

Oxford Park & Ride

Future Strategy Development

Oxfordshire County Council

27th May 2016

Summary

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This document has 24 pages including the cover.

Document history

Job number:			Document ref:			
Revision	Purpose description	Originated	Checked	Reviewed	Authorised	Date
Rev 1.0	First Draft	ACI	SB	ACo	ACo	19/05/16
Rev 2.0	Final Summary	ACI	SB	ACo	ACo	27/05/16

Client signoff

Client	
Project	
Document title	
Job no.	
Copy no.	
Document reference	

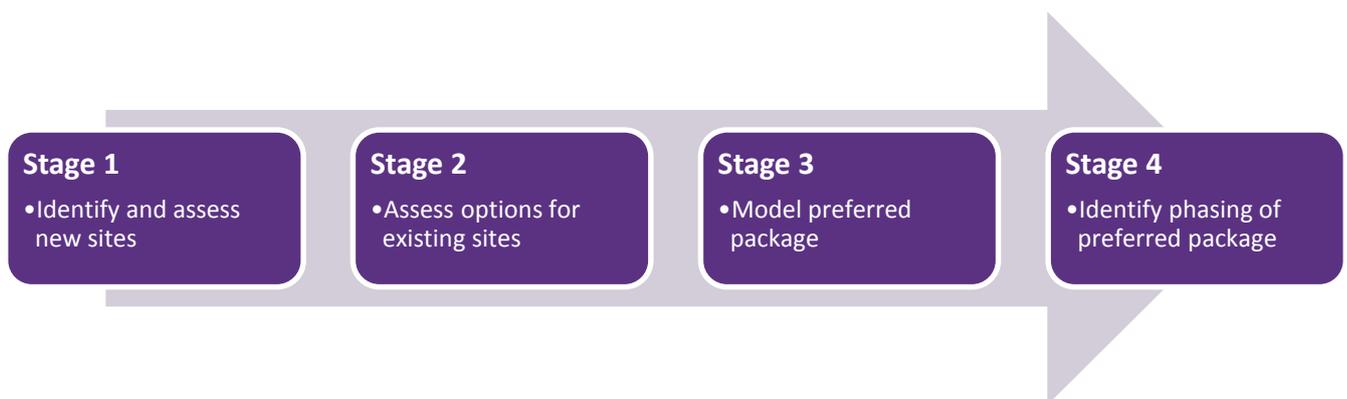
Introduction

Atkins was commissioned in October 2015 to undertake a study for Oxfordshire County Council (OCC) investigating the Park & Ride (P&R) options available to help meet the challenges resulting from the growth in employment and housing in Oxfordshire to 2031. This work builds on the Oxford Transport Strategy (OTS).

The OTS, adopted by OCC in September 2015, proposed a major expansion and reconfiguration of the P&R system in Oxford, to intercept more car trips earlier in their journeys and further away from the city. The OTS proposed six new P&R sites but on the basis of broad locations rather than specific sites. In addition to new P&R sites, the OTS proposed a network of Rapid Transit routes to provide an uplift to transport connectivity in the city, including links between the proposed new P&R sites and the city's Eastern Arc.

To develop the future strategy in regard to P&R, Atkins has undertaken a 4-stage process on behalf of OCC, with a summary provided in Figure 1. Further details on the processes within each stage are outlined later in this summary. Further detail on all stages can also be found in the main report.

Figure 1. Summary of Study Approach



Oxford Transport Strategy

The OTS sets out OCC's transport vision and strategy for Oxford over the next 20 years, as part of the fourth Local Transport Plan (LTP4). It identifies the current and future challenges for transport in the city and sets out a strategy based on a combination of infrastructure projects and supporting measures to enable economic and housing growth.

OTS Proposal for P&R

Having opened the world's first P&R site in the 1970s, the system has grown to provide over 5,000 spaces, all located close to the Ring Road. However, the OTS notes that the popularity of these sites is exacerbating congestion on parts of the Ring Road, particularly around the junctions with the A40 and A34 in North Oxford. This congestion delays all traffic, including buses coming into the city, which impacts the journey times and reliability of bus services from all parts of the city and county.

Morning arrivals at the Peartree, Oxford Parkway, Redbridge and Seacourt P&R sites contribute, in particular, to traffic using the three A34 interchanges to the west of the city. Removing this demand through capturing those users further from the city would have an immediate positive impact on the operation of the A34 and other roads it intersects as vehicles using the sites would no longer need to cross it. The OTS acknowledges that future housing and employment growth within Oxfordshire is set to further exacerbate congestion on the A34, the outer Ring Road and other corridors that feed into the city, unless traffic can be captured before it reaches them.

The OTS concluded that the expansion of the current city-edge P&R sites to meet forecast levels of demand would add substantially to traffic levels on already congested routes, meaning those accessing the city via P&R would encounter significant traffic delays en-route to the P&R sites at peak times. New outer sites were therefore proposed at the broad locations outlined in Table 1. The proposed total provision of over 9,000 spaces will almost double the existing level of capacity. The indicative levels of capacity for each site were determined based on a spreadsheet exercise undertaken as part of the OTS development.

Table 1. Proposed Locations in OTS

Broad Location	Corridor	Main Catchment	Proposed Car Park Capacity
Eynsham	A40(W)	Witney, Carterton, Cheltenham, Gloucester	1,000
Cumnor	A420	Cumnor, Farringdon, Swindon, Wiltshire	1,200
Lodge Hill	A34(S)	Abingdon, Didcot, Science Vale, Newbury, Hampshire	1,600
Sandford	A4074	Wallingford, Didcot, Henley, Reading, Berkshire	1,000
East of Kidlington	A34(N)	Bicester, Banbury, Milton Keynes, Bedfordshire	1,700
Langford Lane	A44, A4260	Chipping Norton, Banbury, Worcestershire, Warwickshire	1,100
Thornhill	A40(E)	As existing	1,800
Total			9,400

Table 1 shows that the OTS proposed a total of 9,400 spaces based on six new sites (plus retention of Thornhill), with the largest new P&R facilities provided on the A34 to the north and south of the city, at sites east of Kidlington and at Lodge Hill. Atkins' work on this commission is taking this proposal from the OTS and developing the P&R element of the proposal further, including developing indicative feasibility drawings, costings and timescales for the various elements to be introduced. Atkins' work also considers the overall level of demand which is expected in the future.

Catchments for Existing P&R Sites

Details of the existing sites are provided in Table 2, including the location, bus service provision and number of spaces available.

Table 2. Existing Sites – Introduction

Name of Site	Location	Bus Service Provision	Number of Spaces
Peartree	South of Peartree Interchange (A34 / A44 Interchange)	300 service to Redbridge P&R via City Centre	1,035
Seacourt	East of Botley Interchange (A34 / A420 Interchange)	400 service to Thornhill P&R via City Centre	794
Redbridge	East of Hinksey Interchange (A34 / Southern Bypass Interchange)	300 service to Peartree P&R via City Centre	1,412
Thornhill	South of the A40, approximately 1km to the east of the Headington Roundabout	400 service to Seacourt P&R via City Centre, plus long-distance coach services to London	1,335
Oxford Parkway	Adjacent to Oxford Parkway Railway Station (current terminus for services to / from London Marylebone via Bicester)	500 service to Oxford Railway Station via City Centre, plus 700 service to Kidlington and Headington	787
Total			5,363

In order to understand the catchment areas for the existing sites, data was extracted from the Oxfordshire Strategic Model (OSM) for the Peartree, Seacourt, Redbridge and Oxford Parkway P&R sites.

With the exception of Seacourt P&R, the data extracted from the OSM suggests that P&R demand appears to be:

- Drawn from a medium to long-distance radius (with users typically coming from beyond the Oxfordshire boundary); and
- Diminished in areas where strong local bus services exist, such as Abingdon and Witney, and stronger in less well populated areas harder to serve by direct, frequent local bus services.

The latter means that when developing new sites, it is important to ensure that there is not a transfer from existing bus services onto new P&R services, as this could mean that a car leg is introduced to a journey which is currently being made by bus only and hence may work against wider sustainable travel policy in the county.

To support this analysis, Atkins has produced a set of maps showing the origin of existing trips to the P&R sites, using the modelled base year (2013). The purpose of interrogating these sources of data is that it helps to understand whether replacement of the existing sites with new sites is likely to provide sufficient coverage of the existing P&R catchment. Notable findings from this assessment include there being relatively few local journeys made to the Peartree site, whereas the Seacourt catchment is much more local in nature. Analysis also shows that there are significant numbers of users of the Redbridge site from the Swindon area, which might be attributable to people choosing to drive cross-country before using the A34 site. Like Peartree, Oxford Parkway derives around 50% of its traffic from the A34(N). This is important in demonstrating that whilst the access from the A34(N) is not as convenient as that for Peartree, there are nonetheless a large number of users at Oxford Parkway from the A34(N), suggesting that the more complex routing from the A34(N) is not a major dis-incentive.

Outcomes of Stage 1

Stage 1 of the commission is to identify and assess new sites. While the OTS identified the broad locations for a new site on each corridor, this stage has sought to determine whether the preferred locations put forward in the OTS are appropriate or whether there are other locations that could be more suitable to facilitate a new P&R site. The stage also sought to examine any notable environmental or local site access constraints, along with an assessment of strategic transport factors such as the ability to serve the catchment effectively. Within Stage 1, there were two sub-tasks:

- **Sub-Task A:** Corridor Assessment – assessing at a high level whether there are other locations on the corridors (over and above those identified by the OTS) which could be suitable for accommodating a new P&R site; and
- **Sub-Task B:** Emerging Preferred Site Assessment – for each emerging preferred location, further consideration of the environmental constraints, local site access constraints and the strategic transport factors for a new P&R site. In addition, land ownership constraints were considered.

Atkins' assessment has identified that there is at least one site on each corridor which appears feasible based on an early high-level assessment. The key findings from Stage 1 are considered to be as follows:

- There is a clear opportunity to develop sites on all corridors identified in the OTS. There is, however, some uncertainty around the need to replace the existing P&R facility at Oxford Parkway with a site on the A34 to the north;
- There are high frequencies and levels of commercial operation of buses on most corridors, but it should be noted that given the commercial operation, this may mean that loadings are already high and hence there may be limited capacity for these buses to practically serve new P&R sites. The exception regarding frequency is the A4074, which is served by two bus routes only and hence the opportunity to serve a new site using existing bus routes only appears limited, without a significant increase in frequency;
- It would be prudent to re-visit this analysis upon publication of the Oxford to Cambridge Expressway study for consultation, to determine whether different strategic routings may have an implication on where the preferred sites should be;

- Care will need to be taken to ensure that long diversions are not required for buses to serve the new sites, as this would significantly reduce attractiveness / feasibility for potential operators. Consideration has been given in Stage 3 to how the Redbridge P&R model could be replicated on some of the corridors, whereby a bus layby is provided for buses in one direction, with the layout allowing terminating buses to perform a u-turn manoeuvre before returning to the city. Whilst this model has clear benefits when a site is served only by terminating services, consideration needs to be given to how such a layout could be adapted if the site is to be served by ‘through’ services as well as terminating services; and
- It may be that the business case for the new bus services to be provided would be strengthened by the allocation of further housing sites to meet unmet housing need in locations which allow the buses to serve the new residential developments and the P&R sites.

The scope of this commission was not to undertake a full site selection assessment for each of these corridors. Such a process will require the development of detailed designs for each site and this level of resources commitment will be required as part of the development of planning applications for any of the sites should they be progressed further.

The process we have undertaken is intended to provide a high level assessment and initial indication of the most favourable locations in order to inform future P&R Strategy and development work. It is recognised that further work will be required to demonstrate the case for each individual site as they progress through the planning process. That assessment, taking the form of a sequential test, would need to capture the alternatives in much greater detail to withstand planning scrutiny. This will be particularly relevant where the sites are within Green Belt or Flood Risk Zones where OCC will be required to demonstrate why there are no suitable alternative locations outside areas with either of these designations.

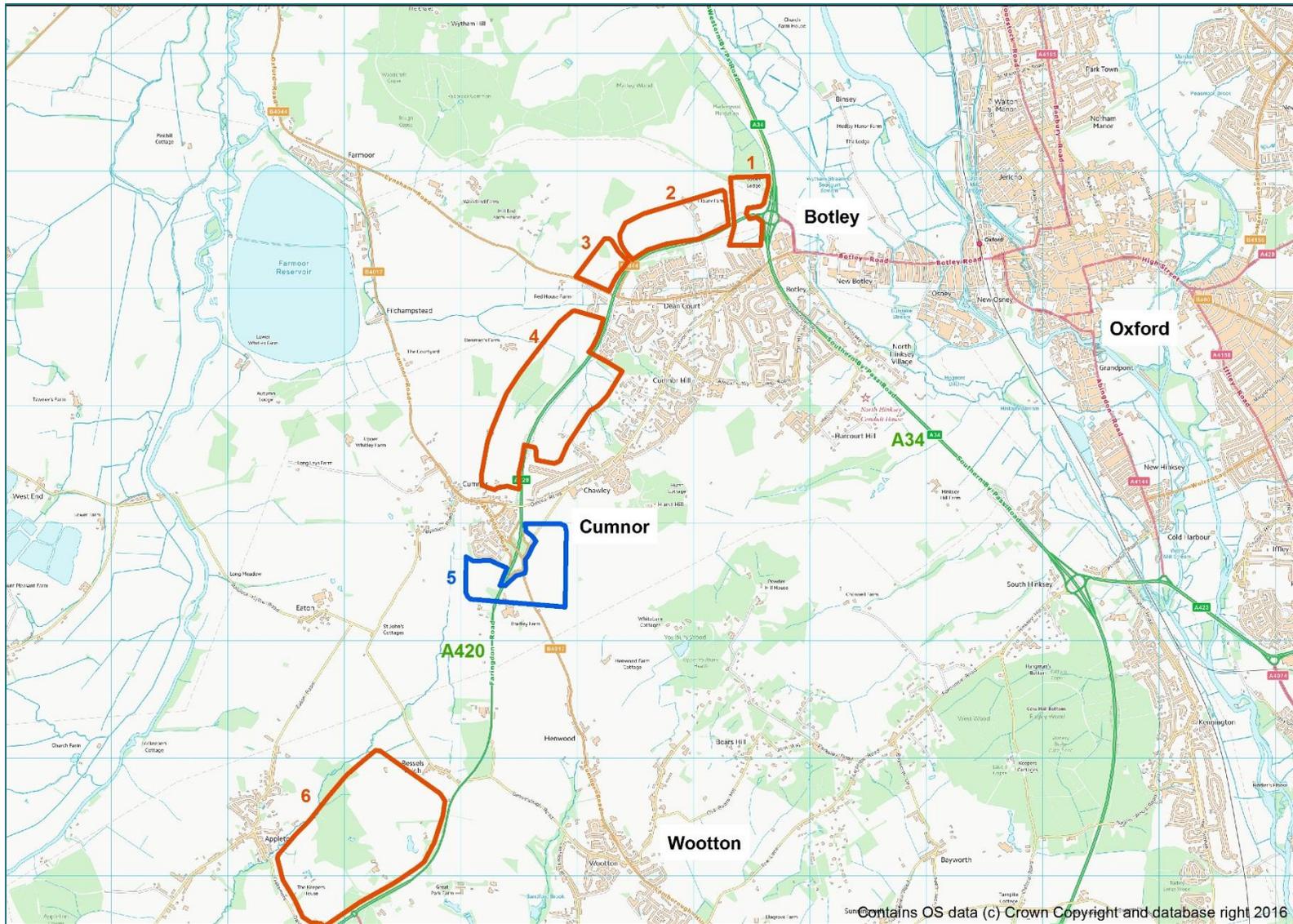
The emerging preferred locations are outlined in Table 3, summarising the high level assessment of environmental constraints, local site access constraints, the ability for the site to be served commercially (based on an assessment of existing passing services) and the local plan position. Maps showing all the land parcels on each corridor are shown in Figures 2-7.

Key to Shading				
Environmental Constraints	Local Site Access Constraints	Ability for Site to be Served Commercially	Ability to Effectively Serve Catchment (Informed by Existing Catchments only)	Local Plan Position (Including Location Relative to Green Belt)
Major concerns associated with developing a site that would place a high risk on securing planning consent	Significant infrastructure requirement which may place a high risk on securing planning consent	Limited provision of bus services in proximity to site leading to potentially significantly more buses being required than for current services. The risk is that bus fares will not adequately cover the operating costs	Significant concern that placement of a P&R facility at this location would not adequately cater for P&R catchment	Site is within Green Belt or in an area earmarked in the Local Plan for a different land use
Some concerns but likely to be able to mitigate	Major infrastructure required but likely to be practical. For example, re-engineering of existing slip roads or junctions or further design work needed due to close proximity of other junctions	Some provision of bus services between the land parcel and Oxford which <i>could</i> be upgraded to P&R and / or future BRT Services. There is potential for the additional cost of operating buses to be covered by bus passenger fares	Some provision of bus services between the land parcel and Oxford which <i>could</i> be upgraded to P&R and / or future BRT Services	Amber shading – not used for this assessment
No notable concerns	New infrastructure required but on a smaller scale than that for the amber / red score. Typically this would be small changes to existing highway to provide access and egress from the site	Frequent services passing the land parcel which <i>could</i> be upgraded to P&R and / or future BRT Services. The levels of potential demand and bus service appear to strongly fit and future services should be commercially viable	Frequent services passing the land parcel which <i>could</i> be upgraded to P&R and / or future BRT Services	Site is outside the Green Belt and does not conflict with other land uses outlined in the Local Plan

Table 3. Emerging Preferred Locations

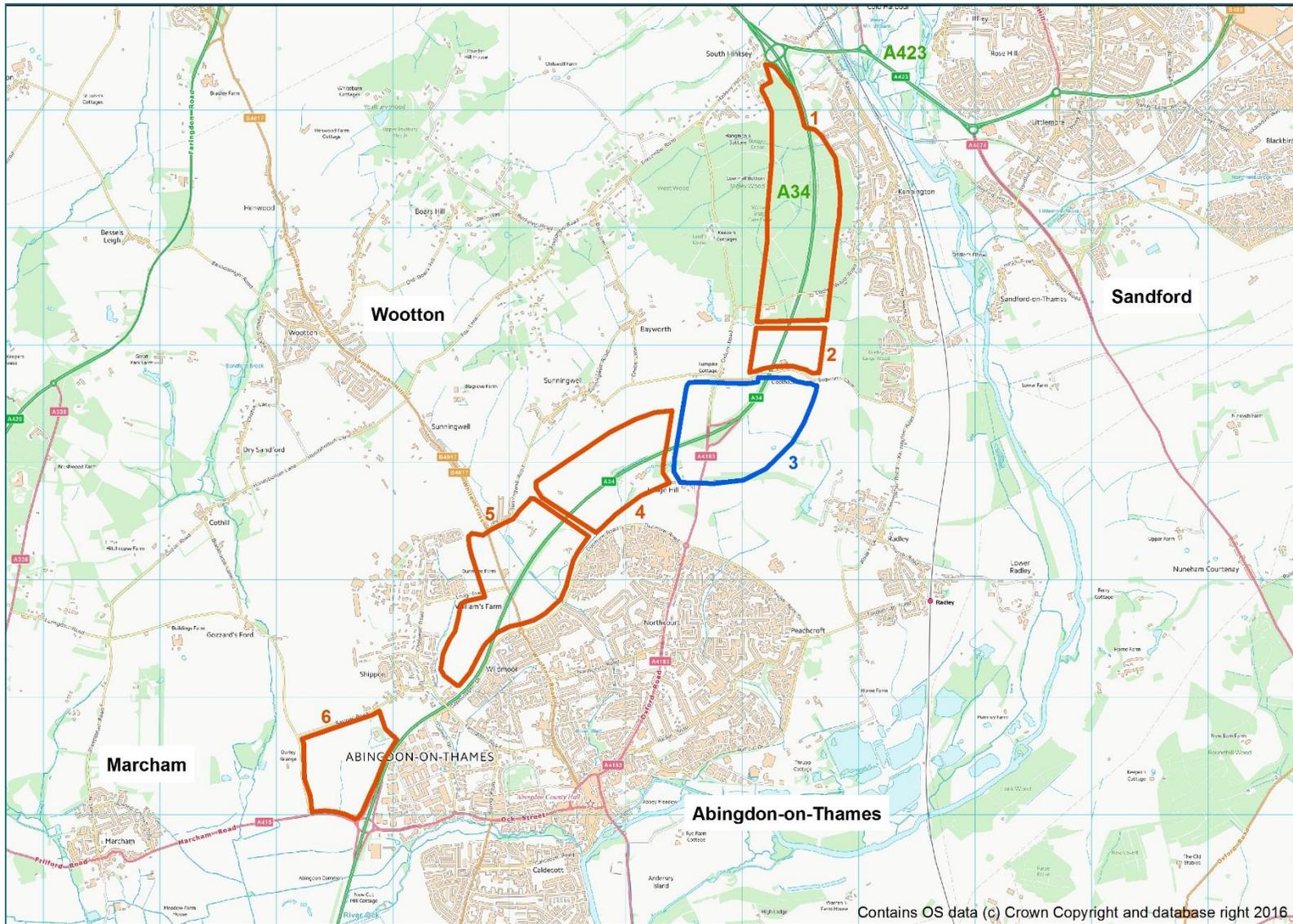
Corridor	Number of Land Parcels in Corridor Assessment	Emerging Preferred Site	Environmental Constraints	Local Site Access Constraints	Ability for Site to be Served Commercially		Local Plan Position (including location relative to Green Belt)
					Ability for Site to be Served Commercially	Ability to Effectively Serve Catchment	
A40	6	Site 6 – west of A40 / Cuckoo Lane Junction (chosen over Site 5 – see main report for details)	No major constraints	Reconfiguration of A40 / Cuckoo Lane	Served by S1 / S2 / S7 / 18	Captures trips currently using Peartree and Seacourt facilities	Outside Green Belt
A420	6	Site 5 – east of A420 / B4017 Junction	No major constraints	All movements possible at existing interchange	Route 66 plus 4 / 4B / X30 via Cumnor Hill	Should feasibly capture the large number of users accessing Seacourt from the A420 corridor	Within Green Belt
A34(S)	6	Site 3 – north-west of Lodge Hill Interchange	No major constraints	Requires south facing slips at Lodge Hill	Several routes via A34 and one via Oxford Road	Located between Abingdon and Oxford hence well placed to serve large element of the existing Redbridge catchment	Within Green Belt. Land safeguarded for the development of the full (all movements) interchange
A4074	5	Site 3 – approximately 0.5-1km south of A4074 / Henley Road Junction in Sandford on Thames	Flood Zone west of A4074	New priority / signalised junction	T2 and X39 / X40	Could serve market south of Ring Road and longer distance trips	Within Green Belt
A34(N)	7	Site 2 – an expansion of the existing P&R facility at Oxford Parkway	Close to existing parking at Water Eaton / Oxford Parkway	Extension of existing parking	Numerous bus routes on Oxford / Banbury Road corridor	Well placed to serve both A34(N) and A4260 / Kidlington market	Within Green Belt
A44	7	Site 7 – south-east of the A44 / A4095 Junction (chosen over Site 6 – see main report for details)	Potential for visual intrusion at Blenheim Palace	Various options at or close to roundabout	S3 only	Able to capture A44 corridor catchment with Kidlington area assumed to be captured by existing bus services, but could offer airport parking	Within Green Belt

Figure 3. A420 Corridor Land Parcels²



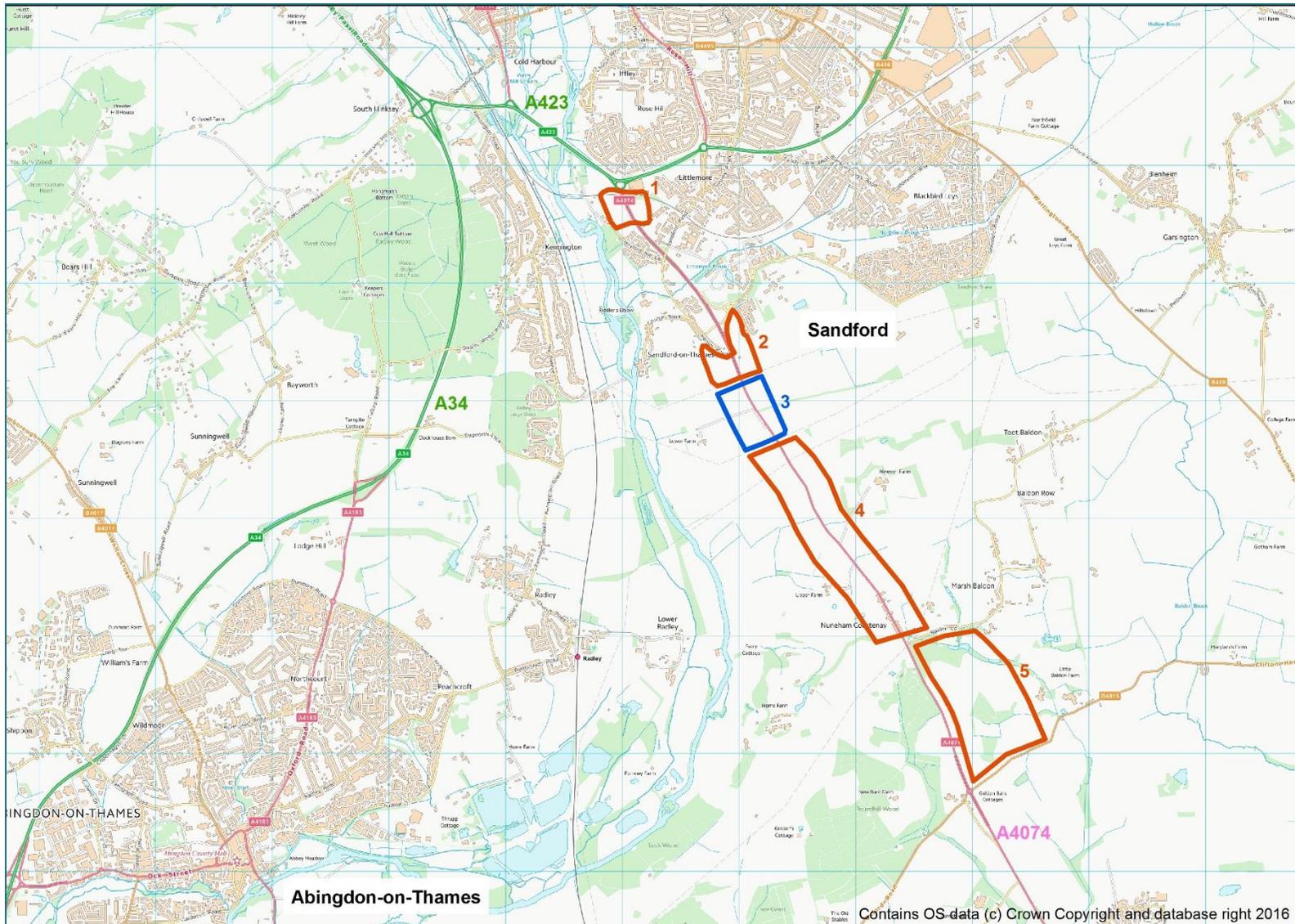
² Blue outline denotes the emerging preferred land parcel(s).

Figure 4. A34(S) Corridor Land Parcels³



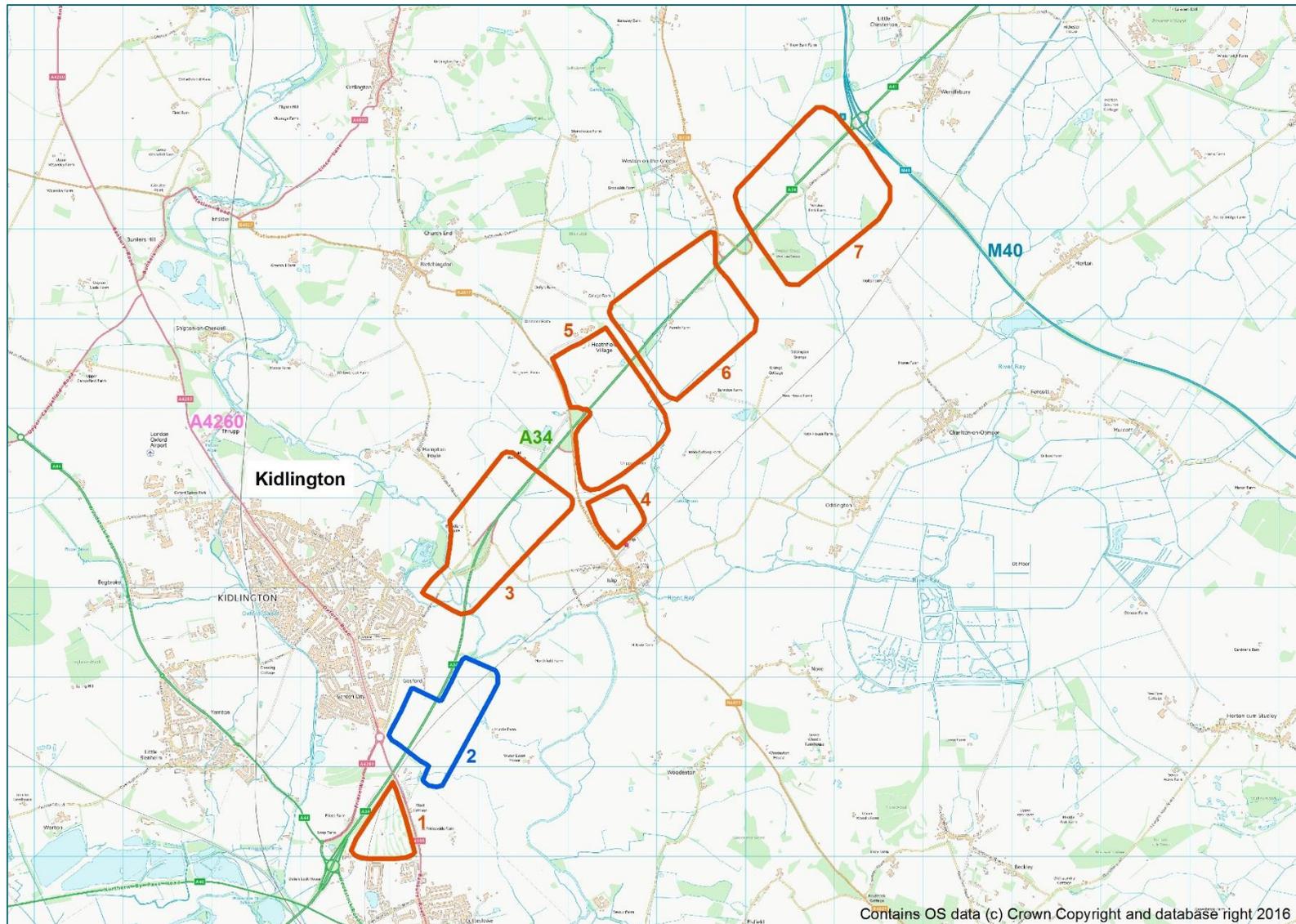
³ Blue outline denotes the emerging preferred land parcel(s).

Figure 5. A4074 Corridor Land Parcels⁴



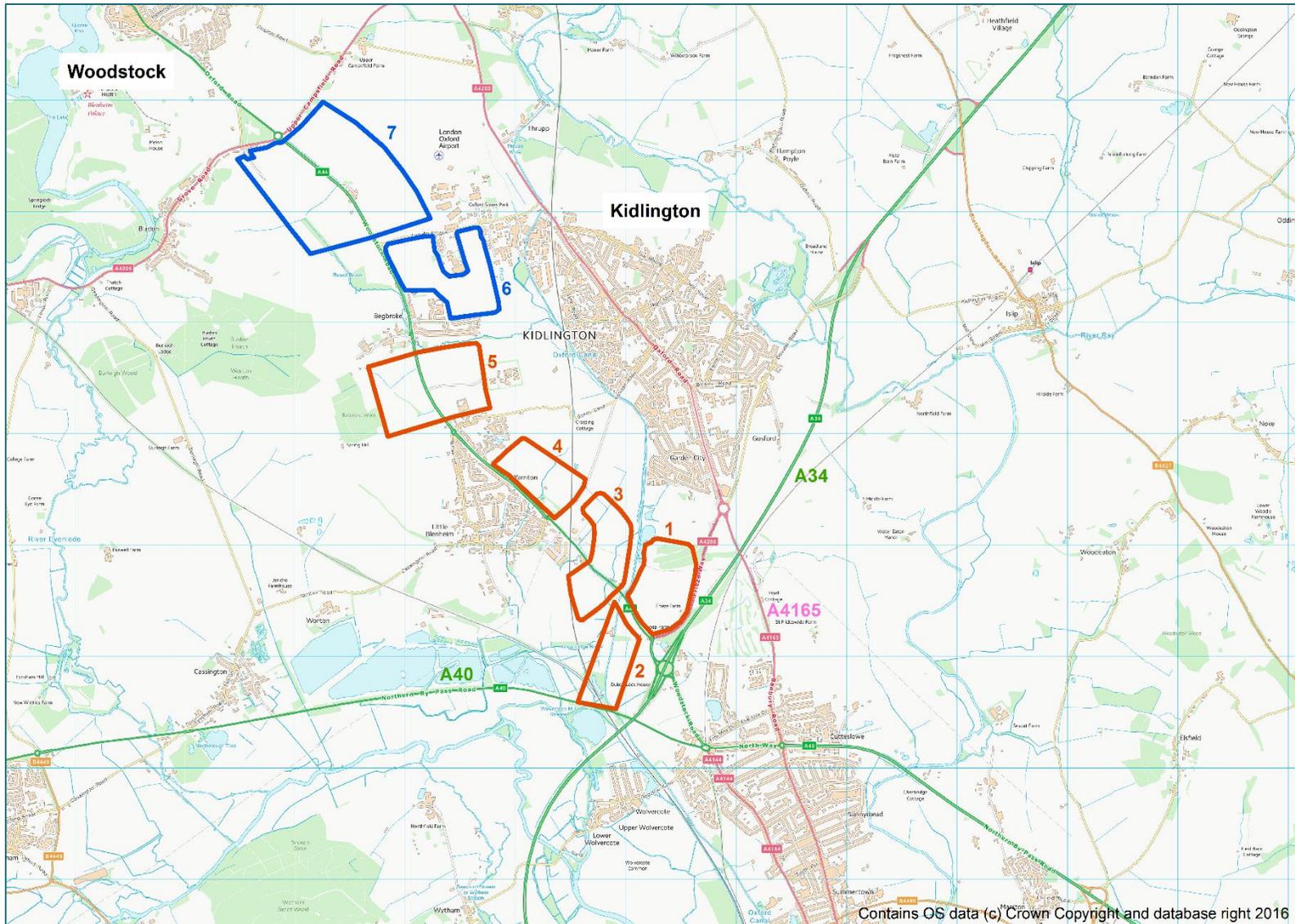
⁴ Blue outline denotes the emerging preferred land parcel(s).

Figure 6. A34(N) Corridor Land Parcels⁵



⁵ Blue outline denotes the emerging preferred land parcel(s).

Figure 7. A44 Corridor Land Parcels⁶



⁶ Blue outline denotes the emerging preferred land parcel(s).

Outcomes of Stage 2 and 3

Stages 2 and 3 covered two key tasks:

- **Sub-Task A:** Produce feasibility drawings for the emerging preferred site locations identified in the previous stage. The primary purpose is to demonstrate that access arrangements can work and it is likely that the designs will change as work progresses on each site following this work; and
- **Sub-Task B:** Use the OSM to understand the impact of the preferred strategy on P&R usage. This in turn has provided the information for Atkins to determine whether the existing sites should be retained as P&R sites or re-developed for other uses.

Feasibility Drawings (Sub-Task A)

A number of guiding principles have been used to inform the process of creating feasibility drawings for the new / expanded sites:

- The feasibility design drawings allow for sites to be served by dedicated services and / or passing conventional bus services. Hence they allow a high level of flexibility at this early stage. However, as more detail is known regarding the preferred operating model, it may be possible to refine / simplify some of the bus infrastructure accordingly;
- The site capacities have been based on the OTS, which was itself informed by a spreadsheet based process of re-assigning demand from the existing network of sites, making an allowance for future growth to 2031;
- Passenger waiting areas are shown indicatively on the drawings, aiming for consistency with the existing high quality provision at city and county-operated sites; and
- Finally, it should be noted that the feasibility design drawings produced are two dimensional only and have been completed without using topographical or geotechnical surveys.

Basic information regarding the site locations, numbers of spaces and costs is outlined in Table 4. Wherever possible, sites are accessed via an expansion of existing junctions, but for some locations, it has been necessary to design completely new infrastructure to accommodate an access to the proposed P&R site. For both Thornhill and Oxford Parkway, access would continue to be via the existing junctions from the highway network.

Key points to note from the table are as follows:

- The numbers of spaces provided for the new sites, in line with the OTS, range from 1,000 (Eynsham and Sandford) to 1,600 (Lodge Hill). The expansion at Thornhill has been based upon an additional 465 spaces being provided, taking the total capacity up to 1,800. As noted earlier, this site serves both P&R towards Oxford (via the 400 bus service) but also towards London via coach services. Two figures are shown for the number of additional spaces to be provided at Oxford Parkway, as further work is required to determine the optimum approach to expansion. The expansion by 820 spaces is based on decking and surface expansion, while the expansion by 1,070 spaces is based on a large surface expansion only. It would be prudent to tie any expansion at this location in with wider development plans for the railway station itself;
- The only site where there is significant OCC land ownership (beyond the highway boundary) is Eynsham;
- The environmental and design work are desktop exercises at this stage and ground investigations and site surveys have not been undertaken. There will therefore be a risk of unknown environmental or engineering constraints that would be expected at this stage of design. Optimism bias has been applied in recognition of unknown risks on a percentage uplift basis agreed with OCC. The scheme costs and level of optimism bias should remain under regular review as each scheme is taken forward in the future;
- Costs, presented in 2016 prices and inclusive of 45% optimism bias, range between £11.3m and £14.1m for the new sites. As well as a total cost, the split into customer building, junction works, site works and land costs is also provided. Construction inflation will need to be applied once the future phasing is fixed; and

- The costs are for the construction only and do not include the development costs that will be required to progress through the detailed design, statutory processes and procurement. A reasonable assumption on development costs is that they will be in the region of 10-15% of the total capital cost. The actual costs for each scheme will depend on the complexity of each site including statutory consents and land ownership issues.

In addition to the feasibility design drawings, following discussions with OCC officers, Atkins has given consideration to off-site access for two of the sites, namely Cumnor and Oxford Parkway, and identified opportunities where alterations could be made in the local area, including changing priority at junctions to provide more convenient access from key routes into the P&R sites.

Table 4. New Site Summary

Site	Number of Spaces	OCC Land Ownership	Cost (2016 prices): Includes 45% Optimism Bias on all Categories				
			Customer Building	Junction Works	Site Works	Land Costs	Total
A40 Site 6 – Eynsham	1,000	Yes	£1.8m	£1.8m	£7.1m	£0.4m	£11.1m
A420 Site 5 – Cumnor	1,200	No	£1.8m	£1.6m	£7.5m	£0.4m	£11.3m
A34(S) Site 3 – Lodge Hill	1,600	No	£2.5m	£0.9m	£10.1m	£0.5m	£14.1m
A4074 Site 3 – Sandford	1,000	No	£1.6m	£2.8m	£6.7m	£0.3m	£11.4m
Thornhill	+465	No	£0	£0	£2.7m	£0.1m	£2.8m
A34(N) Site 2 – Oxford Parkway	+820	No	£0	£0	£9.7m	£0.3m	£10.0m
	+1,070	No	£0	£0	£11.0m	£0.4m	£11.4m
A44 Site 7 – London Oxford Airport	1,100	No	£1.8m	£1.1m	£6.8m	£2.8m	£12.5m

Modelling of Preferred Package (Sub-Task B)

Using the OSM, Atkins has undertaken modelling of a number of different P&R scenarios, as summarised in Figure 8.

Figure 8. Modelling Scenarios



The base year model captures the situation as at 2013, when the five existing P&R sites in the city were operating. The Do Minimum Scenario estimates the demand in 2031 if there were no changes to the P&R system in the city, but assuming that there is growth in job numbers, housing numbers and that other transport infrastructure schemes are introduced. Finally, Scenarios 1 and 2, both for 2031, have been specifically developed for this commission and are as follows:

- **Scenario 1** assumes that by 2031, three existing sites (Peartree, Seacourt and Redbridge) are closed; the existing sites at Oxford Parkway and Thornhill are retained and expanded; with new outer sites being introduced at Eynsham, Cumnor, Lodge Hill, Sandford and London Oxford Airport. The sites would, where practical, be served by extensions of the existing P&R bus services, with no new bus priority provided on the corridors; and
- **Scenario 2** is as per Scenario 1, but significant supporting infrastructure is provided on the routes between the sites and the city centre, in order to deliver faster journey times for buses and hence a more attractive option for potential P&R users. In addition, as per the OTS proposal, new bus rapid transit (BRT) routes are introduced between some of the sites and the city's Eastern Arc, providing additional coverage of the city which is not provided now or in the 2031 Do Minimum scenario.

Note that these model runs do not test the options whereby the outer sites are introduced but all inner sites are retained. However, based on the modelled demand for Scenarios 1 & 2, commentary is provided later in this summary regarding the likely feasibility of this arrangement.

The model is based upon a 12-hour period (07:00 – 19:00) for a typical weekday, but specific breakdowns are available for the AM peak (07:00 → 10:00), inter-peak (10:00 → 16:00) and PM peak (16:00 → 19:00).

Headline Results

It is important to note that the model does not allow for vehicle demand to the city centre to be constrained as a result of parking supply. Hence the model may allow, particularly in future years, for more vehicles to access the city than there are parking spaces. In order to overcome this issue, Atkins has made a number of refinements to the modelling outputs to reflect that the supply of parking in the future will be less than the total demand for spaces.

The headline results, including the manual adjustment regarding constrained parking, are detailed in Table 5. These are the 12-hour figures relating to person demand at the sites. Hence a figure of 885 in the top row of the table for Eynsham suggests that 885 passengers will wish to board P&R services at a new Eynsham site over a 12-hour weekday period:

- The Base Year model shows total usage of the existing sites of 3,760 passengers across all five sites (only the two sites which are retained are shown in Table 5). Note that as part of the modelling process, this figure has been validated (and confirmed to be appropriate) against counts of vehicles at the existing sites as collected by OCC;
- Between the Base Year (2013) and the Do Minimum scenario (2031), there is forecast to be growth from 3,760 passengers to 6,816 passengers. This will reflect a number of different changes being made, but key drivers of this additional demand will be jobs and housing growth both within the city but also at a county and wider regional level;
- Scenario 1 shows forecast usage of 7,100 across the 12-hour period. The highest demand is for both Oxford Parkway and London Oxford Airport, with 12-hour demand of approximately 1,600 users at each. The lowest level of usage is shown for Sandford, with 280 users across the 12-hour period. It is notable that the level of usage of Scenario 1 is not significantly higher than that for the Do Minimum, which may be a reflection of the lack of bus priority assumed for the extended P&R services which will serve the new sites in Scenario 1; and
- Scenario 2 shows forecast usage of approximately 9,400 persons, which is over 2,000 higher than the estimate for Scenario 1. This is a reflection both of the increased attractiveness of the new sites (over Scenario 1) because of faster journeys being offered, but also because of new coverage of the Eastern Arc as a result of the BRT20 and BRT70 routes.

Table 5. Model Outputs including Adjustment

New Package of Sites	Base Year (2013)	Do Minimum (2031)	Scenario 1 (2031)	Scenario 2 (2031)
Eynsham	-	-	885	1,341
Cumnor	-	-	763	845
Lodge Hill	-	-	909	1,484
Sandford	-	-	280	352
Thornhill	744	1,065	1,064	1,048
Oxford Parkway	855	1,970	1,594	1,647
London Oxford Airport	-	-	1,610	2,695
Total	3,760 (all)	6,816 (all)	7,100	9,411

The site capacities outlined earlier in this summary have been based on the OTS, which was itself informed by a spreadsheet based process of re-assigning demand from the existing network of sites, making an allowance for future growth to 2031. Now that modelling of different scenarios has been undertaken, using the OSM, it is possible to re-visit those assumptions regarding site capacities.

Atkins completed an estimate of maximum accumulation for both Scenarios 1 & 2. This exercise shows some reductions and increases in capacity would be required, but this will depend on the scenario which is adopted. For example, the modelling suggests a maximum accumulation of 675 for Eynsham in Scenario 1, which means that a car park capacity of 1,000 is likely to be broadly appropriate, taking account of the need to cater for peak days. However, the maximum accumulation for Scenario 2 exceeds the OTS indication and hence a larger number of spaces would need to be provided. The analysis shows that there are a roughly equal number of instances where an increase or decrease is required. The estimated maximum accumulation at Sandford suggests that a car park with a capacity of 1,000 spaces would be too large for both Scenarios 1 & 2.

Additional Demand from the Workplace Parking Levy

In some cities around the world, including Nottingham in the UK, a demand management measure called a Workplace Parking Levy has been introduced. This typically involves a charge per business (private non-residential) parking space being levied by the local authority, and this income must, in the case of UK legislation, then be re-invested in supporting transport measures.

It is important to note that the cost is borne by the employer. The extent to which the charge is then passed on to employees will vary both within and between individual workplaces. In some instances the employer may decide to either fully or partially subsidise parking for employees, whilst in other locations employers have made the decision that the full cost of the parking must be met by the employee. The level of the actual charge will be a factor in both decisions about how much of the costs are passed on to individuals and the subsequent impact on their travel choices.

Case study material, including the business case from Nottingham in the UK, suggests that Workplace Parking Levy introduction could lead to a 10% reduction in supply of parking in the city. Note that at the current time, very few cities in the world have introduced this policy and hence the available evidence is limited.

In an Oxford context, OCC estimates that there are currently of the order of 6,000 private non-residential spaces in the city centre and hence the introduction of the Workplace Parking Levy may theoretically lead to a potential reduction of approximately 600 spaces if the 10% assumption is applied. Based on a broad

assumption that those who are no longer able to park at their workplace may instead opt to move onto P&R, car sharing, or other parking areas in the city or other modes of transport (a three-way split), Atkins has estimated the impact that the Workplace Parking Levy introduction could have on demand for P&R in the city.

As there are more parking options available in the Eastern Arc (for example, including free at the point of use and on-street spaces), the introduction of a Workplace Parking Levy in that area would be expected to lead to some additional demand for P&R but not to the same extent as that in the city centre context given the reduced number of direct services and longer journey times. For the purpose of this assessment we have assumed that there could be a 5% reduction in supply of parking in the Eastern Arc, which based on approximate supply of 20,000 private non-residential spaces, could lead to a reduction of circa 1,000 spaces. At this stage, the assumption has again been made that there will be a three-way split of those people who lose their space through the introduction of a Workplace Parking Levy, onto P&R, other parking areas and other travel modes.

Based upon these assumptions, our analysis indicates that there could be approximately 600 additional person trips from the P&R sites across a 12-hour period, which represents a range from 20 additional users at Sandford to approximately 150 at London Oxford Airport. This analysis indicates the potential of a Workplace Parking Levy as part of a wider package of interventions.

In this study we have provided an initial high level indication of the potential additional P&R demand that a Workplace Parking Levy could generate based on limited international evidence. To better understand the impacts of any Workplace Parking Levy, business case work would be required over and above the analysis undertaken for this study to develop an understanding of the potential scheme options, the complementary transport package, scheme impacts (transport, social and economic) and political, public and stakeholder acceptability.

Summary of Stages 2 & 3

The assessment undertaken by Atkins has suggested that there may be a broad doubling in demand from the 2013 Base Year (3,760 users across a 12-hour period) to the 2031 Scenario 1 (7,100 users across a 12-hour period). This is largely a reflection of increased demand for travel into the city as a result of both housing and job growth.

Our assessment shows that a network of new larger sites could operate successfully to accommodate a doubling of demand from the Base Year (2013) to Scenario 1 (2031). Under this proposal, the existing city P&R sites at Peartree, Seacourt and Redbridge would be closed, with the existing sites at Oxford Parkway and Thornhill retained and expanded. New sites would be introduced at Eynsham, Cumnor, Lodge Hill, Sandford and London Oxford Airport, aiming to intercept users earlier in their journey and hence reduce the number of car trips made across the busy ring road junctions close to the city.

Based on the results presented, Atkins' view is that there is unlikely to be sufficient demand to justify the financial cost of operating a two-tier system of sites (whereby Peartree, Seacourt and Redbridge are retained, in addition to the new sites being provided). It should be noted, however, that the modelling data is focussed on an average weekday only and is conservative to ensure compliance with government guidance for modelling and appraisal. If there were greater optimism around the demand associated with the new Westgate development in the city centre, and other changes in land use in the city centre, then it may be possible for a case to be developed for the inner and outer sites operating together, subject to more detailed consideration of the following:

- The way in which the supply is spread across the two sets of sites. For example, should capacity be reduced in the inner sites, thereby pushing more users towards the outer sites, hence reducing the number of trips made across the ring road? Could the inner sites be priced to attract short stay trips only? What else could be introduced to incentivise use of the outer sites? For example, marketing of the outer sites for commuters?
- The way in which variable message signage (VMS) or other similar technology could be used to alert users on the corridors to the number of spaces available (in real-time) and charges for both the inner and outer sites, allowing for informed decisions to be made at the earliest opportunity and avoiding wasted trips associated with users trying to access sites which are already full;
- The ability for bus operators to be able to serve both inner and outer sites commercially (without financial support being provided), ensuring that a sustainable business model is developed which does not rely on large annual subsidy being available;

- The increased operating costs associated with a larger number of sites being operated. To incentivise use of the outer sites, could the facilities provided at the inner sites be scaled back?
- Complementary uses of the inner sites, alongside P&R, which could help generate income cover the operating costs of the inner sites. This could include tourist coach parking, click and collect, freight consolidation or a range of non-transport uses.

Outcomes of Stage 4

A draft phasing strategy has been developed by Atkins based on the introduction of new sites as per Scenario 1 and 2. This strategy is summarised in Table 6 which shows the indicative phasing of the new sites / expansion opening. The demand forecasts from the OSM only relate to one future point in time, 2031. To provide a phased strategy we have considered the corridors where future demand is anticipated to come forward sooner and hence the need for additional capacity should be required earlier in the 15 year period. The period between the current time and 2031 has been split into three separate five year periods, based on available information. Key points to note are as follows:

- The phasing assumes that the optimum approach to developing a new network of sites is to focus attention on one segment of the city / catchment at a time, which allows for the capital costs for the sites to be spread across a longer period. In addition, a key advantage of this approach is that it allows for lessons to be learnt as the strategy develops, for example in regard to the way that potential inner site closures or reductions in size / outer site openings are marketed to the general public. This approach also provides time for the local authorities to assess the extent to which the expected level of demand has materialised or whether there have been unforeseen changes;
- The modelling earlier in the report showed that the highest level of usage of sites is forecast at Oxford Parkway (expansion of the existing site) and London Oxford Airport. This is the reason for the north / west side of the city / catchment being addressed first in this strategy, with the following being undertaken in the period 2016 – 2021 (representing the short term):
 - Introduction of two new sites at Eynsham and London Oxford Airport. The timing regarding the creation of the new site at Eynsham is key, as this is linked to wider A40 corridor based improvements being introduced, with timescale limitations for external funds to be spent;
 - Expansion of the existing facility at Oxford Parkway;
 - Commencement of preparatory work on Thornhill Expansion (for implementation in next phase) and
 - Potential closure / reduction in size of the existing P&R facility at Peartree.
- The next phase (2021 – 2026) would see the expansion of the P&R facility at Thornhill and preparatory work start towards the end of the 5-year period on Cumnor and Lodge Hill sites. The modelling has confirmed that whilst the Thornhill car park is very heavily used, there are a large number of users of the car park who are parking for other reasons than for P&R towards Oxford. This is likely to include car sharing / P&R towards London; and
- The final phase of the strategy (2026 – 2031) would see the creation of two new outer sites to the south of the city, at Lodge Hill and Sandford. It is important to re-iterate the key dependency for the site at Lodge Hill, in that the P&R scheme developed at that location does rely upon south facing slip roads being introduced at Lodge Hill Interchange. If this scheme does not come to fruition, then an alternative site would need to be considered for the A34(S) corridor, or further consideration given to how demand from the south can be accommodated through changes at Redbridge and improvements to access. In addition, during this period, the new site at Cumnor would be introduced, potentially replacing all or some of the existing site at Seacourt.

It is important that the phasing strategy is regularly reviewed in the context of known developments for either jobs or houses. The phasing strategy should also be reviewed in light of changes to the public transport network in Oxford, given that bus operators will be constantly reviewing / refining their networks to ensure maximum efficiency, especially in light of cuts to local authority subsidy of bus services. For example, should a higher frequency of commercial service be operated on a given corridor, then it may change the decision regarding whether a dedicated P&R service is required for that site or not.

The timing of the sites around the southern arc of Oxford at Cumnor, Lodge Hill and Sandford allow for the issues surrounding the potential Oxford to Cambridge Expressway and a possible A34 to M40 link to be better understood before any final decisions are made to progress these.

Construction inflation will need to be applied once the future phasing is fixed.

Table 6. Phasing of P&R Strategy – Potential Timing of Future New Sites / Expansion Opening

Sites	2016 - 2021	2021 - 2026	2026 - 2031
Eynsham	●		
Cumnor			●
Lodge Hill			●
Sandford			●
Thornhill - Expansion		●	
Oxford Parkway - Expansion	●		
London Oxford Airport		●	
<i>Potential closures, capacity reductions or alternative uses</i>	<i>Peartree</i>	-	<i>Seacourt</i> <i>Redbridge</i>

Conclusions and Recommendations for Next Steps

Atkins recommends that OCC considers a number of steps to take the P&R strategy forward.

Detailed Phasing

The phasing proposed in this commission is based on the demand forecasting, planned schemes and anticipated timescales for future development.

In taking forward any individual scheme within the proposed programme it is recommended that the delivery programme as a whole remains under regular review alongside updated information on housing and employment expansion, future transport investment and future trends in travel demand in the city (including monitoring the impacts of the redeveloped Westgate Shopping Centre post-opening).

The Need for Inner and Outer Sites

As outlined, Atkins' view from the results of the modelling from this commission is that there is unlikely to be sufficient demand based on the model outputs to justify operating a two-tier system of sites (whereby Peartree, Seacourt and Redbridge are retained) in the longer term. It should be noted that the modelling data is focussed on an average weekday and is conservative to ensure compliance with government guidance for modelling and appraisal.

There are a number of future factors that could increase actual demand for P&R, and for the retention of the inner sites, including higher levels of weekend retail and leisure trips (for example if Westgate exceeds expectations / forecasts) alongside further constraints on parking by either OCC or from key employers themselves that may wish to use some of the existing parking for redevelopment / expansion.

Should OCC wish to proceed with a two-tier approach to P&R provision it is recommended that further work is undertaken to understand the business case of such an approach to ensure the financial risks and potential policy interventions required are better understood. Work should include:

- A review of non-commuting parking needs, including:
 - City centre parking.
 - City edge P&R.
 - Tourist coach parking.
 - Charging.
 - Management and maintenance costs.
 - Other complementary uses (for example, click and collect and freight consolidation).
- Further consideration of the impact of the WPL; and
- Further investigation of the scale of change in parking demand as a result of the Westgate development.

The Operating Model for the New P&R Sites

For the purpose of this commission, Atkins has produced feasibility drawings for the new sites which allow for both dedicated P&R services to be operated and existing bus routes to serve the sites. In some instances this has led to relatively large junctions being provided to access the sites. It may be possible for the supporting bus-only infrastructure to be refined if buses are to only access the sites from certain directions.

As well as the physical layout required for the sites, the operating model will also need to be developed to inform whether dedicated P&R vehicles will be required or whether the sites could be served through frequency / vehicle size upgrades on existing bus routes.

Consideration should also be given to the facilities that would be made available at the sites, including opportunities to provide revenue to support the running costs, for example through provision of click and collect facilities to allow users to collect pre-ordered goods from designated pick-up points.

Finally, whilst indicative walking and cycling infrastructure has been made on the designs, this offering should be refined as further details on the overall site infrastructure are known. For example, the opportunities for bus-only infrastructure to be shared by cyclists to make the greatest use of available roadspace.

The Bus Rapid Transit (BRT) Network

The OTS advocated development of a mass transit network for the city, which includes new BRT services to and from a number of the proposed P&R sites. As part of the commission, Atkins has modelled Scenario 2 which includes new BRT services to the Eastern Arc from the Eynsham, Lodge Hill, Sandford and London Oxford Airport sites. The modelling results for Scenario 2 show a large uplift in passenger demand from that for Scenario 1, which reflects both the faster bus journey times to and from the P&R sites, but also the development of the new BRT20 / BRT70 routes to the city centre.

As part of the OTS development, Atkins gave early consideration to how a BRT network may be provided which provides a significant uplift in transport connectivity across the city. It is recommended that, building on that early work, further work is undertaken to develop the network further, as the results of this assessment would help to shape the future offering for P&R. The P&R phasing will also need to be reviewed and refined in light of the emerging BRT proposals.

The site capacities should also be reviewed in light of the work above on the BRT network.

Consideration of Vehicle Type

The current specification for P&R services in the city is for single-door double-deck buses to be operated with on-bus cash. This gives a high seating capacity but the provision of a single door only leads to longer dwell times than if multi-door vehicles are operated.

The OTS envisages tram-like articulated buses potentially being operated, which are effectively mimicking some of the features of light rail vehicles and hence can be expected to lead to a higher level of mode shift than if conventional buses are operated. Whilst there may be a number of benefits for passengers, the initial outlay for these vehicles can be approximately double that for a double-deck vehicle and there are other

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issues which need consideration including higher operating costs, the trade-off between multi-door vehicles and revenue protection and possible resistance from other road users (for example, cyclists).

Atkins' view for the purpose of this commission is that the business case for articulated vehicles is unlikely to be justified on capacity grounds alone. It is likely to be more cost effective to increase frequencies with conventional buses. However, it would be prudent to review this view as more detail on the operating model is available as part of the development work on the BRT network.

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