 0 - 700
 - 701 - 2,000
 - 2,001 - 4,000
 - 4,001 - 8,000
 - 8,001 - 18,500
- Upper Lee Valley Boundary

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Figure 8 Typical Sunday passenger demand



- Typical Sunday Passenger Demand**
- Upper Lee Valley Boundary
 - 0 - 700
 - 701 - 2,000
 - 2,001 - 4,000
 - 4,001 - 8,000
 - 8,001 - 18,500

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Table 4 below shows the peak period usage for the ten busiest bus routes in the ULV.

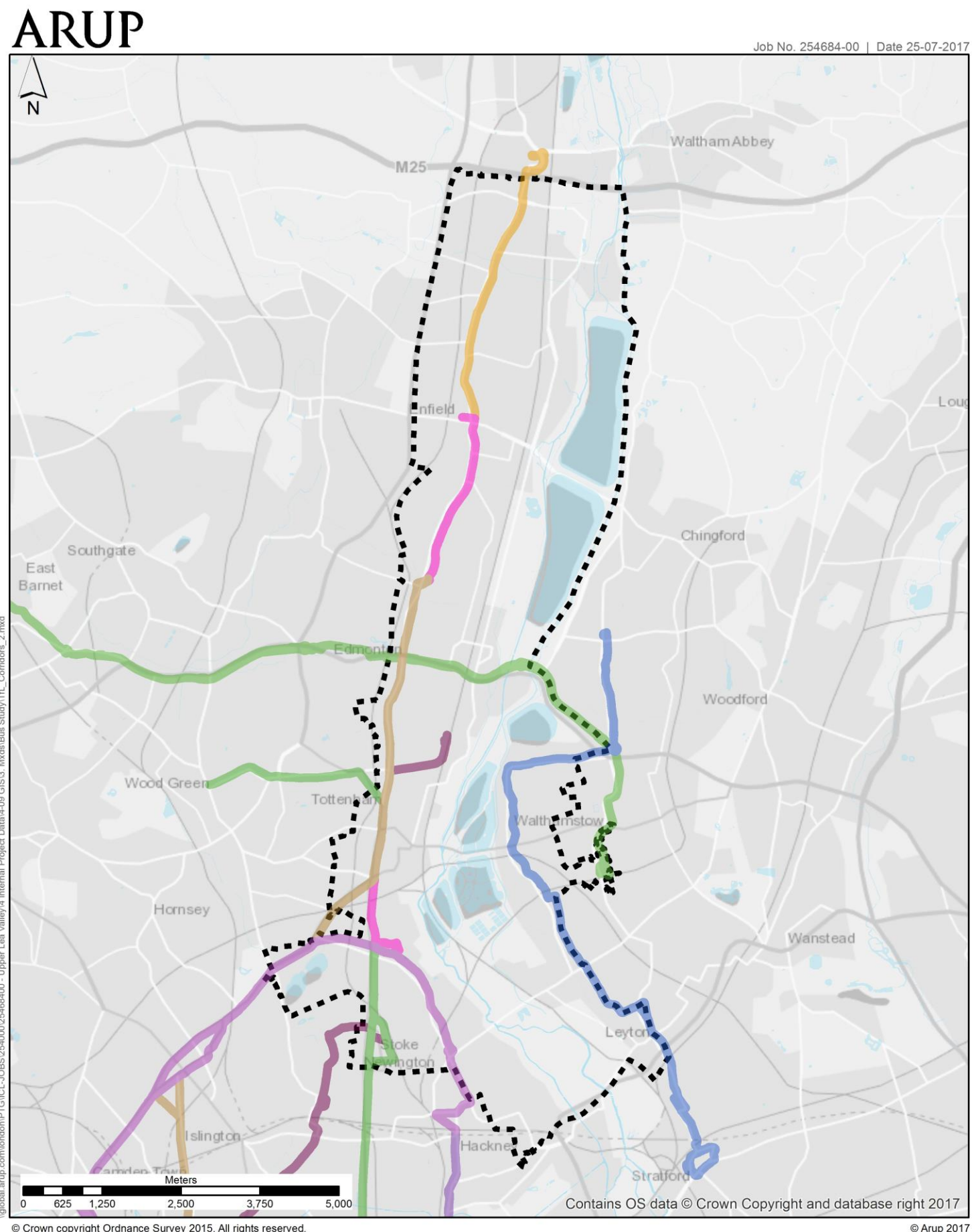
Table 4 Weekday Peak Period Usage for busiest bus routes in ULV

Bus Routes	Average Number of Bus Stops per direction		Total Passenger Demand within ULV study area	
	Total	In the Study Area (%)	AM Peak Period (7:00 – 9:30)	PM Peak Period (16:00 – 18:30)
279	50	49 (98%)	15,163	16,137
149	52	28 (54%)	9,775	10,785
349	33	27 (82%)	8,340	7,864
158	45	20 (44%)	6,833	6,766
259	45	23 (51%)	5,328	6,425
253	45	15 (33%)	5,926	6,146
254	47	15 (32%)	5,762	5,705
243	59	34 (57%)	5,329	5,599
476	43	20 (47%)	5,072	5,380
34	53	11 (21%)	4,673	4,347

Of these routes, six are north-south routes (249, 149, 349, 259, 243 and 476) travelling along the A1010 Hertford Road / Fore Street / Tottenham High Road / A10 High Road. All six bus routes are primary links to and from Central London and terminate at major London Underground stations including Manor House, London Bridge, Seven Sisters, King’s Cross, Waterloo, Euston and Stratford.

Figure 9 summarises the top ten busiest bus routes, in terms of passenger demand and the number of stops, within the ULV study area.

Figure 9 Busiest ULV bus routes



- Busiest bus routes**
- 259
 - 149
 - 158
 - 243
 - 253
 - 254
 - 279
 - 34
 - 349
 - 476
 - ULV Boundary

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 AND BUS PRIORITY STUDY

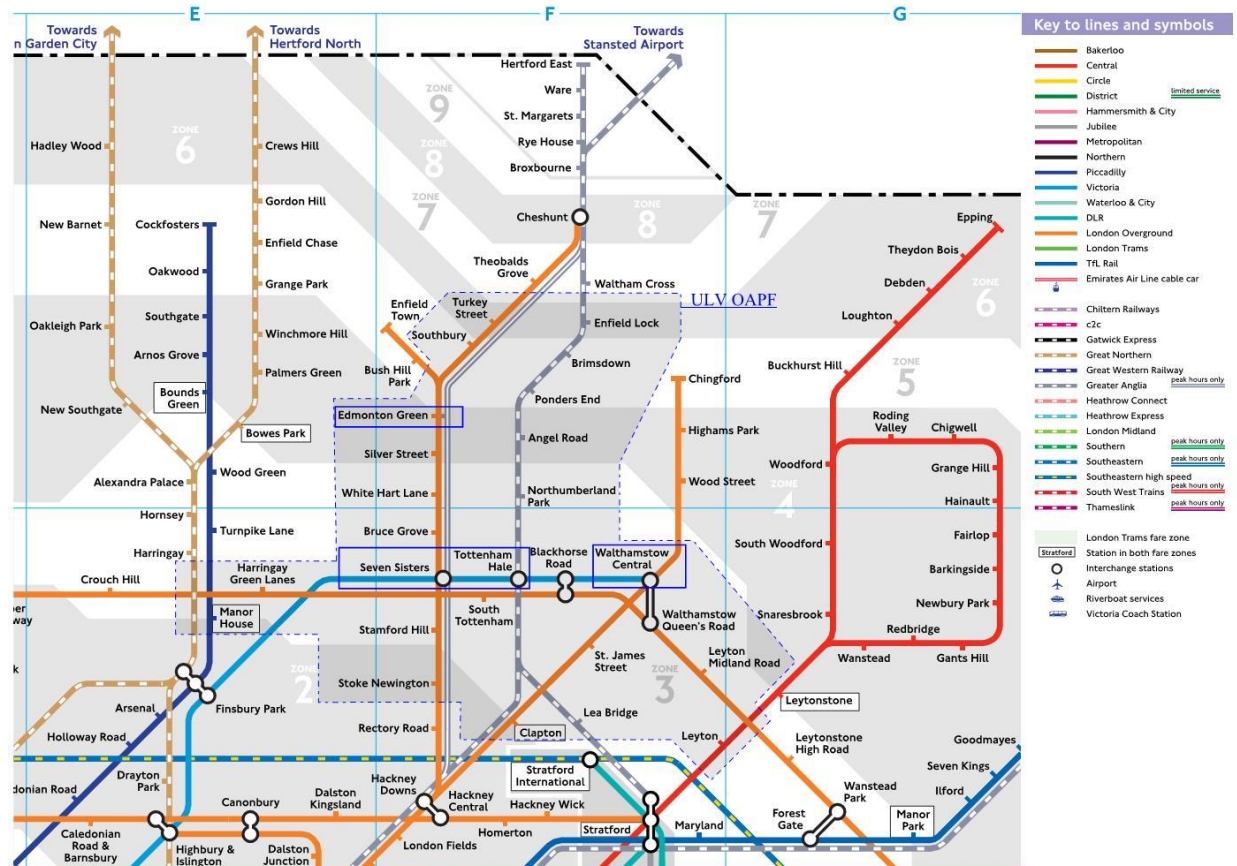
There appears to be a pattern within the ULV study area, showing that bus services are used as connecting modes to major London Underground (Victoria Line) and rail/London Overground interchanges in the peak periods.

Figure 10 shows the key London Underground (LU) and rail stations within the ULV area. The most significant stations in terms of passenger boarding and alighting volumes are highlighted.

The ULV encompasses TfL fare zones 2 to 6, whilst buses have a flat fare across London. LU and rail/London Overground zone fares can change significantly resulting in buses potentially used as:

- Means of reaching the ‘cheaper’ fare zone station – for example Edmonton Green (zone 3) or Walthamstow Central (zone 3); or
- An alternative mode to rail/London Overground routes – for example the London Overground branch between Edmonton Green and Stoke Newington.

Figure 10 Buses interchange with key rail and LU stations (source: TfL)



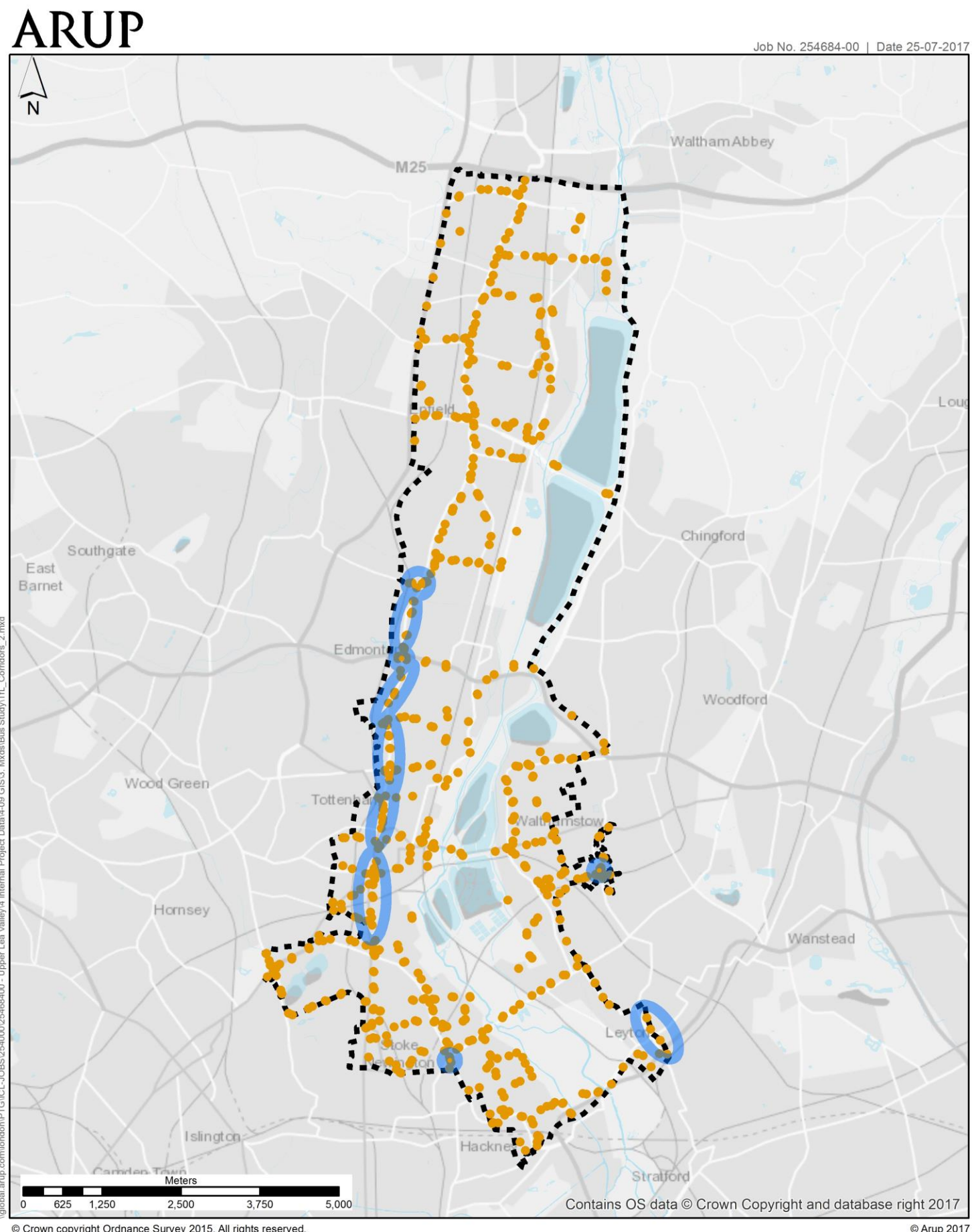
Bus patronage ‘hot spots’

From this work, we identified ten bus stops that reflect the highest level of bus usage:

- Edmonton Green
 - A1010 The Green
 - Edmonton Green bus station
 - The Broadway
- A1010 corridor
 - Sterling Way
 - Fore Street
 - Tottenham High Road
- Walthamstow Central
 - Walthamstow Central bus station
 - Selborne Road
- High Road Leyton; and
- Lower Clapton Road

These ‘hot spots’ have high frequency bus provision and high volumes of passengers alighting and boarding. **Figure 11** illustrates the location of these areas within the ULV area.

Figure 11 Busiest bus 'hot spots' and corridors



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- Busiest bus 'hot spots' and corridors
- TfL bus stops
- ULV Boundary

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3 Existing Performance Review

3.1 Existing Reliability

The following section of the note outlines several service quality measures.

Quality of Service Indicators

TfL uses various performance metrics to determine the route's overall reliability and delay to passengers. These performance metrics are known as Quality of Service Indicators (QSI).

The QSIs are derived for a bus route starting from a representative sample of iBus data for a bus route that considers time of arrival and departure from each bus stop, and compares this with the scheduled arrivals and departures. Using this information, it is then possible to identify the poorly performing routes (showing a significant difference between the actual and the scheduled timetable).

An additional factor to be considered is the bus frequency. TfL bus routes are divided into two categories: high and low frequency. High frequency bus services are routes that have weekday peak frequencies of five or more buses per hour. Low frequency bus services are routes that have four or less than four buses per hour during weekday peak periods. A passenger using this service is more likely to use a timetable. This means it is more important that services run to schedule.⁴

For high and low frequency routes, QSI statistics are calculated from iBus data for a representative sample of scheduled timing points (QSI points) in both directions. Results show performance of routes operating between the hours of 05:00 and 23:59. This data is then compared against the timetable to see how long a passenger waits, compared to the wait time if the bus service ran exactly to schedule. The difference is referred to as Excess Waiting Time (ETW).

EWT is the difference between scheduled waiting time (SWT) and average actual waiting time (AWT). It shows how long passengers wait over and above the scheduled time because of irregular buses or buses not running at all. The ratio between AWT and SWT indicates how long passengers are waiting on average than intended. A ratio of 1.5 means passengers waited 50% longer than intended.

Table 5 and **Table 6** summarise the overall reliability of high and low frequency bus routes in the ULV study area. The data presented here is taken from the TfL Quarter 1 2017/2018 QSI report.

In **Table 5**, it should be noted that the bus routes highlighted in red are the higher demand routes in the ULV study area. TfL benchmarks bus route performance against minimum standards. These vary between routes to take into account different operating environments (i.e. congested corridors, hot spots and route length).

⁴ <https://tfl.gov.uk/forms/14144.aspx#faqs>

Table 5 Quality of Service Indicators for High Frequency (Non-Timetabled) Day Routes in ULV study area

Route	Waiting Times (mins)			AWT / SWT Ratio	Probability of Waiting (%)				
	Scheduled Waiting Time (SWT)	Excess Waiting Time (EWT)	Average Waiting Time (AWT)		< 10 mins	10-20 mins	20-30 mins	>30 mins	Long Gaps
26	5.3	0.9	6.3	1.2	81.2	17.5	1.2	0.2	1.0
29	2.4	0.8	3.3	1.4	97.2	2.7	0.1	0	2.1
30	4.8	1.8	6.6	1.4	77.3	19.8	2.5	0.4	4.0
34	4.4	1.0	5.4	1.2	86.4	12.6	0.8	0.1	1.9
38	2.1	1.1	3.1	1.5	97.0	2.8	0.2	0	2.4
41	3.5	0.7	4.2	1.2	94.3	5.5	0.2	0	1.2
48	4.5	0.8	5.4	1.2	87.4	12.1	0.5	0.1	0.9
55	3.6	1	4.6	1.3	90.8	8.6	0.5	0.1	2.6
56	3.8	1.3	5.1	1.3	87.9	11.1	0.9	0.1	3.4
58	6.3	0.8	7.0	1.1	74.5	23.7	1.6	0.2	0.5
67	5.4	0.6	6	1.1	83.0	16.4	0.6	0.1	0.4
69	4.7	0.9	5.6	1.2	85.5	13.5	0.9	0.1	1.2
73	2.5	1.1	3.6	1.4	95.5	4.3	0.2	0	3.3
76	4.5	1.0	5.4	1.2	86.5	12.6	0.8	0.1	1.6
97	4.7	1.0	5.7	1.2	84.1	14.9	1.0	0.1	1.5
102	4.5	1.1	5.6	1.2	85.3	13.9	0.7	0.1	1.8
106	4.3	0.9	5.1	1.2	89.5	10.0	0.4	0.1	1.1
121	5.9	1.0	6.9	1.2	76.3	21.5	1.9	0.3	1.0
123	5.9	1.0	6.9	1.2	75.6	22.5	1.7	0.2	0.8
141	3.9	0.8	4.7	1.2	90.9	8.8	0.2	0.0	1.2

Route	Waiting Times (mins)			AWT / SWT Ratio	Probability of Waiting (%)				
	Scheduled Waiting Time (SWT)	Excess Waiting Time (EWT)	Average Waiting Time (AWT)		< 10 mins	10-20 mins	20-30 mins	>30 mins	Long Gaps
144	4.4	0.9	5.3	1.2	87.9	11.5	0.5	0.1	1.3
149	3.6	0.7	4.3	1.2	94.2	5.6	0.1	0.0	1.0
158	4.9	1.0	5.8	1.2	83.6	15.0	1.3	0.2	1.4
191	6.0	1.2	7.2	1.2	73.9	22.9	2.7	0.4	1.8
192	5.6	1.0	6.6	1.2	78.6	19.7	1.5	0.2	1.1
212	5.8	0.8	6.6	1.1	79.0	19.5	1.4	0.1	0.9
217	7.2	1.4	8.6	1.2	65.0	28.5	5.1	1.4	1.8
230	6.4	0.7	7.1	1.1	74.0	24.2	1.5	0.2	0.5
236	4.7	1.1	5.8	1.2	83.3	15.4	1.1	0.2	2.0
242	4.1	1.0	5.1	1.2	89.0	10.5	0.5	0.1	1.5
243	4.0	0.9	4.9	1.2	90.2	9.4	0.3	0.0	1.3
253	3.0	0.9	3.9	1.3	95.1	4.7	0.2	0.0	2.3
254	3.1	1.0	4.1	1.3	94.4	5.4	0.2	0.0	2.3
257	4.7	1.0	5.6	1.2	85.4	13.5	1.0	0.1	1.3
259	4.1	0.8	4.9	1.2	90.6	9.0	0.4	0.1	1.1
275	7.0	0.9	7.9	1.1	69.3	26.9	3.4	0.4	0.7
276	5.9	1.0	6.9	1.2	76.0	21.5	2.2	0.3	1.2
279	3.6	0.8	4.5	1.2	92.5	7.2	0.3	0.0	1.8
307	6.3	0.8	7.1	1.1	74.9	22.2	2.6	0.3	1.0
308	7.0	0.9	7.9	1.1	69.4	26.4	3.6	0.6	0.8
341	5.5	1.0	6.5	1.2	78.5	20.0	1.4	0.1	0.9
349	4.6	0.6	5.2	1.1	89.2	10.5	0.3	0.0	0.5

Route	Waiting Times (mins)			AWT / SWT Ratio	Probability of Waiting (%)				
	Scheduled Waiting Time (SWT)	Excess Waiting Time (EWT)	Average Waiting Time (AWT)		< 10 mins	10-20 mins	20-30 mins	>30 mins	Long Gaps
388	5.2	1.3	6.6	1.3	78.4	19.2	2.0	0.4	2.0
393	6.5	1.0	7.5	1.2	71.1	26.0	2.5	0.3	0.8
394	7.0	1.0	8.1	1.2	67.9	27.8	3.7	0.6	0.7
425	6.6	0.7	7.3	1.1	72.4	25.4	1.9	0.3	0.6
444	6.8	0.8	7.6	1.1	70.3	27.1	2.4	0.3	0.5
476	4.4	1.0	5.4	1.2	86.0	13.3	0.6	0.0	1.5
488	6.7	0.8	7.5	1.1	71.1	26.2	2.3	0.4	0.6
W11	6.1	0.7	6.8	1.1	77.5	20.6	1.7	0.2	0.5
W15	4.7	1.2	5.8	1.3	83.3	15.3	1.2	0.1	2.0
W19	7.5	0.8	8.3	1.1	67.6	28.1	3.7	0.6	0.9
W3	3.5	0.8	4.4	1.2	93.0	6.7	0.3	0	1.8
W4	6.0	1.0	6.9	1.2	76.3	21.6	1.9	0.2	0.9
W6	6.6	0.8	7.3	1.1	75.5	20.1	3.8	0.5	1.0
W8	4.7	0.9	5.6	1.2	85.9	13.3	0.7	0.1	1.5

Table 6 Quality of Service Indicators for Low Frequency (Timetabled) Day Routes in ULV study area

Route	Probability of Departure (%)			
	% On Time	Non-Arrival or Not Linked (%)	8 to 2.5 Mins Early (%)	5 to 15 Mins Late (%)
20	78.1	4.7	2.0	15.2
215	83.7	2.0	0.9	13.4
231	80.9	3.1	1.0	15.0
313	78.9	4.2	0.8	16.1
317	80.8	3.5	0.5	15.3
318	86.6	3.3	0.8	9.2
327	81.2	5.6	3.6	9.5
357	81.3	2.6	1.4	14.7
377	86.8	2.7	1.1	9.4
379	88.2	4.0	2.7	5.1
385	84.7	3.0	3.4	9.0
397	77.7	3.5	1.9	16.9
491	83.3	3.5	1.6	11.7
W12	66.0	8.1	1.9	24.0
W14	83.6	4.4	2.1	9.9

Percentage chance of a bus departing on time is the chance that a bus runs at the advertised time or between two minutes early and up to five minutes later than the scheduled departure time.

TfL sets minimum standards for performance for high and low frequency routes. The ULV routes which failed to meet their minimum standards in the last quarter are listed in **Table 7**.

Table 7 Performance against targets, Q1 2017/18

Route	EWT or % on time	Min. Standard
30	1.8 minutes	1.4 minutes
191	1.2 minutes	1.1 minutes
192	1.0 minutes	0.9 minutes
217	1.4 minutes	1.0 minutes
313	78.9%	82%
317	80.8%	82%
327	81.2%	90%
385	84.7%	90%
388	1.3 minutes	1.1 minutes
397	77.7%	82%
W12	66.0%	78%

None of the above routes have been identified as the most significant in terms of passenger boarding and alighting volumes.

Some of these routes, however, serve common corridors, which are known to experience traffic congestion and delays:

- A10 Great Cambridge Road and junction 25 approach – Bus routes 327, 317 and 217 serve sections of the A10 and M25 Junction 25, which experience delays due to traffic congestion;
- Routes 385 and 397 serve the Chingford area and share small sections of the route in common;
- Routes 191 and 192 serve Enfield and have convoluted routes through residential areas with hail and ride sections; and
- Routes 388 and 30 serve the area south of the ULV. Both routes use Wick Road (in proximity of the A12).

iBus Speed Data

iBus is an Automatic Vehicle Location (AVL) system that is installed on the majority of TfL buses to provide passengers with accurate on-board journey information (e.g. ‘next stop’ announcements) using a combination of satellite and GPRS tracking technology.⁵ The tracking system also contains a speedometer that collects the speed of buses.

The speed information assists us in understanding the impacts of road network traffic conditions on bus journeys in the ULV study area. This is particularly important considering the falling average speeds (3% over the last two years⁶) due to roadworks and congestion.

iBus data was obtained for major bus corridors which were identified based on high bus frequency and passenger demand. These indicators made them a priority to identify potential issues and possible short term improvements which would bring significant benefits.

The iBus data obtained was collected during the period from 20 March to 30 March 2017. There were no major accidents reported that could have affected the bus routes during the time in which the iBus data was collected.⁷ **Table 8** shows the bus route segments for which the iBus data has been analysed.

⁵ Transport for London. 23 April 2009. *All London’s buses now fitted with iBus*.

<https://tfl.gov.uk/info-for/media/press-releases/2009/april/all-londons-buses-now-fitted-with-ibus>

⁶ TfL annual report and statement of accounts 2016-17, Transport for London, London, 2017

⁷ It was noted that on 29 March 2017, Route 192 was diverted in multiple locations due to faulty temporary traffic lights at Bury Street, Enfield and Herford Road via Church Street (in both direction). However, a review of the iBus data suggest that the incident did not affect the overall results.

Table 8 ULV bus route segments for which iBus data was analysed

Bus Route	Towards	ID	Bus Speeds Segments	
			From Bus Stop	To Bus Stop
48	Towards London Bridge	1	Walthamstow Bus Station (Stop A)	High Road Leyton / Bakers Arms (Stop WH)
		2	High Road Leyton / Bakers Arms (Stop WH)	Clapton Pond (Stop E)
		3	Clapton Pond (Stop E)	Hackney Central Station (Stop H)
48	Towards Walthamstow Bus Station	4	Hackney Central Station (Stop J)	Clapton Pond (Stop H)
		5	Clapton Pond (Stop H)	High Road Leyton / Bakers Arms (Stop EC)
		6	High Road Leyton / Bakers Arms (Stop EC)	Walthamstow Bus Station (Stop A)
192	Towards Tottenham Hale Bus Station	7	Edmonton Green Bus Station (Stop E)	Granville Avenue Edmonton (stop →E)
		8	Glover Drive / Ikea (Stop L)	Tottenham Hale Bus Station (Stop F)
192	Towards Little Park Gardens	9	Tottenham Hale Bus Station (Stop D)	Glover Drive / Ikea (Stop L)
		10	Town Road (Stop →W)	Edmonton Green Bus Station (Stop B)
230	Towards Wood Green	11	Walthamstow Bus Station (Stop C)	Blackhorse Road Station (Stop BA)
		12	Blackhorse Road Station (Stop BA)	Tottenham Hale Bus Station (Stop D)
		13	Tottenham Hale Bus Station (Stop D)	Tottenham Bus Garage (Stop S)
230	Towards Fyfield Road	14	Tottenham Bus Garage (Stop T)	Tottenham Hale Bus Station (Stop B)
		15	Tottenham Hale Bus Station (Stop B)	Blackhorse Road Station (Stop BB)
		16	Blackhorse Road Station (Stop BB)	Walthamstow Bus Station (Stop B)
476	Towards Euston Bus Station	17	Northumberland Park (Bus Stop NA)	Tottenham High Road / Bruce Grove Station (Stop C)
		18	Tottenham High Road / Bruce Grove Station (Stop C)	Stoke Newington High Street (Stop U)
476	Towards Northumberland Park	19	Stoke Newington Station (Stop E)	Bruce Grove Station (Stop H)
		20	Bruce Grove Station (Stop H)	Northumberland Park (Stop NB)
279	Towards Manor House	21	Angel Corner (Stop E)	Edmonton Green Bus Station (Stop G)
		22	Edmonton Green Bus Station (Stop G)	Stonebridge Road / Seven Sister Station (Stop A)
		23	Stonebridge Road / Seven Sister Station (Stop A)	Manor House Station (Stop AP)
279	Towards Manor House	24	Manor House Station (Stop F)	Birstall Road / Seven Sister Stn (Stop B)
		25	Birstall Road / Seven Sister Stn (Stop B)	Edmonton Green Bus Station (Stop N)
		26	Edmonton Green Bus Station (Stop N)	Angel Corner (Stop H)

Figure 12, Figure 13 and Figure 14 illustrate the average speeds on the selected bus route segments during the morning peak period, evening peak period and for a daily weekday period, respectively.

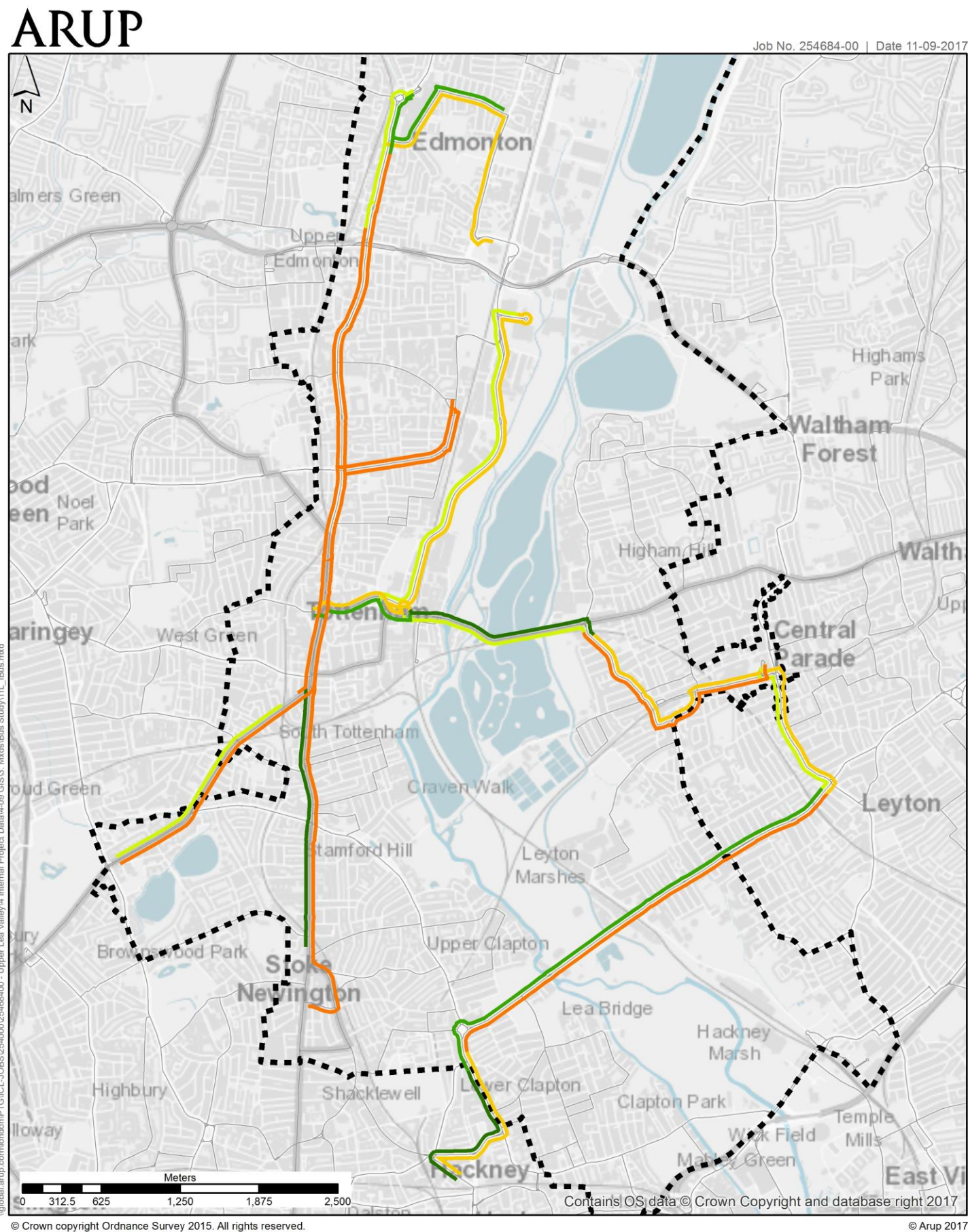
The latest TLRN performance report shows that in Q1 of 2017/18 the 12-hour average weekday traffic speed on major roads in London was 27 kph, with major roads in central London achieving an average 12 kph⁸. **Figure 12, Figure 13 and Figure 14** highlight sections of the ULV network where average bus speeds recorded were less than 8 kph - sections where bus journeys were severely affected by slow speeds, possibly due to traffic congestion.

Corridors consistently showing an average speed lower than 8 kph through the morning peak period, evening peak period and daily weekday period, are:

- A1010/ A10 Southbound - from Edmonton Green (Fore Street j/w Plevna Road) to Stoke Newington (A10 Rectory Road);
- A1010/ A10 Northbound – from Seven Sisters (High Road j/w Seven Sisters Road) to the North Circular (Fore Street j/w North Circular);
- A503 Southbound – from Seven Sisters (Seven Sisters Road j/w A10 High Road) to Manor House (Seven Sisters Road j/w Green Lanes);
- Lansdowne Road both directions – from the junction with A1010 High Road to Northumberland Park;
- A104 Westbound – from Lee Bridge Road j/w Hoe Street to Lee Bridge Road j/w A107 Lower Clapton Road; and
- A1006/ Selborne Road Westbound – from Walthamstow Central to Blackhorse Road j/w Forest Road.

⁸ TLRN performance report Quarter 1 2017-18, Transport for London, London, 2017

Figure 12 Monday to Friday morning average speeds (iBus data)



Average speed weekday morning Upper Lee Valley Boundary

- 0 - 8 kph
- 9 - 15 kph
- 16 - 27 kph
- 28 - 42 kph
- 42+ kph
- Other TfL Bus Routes

Figure 13 Monday to Friday evening average speeds (iBus data)

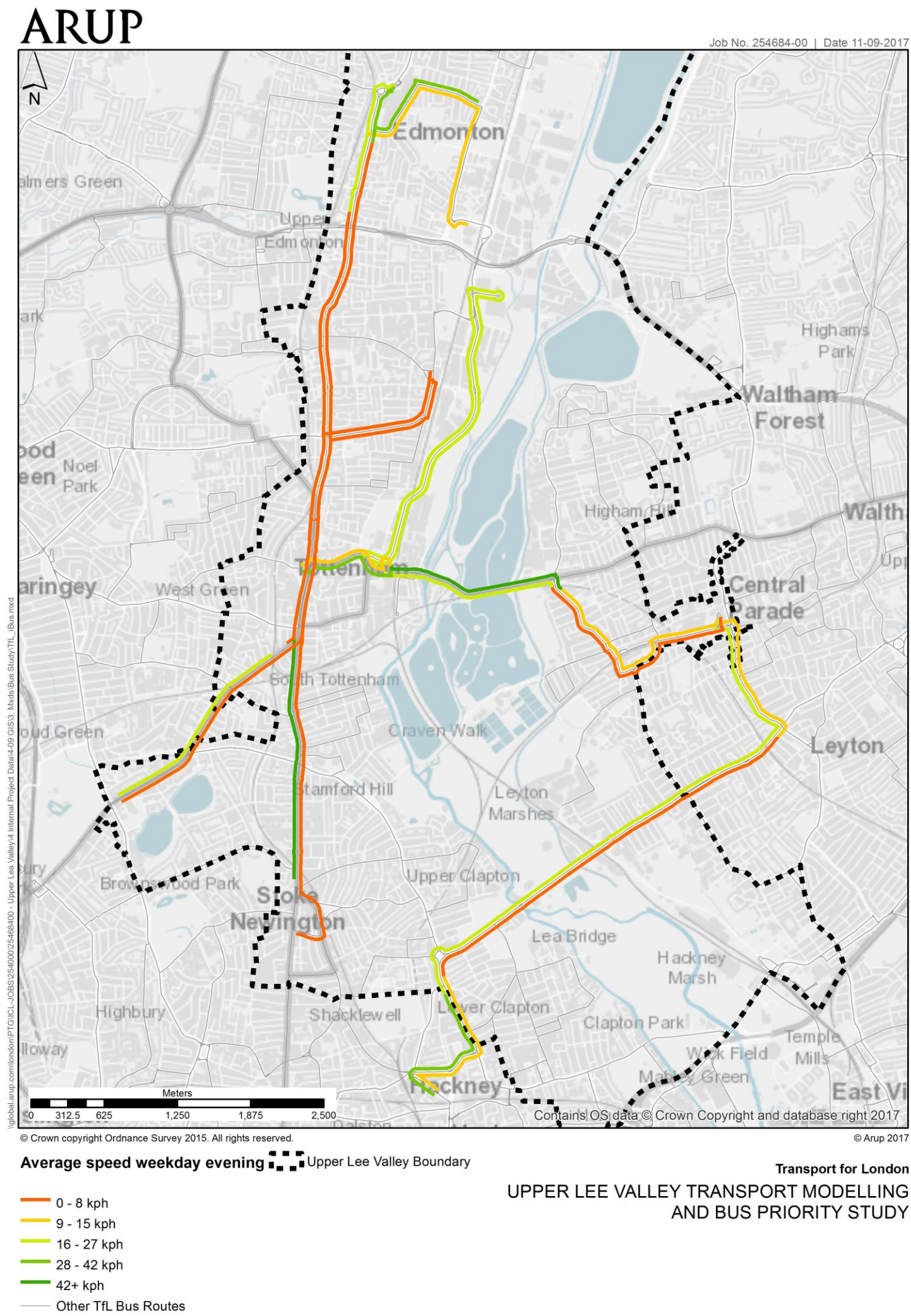
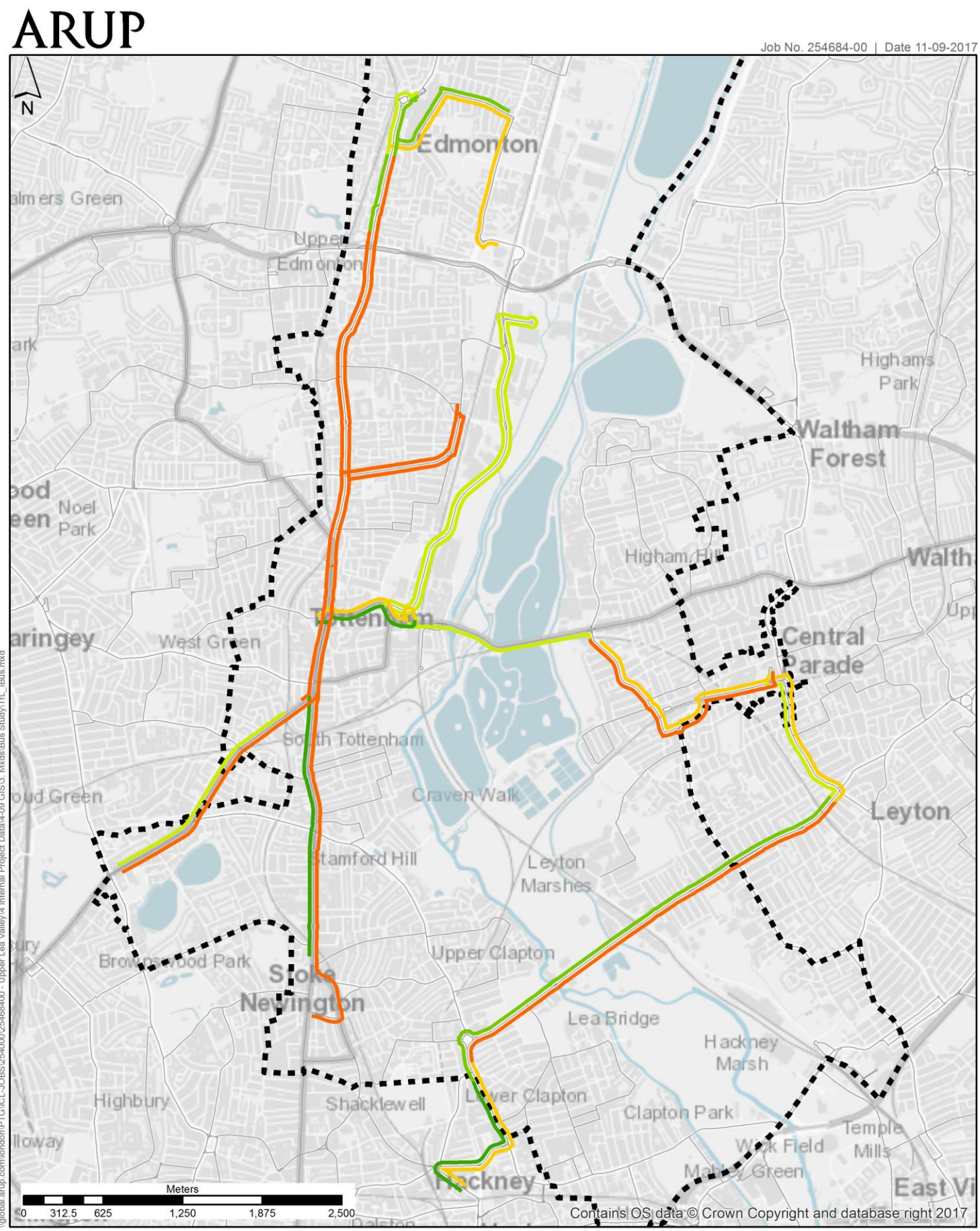


Figure 14 Monday to Friday daily average speeds (iBus data)



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Average daily speed Upper Lee Valley Boundary

- 0 - 8 kph
- 9 - 15 kph
- 16 - 27 kph
- 28 - 42 kph
- 42+ kph
- Other TfL Bus Routes

Transport for London
 UPPER LEE VALLEY TRANSPORT MODELLING
 AND BUS PRIORITY STUDY

4 Planning Context and Growth

The ULV study area has been routinely identified as a high priority area in planning and policy documents published by the GLA and the London Boroughs concerned. The following section of this report presents the most relevant planning policy and highlights the key transport and growth initiatives relating to the ULV.

4.1 Policy Priorities

Upper Lee Valley Opportunity Area Planning Framework (2013)

The OAPF, first published by the GLA in 2013, sets out an overarching framework for the area which is augmented where necessary by boroughs' own planning documents for specific areas.

The OAPF outlines several key priorities to support growth, including enhancing local connectivity through changes to the bus network. The bus network will come under strain as a result of growth in the Opportunity Area and there will be a need to improve bus services to cater for the extra demand.

Poor east-west connectivity across the ULV is an issue for cohesion of the Opportunity Area, and addressing this issue is seen as a priority when determining appropriate interventions.

The OAPF also notes that TfL is committed to delivering an improved interchange at Tottenham Hale. The surface interchange scheme will deliver a new, larger bus station including better arrangements for bus stops and stands, and a new public square that complements the wider public realm improvements brought about by the removal of the gyratory.

TfL, North London Sub-Regional Transport Plan (2016 Update)

The Sub-Regional Transport Plan (SRTP) aims to bridge any gaps between the Mayor's Transport Strategy and the Local Implementation Plans. The SRTP identifies the (North) London region's specific challenges:

- *Facilitate and respond to growth;*
- *Relieve crowding on public transport;*
- *Manage highway congestion;*
- *Enhance connectivity and attractiveness of orbital public transport; and*
- *Improve access to key locations and job services.*

Its research recognises rapid population growth as a challenge for transport, highlighting that half the population of the region lives in areas with a low Public Transport Accessibility Level (PTAL 1 or 2). An estimated 41% of people that work in the sub region travel to work by car.

The SRTP identifies areas of economic and social deprivation, which could benefit from better access to public transport and jobs. It also highlights the need for better balance between movement and place functions on many corridors in the sub region.

The ULV is identified within the SRTP as an Opportunity Area with potential to support more growth, particularly at locations already well served by public transport or where significant improvements are planned.

The SRTP reports 54% bus commuting sub-regional growth from 2001-2011. However, highway congestion and delay have decreased journey time reliability at key locations and increased excess wait times for buses. It predicts that increased levels of traffic congestion and population density are likely to slow bus services further, with an average bus speed decrease of 2% by 2031. This could have a significant impact on the attractiveness of bus services and their mode share.

A City in the East (2016)

The City in the East framework was first announced in 2015. The framework aim is to provide a coherent vision for the development taking place and to shape the future proposals for bringing forward 200,000 homes and 280,000 jobs in the East London area comprising the Lee Valley, Royal Docks, Canada Water, Isle of Dogs and London Riverside.

The document acknowledges some of the Development Infrastructure Funding Studies published to date, including the ULV study completed in 2015.

Draft Mayor of London Transport Strategy (2017)

The Mayor's Transport Strategy (MTS), published as a revised draft last June, identifies the challenges and sets visions and priorities for London's transport network.

The new draft prioritises the health impact of London's transport, promoting a mode shift from car to public transport and active travel. Bus priority is key to achieving the MTS goal of modal shift and better public transport experience. It also identifies opportunities for transport-driven growth as a response to the population growth pressures.

Proposal 80 of the MTS links the proposal for Crossrail 2 with growth in the Upper Lee Valley: *'The Mayor, through TfL and the relevant boroughs, will seek to encourage Network Rail to proceed with enhancements to the West Anglia Main Line to enable and serve sustainable development of the Upper Lee Valley.'*

The MTS seeks to improve London's air quality and the environment. Policy 5 states that, *'the Mayor will take action to reduce emissions, [...], measures will include retrofitting vehicles to reduce emissions, promoting electrification, road charges and restrictions'*. As part of the objective to improve air quality, through Proposal 22, the Mayor will seek to introduce the Ultra-Low Emission Zone in 2019 in Central London and expand this London-wide for heavy vehicles by 2020.

4.2 Growth Assumptions

London Plan (2016)

The current London Plan (2016) identifies the ULV as an Opportunity Area providing up to 15,000 jobs and 20,000 homes by 2031.

A City in the East (2016)

This framework reported on information from 2015 and envisaged up to 20,000 homes and 15,000 jobs in the ULV over the next 20 years (2035).

Upper Lee Valley modelling update (2017)

The most recent ULV modelling work aims to test the latest development assumptions, in line with the new Mayoral aspirations and growth projections. The modelling assumptions for the growth related to the ULV area and the Broxbourne area jointly are:

- 2021 – 45,000 new households and 33,000 new jobs
- 2031 – 89,000 new households and 46,000 new jobs.

4.3 Previous Bus Studies

Upper Lee Valley Transport Study (November 2012)

The 2012 study identified twenty junctions within the ULV study area which have shown potential delays for buses in 2031. The study considered extensions of bus lanes, however, it was concluded that an extensive network of bus lanes is already provided in the study area and constraints were identified which would impede the further extension of bus lanes in proximity of the twenty junctions.

Improvements at signalised junctions in the form of prioritising bus movements was instead tested in the models and proved efficient, showing a reduction of delays in the order of 2% in the morning peak and 5% in the evening peak.

Meridian Water Masterplan and Meridian Water Bus Study (July 2017)

Located in the south-east corner of LB Enfield, the Meridian Water masterplan is one of the biggest regeneration areas in Outer London. It is expected that over the next 20 years, the Meridian Water masterplan will deliver up to 10,000 new homes and create 6,700 jobs.

The future Meridian Water public transport demand will rely on new transport connections and infrastructure, which have been proposed in the area:

- **Meridian Water station** – A new rail station will be delivered to replace the Angel Road station. The new station, Meridian Water, will be located at the north-western corner of the Meridian Way and Glover Drive junction, and will provide a bridge enabling the residents west of the rail line to safely access the Glover Drive bus services.

- **Rail Capacity Improvements** – As part of the STAR (Stratford to Angel Road) scheme, the existing rail service will be improved, with an increase of up to four trains per hour expected in each direction.
- **Crossrail 2** – Meridian Water station could also be served by the Crossrail 2 Broxbourne branch. It is anticipated that this major new line, connecting from Surrey and Hertfordshire, will provide capacity for an additional 270,000 people to travel into and across central London each morning. The information currently available suggests that Crossrail 2 could be delivered by 2033.
- **The Causeway** – This road is the main east-west transport corridor of the Meridian Water masterplan. The Causeway will reconnect the currently fragmented area, providing east-west connectivity and linking to the new Meridian Water station. The alignment will connect Harbet Road to Meridian Way via Glover Drive, creating an opportunity for a high-quality east-west public transport corridor.

To date, TfL has proposed several bus network improvements to support new demand arising from the Meridian Water masterplan development and to complement the new rail links. Potential bus network changes proposed by TfL include:

- Route W8 to be diverted from Pickett's Lock and extended to Meridian Water and Walthamstow;
- Route W6 to be extended to Pickett's Lock to cover the withdrawal of the W8;
- A new route to be introduced that would operate with a similar alignment to route 192, between Meridian Water and Tottenham Hale;
- Route 341 to be restructured and no longer connecting to Northumberland Park;
- Route 476 to be extended into the Meridian Water masterplan; and
- Route 444 to be restructured and diverted into Meridian Water via Conduit Lane and Cooks Ferry roundabout.

In addition, TfL, the LB of Enfield and LB of Waltham Forest identified locations which may benefit from bus priority measures to support bus journey times and improve the attractiveness of bus as a mode of travel in the ULV Opportunity Area. A summary of these locations can be found in **Table 9**. The purpose of the present study is to discern whether these locations are still appropriate or if other locations would be a higher priority for such measures.

Table 9 Potential bus priority locations identified by TfL

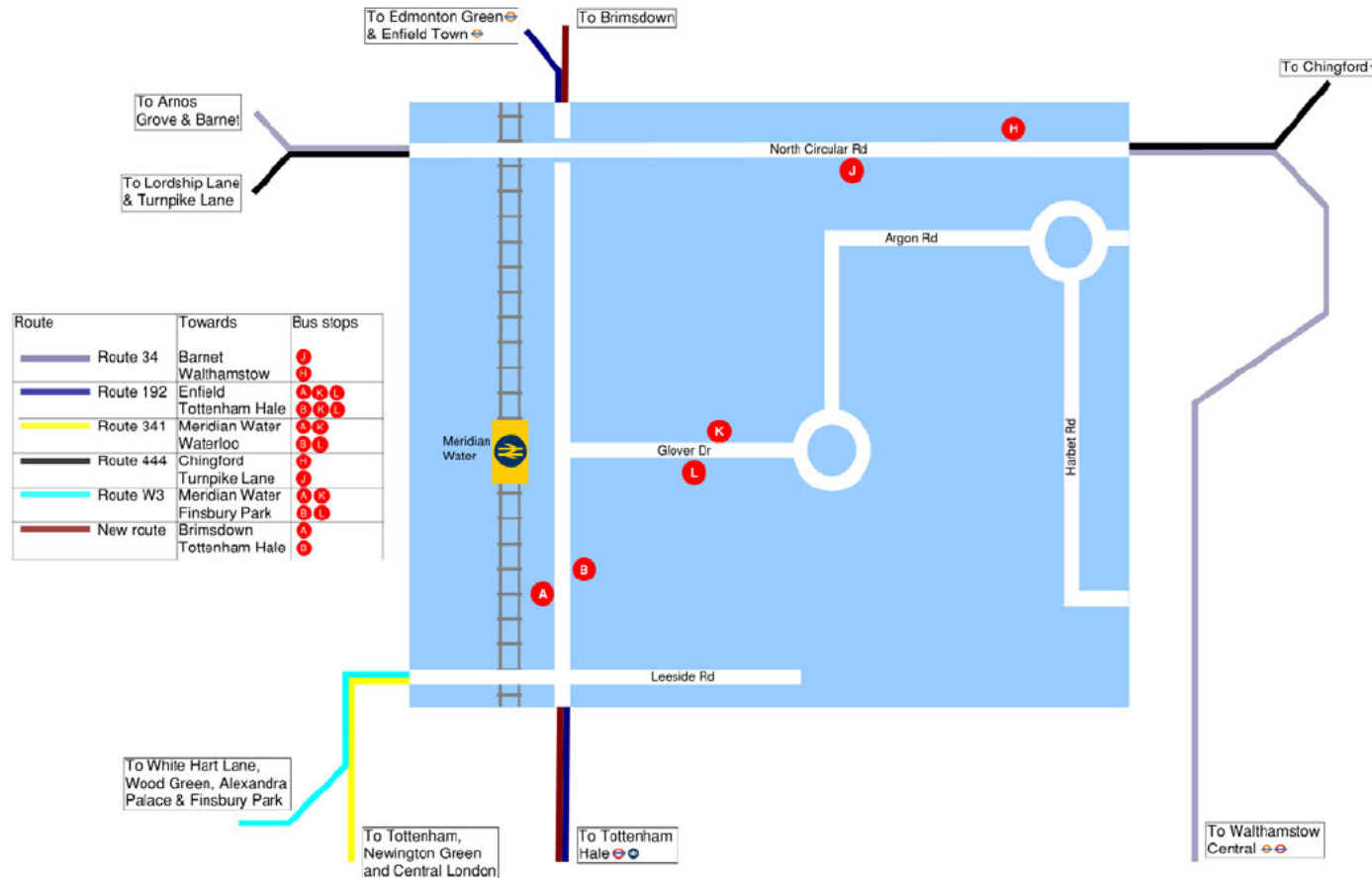
Location	Issue / Opportunity	Identified by
Meridian Water	East-west public transport bridge from Meridian Water	LB Enfield
Meridian Water – Tottenham Hale Corridor	North-south corridor along River Lea and/or bus priority on Watermead Road	TfL
Angel Road – Meridian Water	Link from the site to proposed relocated Angel Road station	TfL
Edmonton Green – Meridian Water	Potential segregated Busway between Plevna Road and Montagu Road or new links along existing highways	LB Enfield
East-West links	Ensuring provision for wider east-west movements is adequate - in particular connections to North Middlesex Hospital and into Waltham Forest	TfL
Blackhorse Lane, Leyton / Lee Bridge – North-South links	Bus gates, turnarounds and bus lane schemes to facilitate bus corridor links between eastern Lee Valley housing areas to Lee Bridge Station and Olympic Park areas	LB Waltham Forrest

In July 2015, Arup was commissioned by LB Enfield to provide support for the development of the wider area bus strategy. This bus strategy focuses on the operation of the buses in and around Meridian Water. It should be noted that the findings and recommendations are indicative and subject to further change and development. The strategy is still in draft form and is under discussion by TfL and LB Enfield.

In the study, three future scenarios were assessed and bus network enhancements were recommended. **Figure 15**, **Figure 16** and **Figure 17** summarise the three future scenarios and their potential bus network improvements.

Figure 15 Meridian Water bus study Scenario A post STAR

Post STAR



Scenario context

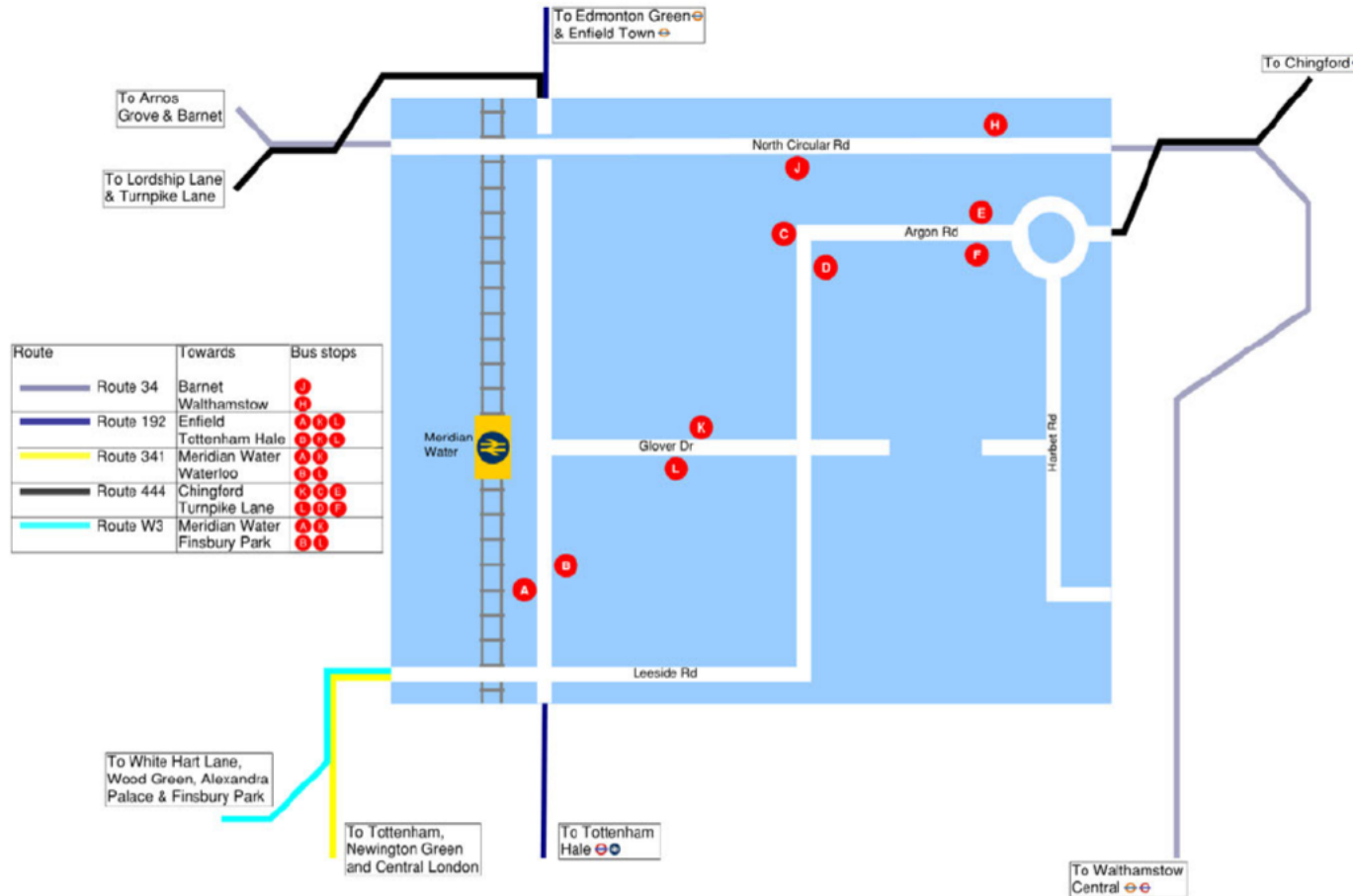
In this scenario, the Stratford to Angel Road rail scheme is operating and the new station is open. Some of the Meridian Water development has been built.

Options

- A new bus route travelling north-south on the A1055 Meridian Way (stopping Meridian Water Station bus stop)
- Additional stops to provide better interchange with Meridian Water station
- Extension of bus route W3 to Meridian Water

Figure 16 Meridian Water bus study Scenario B pre-Crossrail 2

Pre Crossrail 2



Scenario Context

In this scenario, a significant part of the development has been delivered, four tracking and increased rail capacity has also been delivered in anticipation of Crossrail 2.

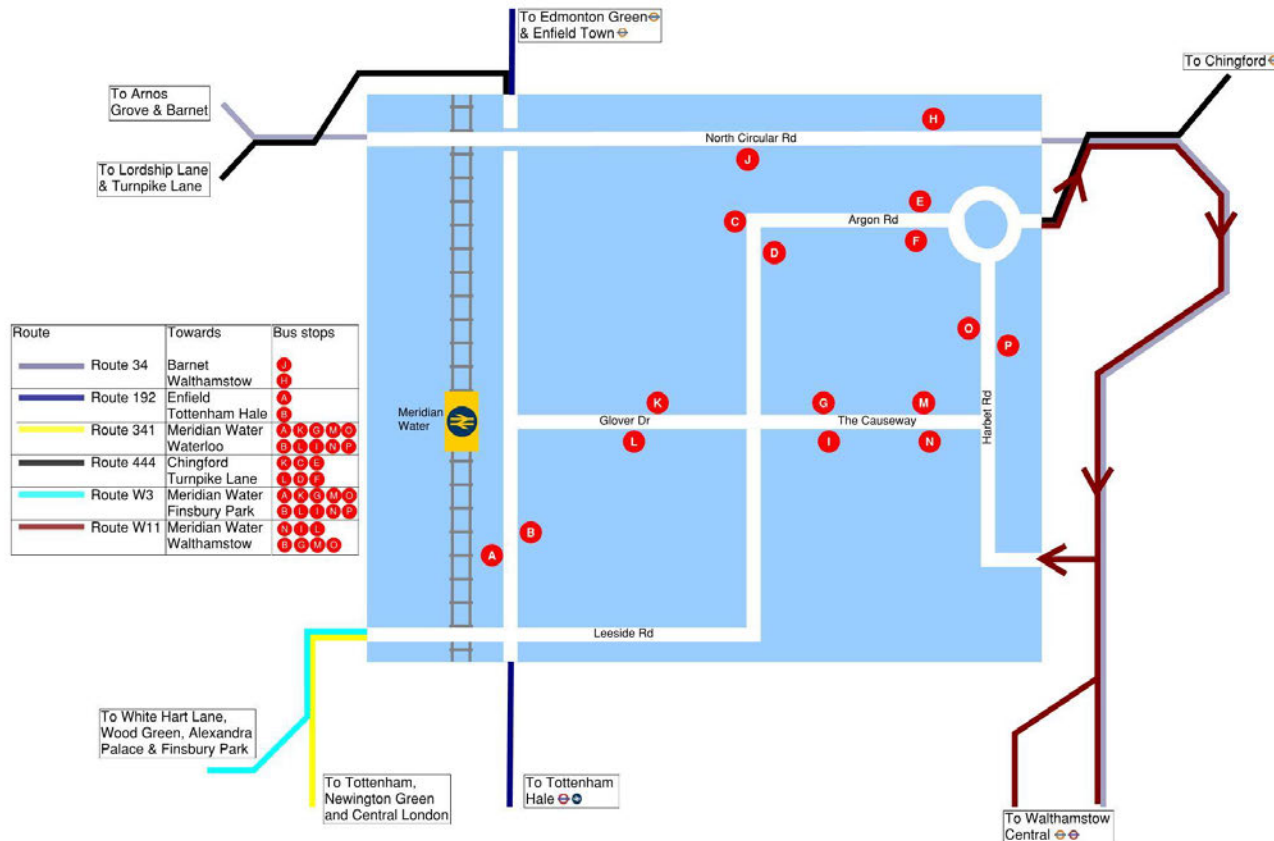
The Causeway bridge over the Lee Navigation may or may not have been delivered. The optioneering suggests Argon Road might be used as an alternative (temporary) option.

Options

- Route 444 is diverted via Conduit Lane/ Glover Drive into Meridian Water
- Routes W3 and 341 could be extended to Harbet Road roundabout
- The new north-south route serving the A1055 could be retained or suppressed depending on the rail capacity

Figure 17 Meridian Water bus study Scenario C post-Crossrail 2

Post Crossrail 2



Scenario Context

This scenario looks at the Masterplan full build out, with the Causeway in place and Crossrail 2 operational.

Options

- Route 444 is diverted via Conduit Lane/ Glover Drive and Argon Road into Meridian Water
- Routes W3 and 341 could be extended to Harbet Road roundabout
- Route W11 could be diverted via Harbet Road and North Circular into Meridian Water serving the station

5 Bus Priority Areas

5.1 Short Term

TfL has already identified several areas for bus priority improvements in the short term (i.e. 2016/17 and 2018/19). These improvements are identified in TfL's Bus Priority Delivery Portfolio (BPDP), which is a funding portfolio that help boroughs identify and deliver locally led bus priority improvements and initiatives that align with improving bus reliability in the network and providing bus priority in areas where significant growth is expected.⁹

Three major programmes form part of the BPDP:

1. **Roads Modernisation Plan (RMP)** – This programme was initiated in 2014 with £4 billion for road improvements in Inner and Central London. RMP is comprised of several major schemes and improvements including TfL's response to the Road Task Force and the Mayor's Cycle Vision.¹⁰
2. **Bus Reliability Scheme** – The purpose of this programme is to reduce bus journey times and improve reliability at pinch point locations (e.g. traffic junctions).⁶
3. **Bus Growth Scheme** – This programme is to unlock Opportunity Areas indicated in the London Plan. Its purpose is to support the growth in these areas by delivering new public transport corridors that support the sustainable development of local communities.⁶

Figure 18 illustrates the most recent London RMP improvements by implementation year, with the ULV boundary indicated. The recent RMP improvements focus on Walthamstow Central station which we have identified as one of the busiest areas for bus boarding and alighting volumes and bus movements in the ULV. More detail can be found in **Table 10**.

The Bus Reliability Programme interventions relating to the ULV are shown in **Table 11** and **Figure 19**, against the busiest sections of the bus network (in terms of volumes of passengers per bus stop). The Reliability Programme interventions correspond with the busiest areas of passenger demand. Our analysis of traffic delay, iBus data and passenger demand supports TfL's proposals and acknowledges that the areas identified would benefit from bus priority measures with passenger benefit accrued by the high number of users.

⁹ Transport for London. *Local Implementation Plan (LIP) 2016/17 Annual Spending Submission Guidance*. <http://content.tfl.gov.uk/lip-guidance-2016-2017.pdf>

¹⁰ Greater London Authority. October 2014. *Road Modernisation Plan*.

<https://www.london.gov.uk/what-we-do/transport/improving-londons-roads/road-network>

Figure 18 Bus RMP programme improvements (source: TfL)

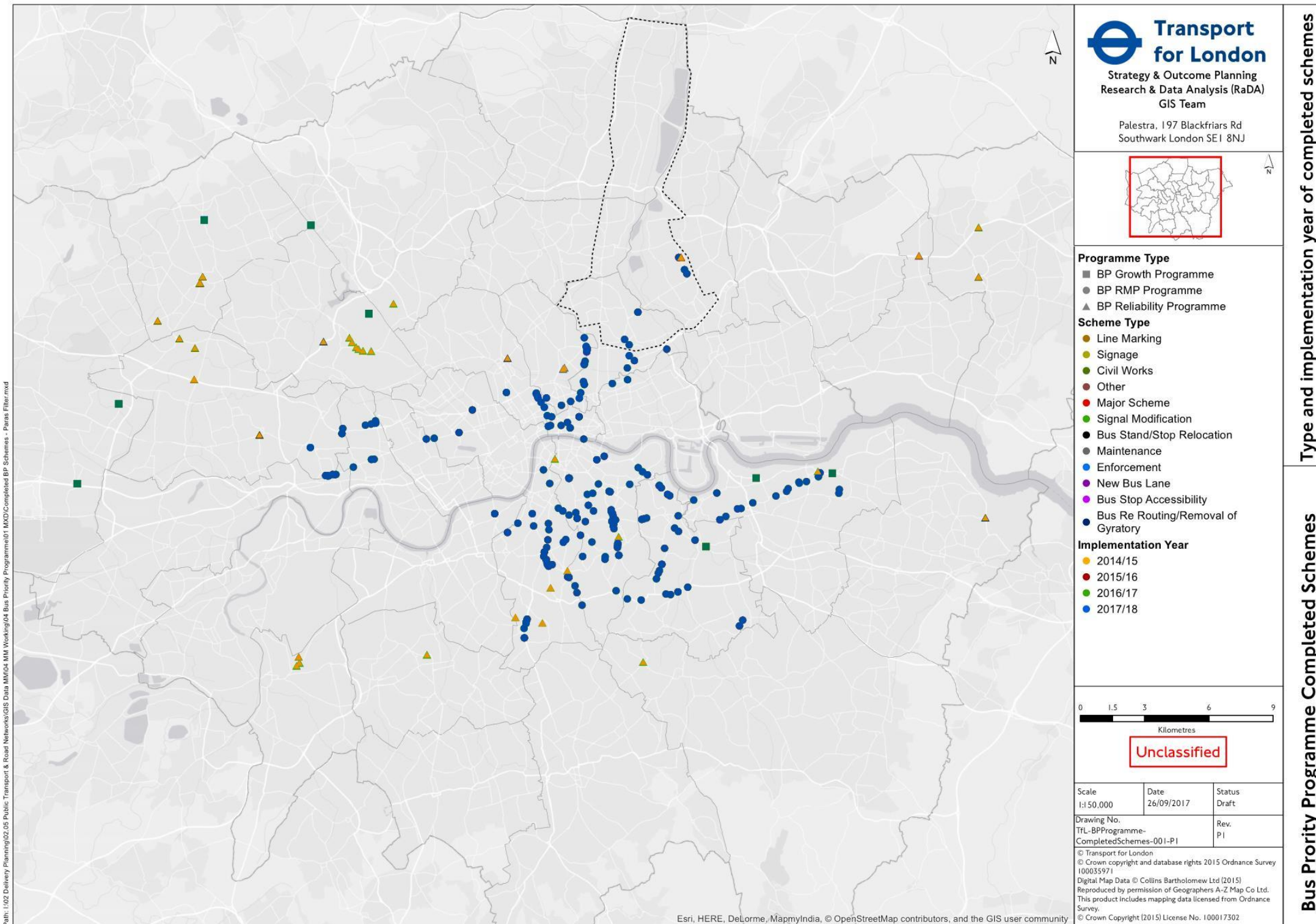


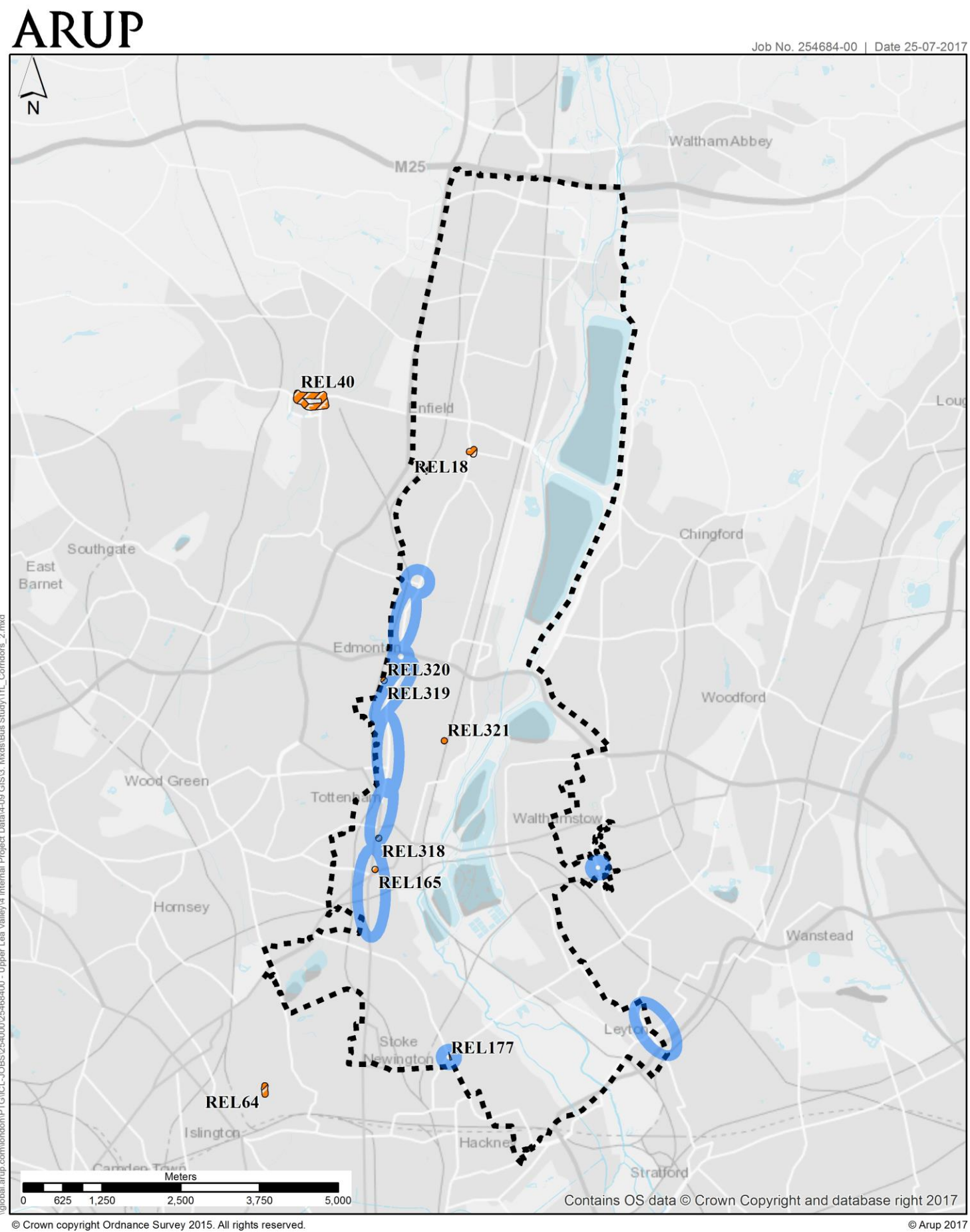
Table 10 Bus RMP programme improvements relevant to ULV (source: TfL)

Scheme ID	Borough	Scheme Name	Implementation Year	Intervention Type
RMP 177	Hackney	Lower Clapton Rd Bus Mitigation	2017/18	18 Major Scheme - Signals

Table 11 Bus Reliability Programme interventions (source: TfL)

Scheme ID	Borough	Scheme Name	Impl Year	Intervention Type
REL 18	Enfield	A1010 Ponders End High St junction with Lincoln Road	2017/18	17 Other - Major Intervention (Priority Junction etc)
REL 40	Enfield	A110 Enfield Town Centre	2018/19	5 Bus Re Routing/Removal of Gyratory
REL 64	Islington	Highbury Barn Bus Stand	2017/18	14 Civil Works
REL 165	Haringey	Seven Sisters Road junction with Broad Lane	2017/18	10 Line Marking - Yellow Box Junction
REL 318	Haringey	Junction of High Road with Phillip Lane	2017/18	11 Line marking - Whole Junction
REL 319	Haringey	High Road junction with Dowsett Road	2017/18	10 Line Marking - Yellow Box Junction
REL 320	Haringey	High Road junction with Dowsett Road	2017/18	11 Line marking - Whole Junction
REL 321	Haringey	Junction of Park Lane with Shelbourne Road	2017/18	9 Line Marking - Keep Clear Marking

Figure 19 Bus Reliability Programme priority interventions within the ULV



- Busiest bus 'hot spots' and corridors
- Bus Priority Improvements
- ULV Boundary

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AND BUS PRIORITY STUDY

In addition to the above, it should be noted that Cycle Enfield and Enjoy Waltham, two of the first Mini Holland borough organisations, are working on schemes which promote the implementation of segregated cycle lanes. In some cases, the schemes might result in loss of bus lanes:

- Forest Road segregated cycle lanes result in removal of sections of bus lanes;
- Proposed A1010 South and North cycle lanes might result in partial removal of sections of bus lanes;
- Proposed Lee Bridge Road scheme might result in partial removal of bus lanes and floating bus stops.

In relation to the last point, analysis of bus journey times (**Figure 12** to **Figure 14**) has shown low average speeds on Lee Bridge Road westbound, indicating a need to improve bus journey times on this section. iBus data have not been analysed for the section of the A1010 north of the A406 North Circular.

5.2 Medium Term

Whilst the most significant proportion of the ULV growth is expected to rely on Crossrail 2, the estimate is that around 45,000 new homes and 33,000 new jobs may be delivered between 2011 and 2021 and therefore prior to Crossrail 2 opening.

The areas most likely to deliver growth within this medium-term timeframe are located south of the A406 North Circular and are close to high frequency bus corridors and major bus/LU interchanges, including Tottenham Hale and Northumberland Park. This means that the forecast population density patterns (**Figure 20**) and employment density patterns (**Figure 21**) will add demand in areas where the pressure for bus services is already high (**Figure 6 to Figure 8** and **Figure 11**).

Demand for bus services as a main mode is likely to increase, but also for demand as a connecting mode to stations, particularly those in a different fare zone which will bring financial benefit to passengers. Therefore improvements to bus services cannot be considered in isolation but need to be considered as packages of public transport measures, for instance, station capacity (step free access from platform to street, lift and escalator capacity) at major interchanges may need to be enhanced to ensure that pinch points in the public transport network are not created.

In absence of network route changes, the areas likely to be impacted in the medium term are similar to the areas currently under pressure.

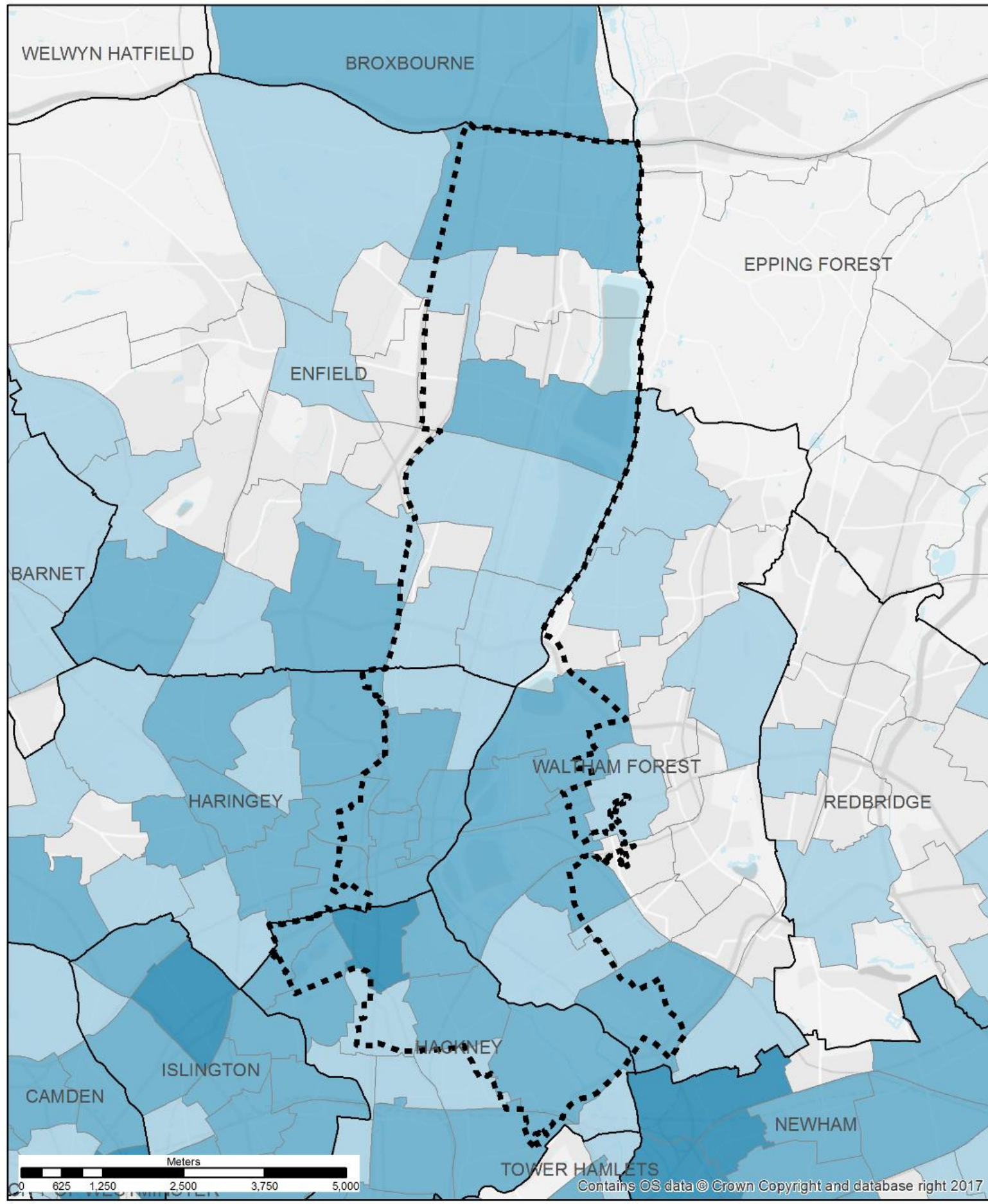
Corridors likely to experience low bus speeds and therefore slow bus journey times are:

- A1010/ A10 both directions;
- Seven Sisters Road south-westbound;
- Lee Bridge Road westbound; and
- Selbourne Road to Blackhorse Road west northbound.

Areas of high bus frequency and high passenger demand per bus stop are:

- Edmonton Green Station;
- Walthamstow Central Station;
- Tottenham Hale Station; and
- A1010 Fore Street/ Tottenham High Street.

Figure 20 Forecast absolute increase in ULV households 2011 to 2021



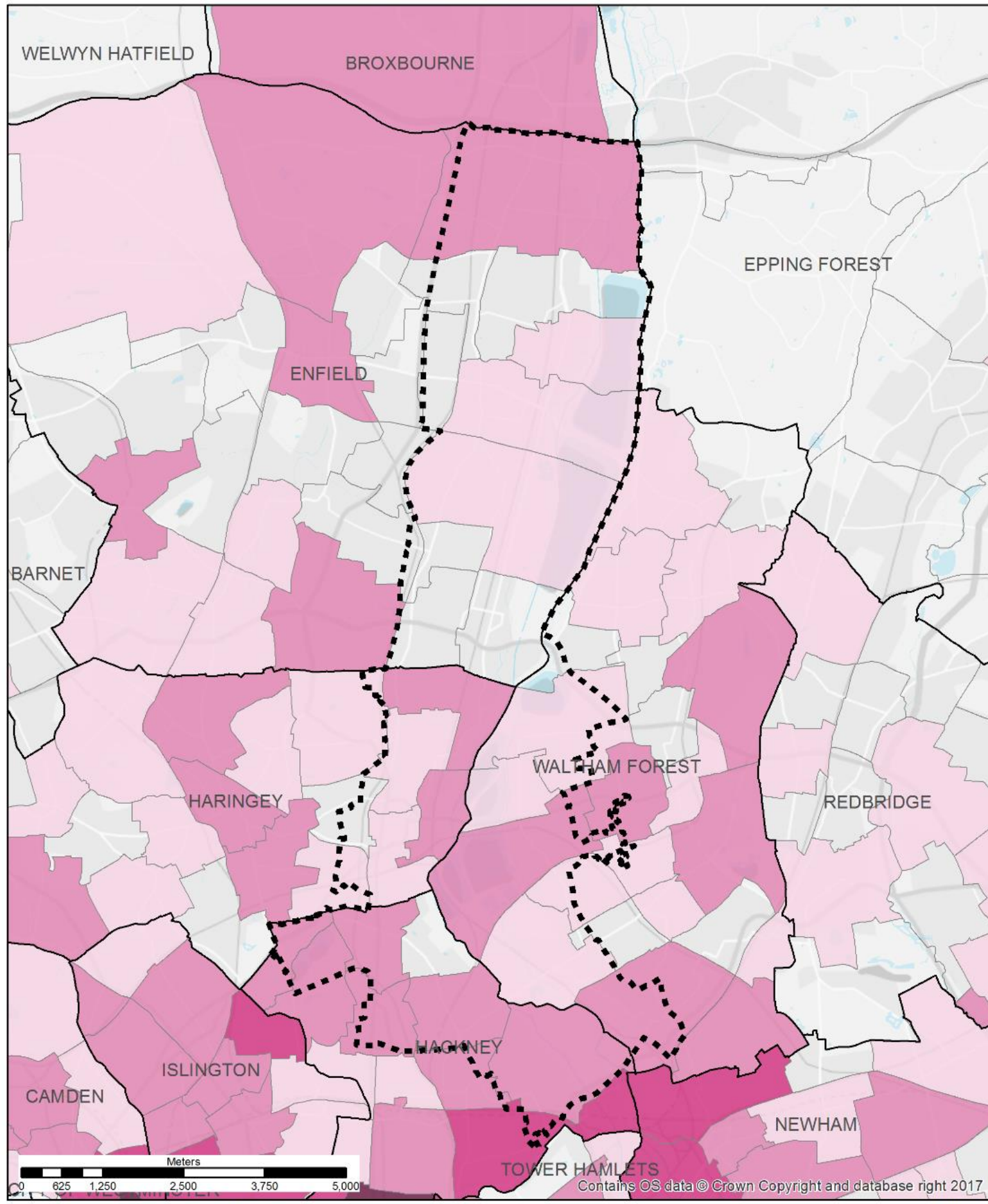
Absolute increase in households from 2011 to 2021

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- < 500
- 500 - 1,000
- 1,000 - 2,500
- 2,500 - 5,000
- > 5,000

ULV TRANSPORT MODELLING
 AND BUS PRIORITY STUDY

Figure 21 Forecast absolute increase in ULV jobs 2011 to 2021



Absolute increase in jobs from 2011 to 2021

- < 500
- 500 - 1,000
- 1,000 - 2,500
- 2,500 - 5,000
- > 5,000

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 AND BUS PRIORITY STUDY

6 Conclusions

At present, 75 bus routes serve the Upper Lee Valley with good baseline network coverage and high frequencies on all major corridors. Residential and employment areas are concentrated in areas with a high Public Transport Accessibility Level, showing a correlation between development density and access to public transport. These areas are mainly at the south and west of the ULV study area, including the key LU stations and the A1010/A10 corridor.

PTAL is poor at the north and east of the ULV, due to lower public transport frequencies and network severance (Lea River, water basins, Lee Valley Park and Strategic Industrial Land). Therefore, to support the projected employment and residential densities included in the 2021 and 2031 development assumptions, bus provision will need to be increased to these areas to make travel by bus more attractive.

High frequency bus corridors are predominantly north/south rather than east/west due to the barrier presented by the Lee Navigation and Lea River. In terms of links to central London, of the top ten busiest routes in the ULV, six of these routes are north/south bound and all terminate at major London stations. Usage on these routes is high due to the access to employment and main LU and rail interchanges they provide. The patronage data suggest that spare capacity on these services is limited.

Bus reliability and journeys are affected by general highway congestion and high volume of passengers, boarding and alighting, with key bus stations attracting many bus passengers and interchange passengers to rail, London Overground and London Underground:

- Tottenham Hale Station;
- Walthamstow Central Station;
- Edmonton Green Station.

Routes leading to and from some of these interchanges have very low average speeds across all peak periods, as is the case for the A1010/A10, Seven Sisters Road, Lee Bridge Road and Selbourne Road.

Bus services along these high frequency corridors are ‘close to capacity’ in terms of boarders and alighters. Some of this demand may be abstracted by rail when rail links are improved however, this may not occur to a significant extent as buses will still be used as a main mode for people for whom price is the largest determinant in choice of mode. Buses will therefore, still be used as a connecting mode for people wishing to access the next fare zone to get cheaper onward rail travel.

Whilst some routes have failed the QSI minimum standards for Excess Wait Time or Percentage on Time, none of these routes have been highlighted as ‘high demand’ routes in the current and short term growth scenarios.

TfL has identified several interventions to improve bus priority in the ULV, including road signage and signal optimisation. These interventions align with the critical areas of passenger demand, development growth and low bus speeds, which we have identified in this study. These interventions are due to be implemented in the short term.

Looking at the medium term, it is possible to anticipate increasing pressure on the same ‘hot spot’ locations due to the proximity of forecast growth areas. The ‘hot spots’ include the main interchanges with LU, rail and Overground, as well as the A1010/A10 and A503 Seven Sisters Road corridors. Following on, in the next steps of this Bus Priority study, mitigation measures for the medium term will be considered for these areas specifically.

Appendix A

Bus routes and frequencies

A1 ULV Bus Routes and Frequencies

Bus Route Number	Towards	Peak Period Frequency¹ (buses per hour)	Bus Type² (Double Decker – DD or Single Decker – SD)	Local Authority
20	Debden Station Walthamstow Central Station	4	DD	Waltham Forest
26	Hackney Wick, Eastway Waterloo Station	6	DD	Hackney
29	Trafalgar Square Wood Green Station	12	DD	Hackney, Haringey
30	Hackney Wick, Chapman Road Marble Arch	6	DD	Hackney
34	Walthamstow Central Barnet High Street / Barnet Church	8	DD	Enfield, Haringey
38	Clapton, Kenninghall Road Roundabout Victoria Bus Station	18	DD	Hackney
41	Archway Station Tottenham Hale Station	10	DD	Haringey
48	Borough Station, Nebraska Street Walthamstow Central Station	8	DD	Hackney, Waltham Forest
55	Leyton Bus Garage Oxford Circus	10	DD	Hackney, Waltham Forest
56	St Bartholomew's Hospital Whipps Cross Roundabout	8	DD	Hackney, Waltham Forest
58	East Ham, White Horse Walthamstow Central Station	5	DD	Waltham Forest
67	Aldgate Station Wood Green Station	0	DD	Hackney, Haringey
69	Canning Town Walthamstow Bus Station	6	DD	Waltham Forest
73	Stoke Newington Victoria Station	12	DD	Hackney, Haringey
76	Waterloo Tottenham Hale Bus Station	8	DD	Hackney, Haringey
97	Chingford Station Stratford City Bus Station	8	DD	Waltham Forest
102	Brent Cross Edmonton Green Bus Station	8	DD	Haringey, Enfield
106	Finsbury Park Station Whitechapel, Cavell Street	8	DD	Hackney
121	Enfield Lock, Island Village Turnpike Lane Station	6	DD	Enfield, Haringey
123	Ilford Lordship Lane	6	DD	Haringey, Waltham Forest
141	London Bridge station Palmer's Green, North Circular Road	9	DD	Hackney, Haringey
144	Edmonton Green Station Muswell Hill Broadway	8	DD	Enfield, Haringey
149	London Bridge Edmonton Green Bus Station	7	DD	Enfield, Haringey, Hackney

Bus Route Number	Towards	Peak Period Frequency¹ (buses per hour)	Bus Type² (Double Decker – DD or Single Decker – SD)	Local Authority
158	Stratford Chingford Mount	8	DD	Waltham Forest
191	Brimsdown Station Edmonton Green Station	6	DD	Enfield
192	Enfield Town Tottenham Hale Station	6	SD	Enfield, Haringey
212	Chingford Station Walthamstow, St James Street Station	6	DD	Waltham Forest
215	Lee Valley Camp Site Walthamstow Central Station	3	DD	Waltham Forest
217	Turnpike Lane Station Waltham Cross	5	DD	Enfield, Haringey
230	Upper Walthamstow, Bisterne Avenue Wood Green Station	5	DD	Haringey, Waltham Forest
231	Enfield Chase Station Turnpike Lane Station	5	DD	Enfield, Haringey
236	Finsbury Park Station Hackney Wick, Eastway	8	SD	Hackney
242	St Paul's Homerton Hospital / Wardle Street	8	DD	Hackney
243	Waterloo Redvers Road	8	DD	Haringey, Hackney
253	Euston Bus Station Hackney Central Station	11	DD	Hackney, Haringey
254	Aldgate Station Holloway, Camden Road	12	DD	Hackney, Haringey
257	Stratford Bus Station Walthamstow Central Station	7	DD	Waltham Forest
259	Edmonton Green Bus Station King's Cross Station	8	DD	Enfield, Hackney, Haringey
275	Barkingside, Tesco Walthamstow, St James Street Station	5	DD	Waltham Forest
276	Newham Hospital Gateway Surgical Centre Stoke Newington, Common	5	SD	Hackney
279	Manor House Station	10	DD	Enfield, Hackney, Haringey
307	Barnet Hospital Brimsdown Station	6	DD	Enfield
308	Clapton, Kenninghall Road Roundabout Wanstead, Woodbine Place	5	DD	Hackney, Waltham Forest
313	Chingford Station Dame Alice Owen School	3	DD	Enfield, Waltham Forest
317	Enfield Town, Little Park Gardens	3	DD	Enfield

Bus Route Number	Towards	Peak Period Frequency ¹ (buses per hour)	Bus Type ² (Double Decker – DD or Single Decker – SD)	Local Authority
	Waltham Cross, Bus Station			
318	North Middlesex Hospital Stamford Hill, Rookwood Road	4	SD	Enfield, Hackney, Haringey
327	Elsinge Estate, Masons Road Waltham Cross, Bus Station	2	SD	Enfield
341	Waterloo Glover Drive / IKEA	6	DD	Hackney, Enfield
349	Ponders End, Enfield Bus Garage Stamford Hill, Rookwood Road	8	DD	Enfield, Hackney, Haringey
357	Chingford Hatch, Prince of Wales Whipps Cross Hospital Whipps Cross Roundabout	4	DD	Waltham Forest
377	Oakwood Station Ponders End, Enfield Bus Garage	2	SD	Enfield
379	Yardley Lane Chingford Station	4	SD	Waltham Forest
385	Crooked Billet, Sainsbury's Chingford Station	1	SD	Waltham Forest
388	Elephant & Castle Stratford City Bus Station	6	DD	Hackney
393	Chalk Farm, Morrisons Clapton Pond	5	SD	Hackney
394	Homerton Hospital Islington, Tolpuddle Street	5	SD	Hackney
397	Debden, The Broadway Salisbury Hall, Sainsbury's	2	SD	Waltham Forest
425	Clapton, Nightingale Road Stratford, Bus Station	5	DD	Hackney
444	Chingford Station Turnpike Lane Station	5	SD	Enfield, Haringey, Waltham Forest
476	Euston Station Northumberland Park Station	8	DD	Hackney, Haringey
488	Bromley-By-Bow Tesco Dalston Junction Bus Station	5	SD	Hackney
491	North Middlesex Hospital Waltham Cross	4	SD	Enfield
616	Old Park Ridings Edmonton Green Bus Station	1	DD	Enfield
617	St Ignatius College Turnpike Lane Bus Station	1	DD	Enfield, Haringey
629	St Ignatius College Haringey Civic Centre	1	DD	Enfield, Haringey
675	Woodbridge School St James Street Station	1	DD	Waltham Forest
W11	Chingford Hall Estate Walthamstow Central Station	6	SD	Waltham Forest
W12	Walthamstow, Coppermill Lane Wanstead Station	3	SD	Waltham Forest

Bus Route Number	Towards	Peak Period Frequency¹ (buses per hour)	Bus Type² (Double Decker – DD or Single Decker – SD)	Local Authority
W14	Leyton, ASDA Woodford Bridge	4	SD	Waltham Forest
W15	Cogan Avenue Estate Hackney Town Hall	8	SD	Hackney, Waltham Forest
W19	Ilford High Road, Hainault Street Walthamstow, Argall Avenue	5	SD	Waltham Forest
W3	Finsbury Park Station Northumberland Park	10	DD	Enfield, Hackney
W4	Oakthorpe Park Estate, Chequers Way Tottenham, Ferry Lane Estate	6	SD	Enfield, Haringey
W6	Edmonton Green Station Southgate Station	6	DD	Enfield
W8	Chase Farm Hospital Picketts Lock Centre	8	DD	Enfield

Notes:

Bus frequency was provided by Nathaniel Chin (TfL, email 12th April 2017) and David Field (TfL, email 11th April 2017).

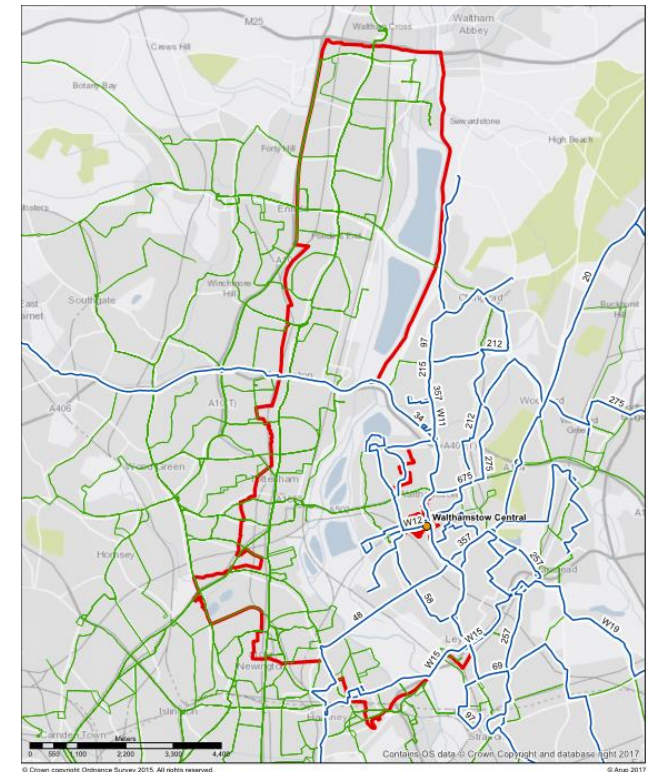
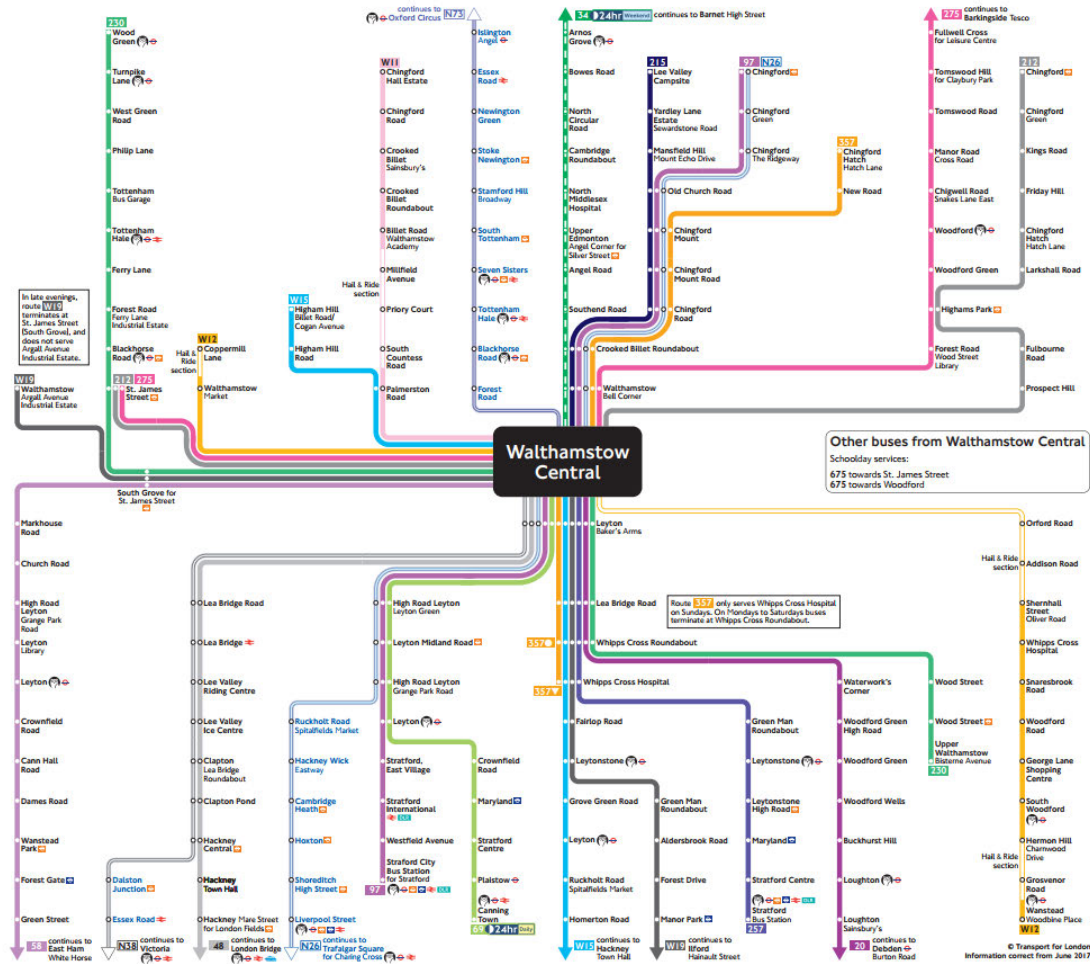
Bus type information was extracted from TfL's Bus Fleet Data and Audits (31st March 2017) <https://tfl.gov.uk/corporate/publications-and-reports/bus-fleet-data-and-audits>.

Appendix B

Bus route mapping

B1 Buses Serving Walthamstow Central

Buses from Walthamstow Central



B2 Buses Serving Edmonton Green

Buses from Edmonton Green

Route finder

Bus route	Towards	Bus stops
102	Brent Cross (no night service)	① ② ③ ④
144	Golders Green (24-hour)	① ② ③ ④
149	London Bridge	① ② ③ ④
191	Brimsdown	① ② ③ ④
192	Enfield Town	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ ⑮ ⑯ ⑰ ⑱ ⑲ ⑳ ㉑ ㉒ ㉓ ㉔ ㉕ ㉖ ㉗ ㉘ ㉙ ㉚ ㉛ ㉜ ㉝ ㉞ ㉟ ㊱ ㊲ ㊳ ㊴ ㊵ ㊶ ㊷ ㊸ ㊹ ㊺ ㊻ ㊼ ㊽ ㊾ ㊿
259	Tottenham Hale	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ ⑮ ⑯ ⑰ ⑱ ⑲ ⑳ ㉑ ㉒ ㉓ ㉔ ㉕ ㉖ ㉗ ㉘ ㉙ ㉚ ㉛ ㉜ ㉝ ㉞ ㉟ ㊱ ㊲ ㊳ ㊴ ㊵ ㊶ ㊷ ㊸ ㊹ ㊺ ㊻ ㊼ ㊽ ㊾ ㊿
279	Manor House	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ ⑮ ⑯ ⑰ ⑱ ⑲ ⑳ ㉑ ㉒ ㉓ ㉔ ㉕ ㉖ ㉗ ㉘ ㉙ ㉚ ㉛ ㉜ ㉝ ㉞ ㉟ ㊱ ㊲ ㊳ ㊴ ㊵ ㊶ ㊷ ㊸ ㊹ ㊺ ㊻ ㊼ ㊽ ㊾ ㊿
349	Waltham Cross	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ ⑮ ⑯ ⑰ ⑱ ⑲ ⑳ ㉑ ㉒ ㉓ ㉔ ㉕ ㉖ ㉗ ㉘ ㉙ ㉚ ㉛ ㉜ ㉝ ㉞ ㉟ ㊱ ㊲ ㊳ ㊴ ㊵ ㊶ ㊷ ㊸ ㊹ ㊺ ㊻ ㊼ ㊽ ㊾ ㊿
491	Ponders End	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ ⑮ ⑯ ⑰ ⑱ ⑲ ⑳ ㉑ ㉒ ㉓ ㉔ ㉕ ㉖ ㉗ ㉘ ㉙ ㉚ ㉛ ㉜ ㉝ ㉞ ㉟ ㊱ ㊲ ㊳ ㊴ ㊵ ㊶ ㊷ ㊸ ㊹ ㊺ ㊻ ㊼ ㊽ ㊾ ㊿
491	Stamford Hill	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ ⑮ ⑯ ⑰ ⑱ ⑲ ⑳ ㉑ ㉒ ㉓ ㉔ ㉕ ㉖ ㉗ ㉘ ㉙ ㉚ ㉛ ㉜ ㉝ ㉞ ㉟ ㊱ ㊲ ㊳ ㊴ ㊵ ㊶ ㊷ ㊸ ㊹ ㊺ ㊻ ㊼ ㊽ ㊾ ㊿
491	North Middlesex Hospital	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ ⑮ ⑯ ⑰ ⑱ ⑲ ⑳ ㉑ ㉒ ㉓ ㉔ ㉕ ㉖ ㉗ ㉘ ㉙ ㉚ ㉛ ㉜ ㉝ ㉞ ㉟ ㊱ ㊲ ㊳ ㊴ ㊵ ㊶ ㊷ ㊸ ㊹ ㊺ ㊻ ㊼ ㊽ ㊾ ㊿
491	Waltham Cross	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ ⑮ ⑯ ⑰ ⑱ ⑲ ⑳ ㉑ ㉒ ㉓ ㉔ ㉕ ㉖ ㉗ ㉘ ㉙ ㉚ ㉛ ㉜ ㉝ ㉞ ㉟ ㊱ ㊲ ㊳ ㊴ ㊵ ㊶ ㊷ ㊸ ㊹ ㊺ ㊻ ㊼ ㊽ ㊾ ㊿
W8	Southgate	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ ⑮ ⑯ ⑰ ⑱ ⑲ ⑳ ㉑ ㉒ ㉓ ㉔ ㉕ ㉖ ㉗ ㉘ ㉙ ㉚ ㉛ ㉜ ㉝ ㉞ ㉟ ㊱ ㊲ ㊳ ㊴ ㊵ ㊶ ㊷ ㊸ ㊹ ㊺ ㊻ ㊼ ㊽ ㊾ ㊿
W8	Chase Farm Hospital	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ ⑮ ⑯ ⑰ ⑱ ⑲ ⑳ ㉑ ㉒ ㉓ ㉔ ㉕ ㉖ ㉗ ㉘ ㉙ ㉚ ㉛ ㉜ ㉝ ㉞ ㉟ ㊱ ㊲ ㊳ ㊴ ㊵ ㊶ ㊷ ㊸ ㊹ ㊺ ㊻ ㊼ ㊽ ㊾ ㊿
W8	Lee Valley Leisure Complex	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ ⑮ ⑯ ⑰ ⑱ ⑲ ⑳ ㉑ ㉒ ㉓ ㉔ ㉕ ㉖ ㉗ ㉘ ㉙ ㉚ ㉛ ㉜ ㉝ ㉞ ㉟ ㊱ ㊲ ㊳ ㊴ ㊵ ㊶ ㊷ ㊸ ㊹ ㊺ ㊻ ㊼ ㊽ ㊾ ㊿

Night Buses

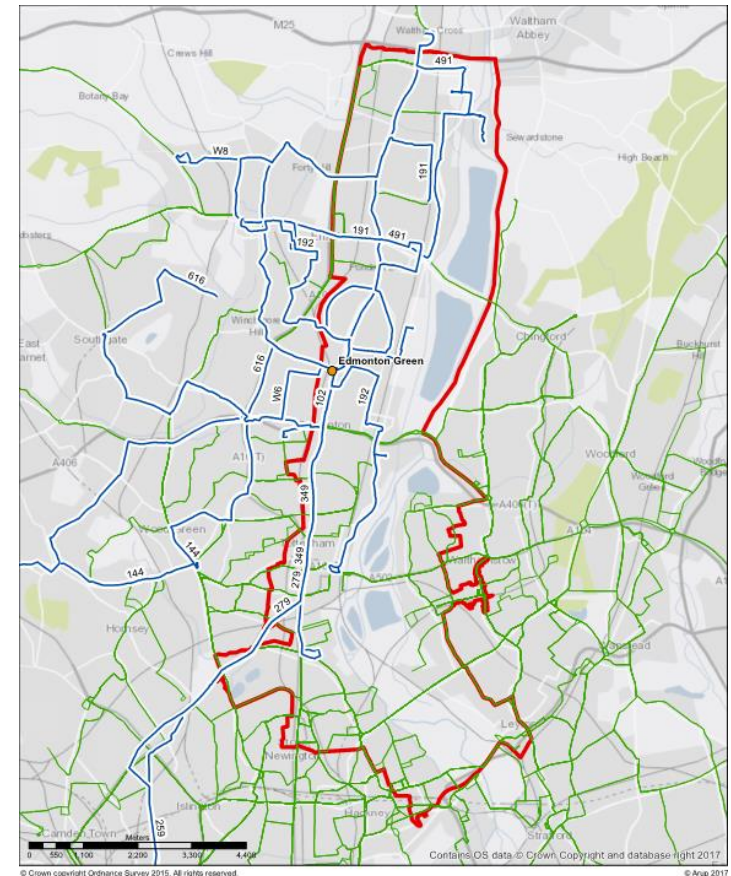
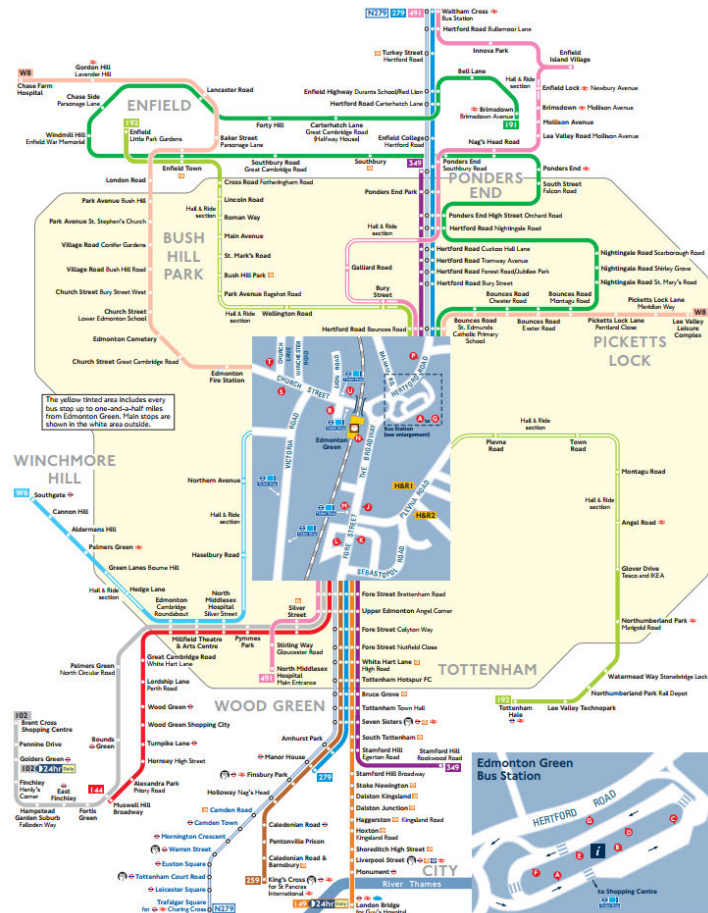
Bus route	Towards	Bus stops
N279	Trafalgar Square	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ ⑮ ⑯ ⑰ ⑱ ⑲ ⑳ ㉑ ㉒ ㉓ ㉔ ㉕ ㉖ ㉗ ㉘ ㉙ ㉚ ㉛ ㉜ ㉝ ㉞ ㉟ ㊱ ㊲ ㊳ ㊴ ㊵ ㊶ ㊷ ㊸ ㊹ ㊺ ㊻ ㊼ ㊽ ㊾ ㊿
N279	Waltham Cross	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ ⑮ ⑯ ⑰ ⑱ ⑲ ⑳ ㉑ ㉒ ㉓ ㉔ ㉕ ㉖ ㉗ ㉘ ㉙ ㉚ ㉛ ㉜ ㉝ ㉞ ㉟ ㊱ ㊲ ㊳ ㊴ ㊵ ㊶ ㊷ ㊸ ㊹ ㊺ ㊻ ㊼ ㊽ ㊾ ㊿

Key

- 279** Day buses in black
- N279** Night buses in blue
- Connections with London Underground
- Connections with London Overground
- Connections with TFL Rail
- Connections with National Rail
- Connections with river boats
- Route 192 operates as Hail & Ride on the section of roads marked as **H&R** on the map.
- Buses stop at any safe point along the road.
- Please indicate clearly to the driver when you wish to board or alight.
- Tube station with 24-hour service Friday and Saturday nights when Night Tube services operates from 19 August 2016

Ways to pay

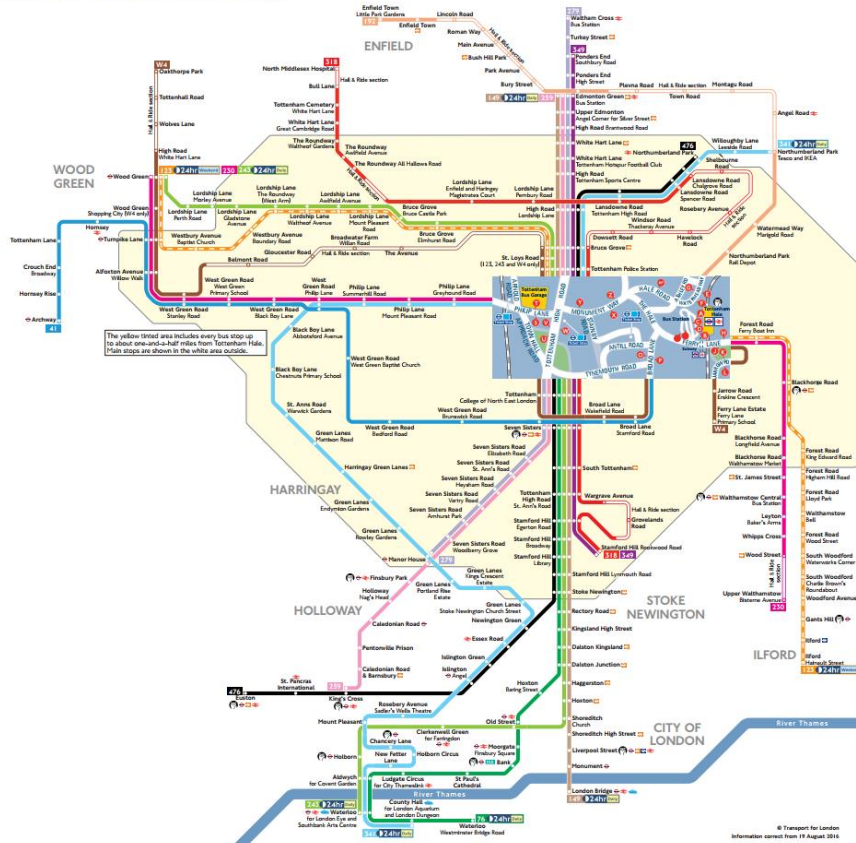
- Use your contactless debit or credit card. It's the same as Oyster and there is no need to top up.
- Top up your Oyster pay as you go credit or buy Travelcards and bus & tram passes at around 4,000 shops across London.
- Sign up for an online account to top up online and see your travel history and spending



- Edmonton Green Bus Station
- Edmonton Green Bus Routes
- Other TIL Bus Routes
- ULV_Boundary

B3 Buses Serving Tottenham Hale

Buses from Tottenham Hale



Route finder

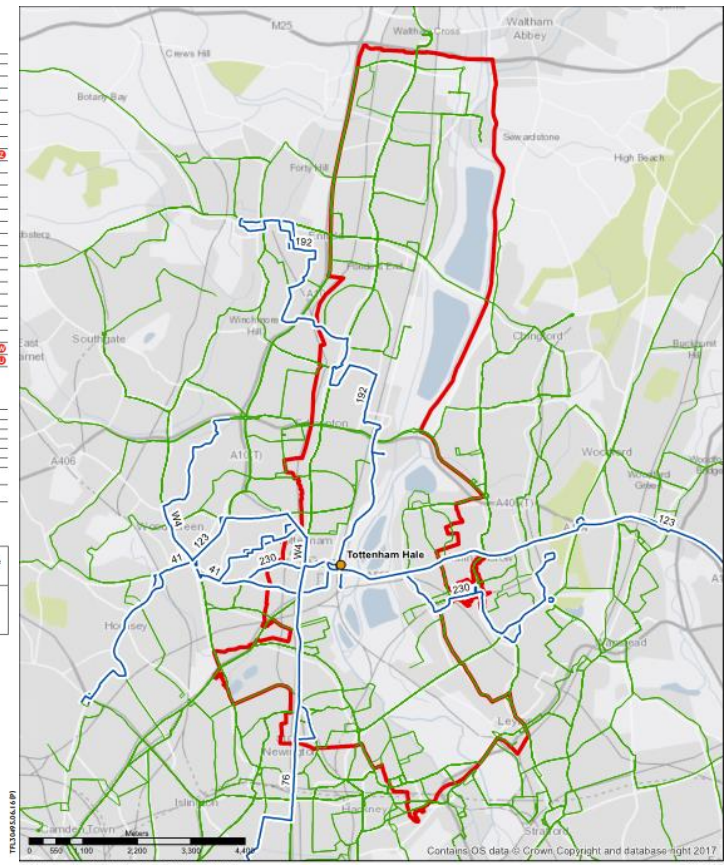
Bus route	Towards	Bus stops
147	Archway	① ②
76	Watlington	① ② ③ ④
173	Ilford	① ② ③ ④
4	Wood Green	① ② ③ ④
192	Edmonton Green	① ② ③ ④
230	Enfield Town	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ ⑮ ⑯ ⑰ ⑱ ⑲ ⑳
243	Wood Green	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ ⑮ ⑯ ⑰ ⑱ ⑲ ⑳
259	Watlington	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ ⑮ ⑯ ⑰ ⑱ ⑲ ⑳
77	Wood Green	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ ⑮ ⑯ ⑰ ⑱ ⑲ ⑳
318	Edmonton Green	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ ⑮ ⑯ ⑰ ⑱ ⑲ ⑳
34	King's Cross	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ ⑮ ⑯ ⑰ ⑱ ⑲ ⑳
349	Manor House	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ ⑮ ⑯ ⑰ ⑱ ⑲ ⑳
476	Waltham Cross	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ ⑮ ⑯ ⑰ ⑱ ⑲ ⑳
W4	North Middlesex Hospital	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ ⑮ ⑯ ⑰ ⑱ ⑲ ⑳
	Stanford Hill	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ ⑮ ⑯ ⑰ ⑱ ⑲ ⑳
	Easton	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ ⑮ ⑯ ⑰ ⑱ ⑲ ⑳
	Ponders End	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ ⑮ ⑯ ⑰ ⑱ ⑲ ⑳
	Stanford Hill	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ ⑮ ⑯ ⑰ ⑱ ⑲ ⑳
	Northumberland Park	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ ⑮ ⑯ ⑰ ⑱ ⑲ ⑳
	Ferry Lane Estate	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ ⑮ ⑯ ⑰ ⑱ ⑲ ⑳
	Oakthorpe Park	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ ⑮ ⑯ ⑰ ⑱ ⑲ ⑳

Key

- ① Connections with London Underground
- ② Connections with London Overground
- ③ Connections with TfL Rail
- ④ Connections with National Rail
- ⑤ Connections with Docklands Light Railway
- ⑥ Connections with Ipe Buses
- ⑦ Operates daily with 24-hour service Friday and Saturday nights
- ⑧ Tube station with 24-hour service Friday and Saturday nights

Ways to pay

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