London Borough of Richmond

PEDESTRIAN AND CYCLE BRIDGE FEASIBILITY STUDY

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OCTOBER 2018

PUBLIC

London Borough **of Richmond**

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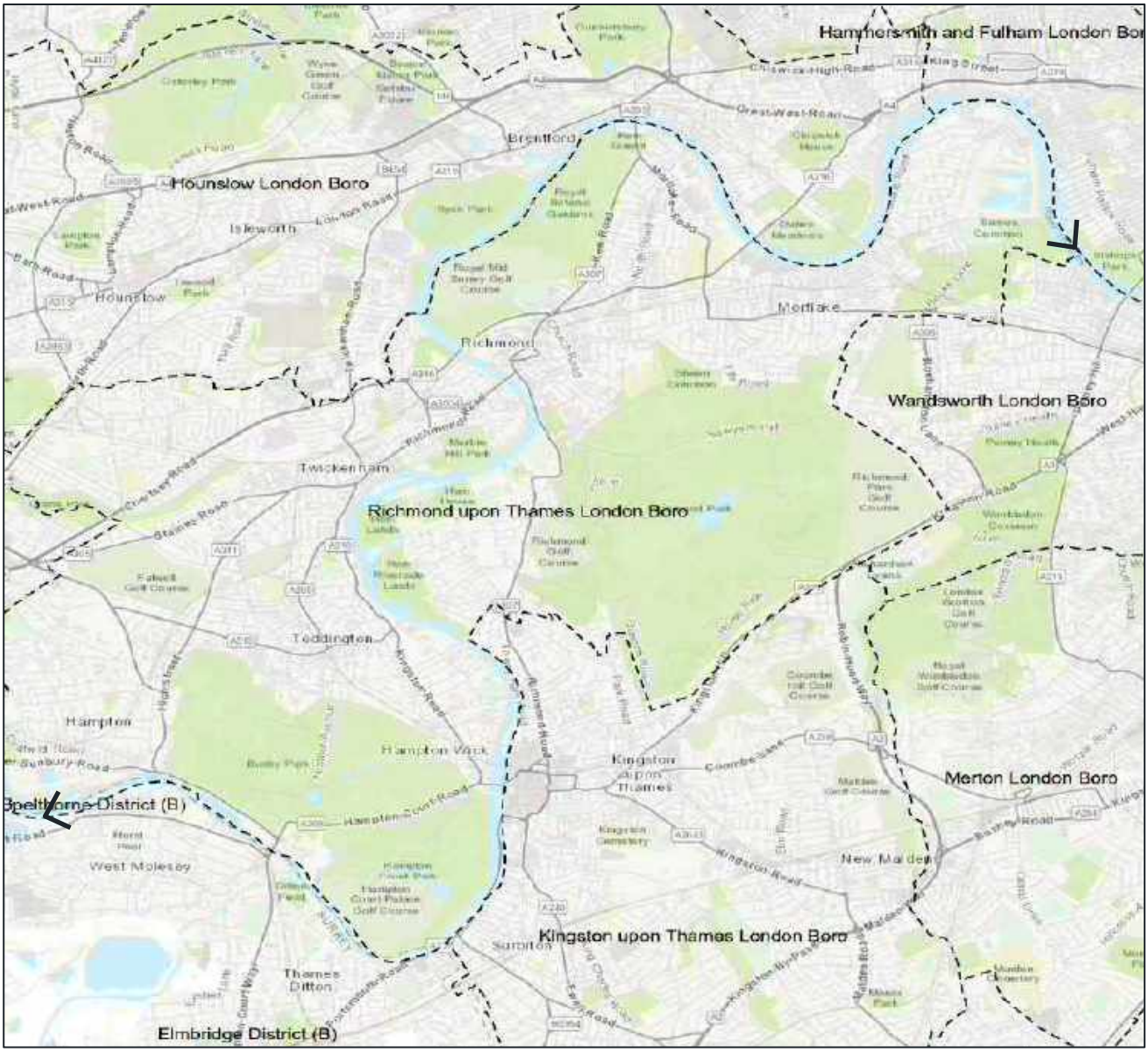
1 INTRODUCTION

1.1.1. The London Borough of Richmond commissioned WSP to undertake this study to determine the feasibility of introducing a new pedestrian and cycle bridge across the Thames within Richmond. As shown in Figure 1.1, this relates to the section of river from near Putney Bridge in the east to Hampton in the west, which is 28km in length. The river is bordered by the boroughs of Richmond, Hounslow, Hammersmith and Fulham and Kingston, as well as the district of Elmbridge.

Figure 1.1 Study area



1.1.2. This report summarises the feasibility study. Should a decision be made to progress with the bridge scheme, the feasibility study will represent a foundation on which further, more detailed planning work can be based.

2 BACKGROUND AND OBJECTIVES

2.1 BACKGROUND

2.1.1. In July 2014, Richmond Council produced a Regulation 123 List which set out infrastructure projects that the Council intended to fund in whole or in part from Community Infrastructure Levy revenue, in accordance with Regulation 123 of the Community Infrastructure Regulations 2010. Two of the "Strategic Transport" projects highlighted were:

- Foot/cycle bridge between Ham and Twickenham, including town centre enhancements for cycling
- Public footbridge between Kew and Brentford

2.1.2. Over the past couple of decades there have been several ideas for new pedestrian and cycle bridges across the Thames in Richmond. These have been championed by different organisations but have generally failed to gain momentum. However, specific plans for bridges in locations close to Twickenham and Brentford have attracted a lot of interest in the last few years.

2.1.3. The reasons for this are many and varied, but are connected in part to perceived increased demand from development (particularly to the north of the river), new funding opportunities and also due to the substantial increase in popularity of cycling across the Capital. However, these are not the only potential locations for a bridge; the remit for this study is much wider, considering all possible locations within the borough.

2.1.4. Given the competing policy and funding demands, there is a need to both justify any form of policy support and expenditure towards a bridge as well as clarify the optimal location, business case and associated priority that should be given to each crossing scheme. These are core aspects which are considered within this study.

2.2 OBJECTIVES

2.2.1. The primary objective of introducing a new bridge across the Thames in Richmond is to improve connectivity, thereby increasing access to homes, jobs, services, leisure activities and transport links. The full list of objectives is identified below:

- Provide a more pleasant and safer journey experience for pedestrians and cyclists who currently suffer from poor amenity on existing bridges.
- Improve the health and wellbeing of residents and others by affecting a mode shift from motorised modes to walking and cycling, and by encouraging new trips to be made by active modes.
- Provide a more direct and coherent route for short journeys over the river and to link into the wider network for longer trips. This will help to connect people to homes, jobs, services, leisure activities and public transport nodes.
- Support the potential for growth and regeneration.
- Contribute to improving the public realm and public spaces around the bridge, and help to activate these areas.

2.2.2. A new crossing which meets the above objectives will contribute towards the delivery of a number of policies and proposals in the Mayor's Transport Strategy (MTS) including:

Healthy streets and healthy people:

- MTS Policy 1: reduce dependency on cars in favour of active, efficient and sustainable modes of travel
- MTS Policy 2: seek to make London a city where people choose to walk and cycle more often
- MTS Policy 3: adopt Vision Zero for road danger in London
- MTS Policy 5: prioritise space efficient modes of transport to tackle congestion and improve the efficiency of streets for the movement of people and goods

New homes and jobs:

- MTS Policy 21: ensure that new homes and jobs in London are delivered in line with the transport principles of Good Growth

2.2.3. An assessment of how well the bridge options meet these objectives as well as those set by LB Richmond is described in Chapter 7.

3 STUDY APPROACH

3.1.1. In order to ascertain whether a new bridge is required in order to cater for existing and future demand that is achievable in engineering terms, a pragmatic approach has been taken to undertaking the feasibility study. The study applies good practice principles which take into account the large extent of the study area and the wide range of objectives for seeking to introduce a new bridge.

3.1.2. The approach to the study has been structured with the aim to answer the following key questions:

- Where are the most promising locations for new cycle/pedestrian bridges?
- What level of demand is there for the new bridges compared to the existing bridges?
- What potential issues and constraints may impact on implementing the bridges?
- What opportunities do the bridges provide for improving connectivity?
- Will the bridges provide value for money?

3.1.3. The study has been split into two key stages:

- Stage 1: Desktop Review, Data Collection and Location Shortlisting
- Stage 2: Appraisal of Specific Sites

Stage 1: Desktop Review, Data Collection and Location Shortlisting

3.1.4. The 28km extent of the river in Richmond was split up into thirty 500m sections. Each of these was subject to a high level assessment to establish their suitability in terms of; the potential demand by pedestrians and cyclists, the constraints regarding landing sites and their attractiveness relative to the adjacent existing bridges. The assessment was informed by existing data and information which included GIS mapping of land-use, environmental features and heritage conditions.

3.1.5. The assessment enabled each location to be scored and prioritised. This was discussed with internal stakeholders at a workshop, and agreement was reached to undertake a more detailed review of several locations as part of Stage 2.

Stage 2: Appraisal of Specific Sites

3.1.6. A site suitability review was undertaken for a total of eight locations within five sections. Four of the locations were subsequently discounted, and following a more detailed review of potential landing sites two more locations were added in and one of these was retained.

3.1.7. This gave a total of five locations (within four sections) which were then subjected to a detailed analysis of demand and a business case assessment. Along with landing site and design considerations, these two main elements informed an overall assessment and prioritisation of the bridge site options.

4 CONTEXT

4.1 EXISTING BRIDGES

Location of Bridges in Richmond

4.1.1. There are ten existing bridges that cross the River Thames within the Richmond boundary which pedestrians and/or cyclists can access. Of these, seven are road bridges and three are foot bridges. The location of the bridges is shown in Figure 4.1.

4.1.2. The distance between bridges ranges from 280m to 7.6km, with an average distance of 3km. The longest expanse of river without a crossing in Richmond is 4.6km (ignoring the 7.6m distance shown below as most of this is outside Richmond). This is between Richmond Bridge and Teddington Footbridge. To put this into context, the average distance between the ten central London bridges (shown in the inset below) is 500m.

Figure 4.1 Existing bridges in Richmond

Characteristics

4.1.3. The key characteristics of the existing bridges in Richmond are outlined in Table 4.1.

4.1.4. Kew Bridge is by far the longest at 360m and Richmond Footbridge is the shortest at 76m. The average length of the bridges within Richmond is 147m.

4.1.5. As highlighted in red text, some of the bridges do not have specific provision for cycle access. Cyclists on Hammersmith Bridge and Richmond Bridge have to share the carriageway with vehicles. Cyclists must demount to travel across the three footbridges, and only Teddington Footbridge has a ramped access.

4.1.6. The last Thames crossings to be built in Richmond are Chiswick Bridge, Twickenham Bridge and Hampton Court Bridge: all of which were completed in 1933.

Table 4.1 key characteristics of existing bridges

Bridge	Design type, completion date	Length	Width	Cycle Lane?	Access	Other features	12-Hour Ped. Count	12-Hour Cycle Count	Total count
Hammersmith Bridge	Suspension Bridge, 2 piers (1887)	210m	13m	No, on road only	Steps + footway/ road	Narrow traffic lanes, 20000 veh/day	3,872	1,923	5,795
Barnes Footbridge	Deck arch bridge, 2 piers (1895)	124m	2.4m	No, foot bridge only	Steps	Runs alongside railway bridge	1,223	256	1,479
Chiswick Bridge	Deck arch bridge, 2 piers (1933)	185m	21m	Yes - shared with pedestrians	Steps + shared use path	40,000 veh/day	382	554	937
Kew Bridge	Arch, 2 piers (1903)	360m	23m	Yes - shared with pedestrians	Steps + shared use path	-	1,665	1,041	2,706
Richmond Footbridge	Deck arch bridge, 3 piers (1894)	76m	8m	No, foot bridge only	Steps	Split into 2 2m walkways	892	200	1,092
Twickenham Bridge	Arch, 2 piers (1933)	118m	20m	Yes - shared with pedestrians	Steps + shared use path	-	706	750	1,456
Richmond Bridge	Stone arch bridge, 4 piers (1777)	91m	11m	No, on road only	Steps + footway/ road	Narrow traffic lanes, 35,000 veh/day	5,258	1,457	6,715
Teddington Footbridge	Suspension, single span (1889)	100m	3m	No, foot bridge only	Steps + ramps	-	1,544	1,042	2,585
Kingston Bridge	Stone Arch, 4 piers (1828)	116m	24m	Yes – shared with pedestrians	Steps + shared use path	50,000 veh/day	4,781	2,302	7,084
Hampton Court Bridge	Concrete Arch, 2 piers (1933)	97m	21m	Yes – shared with pedestrians	Road	-	3,899	1,457	5,356

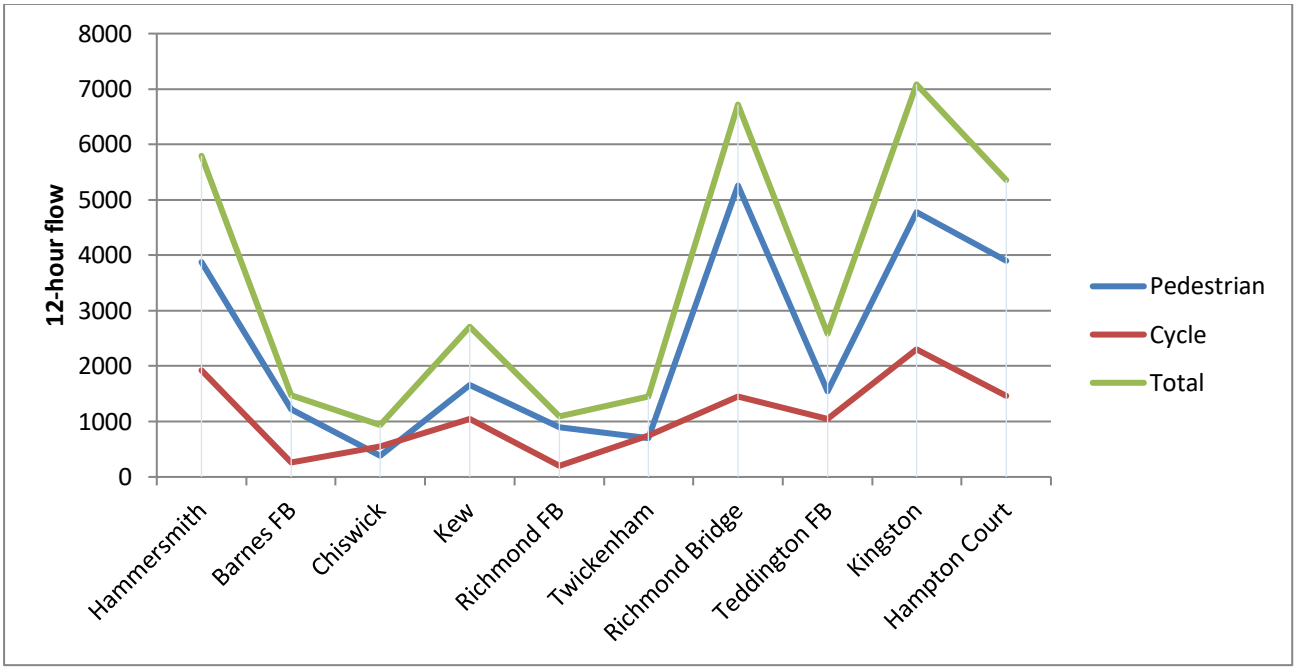
Existing demand

4.1.7. Existing pedestrian and cycle count data was obtained from TfL for each of the ten bridges. The data was available between the years of 2012 and 2017, with surveys undertaken on weekdays during various months of the year. The surveys covered a 12-hour period between 07:00 and 19:00.

4.1.8. An average 12-hour count for pedestrians and cyclists was derived across the seasonal and annual surveys. These are shown in Figure 4.2.

4.1.9. Kingston Bridge is the busiest overall (over 7,000 trips) and has the highest pedestrian flow (2,302 trips). Richmond Bridge has the highest cycle demand with over 5,000 trips. Chiswick Bridge has the lowest overall demand with 937 trips, closely followed by Richmond Footbridge with 1,092 trips.

Figure 4.2 Pedestrian and cycle demand on existing bridges



4.2 OTHER THAMES BRIDGE PROPOSALS IN RICHMOND

4.2.1. As described in Chapter 2, over the last few years ideas have been developed for new pedestrian and cycle bridges across the Thames in Richmond. Information on these bridge proposals is provided below.

Radnor Bridge

4.2.2. The proposal to build a 90m-span pedestrian and cycle bridge between Twickenham and Ham has been championed by a local interest group since 2010. The group has identified their preferred location for the bridge which is between Radnor Gardens to the west and Ham Lands to the east (Figure 4.3). They have developed concept design plans (Figure 4.3) to show how the bridge could be designed and where it would connect into the land either side of the river. These proposals have been discussed with Richmond Council but no commitment was given to consider them further.

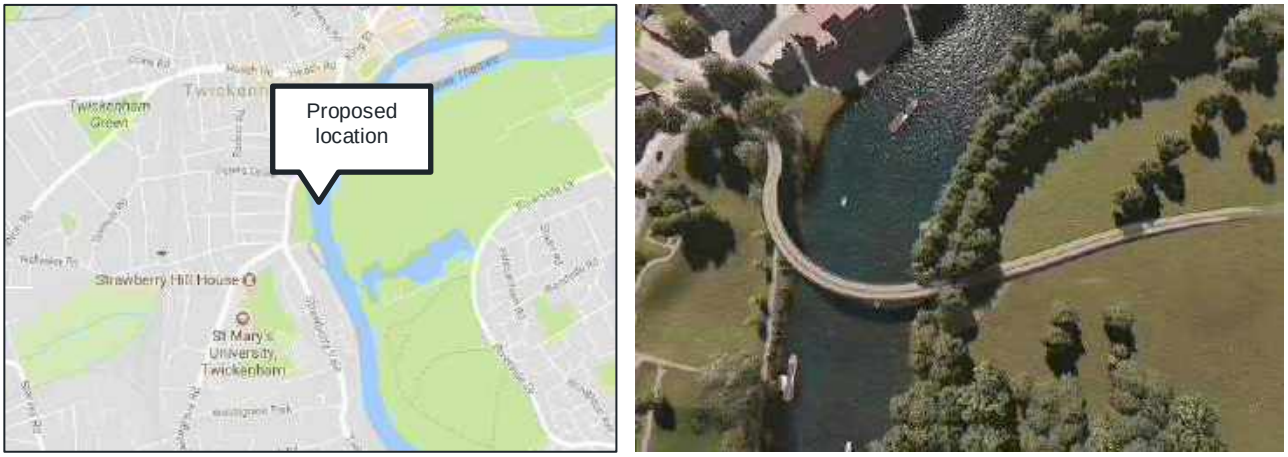
4.2.3. The Radnor Gardens Blog, which documents the progress of the bridge proposal, states: “Our hope is that the Radnor Bridge will become a strategic connector in the area. Improving accessibility to both sides of the river and opening up a more convenient route for commuters and pedestrians alike.” The group has identified their top five reasons for locating a Thames crossing at Radnor Gardens:

1. The topology on both sides at this point is most suited to a bridge crossing of the river. When the bridge starts from the proposed new mini-roundabout on Cross Deep then it only needs to rise 2m to clear sailing masts at high tide below.
2. The location fits best with the landscape strategy for both sides of the river and as a key piece of infrastructure will prove to be the strategic link in the heart of Richmond Borough, offering benefits to the greatest number of residents and reducing the need for numerous cyclists to enter Twickenham town centre or cars to be on the road

3. At this point the best leisure pursuits access for short river strollers is offered. It is the midway point between Richmond Bridge and Teddington Lock and will not challenge access via Hammerton Ferry. Indeed we believe it will encourage greater usage of the ferry boat crossing.
4. It will connect Ham House to Strawberry Hill House, making for a lovely tourism attraction. And the adventurous may also then choose to complete the circle of all four local Houses with the addition of York House and Marble Hill House.
5. Strawberry Hill Station is the closest station (as the crow flies) for people who live in Ham.

4.2.4. The proposed location and a local architect's design for the bridge are shown in Figure 4.3.

Figure 4.3 Location and design for Radnor Bridge



Brentford Gate Bridge

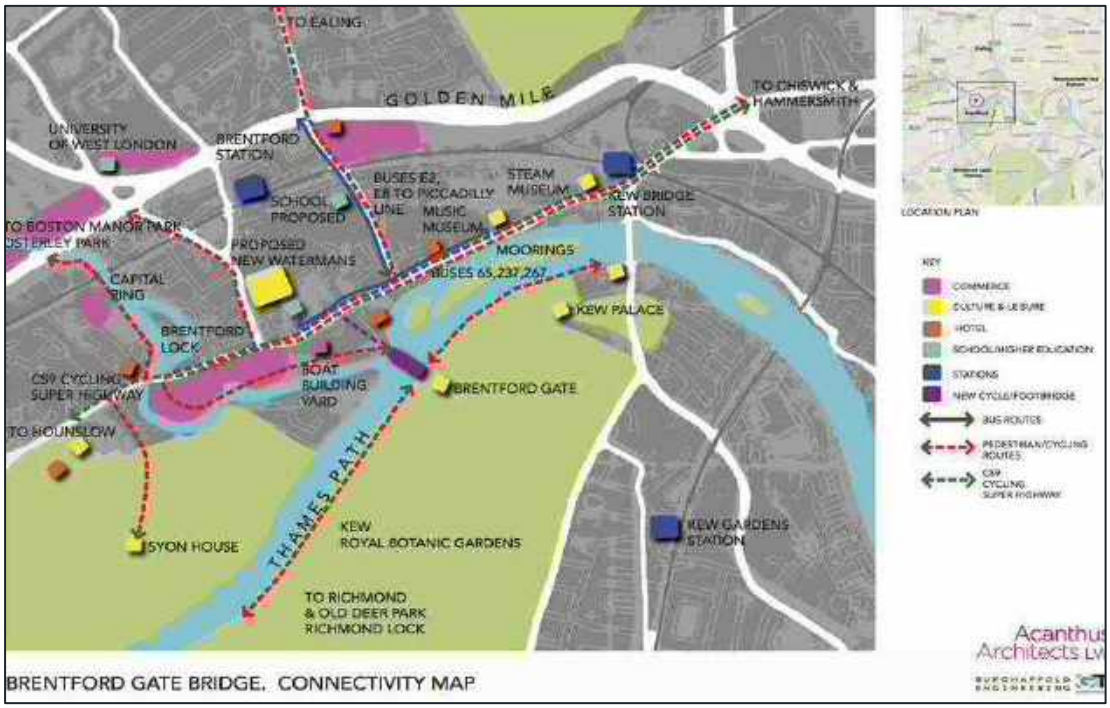
4.2.5. A local interest group has developed proposals for a pedestrian and cycle bridge across the Thames opposite Kew Gardens, which they have named the Brentford Gate Bridge. As with the Radnor Bridge, the proposals consist of visualisations and a plan showing the bridge location. These are shown in Figure 4.4.

4.2.6. The group set objectives for the bridge which are:

- To improve transport with links to Thames Path, Capital Ring, Grand Union Canal, Cycle Superhighway 9 and London Loop.
- It will provide a new commuting route to Golden Mile, Great West Road, where 15,000 are employed.
- Help the environment by reductions in car journeys
- Improve health by encouraging walking and cycling
- Will bring additional visitors to Brentford and Kew, with consequential benefits for local business.
- A new recreational open space and help reduce urban stress
- Help regenerate Brentford's town centre / boost the local economy
- Bring together a diverse neighbourhood

4.2.7. A Crowdfunding campaign was run in 2017 to raise £166,087 funding for feasibility and pre-app planning work. The campaign attracted 100 financial backers but fell short of its target. The current status of the bridge proposals and plans going forward is unknown.

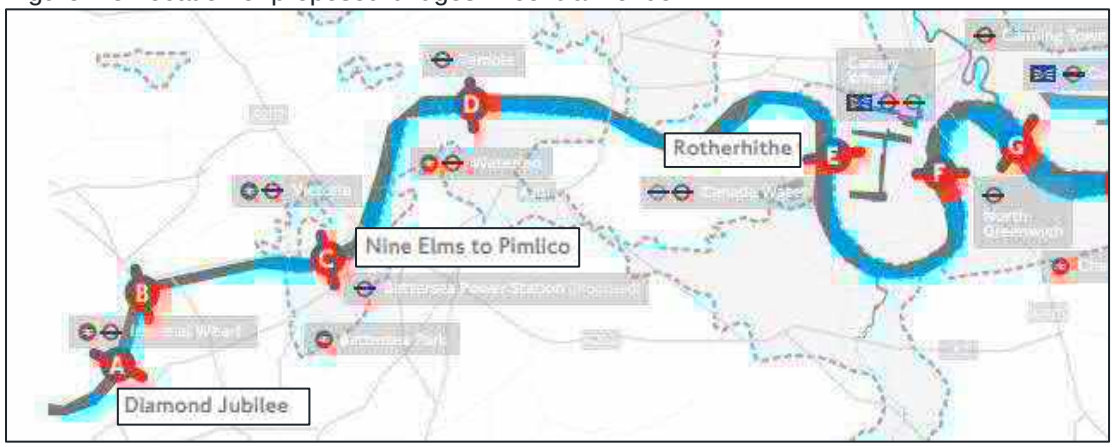
Figure 4.4 Visualisations and plans for Brentford Gate Bridge



4.3 OTHER THAMES BRIDGE PROPOSALS IN LONDON

4.3.1. In addition to the two proposed bridges in Richmond, it is useful to note the key features of the pedestrian and cycle bridges that are planned elsewhere on the Thames in London. The bridges described are the Diamond Jubilee Bridge, Nine Elms to Pimlico Bridge and the Rotherhithe Bridge. The location of these is shown in Figure 4.5.

Figure 4.5 Location of proposed bridges in central London



Diamond Jubilee Bridge

4.3.2. The Diamond Jubilee bridge would provide a new pedestrian and cycle connection between Chelsea and Battersea and would run alongside the Battersea rail bridge. The bridge is equidistant between Battersea Bridge and Wandsworth Bridge. It will provide more direct access across the river and will also allow Imperial Wharf Station to be accessed from the south bank of the river. This will cut journey distances by several kilometres, and encourage the use of public transport. The bridge will also provide cyclists with access to CS8 on the south side of the river, and routes on the north side, such as Q15, to Kensington.

Figure 4.6 Visualisation of Diamond Jubilee Bridge

Table 4.2 Key features of Diamond Jubilee Bridge

Length	228m	Cost	£26m
Demand	1.2-1.5m trips/year forecasted	BCR	2.43 (2004 report)
Bridge type	Three span solution, comprising a small central arch flanked by two larger outer arches, supported by four piers. Structural steel spans		
Status	Planning permission granted in 2014. Approximately 30% of funding sourced. Discussions ongoing between scheme promoters and LB Wandsworth/LB Hammersmith & Fulham		
Funding	£10m from LB Wandsworth CIL, remainder privately funded		
Benefits	• Savings in journey time over 30 years expected to be worth £48m • Significant non-quantifiable benefits to local workers, and residents		
Other	• In 2004, the predicted 1,500 trips per day were not sufficient to justify TfL meeting the full constructionand on-going maintenance costs • TfL made it clear to the relevant boroughs that support wouldbe required from other parties if the bridge was to be progressed		

Nine Elms to Pimlico Bridge

4.3.3. A design team was commissioned in 2017 by LB Wandsworth to undertake the first stage of work which will involve examining the feasibility of the different location options for a new bridge between Vauxhall Bridge and Chelsea Bridge. This is the longest stretch of riverside in central London without a crossing point.

4.3.4. The bridge is supported by the London Plan and Transport for London completed a feasibility study in 2013 which concluded that the scheme is viable and exceeds Government value for money thresholds. The promoters consider that the bridge is required for reasons including that the Nine Elms area to the south is growing rapidly and because the distance between Vauxhall Bridge and Chelsea Bridge is more than double the average gap between river crossings in central London.

Figure 4.7 Visualisation of Nine Elms to Pimlico Bridge

Table 4.3 Key features of Nine Elms to Pimlico Bridge

Length	200m-250m	Cost	£39m (2013, undiscounted, no optimism bias)
Demand	9000 cyclists + 9000 pedestrians per day forecasted	BCR	2.01 (2013 report)
Bridge type	Various options for arch and cable stayed bridges proposed.		
Status	The first stage of technical and feasibility work is currently being undertaken by the design team. Planning permission has not yet been sought.		
Funding	£26 million private sector funding commitment from the regeneration of Nine Elms. Further funding options will be explored in tandem with developing a detailed design.		
Benefits	• Savings in journey time over 60 years expected to be worth £91.5m • Benefit/Cost Ratio of 2.0:1 is above the TfL pass mark of 1.5:1 and exceeds the 2.0:1 which WebTAG guidance suggests indicates of high value for money.		
Other	• Wider transport package: The potential bridge crossing is accompanied by many other transport and urban realm improvements that form a comprehensive transport strategy for Nine Elms on the South Bank. They include an extension of the Northern line to Battersea with two new Tube stations, enhanced bus services, improvements to National Rail stations, new passenger piers at Vauxhall and Battersea Power Station, pedestrian and cycle walkways, and a new Barclays Cycle Hire docking station.		

Rotherhithe Bridge

4.3.5. TfL is investigating the feasibility of providing a new Thames river crossing between Rotherhithe and Canary Wharf for pedestrians and cyclists. This project is one of a number of possible new river crossings for London which are intended to improve cross-river connectivity. These proposed crossings would consist of new public transport, vehicle, pedestrian and cycle links.

4.3.6. It is predicted that there will be a continuing growth in cycling across London and, together with employment and population growth in both the Canary Wharf and Canada Water areas, this will generate an increase in journeys and more demand for walking and cycling facilities in the area.

4.3.7. Based on the studies that TfL has carried out so far, a navigable bridge is proposed as the preferred option for a river crossing between Rotherhithe and Canary Wharf.

4.3.8. TfL went out to consultation on options for the new crossing and this closed in January 2018.

4.3.9. The key objectives of the Rotherhithe to Canary Wharf river crossing are:

- To connect the two Opportunity Areas of Canada Water and the Isle of Dogs.
- To improve connectivity from the Rotherhithe peninsula, particularly the area beyond the walking catchment of Canada Water station.
- To encourage more people to walk and cycle in the area.
- To provide additional capacity and routes for cyclists as an alternative option to existing crossings in the area.
- To produce a well-designed and convenient link which achieves value for money and is fundable; and
- To provide an alternative link to the Jubilee line between Canada Water and Canary Wharf.

Figure 4.8 Visualisation of Rotherhithe Bridge

Table 4.4 Key features of Rotherhithe Bridge

Length	147m	Cost	£225-£300 million (Net Present Value (2016 base year)
Demand	450,000-900,000 cycling trips/year + 1.5m walking trips/year (2031 forecast)	BCR	1.2:1 to 2.0:1 (2008 report)
Bridge type	A swing bridge or a vertical lift bridge are considered to be the most feasible and cost effective options.		
Status	Based on responses to the consultation, TfL will decide the most appropriate form of crossing and continue to develop more detailed designs, together with a construction timeline TfL then expect to consult on the designs for the crossing in 2018. This will allow local residents, visitors and commuters to comment on the proposed designs before they are completed and submitted as part of any consents application in 2019		
Funding	TfL has allocated funds for the development of the crossing in their business plan and are also exploring opportunities for third party funding		
Benefits	• Savings in journey time over 60 years expected to be worth £126m		
Other	• Tunnel and ferry crossing options are also being considered. The cost: benefit assessment for the bridge option appears to be similar to the ferry option, but with the potential for a more transformative impact and realisation of wider long-term economic benefits. A bridge achieves similar benefits at a significantly lower cost than the tunnel		

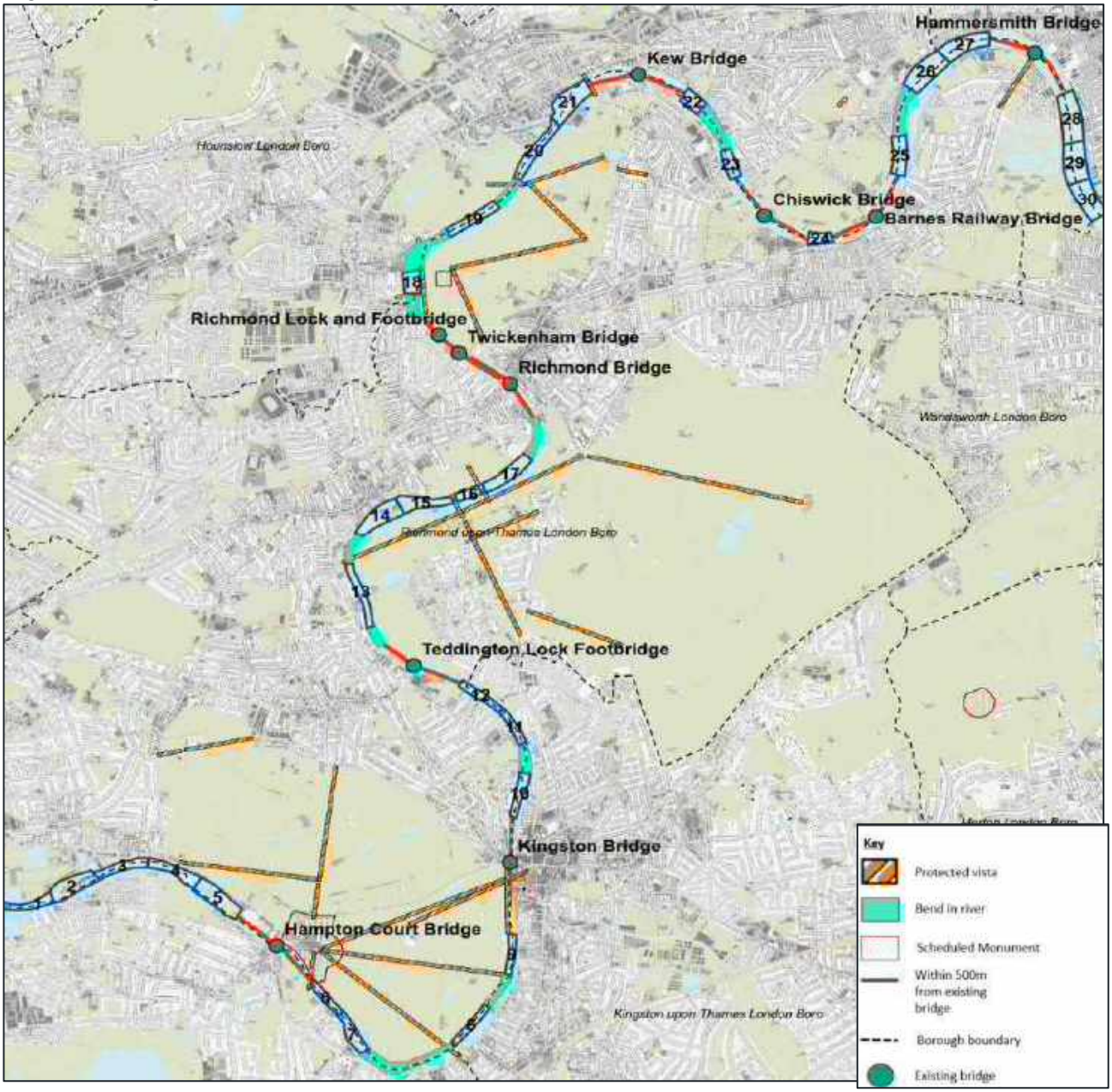
5 STRATEGIC LOCATION ASSESSMENT

5.1.1. This chapter describes the work that has been completed as part of Stage 1 to assess the suitability of river sections across Richmond in order to shortlist locations to take forward to the Stage 2 appraisal of specific sites.

5.1 ASSESSMENT LOCATIONS

5.1.1. The 28km extent of the river in Richmond was split up into thirty 500m sections which are shown in Figure 5.1.

Figure 5.1 Stage 1 assessment locations



5.1.2. Certain areas were excluded as they are affected by the primary factors shown below:

- Bend in river
- Presence of sub-structure
- Protected Vista
- Scheduled Monument
- Within 500m of an existing bridge

5.1.3. The impact of these factors means it is highly unlikely that building a bridge in these locations will be feasible. Other areas which were automatically excluded are those which are within 500m of an existing bridge which pedestrians or cyclists can use.

5.2 LOCATION ASSESSMENT

5.2.1. The full list of criteria used for the Stage 1 assessment is shown overleaf in Figure 5.3.

5.2.2. Each of the 30 sections was subject to an assessment using the secondary factors shown in Figure 5.3. Each factor has sub-categories which were scored as red, amber and green using the data and information identified e.g. current demand on existing bridges, extent of nearby committed development. The information used to inform the assessment is documented in Appendix A.

5.2.3. A weighting was used to indicate the relative importance of each factor. These weightings are shown in Figure 5.2 along with the numeric scores given for red (1), amber (5) or green (10) to indicate the level of demand, impact or proximity.

5.2.4. The assessment enabled each section of the river to be scored on a like for like basis and therefore prioritised. The objective was to identify a shortlist of locations which have the greatest potential for introducing a new river crossing which can then be taken forward to a more detailed assessment in Stage 2 of the study.

5.2.5. The section scores are shown in Table 5.1. These were discussed with internal stakeholders at a workshop, and agreement was reached to undertake a more detailed review of the sections shown in green (also listed in Table 5.2).

Table 5.1 Section scores

Section	Score	Diff' from previous
21	422	-
10	406	16
22	405	1
27	304	101
28	290	14
13	282	8
20	281	1
29	276	5
23	275	1
14	275	0
30	271	4
11	263	8
9	262	1
17	255	7
26	254	1
15	246	8
12	222	24
18	219	3
7	210	9
25	210	0
5	198	12
6	198	0
16	193	5
24	164	29
3	158	6
4	145	13
19	139	6
1	134	5
8	130	4
2	126	4

Table 5.2 Shortlisted bridge locations

Section	Location
21	Between Kew Bridge and Richmond Lock
10	Between Kingston Bridge and Teddington Lock
22	Between Kew Bridge and Chiswick Bridge
27	Between Barnes Railway Bridge and Hammersmith Bridge
28	Between Hammersmith Bridge and Putney Bridge
13	Between Teddington Lock FB and Richmond Bridge

Note: following a more detailed review of potential landing sites two further sites were considered of which one was retained. This is detailed further in Chapter 6.

Table 5.3 Assessment criteria

Factor	Category	Sub-category	Data used	Red	Amber	Green
STAGE 1 - Location long-listing						
Primary factors (exclude from assessment if score as red)						
1	**Bend in river**	n/a	OS base map	On Bend		
2	**Sub-structure**	LU tunnel		Cross Bridge Line		
3	**Protected Vista**	n/a	Protected vista	In Line of Protected Vista		
4	**Scheduled Monument**	n/a	Scheduled monuments	<20m to scheduled monument		
Secondary factors				1	5	10
5	**Indicative demand for new bridge?**	from existing demand	Existing bridge & link cycle & ped flows	Low demand	Medium demand	High demand
6			LTDS origin-destination demand	Low demand	Medium demand	High demand
7			Context plans - inc.attactors & generators	Low demand	Medium demand	High demand
8			Distance from existing bridge	Low demand	Medium demand	High demand
9		from future demand	Committed development	Low demand	Medium demand	High demand
10			London Plan - opportunity areas, growth areas etc	Low demand	Medium demand	High demand
11			Future cycle flow	Low demand	Medium demand	High demand
12	**Potential to improve road safety**	High incidence of ped/cycle collisions on bridges which are nearby?	STATS 19 data, proximity of existing bridges	Low potential	Medium potential	High potential
13	**Network connectivity**	Proximity to existing/planned walk/cycle network		Low connectivity	Medium connectivity	High connectivity
14	**Landing site considerations (high level)**	World Heritage Sites		Directly on bridge line	In near vicinity	Not in near vicinity
15		Local Nature Reserve		Directly on bridge line	In near vicinity	Not in near vicinity
16		Site of Special Scientific Interest		Directly on bridge line	In near vicinity	Not in near vicinity
17		Ecology	Site of Importance for Nature Conservation	Directly on bridge line	In near vicinity	Not in near vicinity
18		Archaeology	Archaeology Priority Area	Directly on bridge line	In near vicinity	Not in near vicinity
19		Conservation Area		Directly on bridge line	In near vicinity	Not in near vicinity
20		Landmark		<20m to landmark.	<60m to landmark.	Not near landmark
21		Tree Preservation Orders		Significant TPOs in vicinity	Some TPOs in vicinity	No TPOs in vicinity
22		Parks and Gardens	Based on web-based mapping review	Within private park or gardens	Within public park or gardens	Not near park or garden

43%
24%
6%
11%
17%

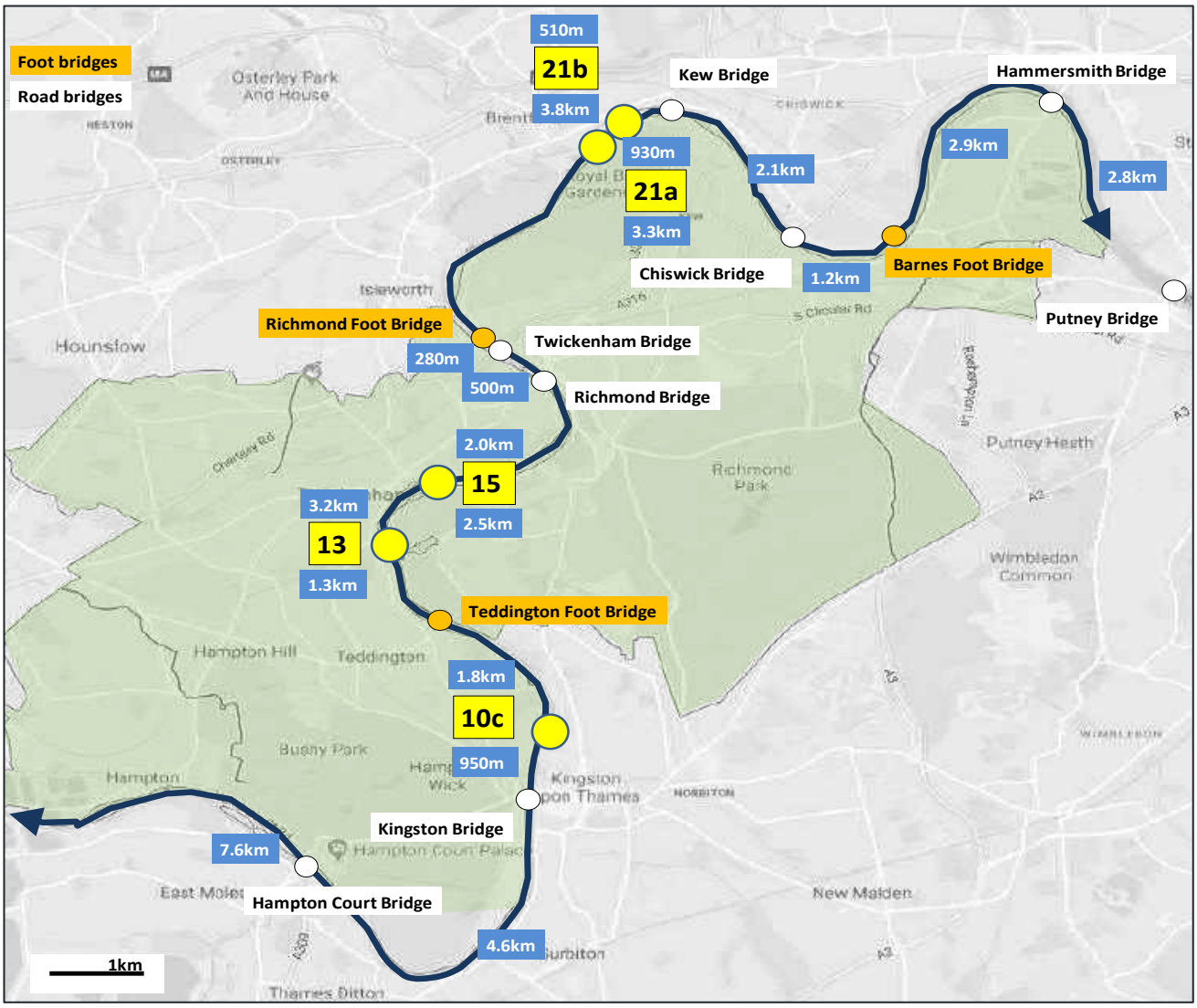
6 WALKING AND CYCLING DEMAND

6.1 OVERVIEW

6.1.1. A site suitability review was undertaken for a total of eight locations within five sections. Four of the locations were subsequently discounted, and following a more detailed review of potential landing sites two further adjacent sites were considered of which one was retained. The site reviews are described in Chapter 7.

6.1.2. A total of five locations (within four sections) have been subjected to a detailed analysis of demand along with landing site and design considerations. As shown in Figure 6.1, these locations are 10c, 13, 15, 21a and 21b.

Figure 6.1 Shortlisted bridge locations and distance between bridges



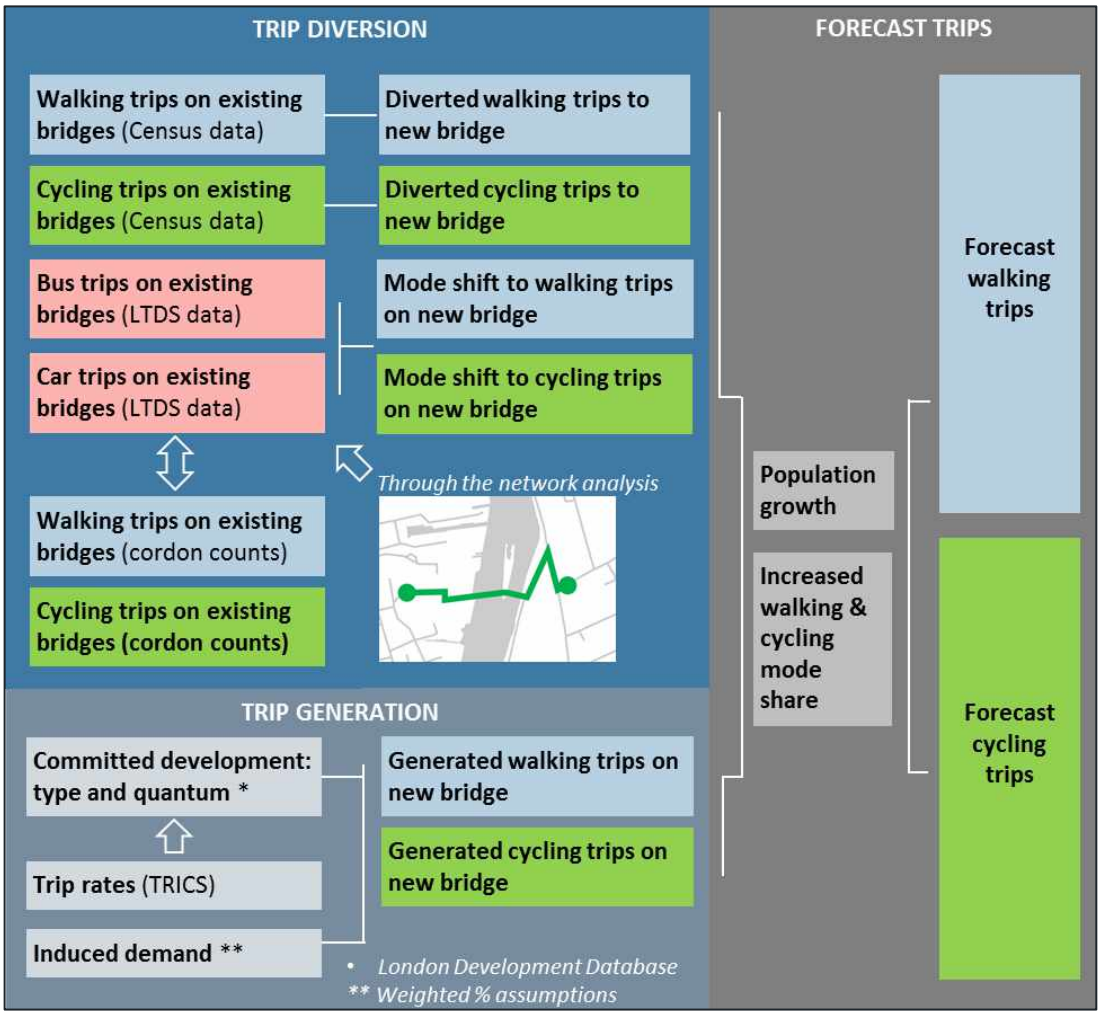
6.2 DEMAND QUANTIFICATION APPROACH

6.2.1. The demand for walking and cycling for the new bridges will largely come from:

- Trip diversion – from journeys across the existing river bridges
- Trip generation – from new journeys created by nearby development

6.2.2. These elements are shown in the methodology diagram in Figure 6.2 and are discussed further in the subsequent text.

Figure 6.2 Demand quantification approach



Key Assumptions

The process for estimating the demand for the new bridges is relatively complex and involves many assumptions. Some of these are listed below.

Demand

- Origin-destination London Travel Demand Survey (LTDS) data and Census 2011 journey to work trips within 5km considered for walking and 8km considered for cycling. This is based on the fact that >90% walking trips are less than 2km and 94% of cycling trips are less than 8km.
- No mode shift is assumed from rail or tube to cycling and walking as accessibility to stations which serve destinations on the opposite side of the river in the vicinity of the bridges is relatively poor.
- The opening year for the bridge is taken as 2024 based on 3 years for feasibility, design and planning work and 2-3 years for construction.

- Increase in cycling mode share of 8% between 2016 to 2026 which is taken from the Richmond Cycling Strategy 2016-2026. Assumption that the walking mode share will increase by 8% by 2041.
- Assumption that 10% of car trips and 10% of bus trips of less than 8km that travel over the existing bridges will switch to cycling and of less than 2km will switch to walking. This represents between 1-5% of all walking/cycling diversion trips.
- Population growth based on GLA projections.

Access and amenity

- Bridges are accessible for all.
- Unrestricted access across the bridges 24hrs.
- Cyclists do not have to dismount to cross the bridges.
- The bridges will provide a better journey experience than the alternative provision on existing bridges and will have sufficient capacity to accommodate demand.
- Network enhancements will be made around the landing points and where required for connecting links on the existing network in the vicinity of the bridges. This will provide a direct, coherent, safe and pleasant and therefore relatively seamless journey across the river.

Demand approach – trip diversion

6.2.3. The proposed bridges are between 510m and 3.8km from the nearest existing bridges. Many current pedestrians and cyclists and some bus and car users will divert to the new bridges. This will vary depending on their reduction in journey time, the benefit they get from the improved level of provision and their improved level of accessibility across the river and in some cases to the river itself.

6.2.4. The Census 2011 journey to work data was used to identify which journeys are made within the walking and cycling catchments. Running a through-the-network GIS routing analysis identified which current bridges they use. The new bridges were then introduced individually to identify how the routing patterns will change and therefore how many trips will divert.

6.2.5. The percentage of diversion trips was then applied to the cordon counts supplied by TfL for the current bridges to get the daily walking and cycling demand for the new bridges. A similar process was then followed using data from the London Travel Demand Survey to determine which trips that are currently made by bus or car will switch to walking or cycling if the new bridges are introduced.

Demand approach – trip generation

6.2.6. Research was undertaken to identify all of the committed development within an 8km catchment around the bridges using the London Development Database. The generated trips were calculated using standard trip rates from the TRICS database.

6.2.7. A proportion of these trips were then assigned to walking and cycling depending on the distance and proximity of the development to the bridges.

6.2.8. The scale of development is relatively low, with around 2,000 residential units, 26,000sqm education, 90,000sqm office and 25,000sqm retail space planned within a 2km catchment of the bridges. The largest residential development in relatively close proximity is 910 units, which is located about 1km from bridge 21b. This is for the redevelopment of Brentford Football Club. The second largest development is in the same area and is close to Brentford High Street where 876 residential units are planned.

6.2.9. The other significant development is 16,000sqm of education development that is due to be built as part of a new campus at Richmond College in Twickenham. This is located about 1.5km from bridge 13 and 1.7km from bridge 15.

6.2.10. The other element of trip generation relates to induced demand which refers to new journeys which will be made to destinations on the other side of the river because of the new bridges. These journeys will not have previously been made because of poor accessibility. This is rather more subjective than estimating development-related trips.

6.2.11. The level of induced demand for each bridge has been based on:

- Population density within a catchment area of approximately1km

- Level of access to the Thames Path
- Number and type of shops, services, parks and leisure activity on the opposite side of the river

6.2.12. The other factors that were considered in quantifying demand were population growth and increase walking and cycling mode share.

6.3 WALKING AND CYCLING DEMAND

6.3.1. By far the most significant contribution to the demand for walking and cycling on the new bridges will come from diversion trips from the existing bridges.

6.3.2. Table 6.1 summarises the percentage diversion in trips by walking and cycling from the existing bridges to the new bridges. The highest levels of diversion are for bridge 13 (53.7%) and bridge 15 (58.5%). Bridge 21a has the lowest level of diversion (11.5%).

Table 6.1 percentage diversion in trips

	Hammersmith	Barnes FB	Chiswick	Kew	Richmond FB	Twickenham	Richmond	Teddington FB	Kingston	Hampton Court	Total % diversion
% Diversion walking to new bridges											
Bridge 10c	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-6.0	-10.2	0.0	-16.2
Bridge 13	0.0	0.0	0.0	0.0	-1.8	-0.5	-10.5	-44.8	-1.0	0.0	-58.7
Bridge 15	0.0	0.0	0.0	0.0	-4.3	-4.1	-21.4	-24.1	-4.6	0.0	-58.5
Bridge 21a	0.0	0.0	0.0	-10.9	-0.6	0.0	0.0	0.0	0.0	0.0	-11.5
Bridge 21b	0.0	-3.1	-0.6	-41.5	-1.2	0.0	0.0	0.0	0.0	0.0	-46.4
% Diversion cycling to new bridges											
Bridge 10c	0.0	0.0	0.0	0.0	0.0	-0.5	0.0	-11.0	-7.4	0.0	-19.0
Bridge 13	0.0	0.0	0.3	-0.2	-1.5	-1.1	-9.6	-37.9	-0.2	0.0	-50.3
Bridge 15	0.0	0.0	0.3	-1.4	-7.1	-4.4	-18.9	-22.8	-5.1	0.0	-59.4
Bridge 21a	0.0	0.0	0.0	-11.3	-2.2	0.0	-0.3	0.0	0.0	0.0	-13.7
Bridge 21b	0.0	-3.2	-1.1	-22.7	-2.5	-0.5	0.0	0.0	0.0	0.0	-30.0

Bridges adjacent to new bridge

6.3.3. Table 6.2 shows the demand for the new bridges broken down by the type of trip diversion and trip generation. This emphasizes just how dominant the trip diversion is from walking and cycling on the existing bridges. On average, this makes up 81% of the total demand and varies across the bridges as follows:

- Bridge 10c – 85%
- Bridge 13 – 86%
- Bridge 15 – 84%
- Bridge 21a – 67%
- Bridge 21b – 67%

Table 6.2 Demand for new bridges

	Bridge 10c		Bridge 13		Bridge 15		Bridge 21a		Bridge 21b		Total
	Walking	Cycling	Walking	Cycling	Walking	Cycling	Walking	Cycling	Walking	Cycling	
Trip diversion *(24-hr flow)*											
Walking	683		1547		2097		220		872		5419
Cycling		340		649		813		148		306	2256
Bus	30	41	0	87	0	177	0	11	44	162	552
Car	5	83	0	152	0	163	0	125	0	250	778
Trip generation *(24-hr flow)*											
Development	0	0	30	1	16	16	24	8	84	10	189
Induced	14	9	63	36	106	58	5	6	20	15	332
Total	**732**	**473**	**1640**	**924**	**2219**	**1227**	**248**	**298**	**1020**	**743**	**9525**
Combined Total Walking & Cycling	**1205**		**2564**		**3446**		**546**		**1763**		

6.3.4. Table 6.3 provides a summary of the walking and cycling demand for all of the bridges within Richmond once one for the new bridges has been introduced. The demand for the existing bridges has been adjusted to take account of the trip diversion. The new bridges with the highest total demand are (in order):

1. **Bridge 15** – **3446** pedestrian and cycle trips, **5th** busiest bridge (11 bridges)
2. **Bridge 13** – **2564** pedestrian and cycle trips, **6th** busiest bridge (11 bridges)
3. **Bridge 21b** – **1763** pedestrian and cycle trips, **7th** busiest bridge (11 bridges)
4. **Bridge 10c** – **1205** pedestrian and cycle trips, **10th** busiest bridge (11 bridges)
5. **Bridge 21a** – **546** pedestrian and cycle trips, **11th** busiest bridge (11 bridges)

Table 6.3 Summary of walking and cycling demand for all bridges in Richmond

	Hammersmith	Barnes FB	Chiswick	Kew	Bridge 21b	Bridge 21a	Richmond FB	Twickenham	Richmond	Bridge 15	Bridge 13	Teddington FB	Bridge 10c	Kingston	Hampton Court
Demand for walking on existing and new bridges* *(24-hr flow)*															
Bridge 10c	4555	1438	450	1958	-	-	1049	830	6186	-	-	1707	732	5052	830
Bridge 13	4555	1438	450	1958	-	-	1030	826	5535	-	1640	1002	-	5566	826
Bridge 15	4555	1438	450	1958	-	-	1004	796	4864	2219	-	1378	-	5368	796
Bridge 21a	4555	1438	450	1745	-	248	1043	830	6186	-	-	1816	-	5625	830
Bridge 21b	4555	1394	447	1146	1020	-	1036	830	6186	-	-	1816	-	5625	830
Demand for cycling on existing and new bridges* *(24-hr flow)*															
Bridge 10c	2263	302	652	1225	-	-	236	877	1714	-	-	1707	473	2508	1714
Bridge 13	2263	302	654	1222	-	-	232	873	1549	-	924	1002	-	2703	1714
Bridge 15	2263	302	654	1208	-	-	219	844	1390	1227	-	1378	-	2570	1714
Bridge 21a	2263	302	652	1087	-	298	231	882	1709	-	-	1225	-	2709	1714

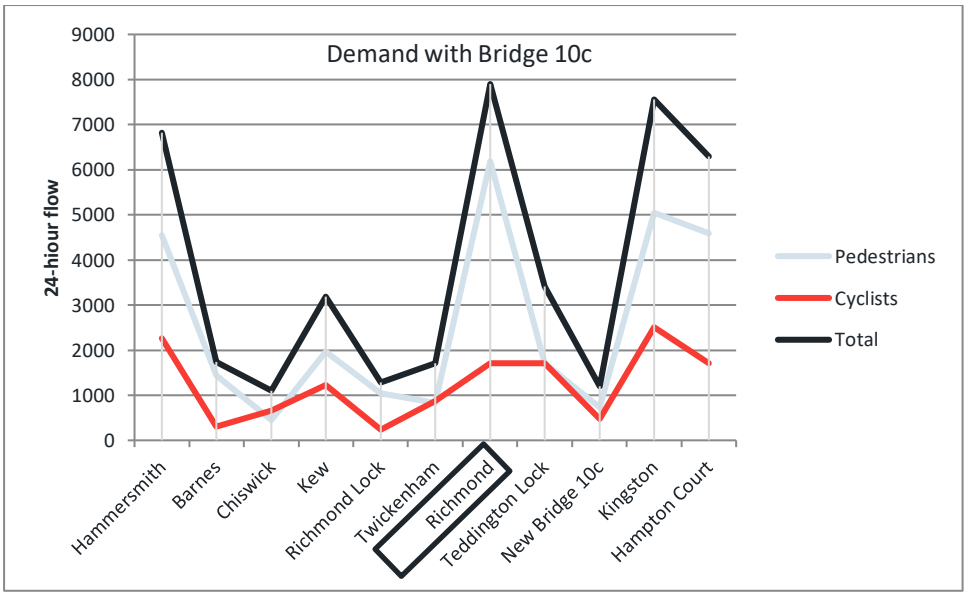
Bridge 21b	2263	292	645	946	743	-	230	877	1714	-	-	1225	-	2709	1714
Total Demand on existing and new bridges* *(24-hr period)*															
Bridge 10c	6818	1740	1102	3183	-	-	1285	1708	7900	-	-	3413	1205	7560	6301
Bridge 13	6818	1740	1104	3181	-	-	1262	1699	7084	-	2564	2004	-	8270	6301
Bridge 15	6818	1740	1104	3167	-	-	1223	1640	6253	3446	-	2756	-	7937	6301
Bridge 21a	6818	1740	1102	2832	-	546	1273	1712	7895	-	-	3632	-	8334	6301
Bridge 21b	6818	1686	1092	2092	1763	-	1266	1708	7900	-	-	3632	-	8334	6301

Bridges adjacent to new bridge Trips diverted from existing bridge

* Demand for existing bridge adjusted to account for diverted trips to new bridge

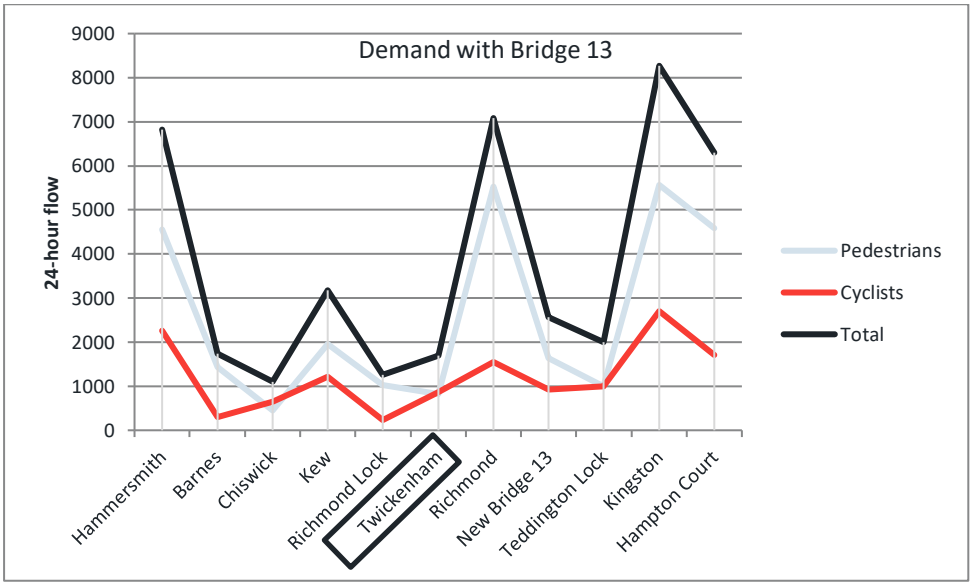
6.3.35. The information in Table 6.3 is set out in a series of line graphs for each bridge in Figure 6.3 to Figure 6.7

Figure 6.3 Demand with Bridge 10c



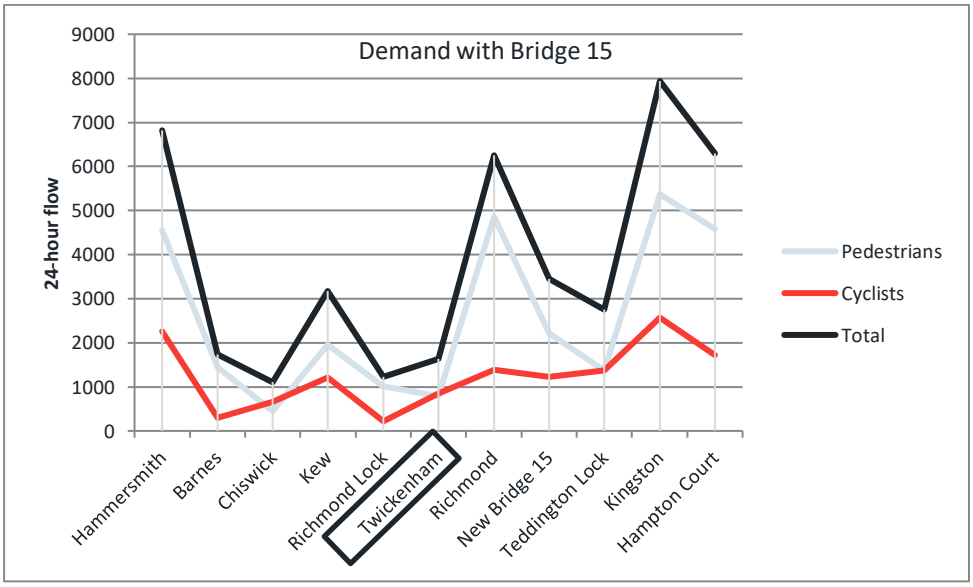
6.3.36. Bridge 10c has the second lowest demand of the new bridges. 60% of the demand is made up from walking trips. As shown in the next section, the relatively low demand can partly be explained by its poor connectivity due to severance on the west side of the river. The demand is particularly low when compared to Kingston Bridge. This is where most of the diversionary trips will have needed to come from for the bridge 10c demand to have been substantially higher. Only 8.8% of Kingston Bridge trips divert to bridge 10c (8.5% divert from Teddington Footbridge). As shown in Figure 6.1, bridge 10c is much closer to Kingston Bridge (950m) than Teddington Footbridge (1.8km).

Figure 6.4 Demand with Bridge 13



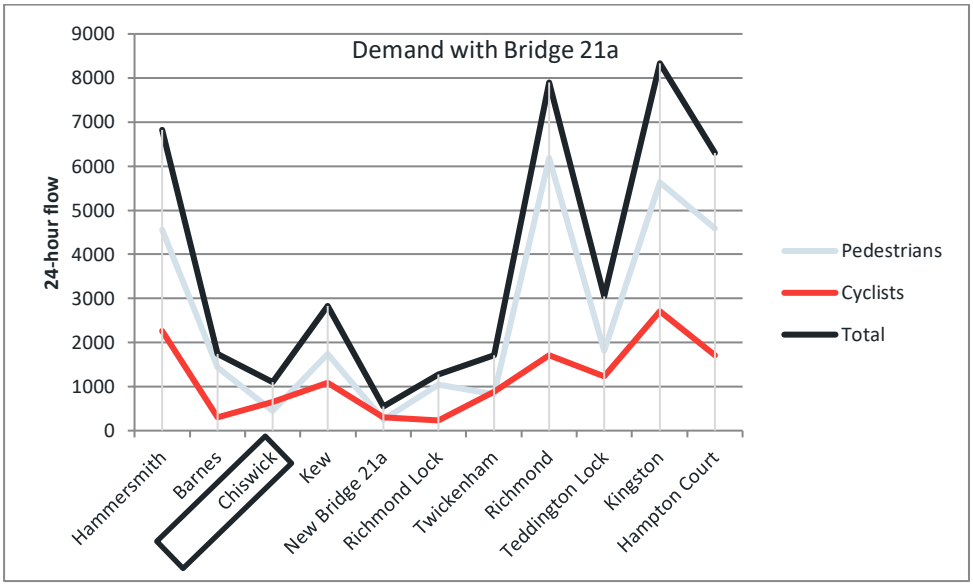
6.3.37. Bridge 13 is the second busiest of the new bridges and 64% of the trips are from walking. It has the highest number of diverted trips of any of the new bridges with 41% diverting from Teddington Footbridge which is 1.3km away and has a relatively high demand (6 out of the 10 existing bridges) at 3632 trips. 10% of trips divert from Richmond Bridge which is 3.2km away.

Figure 6.5 Demand with Bridge 15



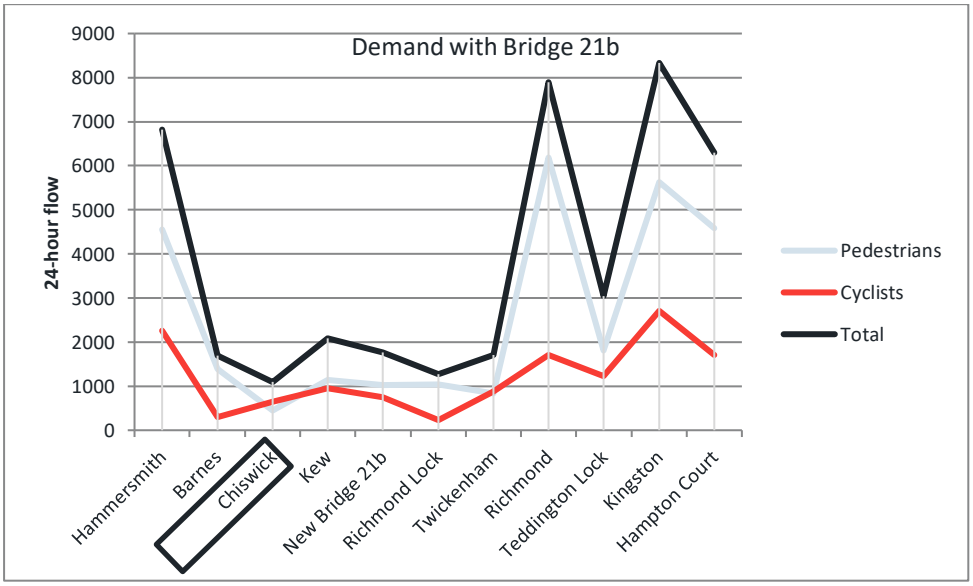
6.3.38. Bridge 15 has the highest demand of all the new bridges and would be the 5th highest out of the total of 11 bridges. It is located between the 2nd (Richmond) and 6th (Teddington) busiest bridges and is equidistance between them at around 2-2.5km away. As identified in the next section, there are significant attractors on either side of the river. 64% of the trips are expected to come from walking. The level of diversionary trips from both bridges is quite high: 20% for Richmond and 23% for Teddington.

Figure 6.6 Demand with Bridge 21a



6.3.39. Bridge 21a has the lowest demand of the new bridges (546 trips) and would be the least busy of all 11 bridges. The bridges either side are the 5th (Kew) and 9th (Richmond footbridge) busiest. As identified in the following section, the lack of permeability through the network to the north of the river is part of the reason for the expected low demand, particularly when compared to bridge 21b where wider connectivity is better.

Figure 6.7 Demand with Bridge 21b



6.3.40. Bridge 21b is the 3rd busiest of the new bridges and would be the 7th busiest of all 11 bridges. 32% of the trips would come from Kew Bridge and 2% from Richmond Footbridge which are 510m and 3.8km away respectively. A higher proportion of the overall trips come from development compared to the other new bridges. However, this still only account for 5% of the trips.

7 WALKING AND CYCLING ACCESSIBILITY

7.1 OVERVIEW

7.1.1. Some of the key factors which will influence the levels of demand for walking and cycling across the new bridges are listed as follows:

- Extent of local attractors as well as land-use type and density.
- Local connectivity between residential areas and attractors on either side of the bridge.
- Extent of the local cycling network and Thames Path.
- Connectivity into the wider cycling network to facilitate longer trips.

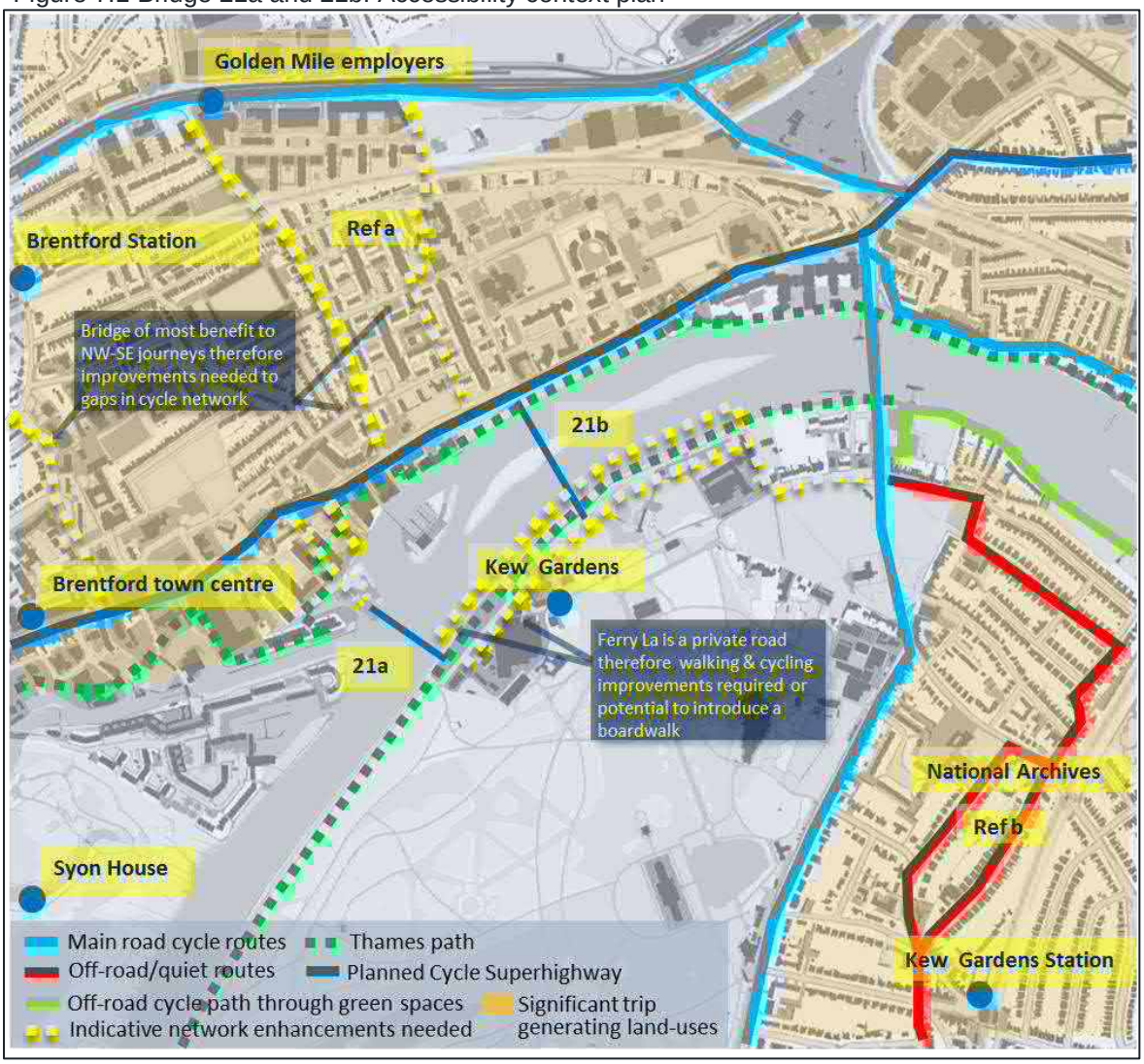
7.1.2. The extent and relevance of these factors is shown on plans for each bridge below. Further insight into the potential for the bridges to improve accessibility is provided by identifying the current and potential future PTAL levels around the new bridges.

7.2 ACCESSIBILITY AND JOURNEY TIMES

Bridge 21a and Bridge 21b – Between Kew Bridge and Richmond Lock

7.2.1. The location of bridges 21a and 21b is shown in Figure 7.1.

Figure 7.1 Bridge 21a and 21b: Accessibility context plan



7.2.2. Both of the bridges would improve accessibility primarily as they would provide a more direct alternative to using Kew Bridge for journeys in a north-west to south-east direction. The main connections that would improve from introducing the new bridges are:

- To Kew Gardens from the areas to the north and to Syon House from the south.
- To Brentford town centre for residents of Kew whose nearest town centre is Richmond which is around 2.5 km away.
- To the Thames Path (south) from the area to the north.
- Longer journeys from south of the new bridges connecting into Cycle Superhighway 9 to travel to Hounslow.
- Longer cycle journeys from south of the new bridges to Ealing.
- Longer cycle journey from north of the new bridges to Richmond Park and Richmond town centre.

7.2.3. The difference in journey time with each of the new bridges is shown in Tables 7.1 and 7.2. The bridges provide a similar reduction in journey time, although it should be noted that this only takes into account a small number of origins and destinations, and they only represent shorter trips by walking and cycling. This is also the case for the origin-destination journey time summaries provided below for the other bridges. A much more extensive trip routing and journey time assessment has been undertaken as part of the demand analysis exercise described in Chapter 6.

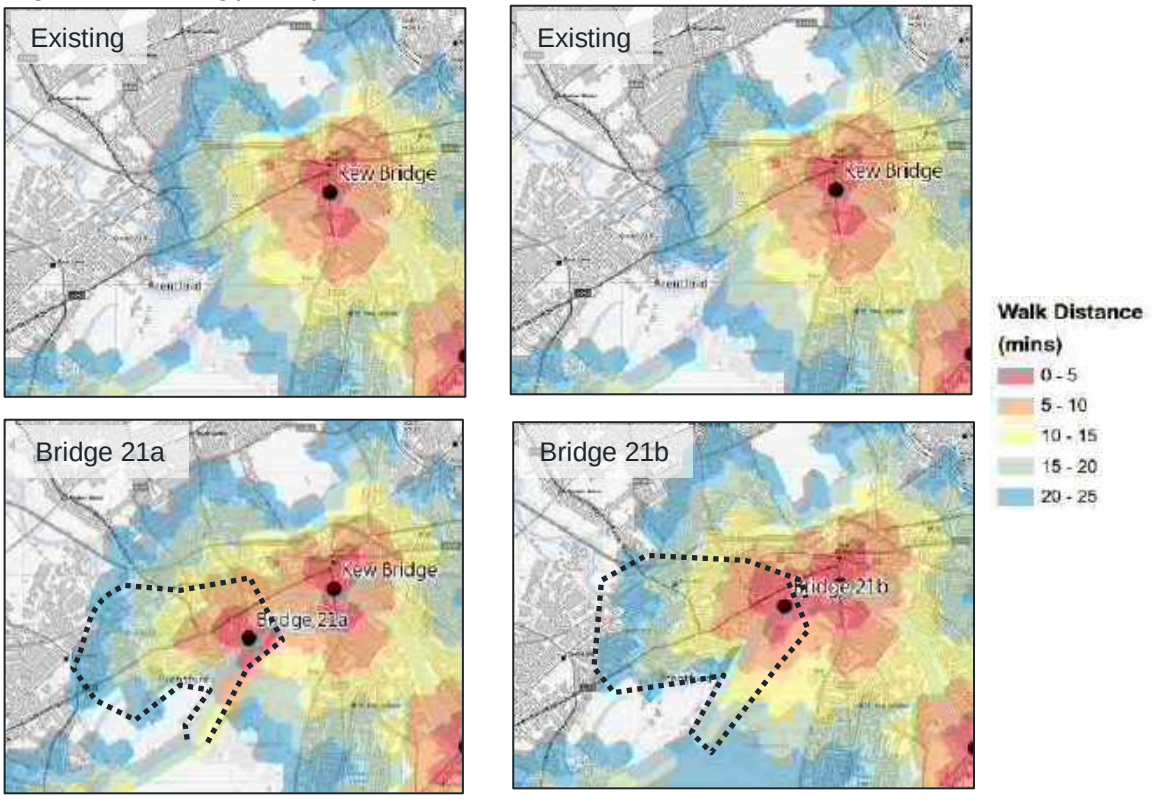
Table 7.1 Bridge 21a: journey time difference (mins)

Origin	Destination	Journey time difference (mins)	
		Walking	Cycling
Brentford Stn	Kew Gardens	-17	-7
Ref a	Thames Path south	-7	-3
Ref b	Brentford town centre	-4	-1
Ref b	Syon House	-3	-1
Ref b	Golden Mile	5	1

Table 7.2 Bridge 21b: journey time difference (mins)

Origin	Destination	Journey time difference (mins)	
		Walking	Cycling
Brentford Stn	Kew Gardens	-10	-5
Ref a	Thames Path south	-17	-6
Ref b	Brentford town centre	-5	-1
Ref b	Syon House	-4	-1
Ref b	Golden Mile	-1	0

Figure 7.2 Walking journey time contours



7.2.4. Figure 7.2 shows the walking isochrones with and without the new bridges. Both bridges are similar in terms of the new areas that will be able to access a river crossing within 25 minutes walking distance (equivalent to 2km) and/or will experience a reduction in journey time to the river.

7.2.5. As shown in Figure 7.1, the southern landing sites are on Ferry Lane which is private land, owned by Kew Gardens. Some improvements will be needed to improve the route for walking and cycling along Ferry Lane back to Kew Green. These can include wayfinding and lighting improvements. Alternatively, the Thames Path can be upgraded to also allow use by cyclists from the bridge to Ferry Lane. Another option, albeit a more costly one, will be to introduce a boardwalk as shown in Figure 7.1.

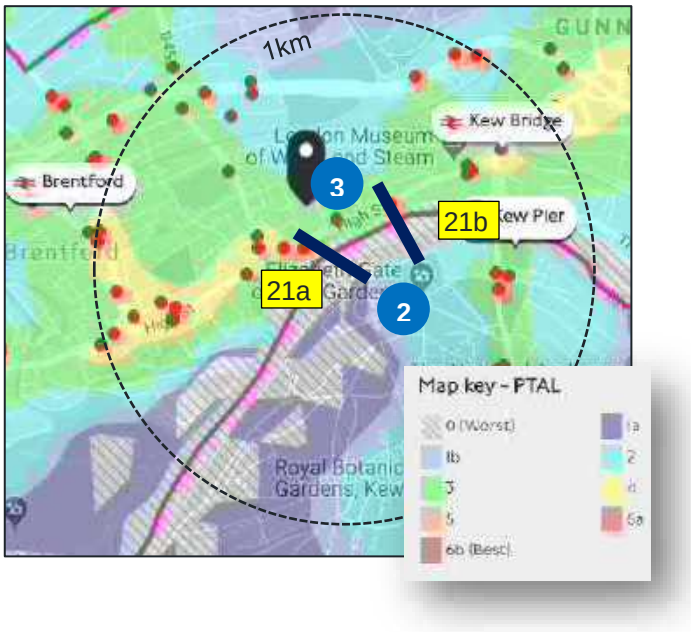
7.2.6. Given that the bridge will be increasing north-south demand on roads to the north of the river, it is likely that improvements will be required, particularly for cycling.

7.2.7. The additional demand a bridge will provide is likely to help with negotiations regarding securing land for the bridge and in potentially seeking funding contributions from Kew Gardens.

7.2.8. The bridges do not provide any significant benefits in terms of improved access to Kew Gardens Station (London Overground and District line) or Brentford Station (South Western) as the next station along the lines are just as convenient.

7.2.9. Figure 7.3 shows the Public Transport Accessibility Levels (PTALs) for the local area. The PTAL score is higher to the north of the river. There is likely to be a small increase in the scores, mainly due to better accessibility to bus services.

Figure 7.3 PTAL map



Bridge 15 and Bridge 13 – Between Teddington Lock Footbridge and Richmond Bridge

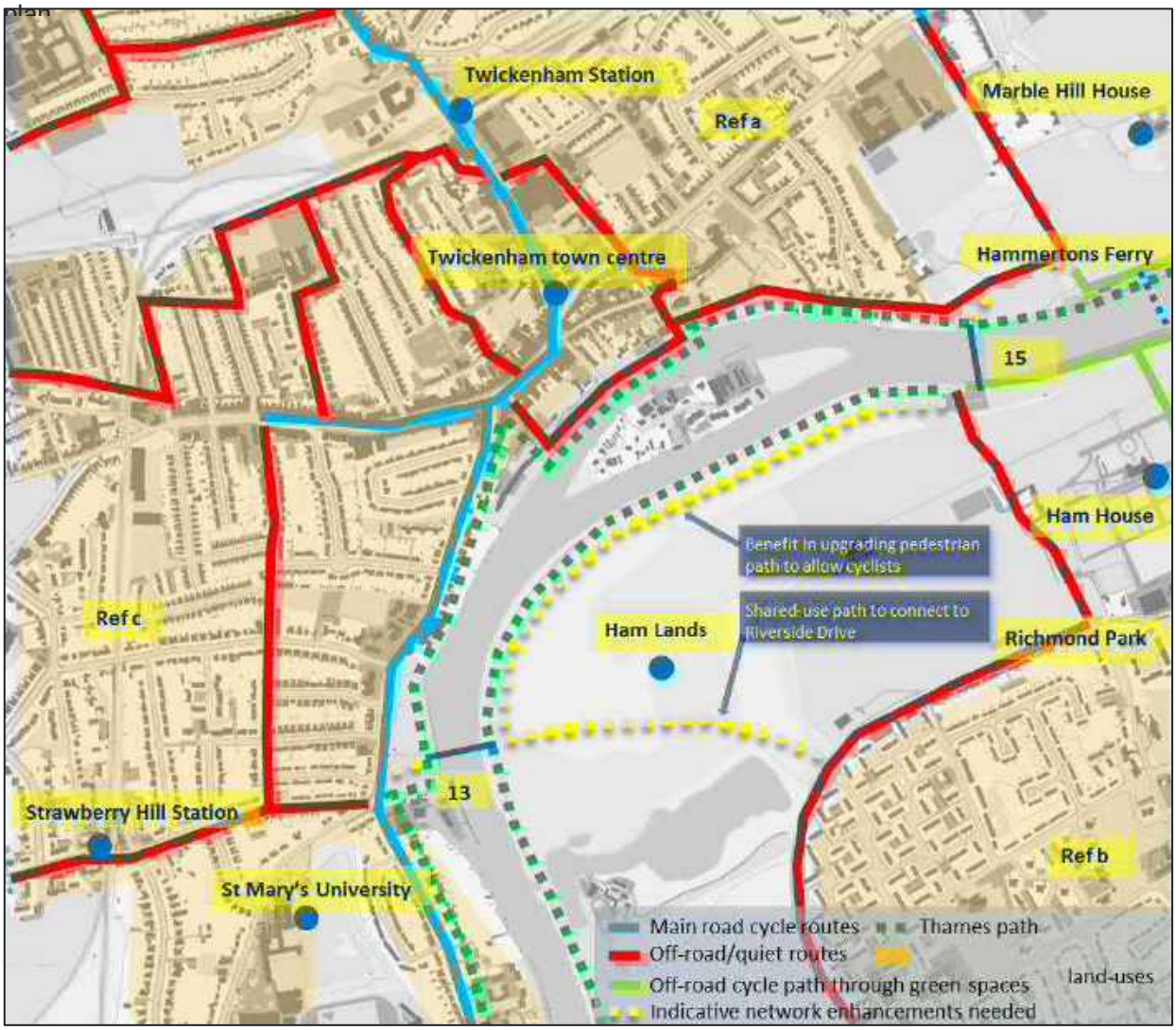
7.2.10. The location of bridges 15 and 13 are shown in Figure 7.4.

7.2.11. The two new bridges are located relatively far away from the existing bridges. Bridge 15 is 2km south of Richmond Bridge and bridge 13 is 1.3km north of Teddington Footbridge. Therefore is it unsurprising that the level of accessibility will be significantly improved if either bridge is introduced. However, of equal if not greater importance are the attractors of demand that lie to the north and south of the bridges.

7.2.12. The main connections that will improve from introducing the new bridges are:

- From Twickenham to Ham Lands, Ham House and Richmond Park.
- To the Thames Path, including to the cyclable sections on the north and south sides of the river east of Ham House.
- From Ham to Twickenham town centre and Twickenham Station.
- From Ham to Strawberry Hill Station.
- Longer cycle journeys from Hounslow to Richmond Park.
- Longer cycle journeys from Twickenham to Kingston.
- Longer cycle journeys from Twickenham and Strawberry Hill to the centre of London.

Figure 7.4 Bridge 15 and 13: Accessibility context plan



7.2.13. The difference in journey time with each of the new bridges is shown in Tables 7.3 and 7.4.

Table 7.3 Bridge 13: journey time difference (mins)

Origin	Destination	Journey time difference (mins)	
		Walking	Cycling
Ref b	Strawberry Hill Station	-19	-6
Ref c	Ham Lands	-27	-7
Ref c	Richmond Park	-10	-3
Ref b	Twickenham town centre	-22	-7
Ref b	Twickenham Station	-29	-8

Table 7.4 Bridge 15: journey time difference (mins)

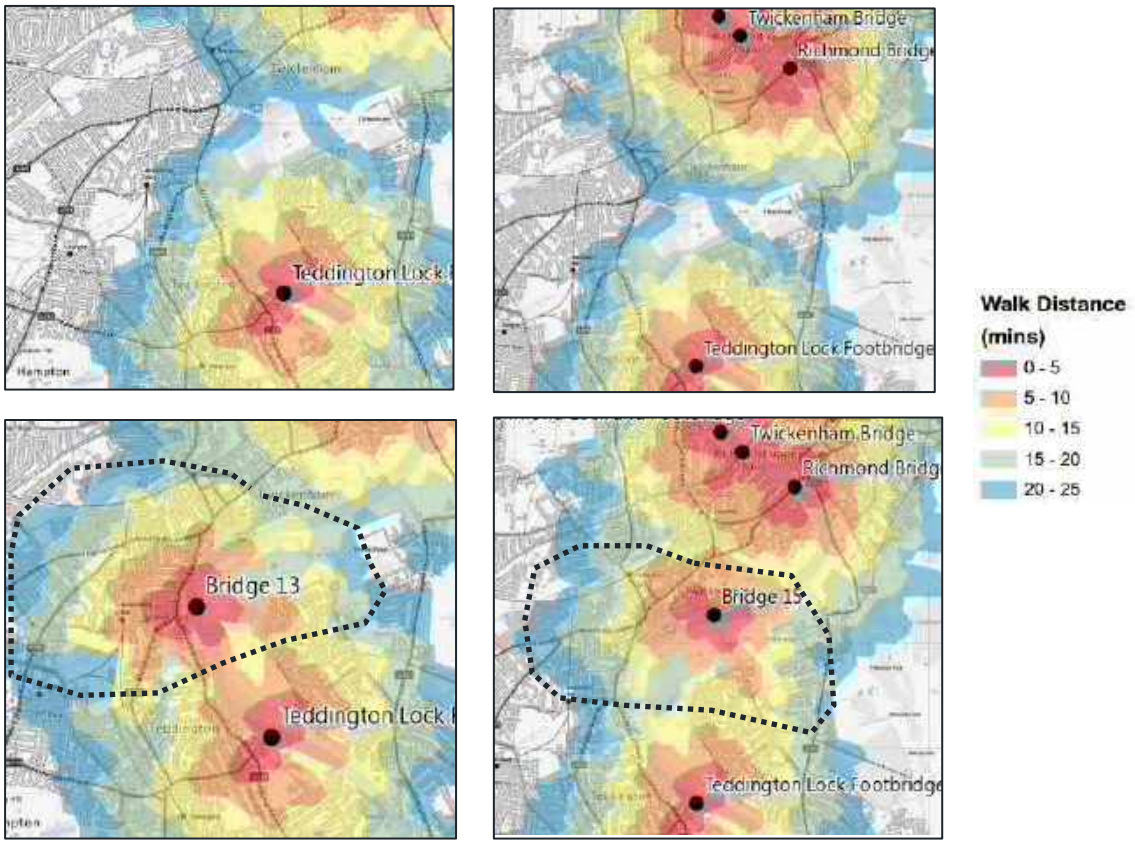
Origin	Destination	Journey time difference (mins)	
		Walking	Cycling
Ref a	Ham Lands	-33	-8
Ref a	Thames Path south	-38	-11
Ref a	Richmond Park	-8	-3
Ref b	Twickenham town centre	-23	-7
Ref b	Twickenham Station	-24	-7

7.2.14. The residential areas to the north and west of the river have relatively poor access to parks and gardens. Providing a bridge at either location unlocks much more demand for the use of Ham Lands and Richmond Park.

7.2.15. The closest town centres to Ham are Richmond and Kingston which are about 3km away. With the new bridges the residential area of Ham will be less than 1km to the shops and services at Twickenham.

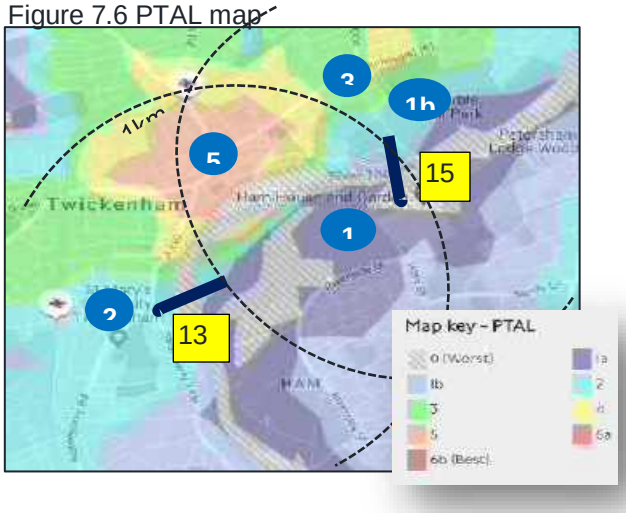
7.2.16. The walking isochrones with and without the new bridges are shown in Figure 7.5. With the introduction of the new bridges there is a more noticeable expansion of the 25 minute walking isochrones for bridge 13. This takes in large areas of Strawberry Hill and Twickenham Green for which it was not previously possible to access a point to cross the river within 25 minutes. Bridge 15 opens up access to much of Twickenham town centre.

Figure 7.5 Walking journey time isochrones



7.2.17. What is clearly evident in Figure 7.6 is the difference in PTAL scores north and south of the river, ranging from 3-5 to the north and 1a-1b to the south. Ham has particularly poor access to rail and underground services. The nearest stations are at Richmond and Twickenham. With bridge 13 and bridge 15, there is a reduction in journey time by walking to Twickenham Station of 29 minutes and 24 minutes respectively. The walking time to the station will be around 25 minutes and it will take seven minutes to cycle.

Figure 7.6 PTAL map



7.2.18. Whilst the journey time from the Ham area to stations and bus stops will significantly improve, the PTAL value for the areas to the south and east of Ham will not change dramatically. This is because the station is over 1km away and the bus stops are about 1km away. The PTAL calculation includes bus stops which are within 640m and rail stations within a 960m walk distance.

7.2.19. It should be noted that the accessibility assessment has not taken into account the Hammerton Ferry service. This is because it is only runs daily between February and October (10:00am-6:00pm/6:30pm) and during weekends between December and January. The

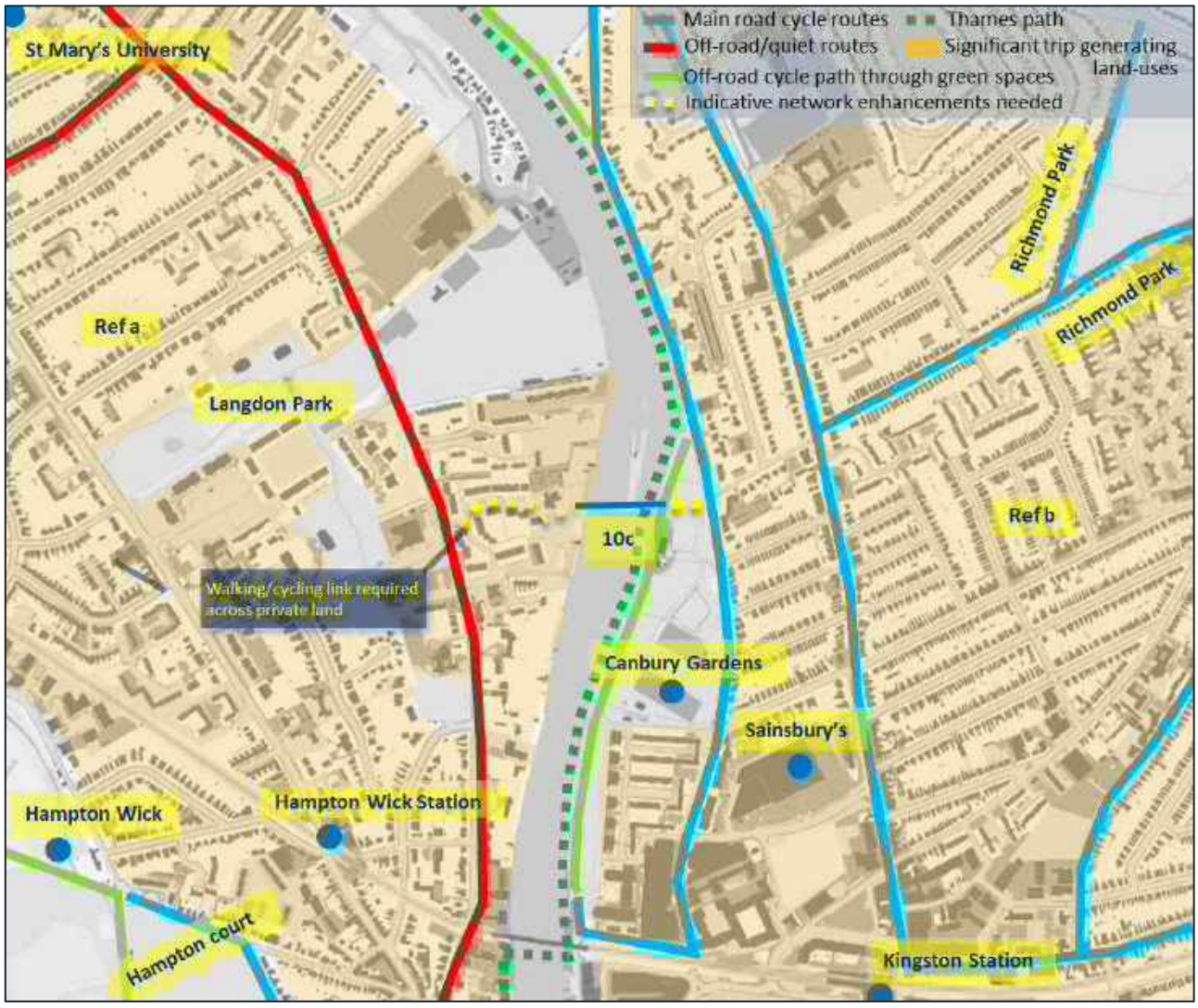
service is closed in November. The level of convenience and amenity is not comparable to a bridge, particularly for cyclists.

7.2.20. Bridge 13 will require a new connecting link into Riverside Drive. It will also be beneficial to upgrade the Thames Path to the east to allow use by cyclists. This will provide a continuous off-road cycling route along the Thames from the bridge to Richmond.

Bridge 10c – Between Kingston Bridge and Teddington Lock Footbridge

7.2.21. The location of bridge 10c is shown in Figure 7.7.

Figure 7.7 Accessibility context plan



7.2.22. Bridge 10c is located 1.8km from Teddington Footbridge and 950m from Kingston Bridge. The new bridge will provide a relatively small improvement in accessibility due to the small catchment areas to the east and west of the river. These are constrained by severance from the rail line through Hampton Wick, and due to the large expanses of parkland at Hampton Wick and Richmond Park. The majority of pedestrians and cyclists travelling between the larger catchment areas of Kingston town centre and the areas to the south will use Kingston Bridge.

7.2.23. There are also relatively few attractors of demand on either side of the river. The main connections that would improve from introducing the new bridges are:

- From residential areas around Langdon Park to Richmond Park.

- From residential areas around Langdon Park to Sainsbury's.
- From residential areas around North Kingston to Hampton Wick.
- From residential areas around North Kingston to St Mary's University.

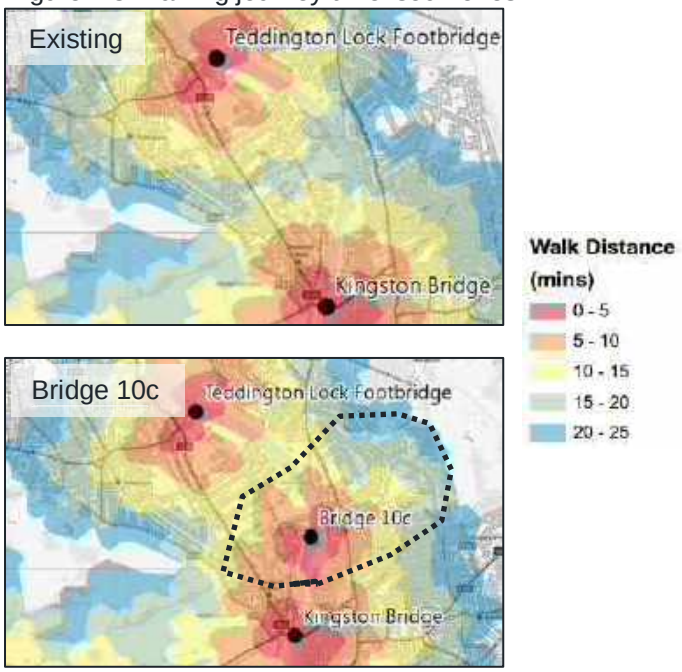
Table 7.5 Bridge 10c: journey time difference (mins)

Origin	Destination	Journey time difference (mins)	
		Walking	Cycling
Ref a	Richmond Park	-5	-1
Ref a	Sainsbury's	3	-1
Ref b	Hampton Wick	0	0
Ref b	St Mary's University	-9	-3

7.2.24. The difference in journey time with the new bridge is shown in Tables 7.5. This results show that there is only a marginal improvement in accessibility between these points.

7.2.25. Figure 7.8 shows the walking isochrones with and without bridge 10c. Compared to the other bridges, bridge 15 only opens up a small area that previously could not access a river crossing within 25 minutes' walk. This is in the top right of the isochrone maps next to Richmond Park. It can be seen that there is only a small reduction in journey time within and without the introduction of bridge 10c.

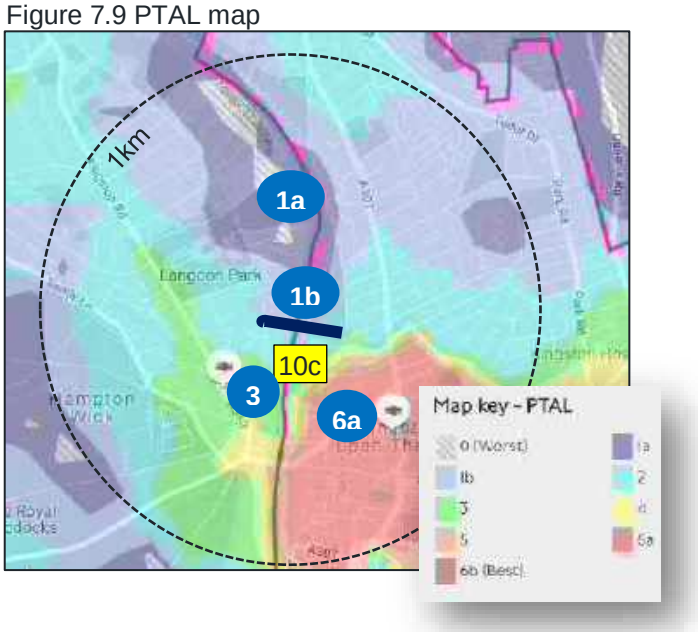
Figure 7.8 Walking journey time isochrones



7.2.26. As shown in Figure 7.9, the PTAL levels around the bridge area are very low at between 1a and 1b. This is because they are just over the PTAL walking catchment of 960m to rail stations. Introducing the new bridge will not change this. However, it will provide access to bus stops and services on the opposite side of the river therefore the PTAL score is likely to increase slightly.

7.2.27. The landing area to the west of the bridge is private land. There are streets and paths within this area that connect back into Broom Road which is public highway. However, they stop about 80m short of the river and therefore a connecting pedestrian-cycle link will need to be introduced through agreement with the landowner.

Figure 7.9 PTAL map



8 LANDING SITE AND DESIGN CONSIDERATIONS

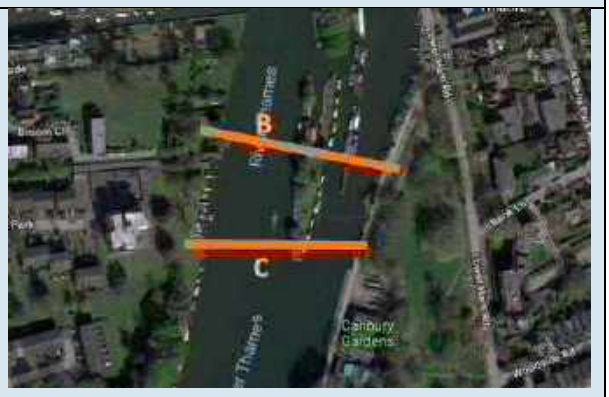
8.1.1. This chapter provides information on the general design considerations and assumptions for all of the bridges as well as the costs for each bridge. For each individual bridge location details are given regarding the landing site considerations, issues, constraints and opportunities. Further information is documented in the bridge location reviews contained in Appendix B.

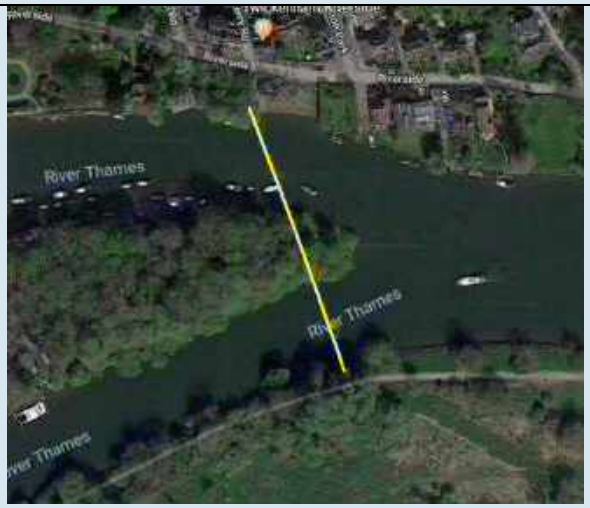
8.1.2. As discussed in Chapter 5, a total of ten bridge locations have been reviewed in Stage 2 of the feasibility study. Five of these were retained and subjected to a more detailed assessment which is summarised in this chapter.

8.1 DISCOUNTED SITES

8.1.1. The five sites which were disregarded were done so on the basis of identifying critical issues regarding their feasibility. These are summarised in Table 8.1.

Table 8.1 Discounted bridge locations

Bridge 10a	650m north of Kingston Bridge
Critical issues • Compulsory purchase of prestige houses required to accommodate ramps and connection to the main road at west side of the bridge. • No major route or Public Right of Way connection to west.	
Bridge 10b	1100m north of Kingston Bridge
Critical issues • Major impacts on adjacent boathouse (Grade 2 listed structure).	

Bridge 15a		2.1km south of Richmond Bridge
Critical issues	• Difficult to gain addition height to the north of bridge to avoid high risk flood area. • Northern landing site is within private gardens and insufficient land available for ramp. Adjacent access to Twickenham Yacht Club • Conservation area, wildlife/habitat on Eel Pie Island • High flood risk area to south of bridge	
Bridge 22		500m east of Kew Bridge
Critical issues	• Use of allotment land required to south side. Compulsory purchase of residential properties needed to connect to Bushwood Road, or need use of Priory Park Tennis Club land to access Forest Road. • Compulsory purchase of residential property required on north side to provide adequate access to Thames Road. • Likely rights to light and intrusion issues with bridge landing to north side.	
Bridge 28		670m south of Hammersmith Bridge
Critical issues	• Compulsory purchase of residential property required on east side to provide adequate access to Rainville Road. • Lack of existing direct access from bridge landing sites at north and south to existing road network. • Alternative site to north (shown below) provides good landing site to west on 'Metropolitan Open Land', with direct access to local network. However, similar constraints to other locations in terms of lack of through route to network. New development to the east presents even more of a constraint.	

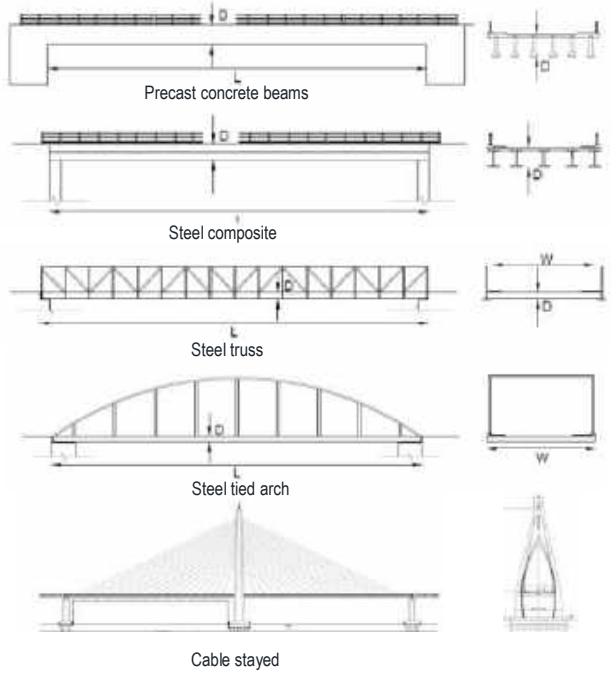
8.2 DESIGN CONSIDERATIONS

Bridge design

8.2.1. There are several bridge design types which can be considered for the river crossing which include:

- Precast concrete beams
- Steel composite
- Steel truss
- Steel tied arch
- Cable stayed

Figure 8.1 Bridge design types



8.2.2. Factors to consider are span length, cost, required bridge depth as well as heritage and aesthetic sensitives.

8.2.3. Whilst cost is clearly a key consideration in delivering a bridge which provides an acceptable benefit-cost ratio, the other primary factors in this case are the bridge aesthetics and deck height.

8.2.4. All of the bridges are in locations where there are aesthetic sensitivities due to their proximity to conservation areas, historic buildings, sites of nature importance and/or protected vistas.

8.2.5. Most of the sites have constraints regarding the areas of land that are available for the ramps. As the ramps are limited to a maximum of 1:20 gradient to be accessible by cycles and pedestrians, every 500m of bridge thickness would increase the ramp length by 10m.

8.2.6. Given that this is an initial feasibility stage assessment of the potential for new bridges in Richmond, for simplicity it is assumed that the most appropriate form of bridge is cable stayed. This is likely to be a less visually intrusive addition to the riverscape and will minimise the deck height at the landing points, thus minimising the ramp lengths.

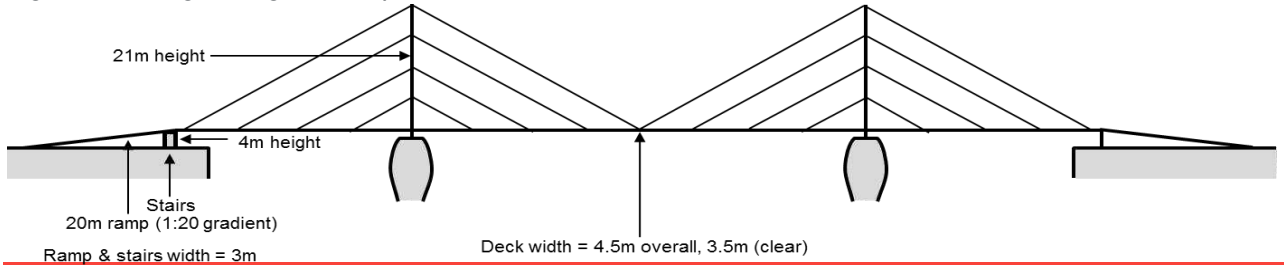
Figure 8.2 Typical largest vessel operating between bridge 21b and 10c

8.2.7. The number of piers will need to be determined based on a detailed analysis of a range of factors including navigation width, proximity to bends in the river, vessel types, low water levels and scour around the pier locations. For the purposes of this assessment it has been assumed that the bridges will require two piers. For bridges 10c and 21b, one of the piers will be located on the central island. Estimates have been included in the bridge costs for pier protection. Compared to the bridge construction itself, these costs can be significant.

8.2.8. The location of bends and the maximum vessel size was used to inform the location longlist assessment in Stage 1. For context, the typical largest type of vessel that the bridges will need to accommodate is shown in Figure 8.2. This is approximately 30m in length.

8.2.9. Other assumptions regarding the deck height, deck width and ramps width are shown in Figure 8.3.

Figure 8.3 Bridge design assumptions



8.2.10. The required navigation height of the bridges is informed by the height of adjacent bridges. The Port of London Authority provided advice regarding their requirements. The navigation heights as listed as follows:

- Bridge 10c: Height of navigation channel to be maintained – 7.3m above Mean High Water Springs
- Bridge 13: Height of navigation channel to be maintained – 5.6m (similar to Teddington Bridge east span).
- Bridge 15: Height of navigation channel to be maintained – 5.6m (similar to Teddington Bridge east span).
- Bridge 21a: Height of navigation vertical clearance to be maintained – 5.5m (similar to Kew Bridge span 4).
- Bridge 21b: Height of navigation vertical clearance to be maintained – 5.5m (similar to Kew Bridge span 4).

Bridge costs

8.2.11. The costs for constructing and maintaining the bridges are shown in Table 8.1. The assumptions made regarding the percentage cost for risk and design are the same for all bridges. The cost required to upgrade or introduce new links to connect into the existing network are relatively minor compared to the bridge construction cost. Therefore, a cost has only been included for the new link required across Ham Lands for bridge 13 as this will be more substantial than for the other bridges. This is a conservative estimate based on a 570m long bound shared use path which has lighting. The costs do not take into account the requirement for a 200-300m section to be raised as discussed in the following section.

8.2.12. It should be noted that no allowances have been made at this stage of the feasibility work for any costs regarding land acquisition and Compulsory Purchase Orders.

8.2.13. A more detailed breakdown of the costs is provided in the following chapter.

Table 8.1 Bridge costs

	Bridge 10c	**Bridge 13**	**Bridge 15**	**Bridge 21a**	**Bridge 21b**
Length	110m	90m	90m	125m	180m
Construction cost (£)*					
Bridge build	6,635,000	8,185,000	8,185,000	6,972,500	10,390,000
20% risk	927,000	837,000	837,000	994,500	1,278,000
10% design	463,500	418,500	418,500	497,250	639,000
Total	**8,025,500**	**9,440,500**	**9,440,500**	**8,464,250**	**12,307,000**
Maintenance cost (£) (p.a.)**	21,639	20,723	20,723	26,212	26,212
Connecting network link (£)	0	100,000	0	0	0
PLA cost (£) (p.a)	40,388	33,262	33,262	65,328	65,328

* 2018 price base

* Indicative annual cost, averaged out over bridge lifespan (2010 prices)

8.3 LANDING SITE CONSIDERATIONS

8.3.1. As discussed earlier, a review of all of the Stage 2 shortlisted sites was completed and these are contained in Appendix B. Some of the landing site considerations were identified within these reviews. The following section provides a more detailed site specific assessment of the constraints and risks for each location, which include the following:

- Land ownership
- Network connections
- Aesthetic and heritage sensitivities
- Flood risk
- Moorings
- Conservation areas

- Protected trees
- Visual intrusion

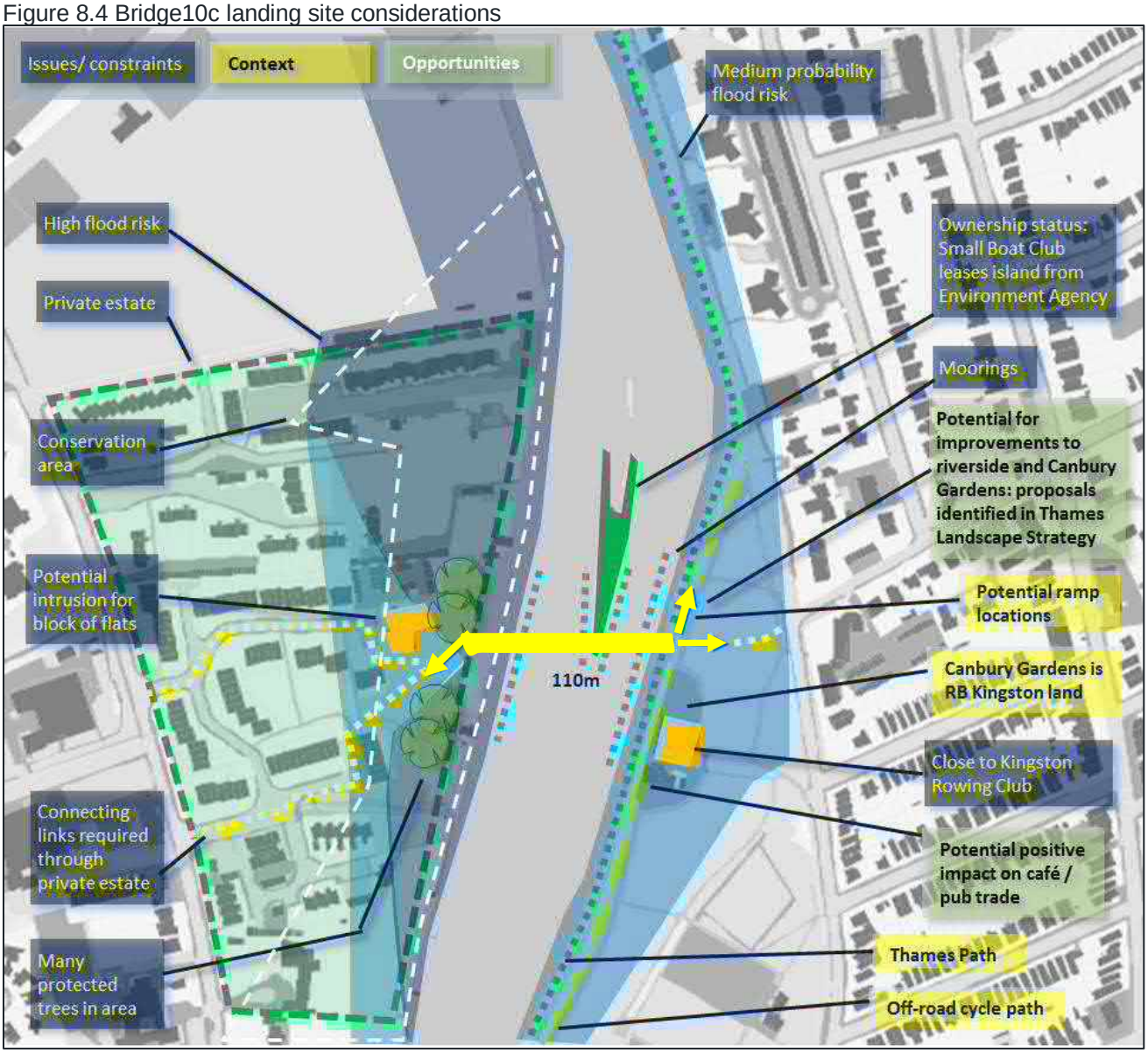
Opportunities

- Potential for commercial activity and/or development
- Local area enhancement

Bridge 10c – Between Kingston Bridge and Teddington Lock

8.3.2. The key issues, constraints and opportunities around the landing site for bridge 10c are summarised in Figure 8.4.

Figure 8.4 Bridge10c landing site considerations



8.3.3. The key constraints at bridge location 15c are on the west side of the river where the landing site is on private land, is within an area which has a high probability of flood risk, has trees which are protected and is within a conservation area. The ownership of the central island by the Environment Agency (EA) and long-term lease by the Small Boat Club (since the 1960's) is also a significant risk.

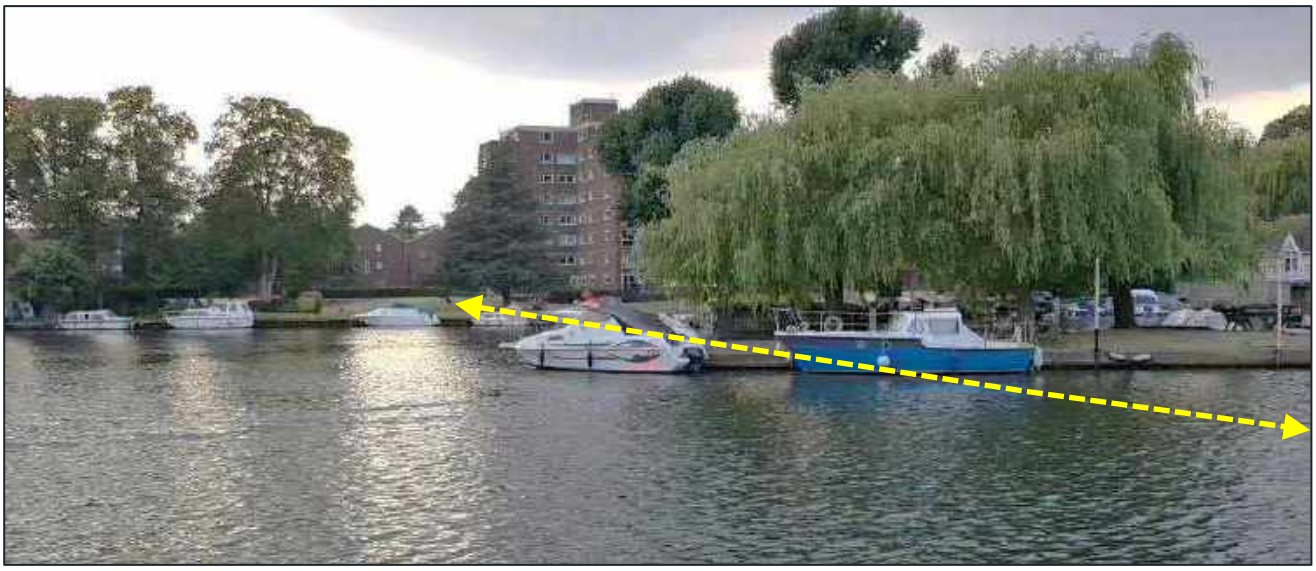
8.3.4. Other less critical constraints are visual intrusion for nearby residential buildings to the west and the proximity of moorings on both banks of the river and island.

8.3.5. According to the Environmental Agency's flood risk mapping, the west bank is categorised as a high risk flood zone and the east bank a medium risk flood zone. The definition is categorised as follows:

- Low risk: 0.1%-1.0% chance of flooding within any one year
- Medium risk: 1%-3.3% chance of flooding within any one year
- High risk: >3.3% chance of flooding within any one year

8.3.6. Photographs of the view looking west of the bridge location from Canbury Gardens are shown in Figure 8.5.

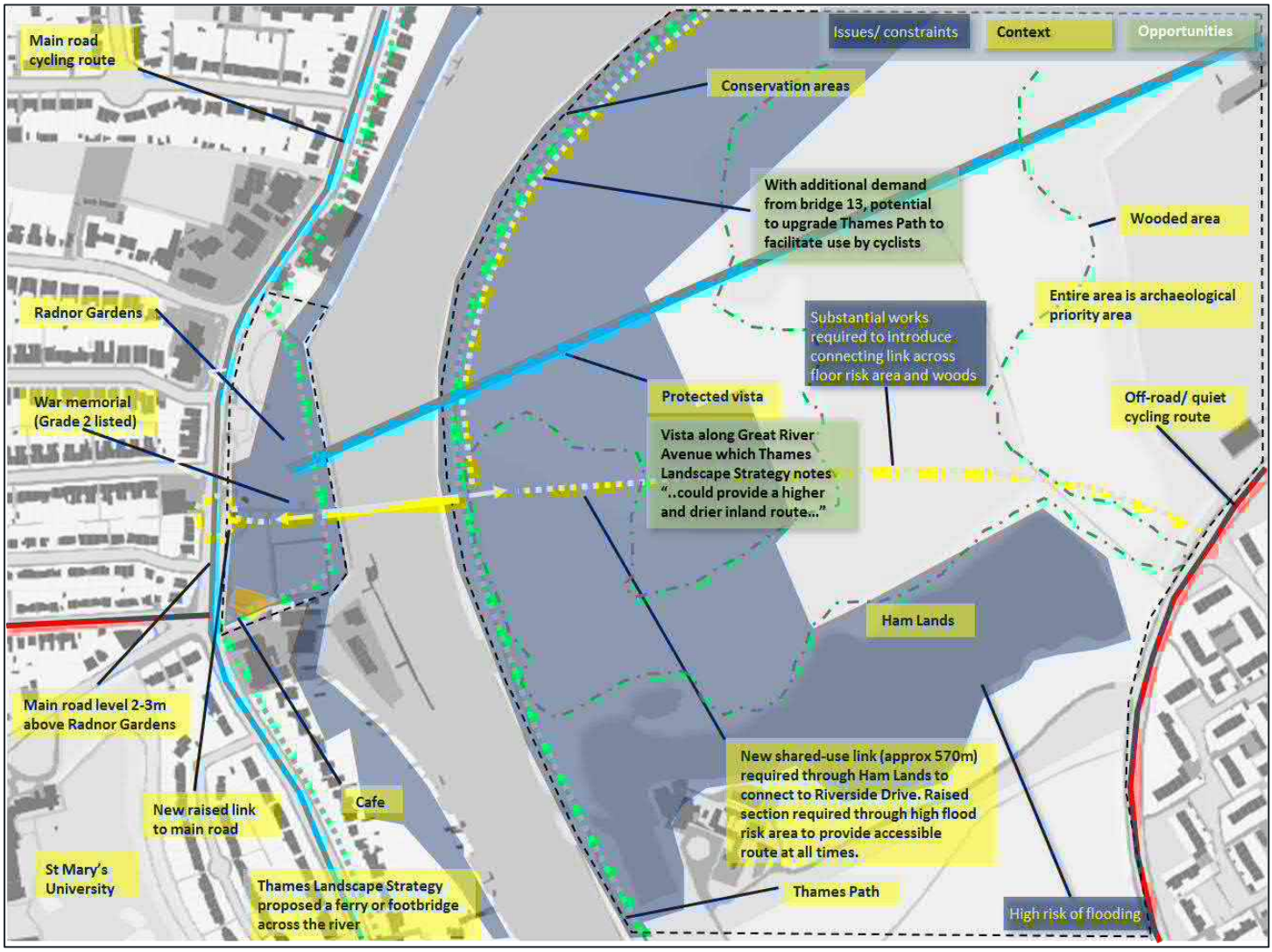
Figure 8.5 Bridge 10c location: views from Canbury Gardens



Bridge 13 – Between Teddington Lock Footbridge and Richmond Bridge

8.3.7. The key issues, constraints and opportunities around the landing site for bridge 13 are summarised in Figure 8.6.

Figure 8.6 Bridge 13 landing site considerations



8.3.8. The key constraint at bridge location 13 is the new link which is required to connect back to the network at Riverside Drive. This will be approximately 570m in length and will need to run through extensive areas of woodland as indicated in Figure 8.6. The initial 200m-300m of the link from the bridge will need to be raised to mitigate for the flood risk so that it is accessible at all times for pedestrians and cyclists.

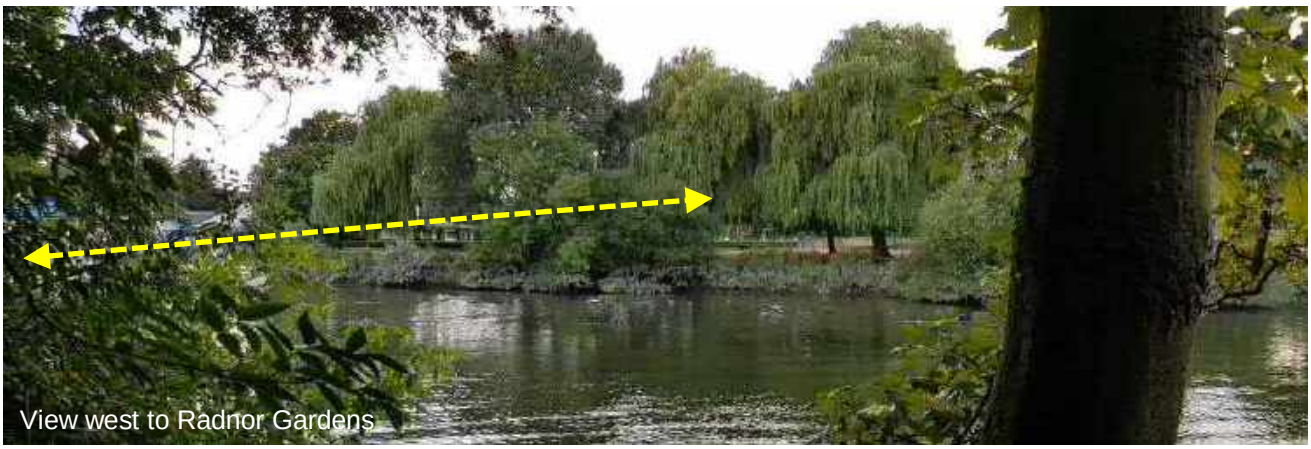
8.3.9. The additional demand generated by the bridge may provide justification for upgrading the east-side Thames Path to the north to allow cyclists. This will provide a continuous riverside link to Richmond.

8.3.10. An alternative access route is along the line of the protected vista along Greater River Avenue. This is one of the proposals in the Thames Landscape Strategy and was suggested as it "...could provide a higher and drier inland route to avoid the twists and turns of the river".

8.3.11. On the west side the bridge ramp can easily connect to the road as this is raised approximately 2-3m above the level of Radnor Gardens.

8.3.12. Photographs of the bridge 13 landing sites are Figure 8.7.

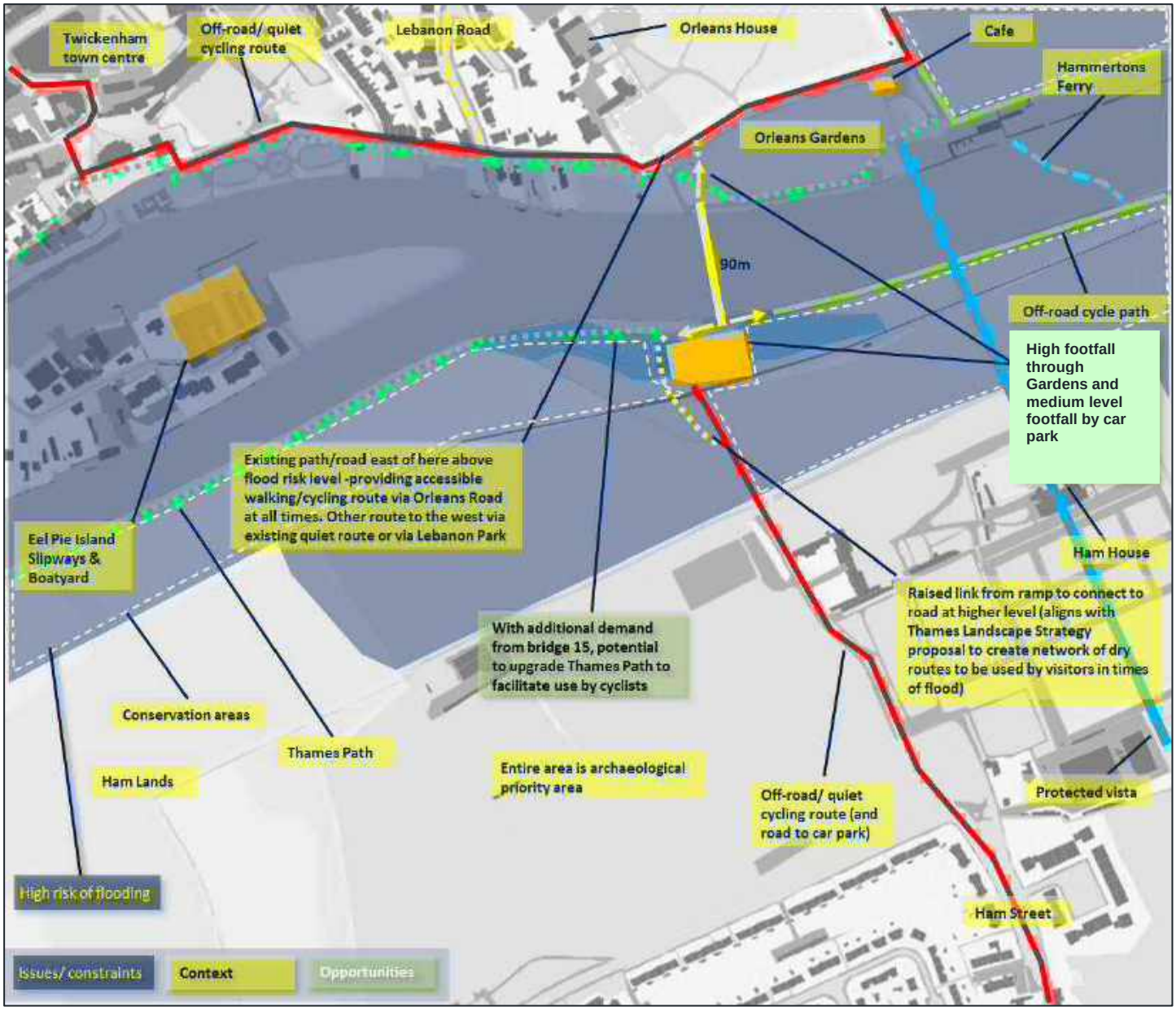
Figure 8.7 Bridge 13 location



Bridge 15 - Between Teddington Lock Footbridge and Richmond Bridge

8.3.13. The key issues, constraints and opportunities around the landing site for bridge 15 are summarised in Figure 8.8.

Figure 8.8 Bridge15 landing site considerations



8.3.14. On both sides of the river at the location of bridge 15 there is a high risk of flooding. On the north side, the bridge will land within Orleans Gardens and connect back to the existing quiet cycling route (shown in red). The short section between the bridge and this route will need to be raised slightly above the current ground level to mitigate against flooding. In times of flood, access can gained via Orleans Road to Richmond Road and Twickenham. The more direct route will be via Twickenham Riverside through Sion Lane/Church Lane. However, this is also prone to flooding and these issues are more difficult to address.

8.3.15. On the south side a raised path can be introduced at the edge of the car park and, as indicated, can link back to the road where the land is higher. This will then provide a continuous pedestrian and cycle route across the river which is accessible at all times. All of the land required for these links is public.

8.3.16. With the additional demand provided by the bridge, there may be justification to upgrade the Thames Path between bridge 15 and Teddington Lock to allow use by cyclists. In practice this happens at the moment but the path is not wide enough to provide the required level of comfort for cyclists or pedestrians. The path is also unbound. Upgrading the link will provide a continuous cycle path between Kingston and Richmond.

8.3.17. The footfall around the north bank landing point is already high. Pedestrian activity is lower on the south side but is still relatively high. This is also a popular cycling route. With the demand generated by the bridge it may be financially viable for a business to operate a café or similar outlet at the southside bridge landing point. The bridge will also provide the opportunity to make localised public realm and landscaping improvements in the vicinity of the southern landing location.

8.3.18. There is less potential for food/drink outlets or local area improvements on the northside as there is already a café and as Orleans Gardens already has a defined character which fits in well with its surroundings.

8.3.19. As mentioned in Chapter 7, the Hammerton Ferry runs daily between February and October (10:00am-6:00pm/6:30pm) and during weekends between December and January. The service is quite well used, albeit mainly by pedestrians and for non-commuting purposes. With the introduction of the bridge, the long-term sustainability of the operation is likely to be compromised.

8.3.20. Photographs of the bridge 13 landing sites are shown in Figure 8.9 and Figure 8.10.

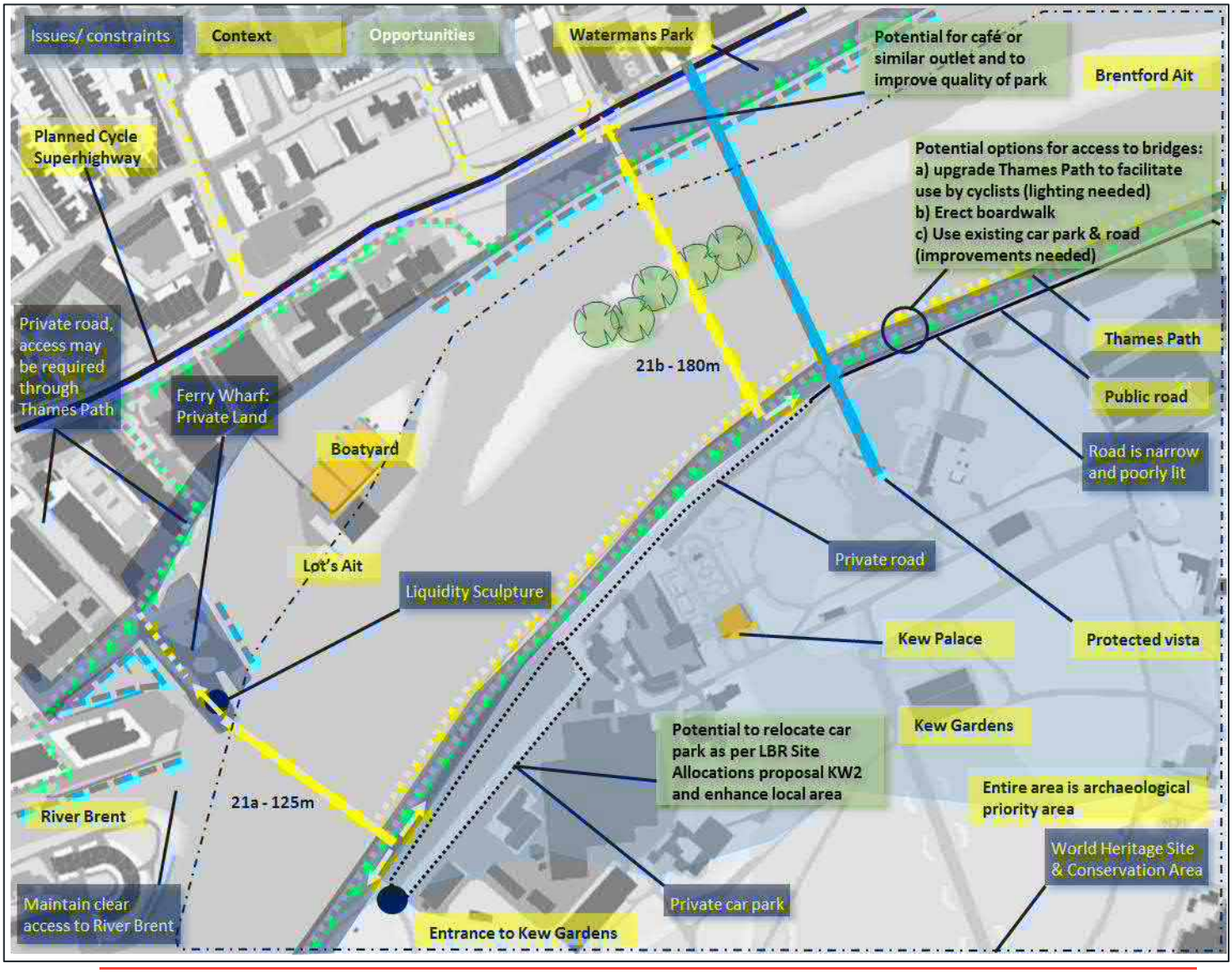
Figure 8.9 Bridge 15 location

Figure 8.10 Bridge 15 location

Bridge 21a and 21b – Between Kew Bridge and Richmond Lock

8.3.21. The key issues, constraints and opportunities around the landing sites for bridge 21a and 21b are summarised in Figure 8.11.

Figure 8.11 Bridge21a and 21b landing site considerations



8.3.22. The landing points for both bridges are in areas of high flood risk. On the north side these extend back further. For bridge 21b this may be less of an issue given that the A315 is raised 2-3m above the level of Watermans Park. The bridge can connect to the road via an elevated path. This is public land. Junction treatment or a crossing point will be required for cyclists to connect into the planned Cycle Superhighway 9. The introduction of the bridge will provide the potential to make localised public realm and landscaping improvements in the vicinity of the landing site. The additional activity at this location may provide the demand for a café or similar outlet.

8.3.23. The landing site for bridge 21a is within Ferry Wharf which is privately owned. Therefore it is uncertain whether agreement can be reached to acquire this land to build the bridge. Furthermore, it is likely that access to the A315 will need to be made along the Thames Path and via Goat Wharf. An agreement was made as part of the planning agreement for the surrounding development to allow 24hr access on the Thames Path in perpetuity. This is likely to extent to pedestrians only and therefore permission will need to be given to allow cyclists to use this section of the Thames Path as well.

8.3.24. Within Ferry Wharf there is a 6m high artwork called the 'liquidity sculpture' (shown in Figure 8.12). This will need to be relocated in order to build the bridge. The sculpture was commissioned by the developers and was very unpopular with residents when it was being constructed.

8.3.25. As part of subsequent design feasibility work, in identifying the pier locations for bridge 21a, consideration will need to be given to the operational requirements of river traffic along River Brent. There is the potential for future freight activity on the river and this is an aspiration of Transport for London.

8.3.26. The landing sites for both bridges on the south bank are likely to be located on private land which is owned by Kew Gardens. For bridge 21a, there is a grass verge (shown in Figure 8.12) which can accommodate the ramp/s with minimal loss of trees and/or parking spaces. The connecting route back to Kew Green can either be through the car park and Ferry Lane, via an upgraded Thames Path (to allow cyclists) or possibly using a boardwalk. These options are shown in Figure 8.11. Flood mitigation measures will need to be considered for routes along the Thames Path or a boardwalk.

8.3.27. Ferry Lane is quite narrow, although only serves the car park and service yards so traffic levels are low. The Thames Path is relatively wide at 3-4m and connects back into Ferry Lane where it returns towards Kew Green at the edge of Kew Gardens. As it is wide it has the potential for upgrading to allow cyclists.

8.3.28. Richmond's Site Allocations Plan contains a proposal (KW2) to relocate the car park to within the Kew Gardens grounds to provide space to introduce a bridge or ferry, and to generally improve the quality of the river frontage.

8.3.29. Similar to bridge 21a, for bridge 21b there is also a grass verge within which a ramp can be located. This is shown in Figure 8.12. The access options to connect to Kew Green are the same as for bridge 21a.

8.3.30. Bridge 21a crosses Brentford Ait and it likely that a pier will need to be installed on the island to build the bridge. The island is heavily wooded and is an attractor of wildlife. The island is under the administration of Richmond and the PLA. The bridge will pass over moorings at the edge of Waterman Park which is another constraint. There is a current planning application to redevelop the moorings.

8.3.31. Due to the close proximity of the bridges to Kew Gardens, and the likelihood that the landing site will be on their land, the context sensitive nature will need to be considered in the bridge design. The bridges are also within a world heritage site and a conservation area. The Kew Gardens Landscape Master Plan in 2010 suggested that an 'elegant footbridge' can be erected within this location.

8.3.32. Photographs of the bridge 21a and 21b landing sites are shown in Figure 8.12.

Figure 8.12 Bridge 21a location

Landing Site Considerations – Review Summary

8.3.33. A summary of the constraints, issues and opportunities for each of the bridge sites is provided in Table 8.2. The assessment against the key criteria for the landing sites is shown in Table 8.3

Table 8.2 Summary of landing site constraints, issues and opportunities

Constraints and Issues	Opportunities
Bridge 10c	
▪ West side landing site is on private land ▪ West side landing site is within an area with high probability of flood risk ▪ West side landing site has trees which are protected and is within a conversation area ▪ Central island owned by EA and leased to the Small Boat Club (since the 1960's) ▪ Less critical are visual intrusion for nearby residential buildings to the west and proximity of moorings	▪ Potential to improve east riverside and Canbury Gardens ▪ Positive impact on east side café and pub, helping to active the area
Bridge 13	
▪ Substantial new link (approx. 570m) to connect back to the network at Riverside Drive. Will pass through woodland ▪ Initial 200m-300m of link would need to be raised to mitigate for flood risk ▪ Western site is within a conservation area	▪ The additional demand may justify upgrading the Thames Path to allow cyclists. This will provide a continuous riverside link to Richmond ▪ An alternative access route is along the line of the protected vista along Greater River Avenue ▪ Note: both sides of the bridge are public land
Bridge 15	
▪ On both sides of the river there is a high risk of flooding ▪ Southern site is within a conservation area ▪ With the introduction of the bridge the sustainability of the Hammerton Ferry operation is likely to be compromised	▪ The additional demand may justify upgrading the Thames Path to allow cyclists. This will provide a continuous cycle path between Kingston and Richmond ▪ With the demand generated it may be financially viable for a business to operate a café or similar outlet at the southside bridge landing point ▪ The bridge will provide the opportunity to make localised public realm and landscaping improvements in the vicinity of the southern landing location ▪ Note: both sides of bridge are public land
Bridge 21a and Bridge 21b	
▪ The landing points for both bridges are in areas of high flood risk ▪ The landing site for bridge 21a is within Ferry Wharf which is privately owned ▪ For bridge 21a it is likely that access to the A315 will be made along the Thames Path and via Goat Wharf. Permission may be required to allow cyclists to use this section of the Thames Path ▪ Within Ferry Wharf there is a 6m high artwork called the 'liquidity sculpture'. This will need to be	▪ The introduction of bridge 21b will provide potential to make localised public realm and landscaping improvements in the vicinity of the northern landing site. The additional activity at this location may provide the demand for a café or similar outlet ▪ The Thames Path is relatively wide at 3-4m and connects back into Ferry Lane. This has the potential for upgrading to allow cyclists ▪ Richmond's Site Allocations Plan contains a proposal to relocate the car park to provide space

relocated in order to build bridge 21a ▪ The landing sites for both bridges on the south bank are likely to be located on private land which is owned by Kew Gardens ▪ Ferry Lane is quite narrow and poorly lit ▪ Bridge 21a crosses Brentford Ait and it likely that a pier will need to be installed on the island to build the bridge ▪ Due to the close proximity of the bridges to Kew Gardens, the context sensitive nature will need to be considered in the bridge design ▪ The bridges are also within a world heritage site and a conservation area	to introduce a bridge or ferry, and to generally improve the quality of the river frontage

Table 8.3 Landing site assessment

Ref	Landing Site Considerations - Key Criteria for Stage 2 Review	Criteria Scoring			Bridges					Comments
		RED	AMBER	GREEN	10c	13	15	21a	21b	
1	Land ownership	Not publicly accessible	Public space or a public accessible space one side of bridge	Public space or a public accessible space both sides of bridge						10c - north side private, 21a north side private, 21b south side private
3	Planning areas	Over approved planning areas.	Over planning areas with pending decision or in planning areas where the land-ing site could be incorporated into design.	Outside any identified planning areas.						Site 21b - Waterman's Park, planning application in to redevelop for moorings
4	Green Spaces	N/A	Not a green space	Is a green space. Assumption that long term improvement can be made to green space and temporary impacts can be mitigated.						
5	Protected vistas, heritage and aesthetic sensitivities	Significant impact	Minor impact	No impact						Thames Strategy (not a formal document) mentions vista from Richmond Hill. 13 - close to protected vista.15 - Twickenham riverside contains historic residential buildings (not protected).21b aethetic sensitivities as close to protected vista.
6	Flood risk	High Probability	Medium Probability	Low or Very Low probability						
7	Moorings and other river uses (e.g. boatyards, rowing clubs)	Signficant presence/historical significance	Minor presence/historical significance	No presence/historical significance						10c - moorings on all banks including island
8	Topography	Land drops away on egress fron	Landing site at 5-6m say and level from river bank	Landing is high (say above 8m) and/or space to raise ground levels as integrated solution (e.g. parks).						21b - A315 to north of Watermans Park 3-4m above landing point
9	Conservation areas/ Site of Nature Importance	Both side of bridge within these areas	One side of bridge within these areas	Neither side of bridge within these areas						
10	Protected trees	Large number of protected trees	Small number of protected trees	No protected trees						
11	Proximity to residential buildings	< 20m to residential building.	Approx. 20m from building with win-dows facing landing point	If: a) bridge landing arrives significantly far from a residential area (> 20m); b) is not a residential building; c) there are no windows facing the bridge landing.						
12	Sevice Utilities	Assumed all landing sites have the same level of complexity.	Assumed all landing sites have the same level of complexity.	Assumed all landing sites have the same level of complexity.						
13	Listed building	The footprint of a listed building forms part of landing site.	Adjacent to listed building	No listed building						
14	Building of townscape merit	N/A	The footprint of a building of townscape merit forms part of landing site.	No building of townscape merit						
15	Requirement for improvements to connecting links	Substantial improvements required	Small-scale improvements required	Very minor improvements required						13- Substantial length new links required through Ham Lands
16	Potential for commercial activity and/or development	No potential	Limited potential	Significant potential						e.g. café potential for 21a 21b north side, 15 northside
17	Potential for local area enhancement	No potential	Limited potential	Significant potential						

9 OUTLINE BUSINESS CASE

9.1 OVERVIEW

9.1.1. This chapter describes the outputs from the business case for the new bridges. It firstly discusses the strategic case and then follows by outlining the economic analysis and quantification of benefits.

9.2 STRATEGY AND OBJECTIVES

Strategic Context

9.2.1. In July 2014, Richmond Council produced a Regulation 123 List which set out infrastructure projects that the Council intended to fund in whole or in part from Community Infrastructure Levy revenue, in accordance with Regulation 123 of the Community Infrastructure Regulations 2010. Two of the "Strategic Transport" projects highlighted were:

- Foot/cycle bridge between Ham and Twickenham, including town centre enhancements for cycling
- Public footbridge between Kew and Brentford

9.2.2. Given the competing policy and funding demands, there is a need to both justify any form of policy support and expenditure towards a bridge as well as clarify the optimal location, business case and associated priority that should be given to each crossing scheme.

Project Objectives

9.2.3. The objectives for this project are as follows:

Table 9.1 Landing site assessment

Objectives	Main benefits by user group
▪ Provide a more pleasant and safer journey experience for pedestrians and cyclists who currently suffer from poor amenity on existing bridges	All users/ local residents – improved safety, ambience and wellbeing of current and future pedestrians and cyclists
▪ Improve the health and wellbeing of residents and others by affecting a mode shift from motorised modes to walking and cycling, and by encouraging new trips to be made by active modes	Mode shifted users – health and wellbeing benefits from walking/ cycling Boroughs – reduced motorised traffic All - improved air quality
▪ Provide a more direct and coherent route for short journeys over the river and to link into the wider network for longer trips. This will help to connect people to homes, jobs, services, leisure activities and public transport node	Residents – better access to jobs, services, leisure activities and public transport All users/ local residents – improved journey time
▪ Support the potential for growth and regeneration	Developers – support growth and regeneration
▪ Contribute to improving the public realm and public spaces around the bridge, and help to activate these areas	All users / local residents – improved urban realm Businesses - provide opportunities for small-scale food/drink outlets around landing sites

9.2.4. The expected benefits of a scheme can be evaluated using a Strategic Assessment Framework (SAF). It has been designed to help ensure that the multitude of transport projects identified and developed each year by TfL and its partners effectively contribute to the delivery of the Mayor's Transport Strategy (MTS) goals and outcomes. It is intended to be used to strengthen current TfL assessment methodology to ensure a consistent check of the strategic fit of intervention options, in reference to the MTS, before any business case is developed. Whilst the promoter for this scheme is Richmond Council rather than TfL,

given the potential future involvement of TfL if the bridge project is progressed it is prudent to use their strategic assessment approach.

9.2.5. The results of a strategic assessment are designed to reflect the latest information available, including new information that comes to light whilst developing and updating business cases. The application of SAF therefore intends to provide the best possible evidence base at a project level, and to help construct possible scenarios for the overall future programme. Where there is no data available yet, a qualitative judgement is made, based on considerations around a series of criteria linked to the MTS goals, challenges and outcomes.

9.2.6. A fundamental principle of the methodology is that it is intended to provide evidence to decision makers to help inform decision making, but should not be used in a mechanistic way to determine 'the answer'. By using the SAF, the information and development of scenarios helps decision makers understand the key choices and alternatives, and enables them to make informed decisions based upon the evidence.

Strategic Assessment Framework Outputs

9.2.7. The SAF outputs showing the benefits of this project against the Mayor's Transport Strategy outcomes and policy are shown in Figure 9.1 and Figure 9.2 respectively. The policy measures are those which were identified earlier has having the greatest relevance to this project.

Figure 9.1 Achieving MTS outcomes

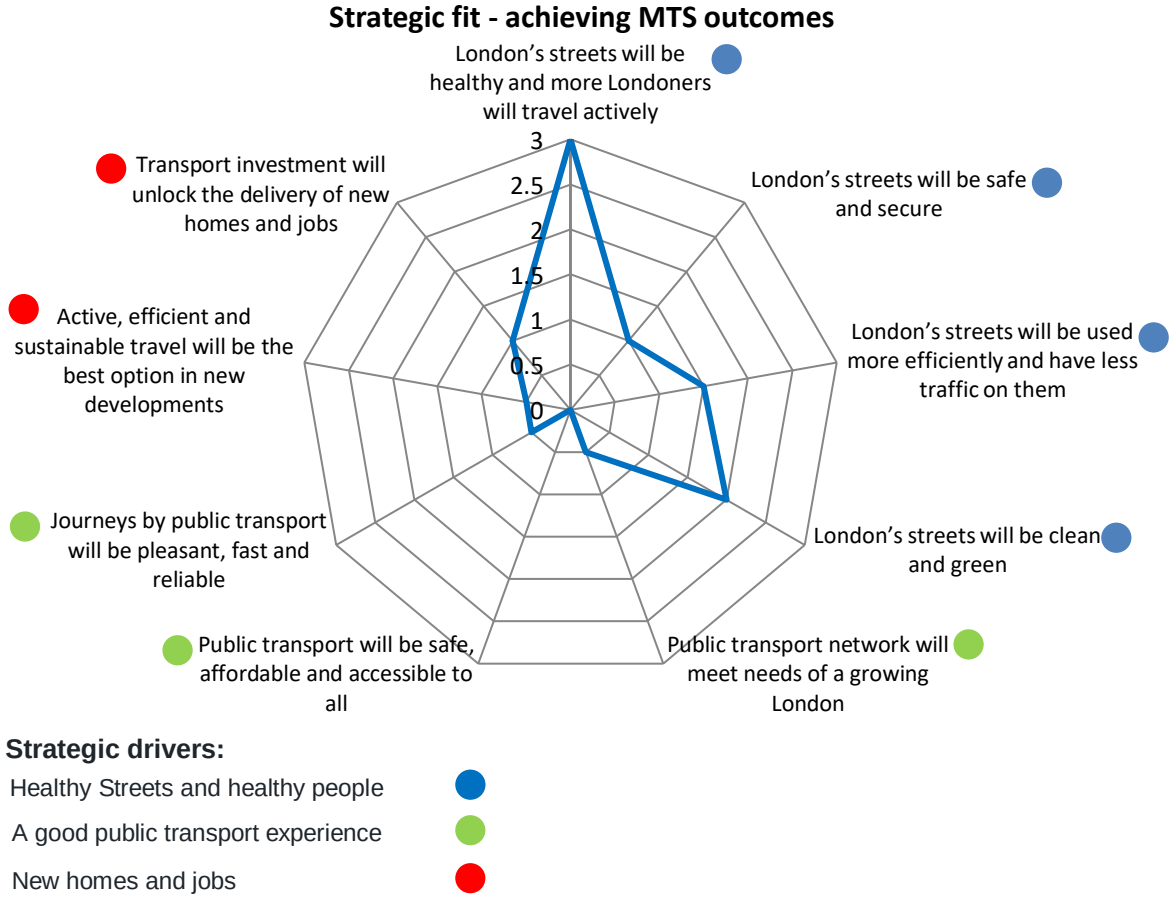
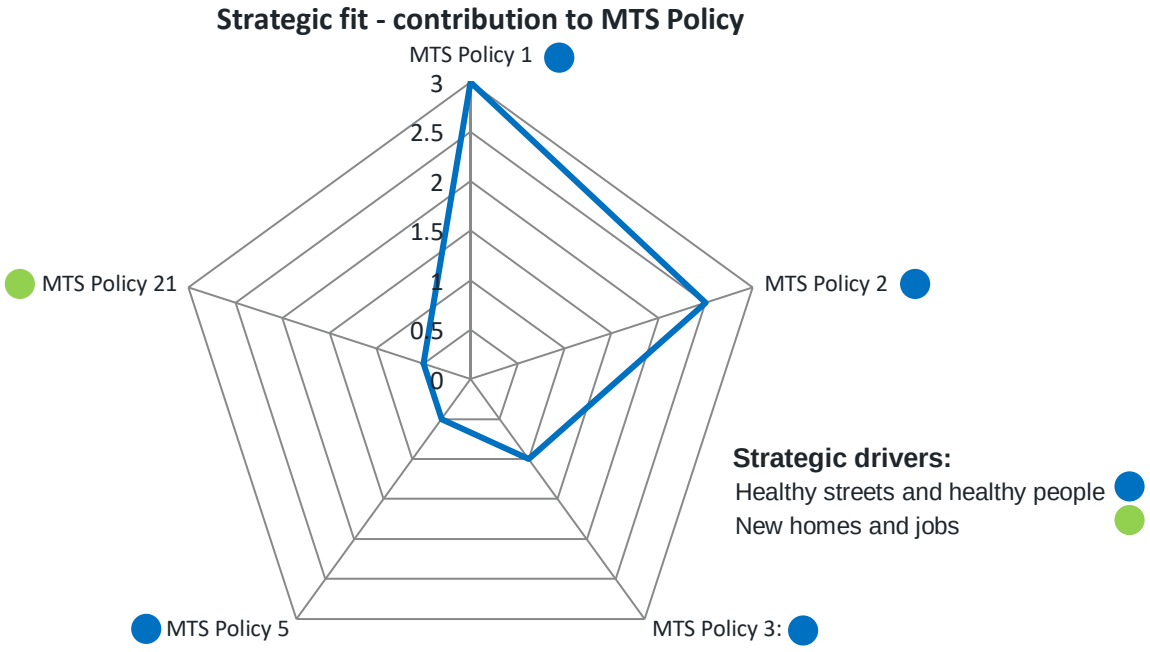


Figure 9.2 Contribution to MTS Policy



Policies:

MTS Policy 1 - Reduce dependency on cars in favour of active, efficient and sustainable modes of travel

MTS Policy 2 - Seek to make London a city where people choose to walk and cycle more often

MTS Policy 3 - Adopt Vision Zero for road danger in London

MTS Policy 21 - Ensure that new homes and jobs in London are delivered in line with the transport principles of Good Growth

MTS Policy 5 - Prioritise space efficient modes of transport to tackle congestion and improve the efficiency of streets for the movement of people and goods

9.3 ECONOMIC ANALYSIS

Overview

9.3.1. This section describes the economic analysis which includes combining cost and calculated benefits to derive a Benefit Cost Ratio (BCR). This analysis uses a range of assumptions which are identified in the following text. Sensitivity tests were applied to some of the more at-risk factors.

9.3.2. The costs for the bridges were developed by WSP's bridges engineering team and are split into capital costs and operational costs as detailed below.

Capital Costs

9.3.3. The capital costs include costs for the bridge itself as well as costs for the connecting links on each side of the river. The costs for pier protection are included. Table 9.2 shows the breakdown of the capital costs.

Table 9.2 Capital cost of bridges

Cost Item	Cost					Price Base
	Bridge 10c	Bridge 13	Bridge 15	Bridge 21a	Bridge 21b	
Capital Cost	£8,025,500	£9,440,500	£9,440,500	£8,464,250	£12,307,000	2018
CapEx in 2010 Prices	£7,060,161	£8,304,960	£8,304,960	£7,446,137	£10,827,546	2010
CapEx in Market Prices	£8,401,592	£9,882,902	£9,882,902	£8,860,903	£12,884,779	2010
CapEx in Market Prices with Optimism Bias	£12,602,388	£14,824,353	£14,824,353	£13,291,354	£19,327,169	2010
CapEx in Market Prices with Optimism Bias, Discounted	£8,631,952	£10,153,877	£10,153,877	£9,103,856	£13,238,061	2010

Operational Costs (Maintenance)

9.3.4. The operational costs were based on a range of maintenance requirements. These are common to all five bridges. The differential in operational costs is a factor of the bridge length.

9.3.5. The operational cost varies on an annual basis depending on the frequency of a particular maintenance activity being required.

9.3.6. The maintenance items for the bridges are listed in Table 9.3. These include an annual Port of London Authority Payment which is quite substantial due to the high value of these river assets. In practice, it may be possible to negotiate a one off payment for the life of the bridge which may provide cost savings. A subsequent detailed feasibility study will identify where the piers should be located and whether these river bed areas are on Crown Estate land. If this is the case then an annual consideration payment may be required as well.

Table 9.3 Operation cost of bridges

Cost Item	Periodicity
Port of London Authority Costs	Annual
General Inspection	2 Years
Principal Inspection	6 Years
Structural Inspection	30 Years
Bearing Replacement	25 Years
Lighting (a)	20 Years
Lighting (b)	2 Years
Painting	20 Years
Resurfacing	20 Years
Cable Replacement	60 Years

9.3.7. The indicative, annual average maintenance costs over the bridge life are shown in Table 9.4.

Table 9.4 Annual average maintenance costs

Cost Item	Indicative Annual Cost (2010 Prices)				
	Bridge 10c	Bridge 13	Bridge 15	Bridge 21a	Bridge 21b
Port of London Authority Costs	£40,388	£33,262	£33,262	£65,328	£65,328
General Inspection	£436	£436	£436	£436	£436
Principal Inspection	£582	£582	£582	£582	£582
Structural Inspection	£109	£109	£109	£109	£109
Bearing Replacement	£3,702	£3,702	£3,702	£3,702	£3,702
Lighting (a)	£3,199	£3,199	£3,199	£3,506	£3,926
Lighting (b)	£5,834	£5,834	£5,834	£5,976	£6,692
Painting	£5,344	£4,878	£4,878	£6,055	£6,780
Resurfacing	£1,505	£1,232	£1,232	£2,198	£2,461
Cable Replacement	£928	£751	£751	£1,361	£1,524

Bridge Demand

9.3.8. The demand reported in Chapter 6 was taken and uplift was applied to reflect walking and cycling policy growth. The demand was also segmented into “Business”, “Commute” and “Other” journey purposes for the application of more accurate annualisation and value of time assumptions.

9.3.9. As reported in Chapter 6 the demand is split into demand which transfers from existing bridges and demand which is “new” being driven by transfer from Car and Bus, and new developments. The demand levels vary on an annual basis due to growth being applied and the tables below report an indicative annual average value for the different segments of demand.

Walking Demand

9.3.10. The existing and new demand for walking is shown in Table 9.5.

Table 9.5 Demand for walking

Segment	Existing Demand	Existing Demand with Growth	New Demand	New Demand with Growth
Bridge 10c Annualised **Walk** Demand Levels				
Business	3,010	7,284	154	373
Commute	83,240	201,460	4,268	10,330
Other	157,210	380,484	8,061	19,509
Bridge 13 Annualised **Walk** Demand Levels				
Business	6,822	16,511	132	320
Commute	188,678	456,642	3,658	8,854
Other	356,342	862,428	6,909	16,722
Bridge 15 Annualised **Walk** Demand Levels				
Business	9,247	22,380	71	171
Commute	255,745	618,961	1,951	4,722
Other	483,008	1,168,989	3,685	8,918
Bridge 21a Annualised **Walk** Demand Levels				
Business	925	2,239	101	245

Commute	28,929	70,014	3,162	7,653
Other	48,314	116,931	5,281	12,782
Bridge 21b Annualised **Walk** Demand Levels				
Business	3,675	8,893	539	1,305
Commute	114,925	278,143	16,865	40,817
Other	191,938	464,533	28,167	68,170

Cycle demand

9.3.11. The existing and new demand for cycling is shown in Table 9.6.

Table 9.6 Demand for cycling

Segment	Existing Demand	Existing Demand with Growth	New Demand	New Demand with Growth
Bridge 10c Annualised **Cycle** Demand Levels				
Business	1,093	2,714	398	989
Commute	61,841	153,594	22,540	55,984
Other	57,085	141,783	20,807	51,679
Bridge 13 Annualised **Cycle** Demand Levels				
Business	2,084	5,175	771	1,915
Commute	117,896	292,820	43,627	108,356
Other	108,831	270,304	40,272	100,024
Bridge 15 Annualised **Cycle** Demand Levels				
Business	2,611	6,484	1,144	2,840
Commute	147,724	366,904	64,713	160,728
Other	136,365	338,691	59,737	148,369
Bridge 21a Annualised **Cycle** Demand Levels				
Business	405	1,005	393	976
Commute	30,512	75,784	29,649	73,639
Other	21,133	52,488	20,535	51,003
Bridge 21b Annualised **Cycle** Demand Levels				
Business	835	2,075	1,152	2,861
Commute	62,993	156,455	86,888	215,804
Other	43,629	108,361	60,179	149,467

Quantified Benefits

9.3.12. The following impacts of the bridge have been quantified and valued:

- Journey time savings
- Safety
- Ambience
- Health

- Emissions
- Absenteeism
- Decongestion

Journey time savings

9.3.13. The new bridges will enable some pedestrians and cyclists within their catchment to save time on journeys across the river by being conveniently placed for them, providing a direct connection between the local areas around the bridges rather than having to use the less convenient existing bridges. The bridge may also provide a better connection to the wider network thus enabling journey time savings for longer cycling trips.

9.3.14. Analysis undertaken as part of the Stage 2 work estimated the journey distances for walk and cycle trips, with and without the new bridge. This was then converted into a journey time by assuming an average speed of 4.8 km/h for pedestrians and 14 km/h for cyclists.

9.3.15. The monetary value of time savings (taken from WebTAG) was applied to the time savings for pedestrians and cyclists.

Safety

9.3.16. Since the bridges will not be used by motor vehicles, it will contribute towards improved safety by reducing the number of accidents arising from collisions with pedestrians and cyclists (although not necessarily between pedestrians and cyclists themselves).

9.3.17. In order to estimate the scale of the benefit, statistics on accident data per km savings were used against which WebTAG parameters were assigned for the value of an accident saving.

Ambience

9.3.18. Trips that use the new pedestrian and cycle bridges instead of the existing bridges (which in most cases are shared with motorised traffic) will experience a more pleasant journey, and this has been captured within the business case as a benefit of the bridges.

9.3.19. Although there are no values of time for ambience that are explicitly related to crossing a segregated bridge, WebTAG recommends using proxy's that represent the quality of the network link surfacing and the width and separation of cycle links from traffic. Values of time are given for these metrics.

Health

9.3.20. Since some trips are expected to shift mode from car and bus to walk and cycle, there will be a health benefit for people making those trips due to their increased level of exercise. Two resulting impacts can be quantified and valued using guidance in Unit 3.14.1 of WebTAG (based on World Health Organisation research):

- Reduced mortality rates – on average, the number of deaths amongst the affected people will reduce very slightly on any given year; and
- Reduced levels of absenteeism – the improved level of health means that the average rate of short-term absenteeism amongst the affected people will decrease.

9.3.21. For trips that shift mode to walk and cycle as a result of the new bridge, the distance per trip was calculated using GIS.

9.3.22. The reduced absenteeism benefit is calculated in a similar way, based on the WebTAG guidance which states that short term absenteeism can be reduced by at least 6% amongst those who take at least 30 minutes exercise a day. Using WebTAG parameters to estimate the reduction in days of absenteeism from work as a result, and valuing it using the average daily salary in London, gives the reduced absenteeism benefit as shown in Tables 9.10 to 9.14.

Emissions

9.3.23. Given that there will be a reduction in fuel consumption; there will also be an associated reduction to emissions of various pollutants. WebTAG Unit 3.3.5 provides parameters that can be used to translate changes to fuel consumption in to a quantification and valuation of changes to emissions of CO_2. The

calculations take into account factors such as improved vehicle efficiency and changes to the proportion of electric cars over time, sourced from WebTAG.

Absenteeism

9.3.24. Improved health from increased physical activity from walking or cycling can also lead to reductions in short term absence from work. These benefits have been estimated using the methods recommended by WebTAG. The method requires estimates of the number of new walkers and cyclists who are commuting; assumptions regarding the time per day they will spend active; and average absenteeism rates and labour costs.

Decongestion

9.3.25. Mode switch from car to active modes will benefit those who continue to use the highways (decongestion benefit) and impact on indirect tax revenues.

Non-quantified benefits

9.3.26. The key non-quantified benefits of the new bridges are likely to include the following:

- Provide a catalyst for improvement to the quality of environment around the bridge locations
- Enhance the image of the local areas which may lead to an uplift in land prices and rental values
- Provide opportunities for drink/food outlets around some of the landing sites. Through helping to activate the local areas this may encourage further trade for businesses in these local environs
- Provide better access to skills and jobs
- Contribute towards growth and regeneration in the neighbouring areas

9.3.27. The scale of these benefits will vary significantly between the bridge locations. For example, there is greater potential for enhancing the image of the area around the north bank of bridge 21b compared to the north side of bridge 15 which has a unique character befitting its historical character and sensitive context. Bridge 15 provides significant improvements in accessibility to Twickenham town centre and via Twickenham Station to central London which may bring improvements in skills and job opportunities.

9.3.28. These benefits have not been quantified within the business case as it would be extremely difficult to distinguish the impact of the bridge on its own given the other improvements that are due to occur in the area. However, the construction of the bridges is likely to contribute positively to all of these benefits by providing visible, permanent infrastructure that links each side of the river and thus increasing the accessibility and local catchment area.

Key assumptions

9.3.29. The key assumption that were used in the quantification of benefits include the following:

- Appraisal Period: 60 years
- Project build year: 2021
- Project opening year: 2024
- Market Price Converter 1.19

9.3.30. The growth values used in the modelling were:

- GDP per Capita
- Population Growth

9.3.31. Walking and cycling were assumed to grow in line with local authority and TfL policy aspirations. The growth rates are shown in Table 9.7. The increase in cycle mode share from 7% to 15% is identified as a target in the Richmond Cycle Strategy to be achieved by 2026. The borough does not have a walking target. However, the TfL Walking Action Plan provides low and high level forecasts for the expected increase in walking trips to 2041. The predicted low level forecast is 9%. A slightly more conservative estimate has been taken to reflect the fact that the TfL forecast covers the whole of London whereas Richmond is located in outer London. The growth rate is capped at 20 years from the appraisal year. The cycling mode shift target has been extended to that year to give a more conservative estimate of future demand.

Table 9.7 Growth rates for walking and cycling

Mode	2015	2041
Walking	7%	15%
Cycling	7%	15%

9.3.32. The discount rates for future years are shown in Table 9.8.

Table 9.8 Discount rates

Years from Base Year	Rate
0	3.5%
30	3.0%
75	2.5%
125	2.0%
200	1.5%
300	1.0%

9.3.33. The levels of optimism bias used are shown in Table 9.9.

Table 9.9. Levels of optimism bias used

CapEx	OpEx
50%	1.6%

Outcome of Quantified Analysis

9.3.34. Tables 9.10 to 9.14 summarise the results of the analysis, broken down into the benefits and costs.

Table 9.10 Bridge 10C Summary Table

Net Benefit to Passengers and Private Sector (including tax impacts)	**£ PV**
1a. User Benefit - Time Saving	27,910,527
1b. User Benefit - Ambience	52,781
1c. User Benefit - Absenteeism	810,105
1d. User Benefit - Health Benefit	613,334
2. Revenue Benefit	
3. Non User Benefits - Road Decongestion	2,657,583
4. Non User Benefits - Noise, Air Quality, Greenhouse Gases, Accident Benefits and Others	118,377
5. Indirect Taxation	-76,407
Sub-Total (a)	32,086,300
Costs to Government (broad transport budget)	
1. Grant (Capital) Costs	8,631,952
2. Operating and Maintenance Costs	1,511,700
Sub-Total (b)	10,143,651
Net Present Value (NPV) (a-b)	**21,942,649**
Benefit Cost Ratio to Government (BCR) (a/b)	**3.16**
Wider Economic Benefits Impact (c)	
Net Present Value including Wider Economic Benefits (NPV) (a+c-b)	**21,942,649**
Benefit Cost Ratio to Government (BCR) including Wider Economic Benefits ((a+c)/b)	**3.16**

Table 9.11 Bridge 13 Summary Table

Net Benefit to Passengers and Private Sector (including tax impacts)	**£ PV**
1a. User Benefit - Time Saving	49,299,031
1b. User Benefit - Ambience	110,218
1c. User Benefit - Absenteeism	1,488,713
1d. User Benefit - Health Benefit	1,109,115
2. Revenue Benefit	
3. Non User Benefits - Road Decongestion	5,302,772
4. Non User Benefits - Noise, Air Quality, Greenhouse Gases, Accident Benefits and Others	236,202
5. Indirect Taxation	-152,459
Sub-Total (a)	57,393,592
Costs to Government (broad transport budget)	
1. Grant (Capital) Costs	10,153,877
2. Operating and Maintenance Costs	1,309,671
Sub-Total (b)	11,463,548
Net Present Value (NPV) (a-b)	**45,930,044**
Benefit Cost Ratio to Government (BCR) (a/b)	**5.01**
Wider Economic Benefits Impact (c)	
Net Present Value including Wider Economic Benefits (NPV) (a+c-b)	**45,930,044**
Benefit Cost Ratio to Government (BCR) including Wider Economic Benefits ((a+c)/b)	**5.01**

Table 9.12 Bridge 15 Summary Table

Net Benefit to Passengers and Private Sector (including tax impacts)	**£ PV**
1a. User Benefit - Time Saving	47,697,097
1b. User Benefit - Ambience	146,712
1c. User Benefit - Absenteeism	2,148,426
1d. User Benefit - Health Benefit	1,586,301
2. Revenue Benefit	
3. Non User Benefits - Road Decongestion	6,459,256
4. Non User Benefits - Noise, Air Quality, Greenhouse Gases, Accident Benefits and Others	287,715
5. Indirect Taxation	-185,708
Sub-Total (a)	58,139,799
Costs to Government (broad transport budget)	
1. Grant (Capital) Costs	10,153,877
2. Operating and Maintenance Costs	1,309,671
Sub-Total (b)	11,463,548
Net Present Value (NPV) (a-b)	**46,676,250**
Benefit Cost Ratio to Government (BCR) (a/b)	**5.07**
Wider Economic Benefits Impact (c)	
Net Present Value including Wider Economic Benefits (NPV) (a+c-b)	**46,676,250**
Benefit Cost Ratio to Government (BCR) including Wider Economic Benefits ((a+c)/b)	**5.07**

Table 9.13 Bridge 21a Summary Table

Net Benefit to Passengers and Private Sector (including tax impacts)	**£ PV**
1a. User Benefit - Time Saving	1,289,393
1b. User Benefit - Ambience	23,834
1c. User Benefit - Absenteeism	1,023,379
1d. User Benefit - Health Benefit	765,218
2. Revenue Benefit	
3. Non User Benefits - Road Decongestion	3,247,656
4. Non User Benefits - Noise, Air Quality, Greenhouse Gases, Accident Benefits and Others	144,661
5. Indirect Taxation	-93,373
Sub-Total (a)	6,400,767
Costs to Government (broad transport budget)	
1. Grant (Capital) Costs	9,103,856
2. Operating and Maintenance Costs	2,205,420
Sub-Total (b)	11,309,276
Net Present Value (NPV) (a-b)	**-4,908,509**
Benefit Cost Ratio to Government (BCR) (a/b)	**0.57**
Wider Economic Benefits Impact (c)	
Net Present Value including Wider Economic Benefits (NPV) (a+c-b)	**-4,908,509**
Benefit Cost Ratio to Government (BCR) including Wider Economic Benefits ((a+c)/b)	**0.57**

Table 9.14 Bridge 21b Summary Table

Net Benefit to Passengers and Private Sector (including tax impacts)	**£ PV**
1a. User Benefit - Time Saving	11,237,583
1b. User Benefit - Ambience	77,127
1c. User Benefit - Absenteeism	3,129,874
1d. User Benefit - Health Benefit	2,371,254
2. Revenue Benefit	
3. Non User Benefits - Road Decongestion	9,899,327
4. Non User Benefits - Noise, Air Quality, Greenhouse Gases, Accident Benefits and Others	440,947
5. Indirect Taxation	-284,613
Sub-Total (a)	26,871,497
Costs to Government (broad transport budget)	
1. Grant (Capital) Costs	13,238,061
2. Operating and Maintenance Costs	2,251,271
Sub-Total (b)	15,489,332
Net Present Value (NPV) (a-b)	**11,382,165**
Benefit Cost Ratio to Government (BCR) (a/b)	**1.73**
Wider Economic Benefits Impact (c)	
Net Present Value including Wider Economic Benefits (NPV) (a+c-b)	**11,382,165**
Benefit Cost Ratio to Government (BCR) including Wider Economic Benefits ((a+c)/b)	**1.73**

Sensitivity tests

9.3.35. Key to the benefits associated with the bridges are the time savings for those using the new bridges. As described earlier, the time savings were derived from GIS analysis and were subject to assumptions and a degree of averaging and aggregation. The demand levels were derived from existing survey data and census journey to work analysis, both of which are subject to their own assumptions.

9.3.36. Sensitivity tests were run, modifying the calculated time saving value for users, and the demand levels, and re-calculating the outturn BCR for each of the bridge options under these different modifications. These tests aid understanding of the impact of any divergence of the calculated demand and time saving from the realised outturn value should the bridge be built.

9.3.37. The results of the sensitivity test for time savings and demand are shown in Tables 9.15 and 9.16 respectively.

Table 9.15 Sensitivity Test: Time Saving

Bridge	**Modification to Calculated Time Saving**						
	-20%	-10%	-5%	Central	+5%	+10%	+20%
10c	2.61	2.89	3.03	3.16	3.30	3.44	3.71
13	4.15	4.58	4.79	5.01	5.22	5.44	5.87
15	4.24	4.66	4.86	5.07	5.28	5.49	5.90
21A	0.54	0.55	0.56	0.57	0.57	0.58	0.59
21B	1.59	1.66	1.70	1.73	1.77	1.81	1.88

Table 9.16 Sensitivity Test: Demand

Bridge	Modification to Calculated Demand						
	-20%	-10%	-5%	Central	+5%	+10%	+20%
10c	2.53	2.85	3.01	3.16	3.32	3.48	3.80
13	4.01	4.51	4.76	5.01	5.26	5.51	6.01
15	4.06	4.56	4.82	5.07	5.33	5.58	6.09
21a	0.45	0.51	0.54	0.57	0.59	0.62	0.68
21b	1.39	1.56	1.65	1.73	1.82	1.91	2.08

10 BRIDGE OPTIONS SUMMARY AND APPRAISAL

10.1 OVERVIEW

10.1.1. This chapter provides a summary of the key features and outputs for each bridge as described in previous chapters. A high level appraisal is made against these outputs which has informed the recommendations regarding the feasibility of introducing new bridges within Richmond.

10.2 SUMMARY OF BRIDGE FEATURES AND OUTPUTS

10.2.1. A summary of the key features and quantified outputs from the demand analysis, cost estimation and business case assessment is provided in Table 10.1.

Table 10.1 Summary of key features and outputs for the bridges

		Bridge 10c	Bridge 13	Bridge 15	Bridge 21a	Bridge 21b
Bridge length		110m	90m	90m	125m	180m
Landing site location	**North/ West**	Richmond	Richmond	Richmond	Hounslow	Hounslow
	South/ East	Kingston	Richmond	Richmond	Richmond	Richmond
Landing site public/ private land	**North/ West**	Private	Public	Public	Private	Private
	South/ East	Public	Public	Public	Private*	Private*
Distance to next bridge	**North**	1.8km	3.2km	2.0km	0.5km	0.9km
	South	0.9km	1.3km	2.5km	3.8km	3.3km
Demand (24hr period)	**Walking**	732	1,640	2,219	248	1,020
	Cycling	473	924	1,227	298	743
	Total	1,205	2,564	3,446	546	1,763
Rank out of 11 bridges for demand (1= busiest)		10	6	5	11	7
Bridge cost (£)	**Capex**	8,025,500	9,540,500	9,440,500	8,464,250	12,307,000
	Opex (p.a.)	62,027	53,985	53,985	91,540	91,540
Benefit-Cost Ratio		3.16	5.01	5.07	0.57	1.73

* Option identified to connect directly to Thames Path which is a public asset

10.2.92. From the outputs in the table above it is clear that a stronger case for certain bridges. Bridges 13 and 15 will be on public land which is highly beneficial in terms of gaining planning consent and avoiding potential compensation payments.

10.2.93. These two bridges are in areas which are lease well served by bridge connections. This is one of the reasons why they will provide a substantial improvement in accessibility. This is significant as they will serve areas which currently have poor access to public transport and town centre amenities. The demand is relatively high and, given they will have short spans, the build cost is lower the other bridges. These factors contribute to the higher benefit-costs ratios.

10.3 BRIDGE OPTIONS APPRAISAL SUMMARY

Impacts Assessment

10.3.1. Table 10.2 provides a multi-criteria assessment using some of the quantitative factors shown in Table 10.2 as well as landing site considerations which are more qualitative. This information is taken from Chapter 7, Table 8.2 Table 8.3.

Table 10.2 Bridge impacts assessment

	Assessment factor	Bridge 10c	13	15	21a	21b	Scoring	
1	Benefit-cost ratio						G = high	R = low
2	Demand for walking & cycling						G = high	R = low
3	Cost						G = low	R = high
4	Accessibility benefit						G = high	R = low
5	Potential increase in PTAL						G = high	R = low
	Landing site considerations:							
6	Landing sites: LB Richmond/ other						G = both LBR	A = one LBR
7	Landing sites: public or private						G = both public	R = both private
8	Flood risk						G = low	R = high
9	Link improvements required						G = minor	R = major
10	Potential: commercial activity						G = high	R = low
11	Potential: local area enhancement						G = high	R = low

10.3.2. Commentary is provided above regarding the respective quantitative benefits of the bridges. Putting these alongside the qualitative elements in Table 10.2 adds further insight into which bridges have greater potential and the aspects that will need to be considered further in subsequent stages of work to challenge this.

10.3.3. As discussed, Bridges 13 and 15 stand out as front runners for several reasons. However, there will be significant issues to overcome regarding the flood risk in these areas and the feasibility of providing a connecting link for bridge 13 through Ham Lands. These are likely to add to the bridge cost which will reduce its value for money.

10.3.4. Bridge 10c gives a good BCR value but there will be major obstacles to overcome regarding providing access through the landing site area to the west and on the central island, which may be insurmountable. This bridge also gives negligible benefits in terms of the local area accessibility.

10.3.5. Bridge 21b provides a lower BCR but is likely to provide greater improvements in accessibility and more potential to enhance the areas either side of the bridge. However, one side is privately owned and the bridge must cross Brentford Ait which raises ecology, biodiversity and arboriculture issues.

10.3.6. The BCR for Bridge 21a is below the level at which it is considered that new infrastructure will provide value for money.

Achieving Project Objectives

10.3.7. Table 10.3 identifies how well the different bridge options meet the project objectives set out in Chapter 2.

10.3.8. The bridges have been given similar scores regarding providing a more pleasant and safer journey experience. This is because the quality of provision and amenity is expected to be significantly better than the adjacent bridges. The only difference is that bridges 13 and 15 score slightly higher because they are adjacent to Richmond Bridge which lacks dedicated facilities for cyclists and as such they have to share the road with vehicles.

10.3.9. The forecasted mode shift from buses and cars to cycling and walking is higher for bridges 15 and 21b.

10.3.10. Bridges 13 and 15 provide more direct and legible routes to key attractors and to link in to the existing network.

10.3.11. Bridges 10c and 21a have the least potential to improve the public realm and public spaces. This is largely due to the fact that the west side of bridge 10c and the north side of bridge 21a are within residential developments.

Table 10.3 Bridge impacts assessment

	Objectives	Bridge				
		10c	13	15	21a	21b
1	Provide a more pleasant and safer journey experience	✓	✓	✓	✓	✓
2	Improve the health and wellbeing of residents and others by affecting a mode shift	✓	✓	✓✓	✓	✓✓
3	Provide a more direct and coherent route for short journeys and to link into the wider network	✓	✓✓	✓✓✓	✓	✓
4	Support the potential for growth and regeneration	✓	✓	✓	✓	✓
5	Contribute to improving the public realm and public spaces	✓	✓✓	✓✓	✓	✓✓

Delivery Risks

10.3.12. Table 10.4 gives a high level assessment of the risks in delivering the bridges.

10.3.13. Bridges 10c, 21a and 21b have significant risks around public acceptability given that they will need to use private land. There are higher economic risks for bridges 13 and 21b due to the ability to secure funding for the scale of cost identified or due to the potential for costs to escalate.

10.3.14. Social risks are more significant for bridges 10c and 21a due to potential opposition regarding concerns about visual intrusion and increased noise.

10.3.15. The buildability of bridge 13 carries increased risks due to the need to elevate the connecting link across the area of high flood risk and take the route nearly 600m through dense areas of woodland.

10.3.16. There are clear legal implications of having to secure land on both sides of the river to build bridges 10c and 21a. Bridge 10c also requires use of the central island.

10.3.17. Due to the long connecting link required through natural habitat and woodland for bridge 13, and the likely need to locate a pier on Brentford Ait for bridge 21b there are greater environmental risks.

Table 10.4 Delivery risks assessment

Delivery risks		Bridge					Factors
		10c	13	15	21a	21b	
1	Political	xxx	x	x	xxx	xx	Stakeholder approval, public consultation
2	Economic	xx	xxx	xx	xx	xxx	Provision of funding, cost escalation
3	Social	xxx	x	xx	xxx	xx	Visual intrusion and noise impact on residents
4	Technological	xx	xxx	xx	xx	x	Buildability of bridge and links to address flood risk
5	Legal	xxx	x	x	xxx	xx	Land agreement/ acquisition, planning
6	Environmental	xx	xxx	xx	xx	xxx	Conservation, ecology/biodiversity, arboriculture
xxx - higher risk x - lower risk							

Recommendations

10.3.75. Through the development of this outline feasibility study and considering all of the factors discussed in this chapter, it has been possible to make recommendations regarding the future development of pedestrian and cycle bridges across the River Thames in Richmond.

10.3.76. Regarding the feasibility, benefits and deliverability of the bridges, they are prioritised as follows:

1. **Bridge 15**
2. **Bridge 13**
3. Bridge 21b
4. Bridge 10c
5. Bridge 21a

10.3.77. However, given the key issues and constraints identified, it recommended that **further consideration is given to bridge 15 and bridge 13 only**.

11 NEXT STEPS

11.1 OVERVIEW

11.1.1. The recommendation is that more detailed feasibility work is undertaken for bridges 13 and 15. Some of the elements that need to be considered as part of this are set out below.

11.2 DEMAND FORECASTING

11.2.1. This initial demand analysis provides a broad assessment of potential daily demand for new river crossings, and demonstrates that some bridges will attract a significant number of pedestrians and cyclists.

11.2.2. As the project progresses more detailed work is recommended to refine this analysis and confirm some of the assumptions made. This further work should include exploring:

- Propensity to shift mode based on congestion and bus service crowding
- Demand sensitivities related to walking and cycling mode shift potential informed by new TfL cycling/walking models and analysis
- Directional flows over 24hrs during the week and weekend across existing bridges
- Pedestrian and cycle flows on the Thames Path during the week and weekend
- Levels of activity around landing sites, particularly within parks and green spaces
- Demand patterns over the year for some of the key attractors in the vicinity of the bridges
- Extent of potential for local area enhancement. This will inform the demand analysis and potential for commercial activity, which in turn may influence the business case

11.3 DESIGN FEASIBILITY

11.3.1. As discussed in detail in earlier chapters, there are many risks regarding certain elements of the design feasibility. In addition, given the high level nature of this study, many assumptions needed to be made. In subsequent work, further investigation is needed to identify the extent to which these risks can be mitigated and to firm up on some of the bridge design requirements. Some of the specific areas of work may include:

- Consideration of pier locations, topology, bridge height/profile and the area of land required for ramps/stairs
- Pier protection options
- Detailed topological survey to identify levels and the location of features around the landing sites such as trees, paths and structures
- Feasibility of constructing elevated sections of shared-use path to avoid flood risk
- Measures needed to upgrade the Thames Path to allow cycling
- Requirement for upgrades to the existing network, particularly with regarding to providing new junctions and crossings
- More detailed costs related to the above factors

11.4 PLANNING CONSIDERATIONS

11.4.1. This early stage feasibility work has not considered the requirement and processes regarding gaining planning approval. However, as part of the next stage of the study these matters will need to be discussed with stakeholders as they can have material impacts on the scope of the feasibility work required as well as the timescales for taking the project forwards. Some of the considerations are listed below:

- Discussion with stakeholders, including Richmond Council, the PLA and EA regarding the appropriate planning consent routes available and the documents that are likely to be required to support any submission
- The approval process regarding upgrading the Thames Path to allow cycling

- Requirements and costs for PLA license, EA license, Marine Management Organisation license and any ongoing payments required by Crown Estates
- Surveys and site specific assessments which may include: archaeological assessment, tree report and impact assessment, ecology and biodiversity study, local flood risk assessment and consideration of aesthetic and heritage sensitivities.

11.5 STAKEHOLDER ENGAGEMENT

11.5.1. More extensive stakeholder discussions will need to take place at the next stage of the project in order to address the points identified above. The key parties with whom engagement will be required may include:

- Transport for London
- Environment Agency
- Ports of London Authority
- London Borough of Richmond (various stakeholder representation required)
- Local interest groups/ residents organisations including the Ham and Petersham Neighbourhood Forum
- Twickenham Business Improvement District
- Representatives from key local attractors including Ham House and St Mary's University

Appendix A

STAGE 1 ASSESSMENT INFORMATION

Constraints Plan 1

Date Modified:

Drawn By:

Ealing London Boro

Hammersmith and Fulham London Boro

Kew Bridge

Hounslow London Boro

Chiswick Bridge

Barnes Foot Bridge

Richmond Lock and Footbridge

Twickenham Bridge

Richmond Bridge

Wandsworth London Boro

Richmond upon Thames London Boro

Teddington Lock Footbridge

Merton London Boro

Kingston Bridge

Kingston upon Thames London Boro

Hampton Court Bridge

Elmbridge District (B)

0 0.2 0.4 0.8 1.2 1.6

Kilometres

Key

- Local nature reserve
- Parks and gardens
- Conservation Area
- World Heritage Site
- Borough Boundary

File:

Constraints Plan 2

Date Modified:

Drawn By:

Ealing London Boro

Hounslow London Boro

Hammersmith and Fulham London Boro

Hammersmith Bridge

Kew Bridge

Chiswick Bridge

Barnes Railway Bridge

Richmond Lock and Footbridge

Twickenham Bridge

Richmond Bridge

Wandsworth London Boro

Richmond upon Thames London Boro

Teddington Lock Footbridge

Kingston Bridge

Merton London Boro

Kingston upon Thames London Boro

Key

Risk of Flooding from Rivers and Sea (Eng) (<250k)

Probability

- High
- Medium
- Low
- Very Low
- District Boundary

0 0.2 0.4 0.8 1.2 1.6

Kilometres

File:

Constraints Plan 3

Date Modified:

Drawn By:

Ealing London Boro

Hammersmith and Fulham London Boro

Hammersmith Bridge

Kew Bridge

Hounslow London Boro

Chiswick Bridge

Barnes Foot Bridge

Richmond Lock and Footbridge

Twickenham Bridge

Richmond Bridge

Wandsworth London Boro

Richmond upon Thames London Boro

Teddington Lock Footbridge

Merton London Boro

Kingston Bridge

Kingston upon Thames London Boro

Hampton Court Bridge

Elmbridge District (B)

Key

- Archaeological Priority Area
- Landmark – less than 1 year old
- Landmark – 1-3 years old
- Landmark – 3-6 years old
- Landmark – >6 years old
- Borough Boundary

0 0.2 0.4 0.8 1.2 1.6 Kilometres

File:

Constraints Plan 4

Date Modified:

Drawn By:

Ealing London Boro

Hammersmith and Fulham London Boro

Hammersmith Bridge

Kew Bridge

Hounslow London Boro

Chiswick Bridge

Barnes Foot Bridge

Richmond Lock and Footbridge

Twickenham Bridge

Richmond Bridge

Wandsworth London Boro

Richmond upon Thames London Boro

Teddington Lock Footbridge

Merton London Boro

Kingston Bridge

Kingston upon Thames London Boro

Hampton Court Bridge

Elmbridge District (B)

Key

- Tree Preservation Order
- Site of Nature Importance
- Site of Special Scientific Interest
- Borough Boundary

0 0.2 0.4 0.8 1.2 1.6 Kilometres

File:

Constraints Plan 5

Date Modified:

Drawn By:

File:

Ealing London Boro

Hammersmith and Fulham London Boro

Hounslow London Boro

Wandsworth London Boro

Richmond upon Thames London Boro

Merton London Boro

Kingston upon Thames London Boro

Elmbridge District (B)

Hammersmith Bridge

Kew Bridge

Chiswick Bridge

Barnes Railway Bridge

Richmond Lock and Footbridge

Twickenham Bridge

Richmond Bridge

Teddington Lock Footbridge

Kingston Bridge

Hampton Court Bridge

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

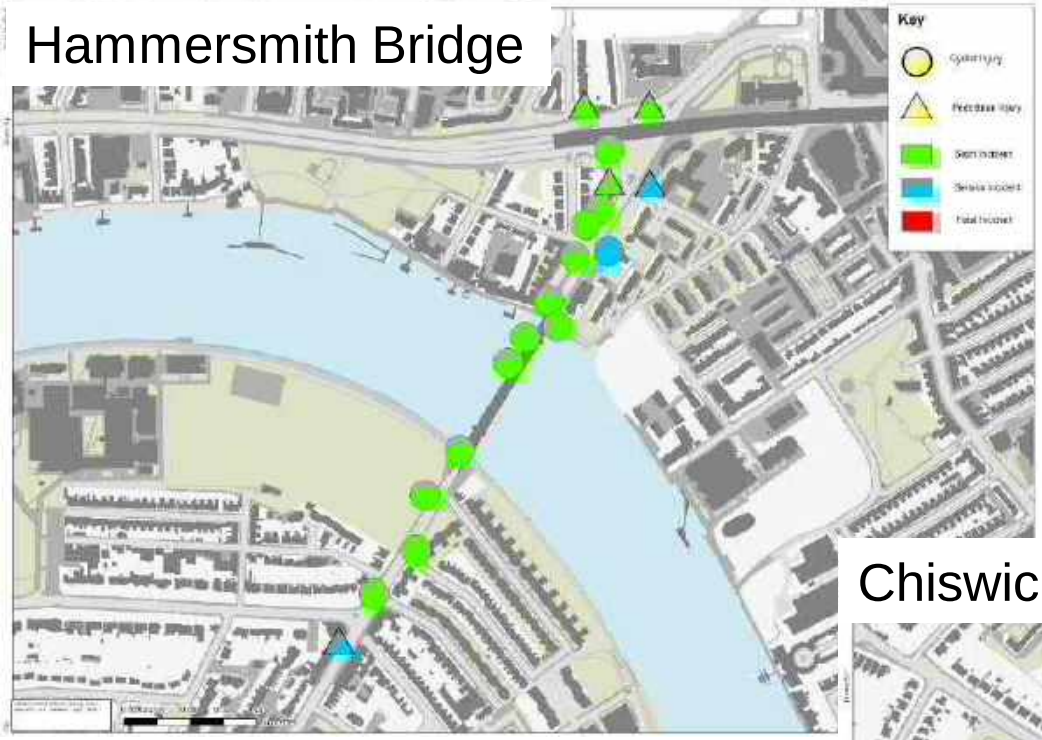
Key

- Protected vista
- Bend in river
- Scheduled Monument
- Within 500m from existing bridge
- Borough boundary
- Existing bridge

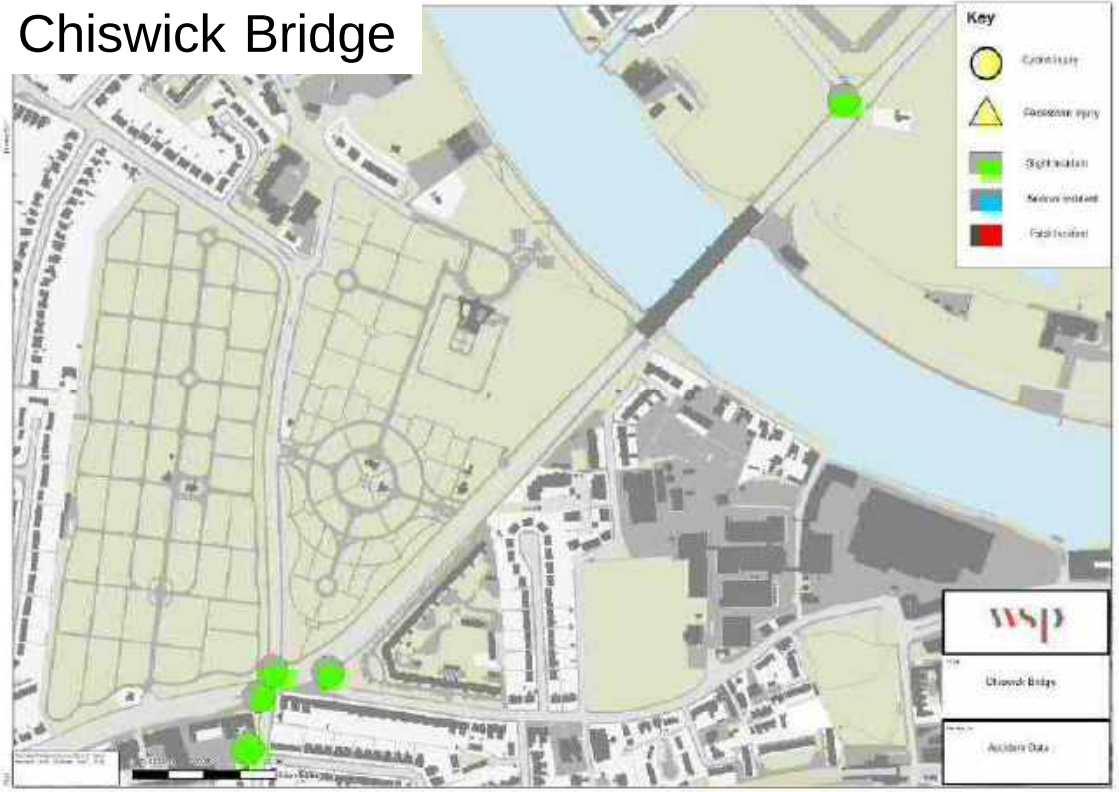
0 0.2750.55 1.1 1.65 2.2 Kilometres

POTENTIAL TO IMPROVE ROAD SAFETY– COLLISIONS

Hammersmith Bridge

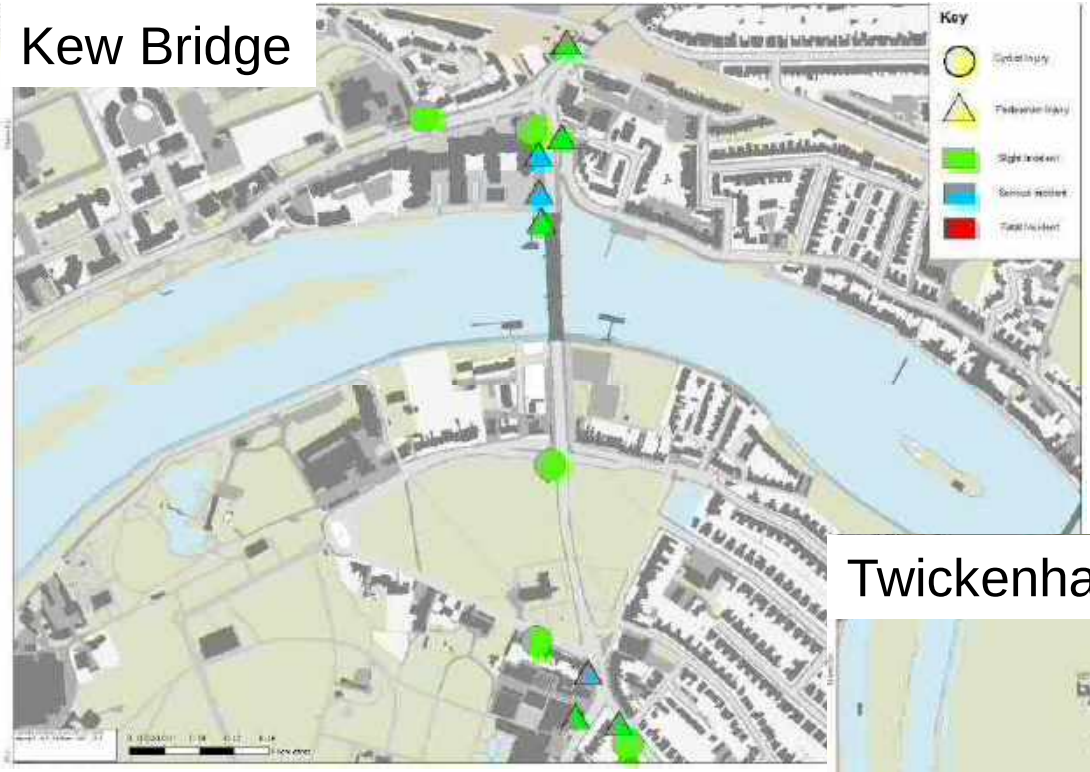


Chiswick Bridge

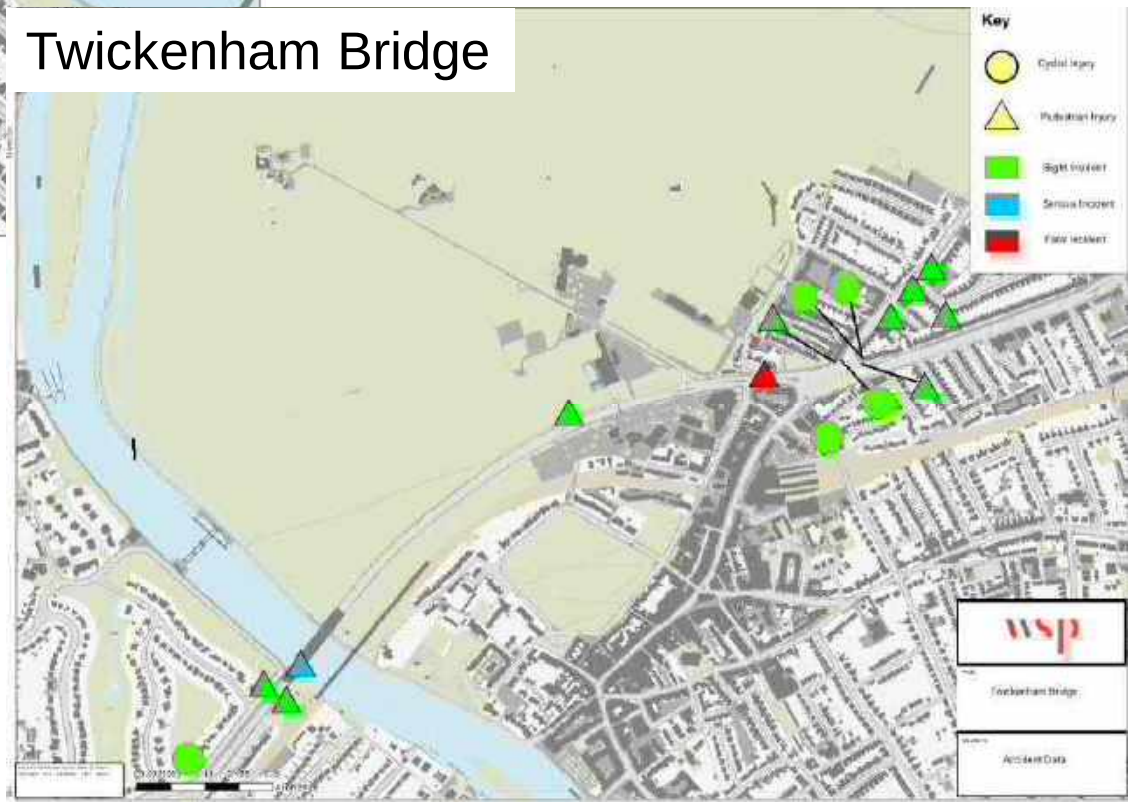


POTENTIAL TO IMPROVE ROAD SAFETY– COLLISIONS

Kew Bridge

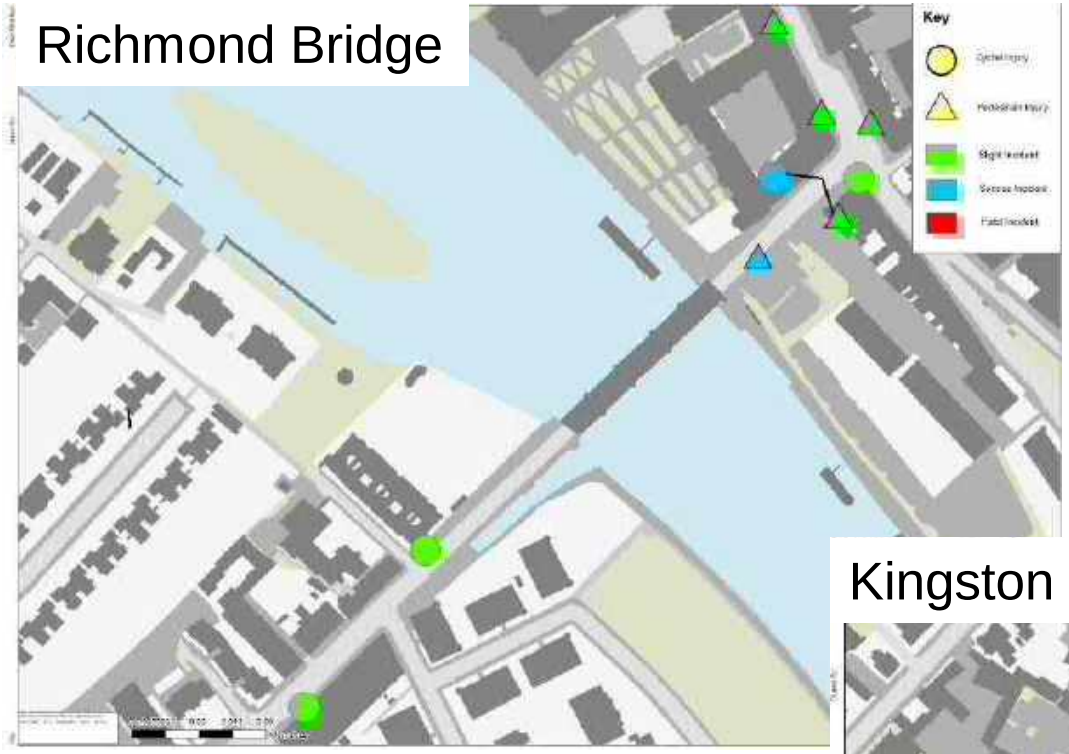


Twickenham Bridge

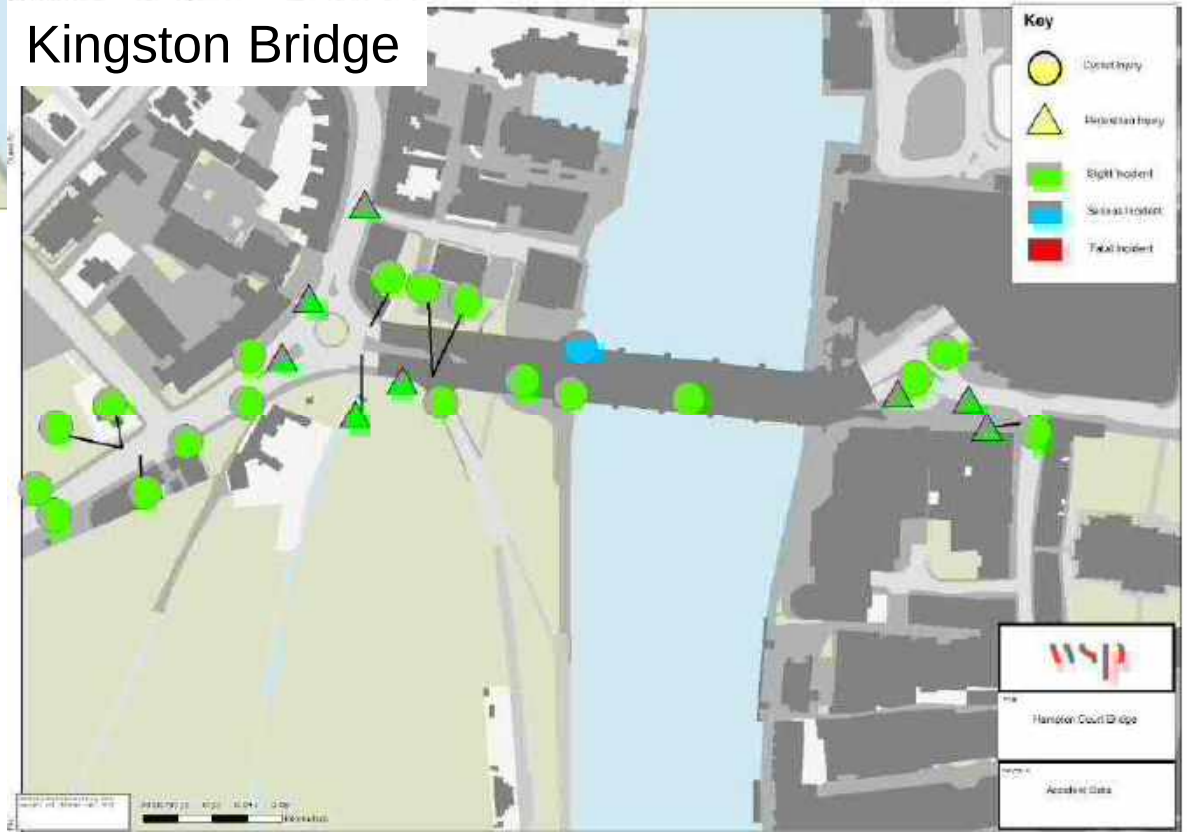


POTENTIAL TO IMPROVE ROAD SAFETY– COLLISIONS

Richmond Bridge

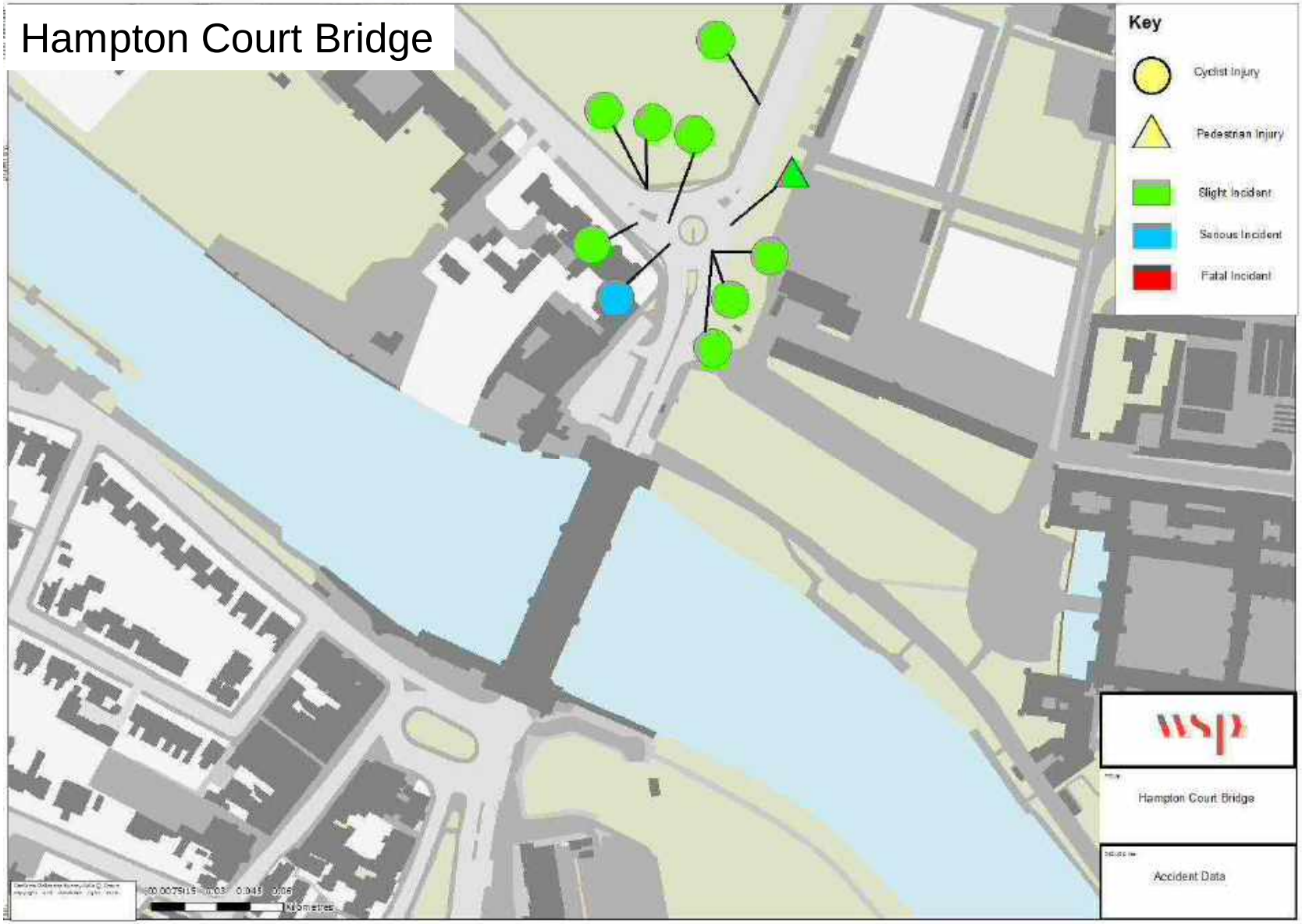


Kingston Bridge

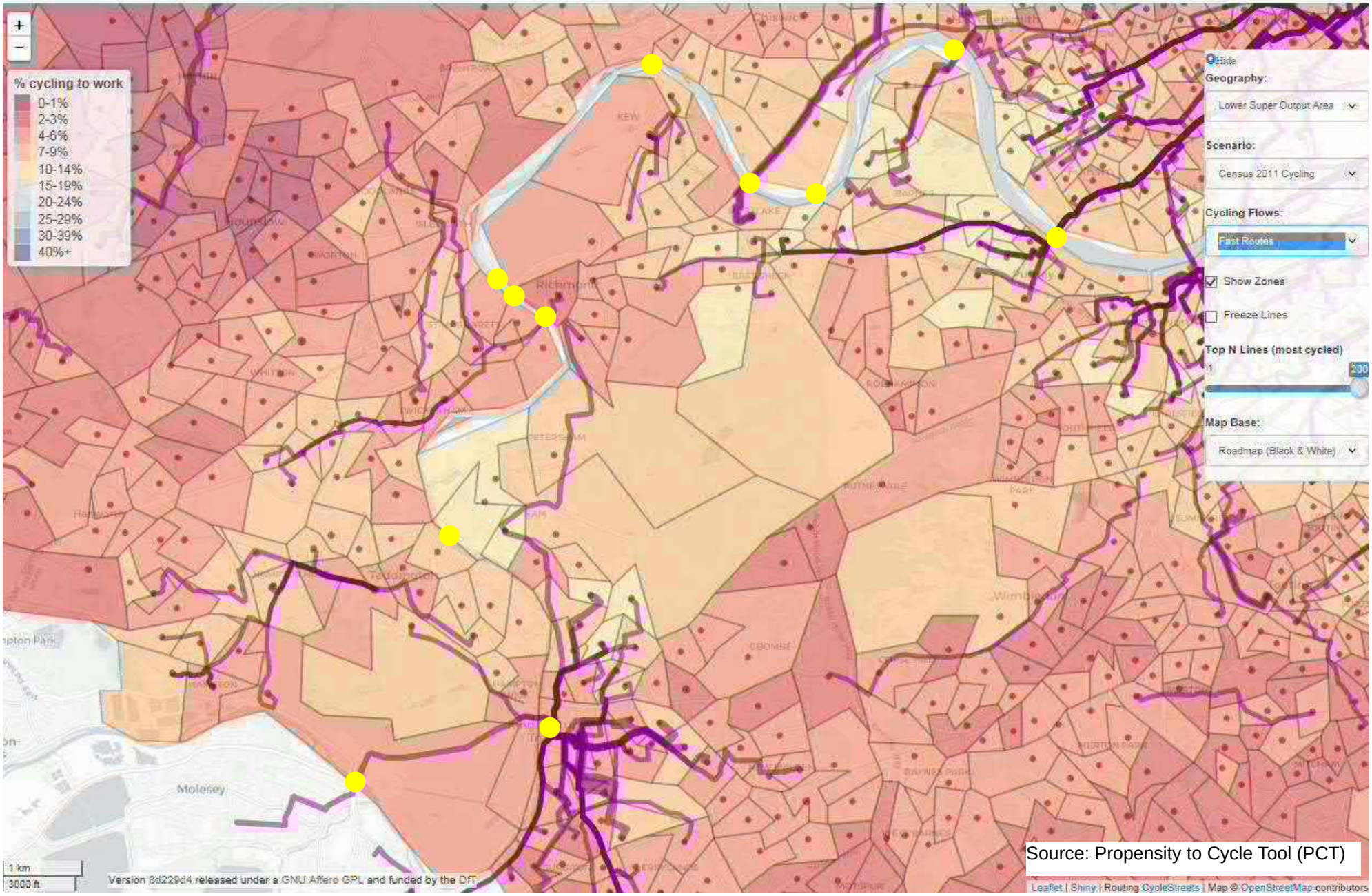


POTENTIAL TO IMPROVE ROAD SAFETY– COLLISIONS

Hampton Court Bridge

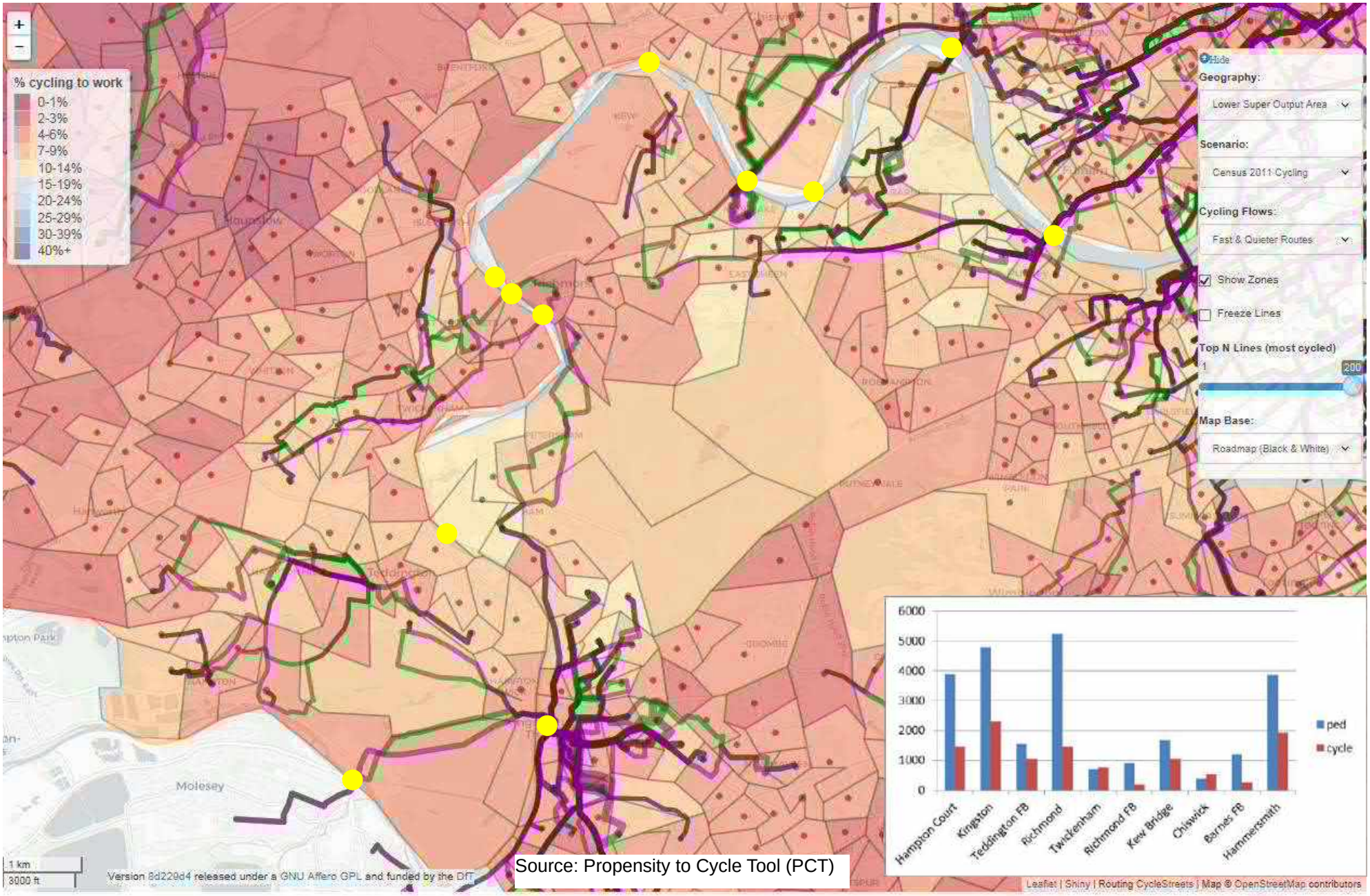


CURRENT DEMAND – CYCLING: PCT TOOL



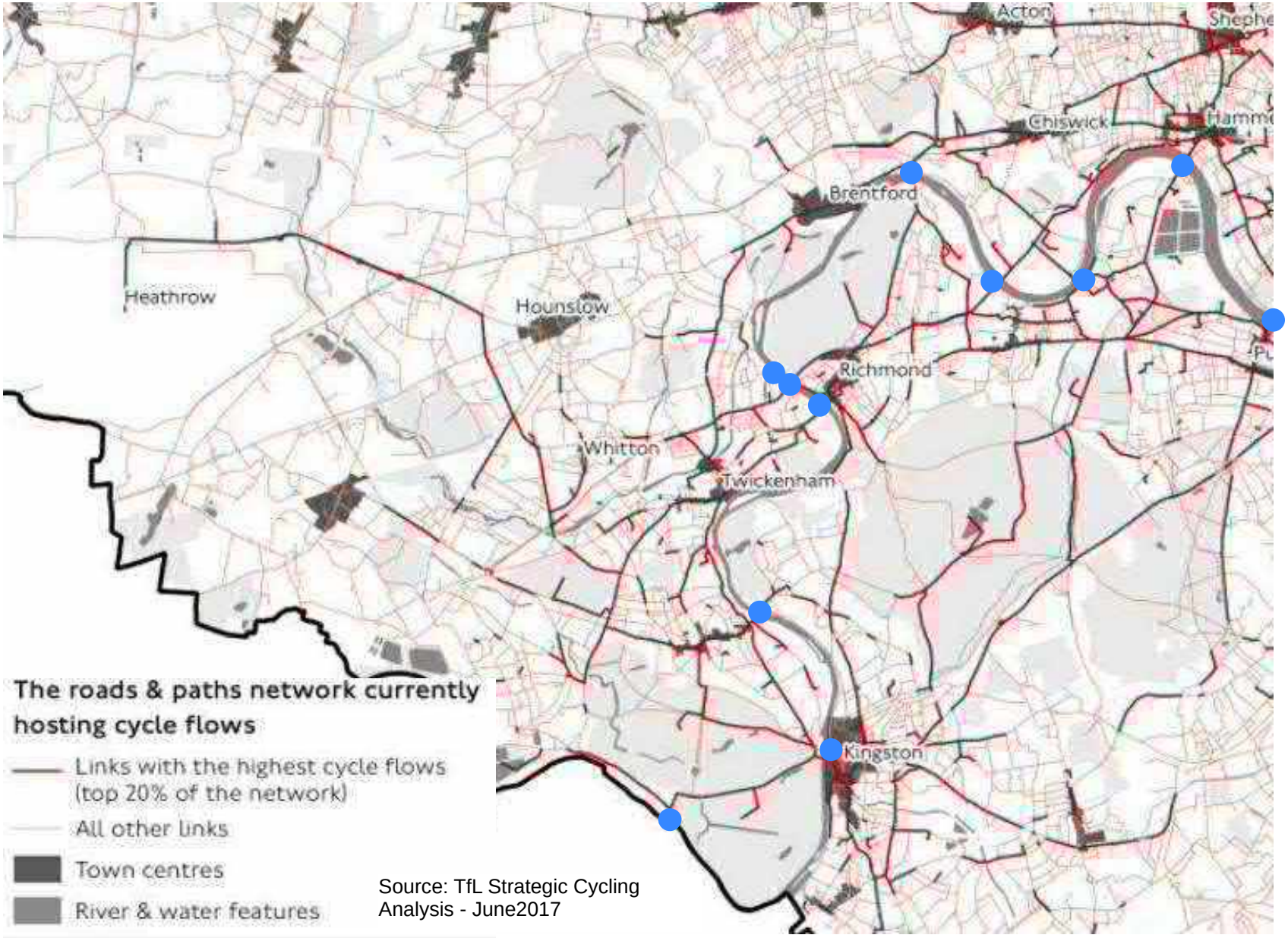
Source: Propensity to Cycle Tool (PCT)

CURRENT DEMAND – CYCLING: PCT TOOL



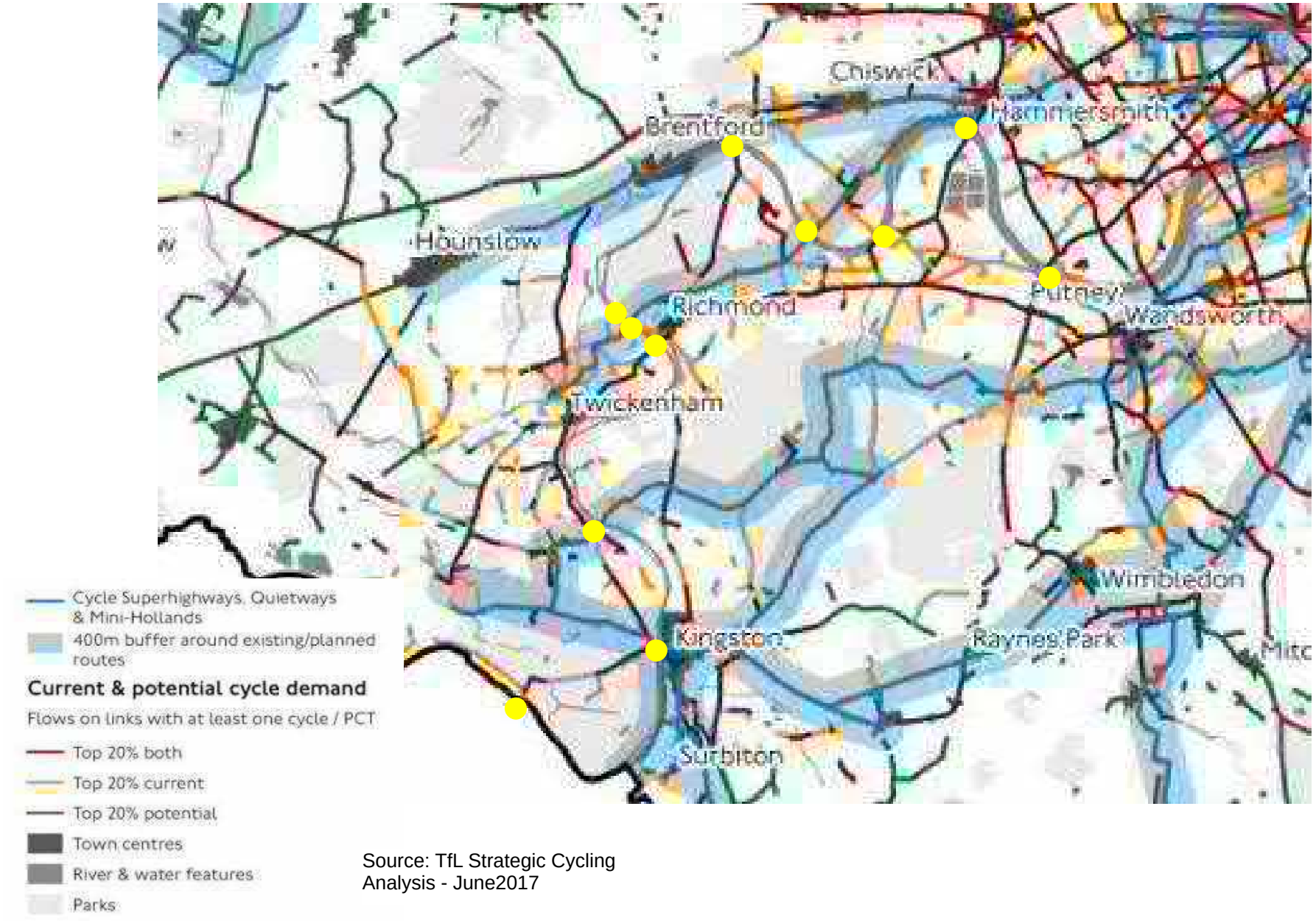
Source: Propensity to Cycle Tool (PCT)

CURRENT DEMAND – STRATEGIC CYCLING ANALYSIS



Source: TfL Strategic Cycling Analysis - June2017

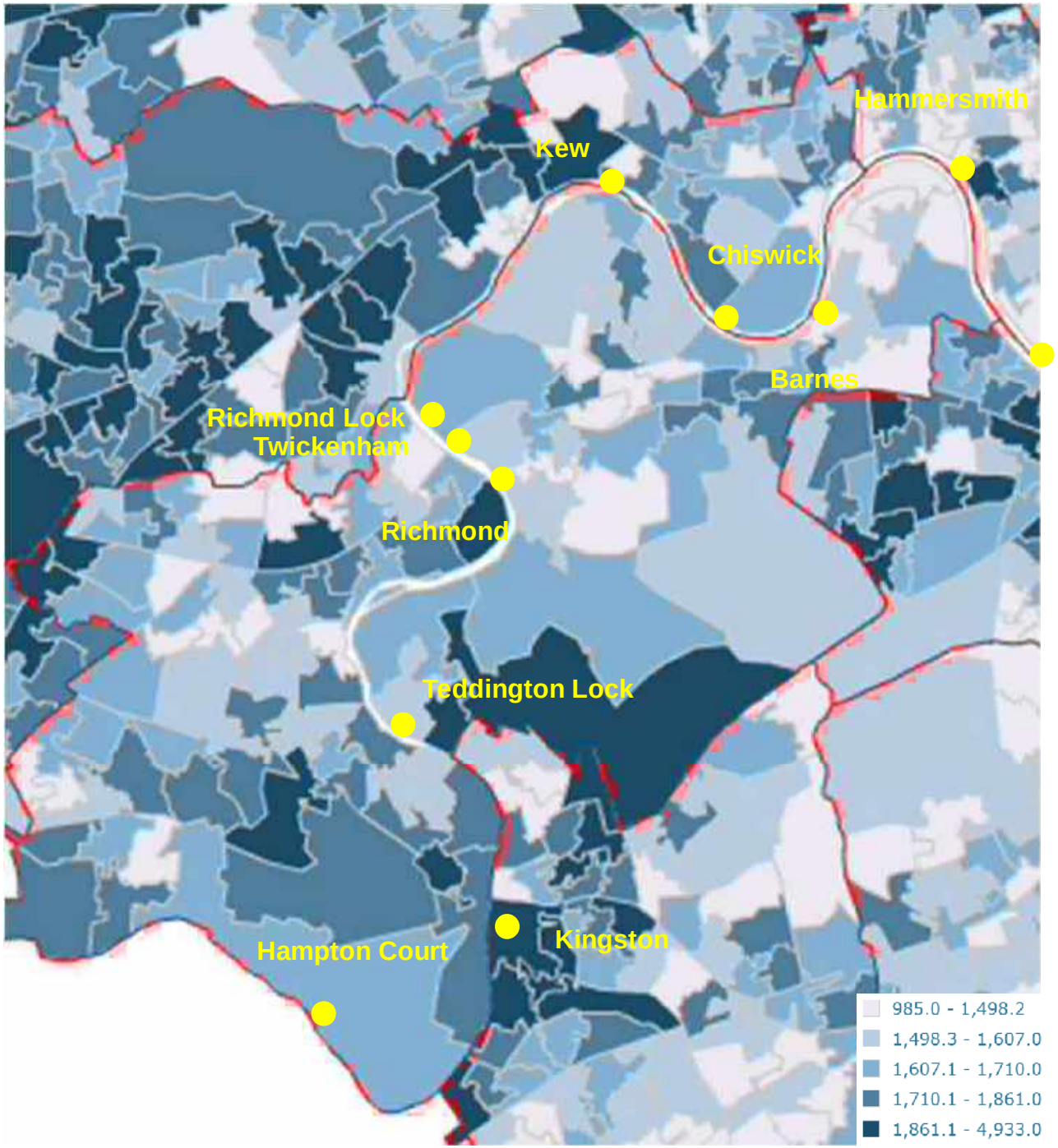
FUTURE DEMAND – STRATEGIC CYCLING ANALYSIS



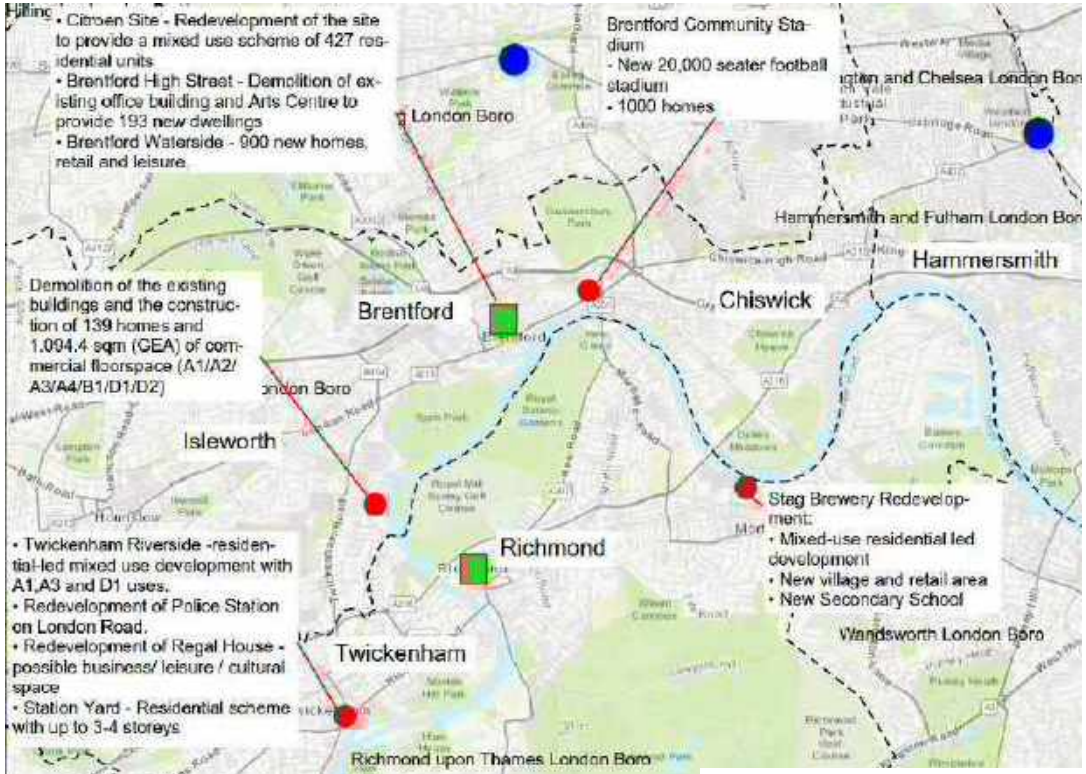
Source: TfL Strategic Cycling Analysis - June2017

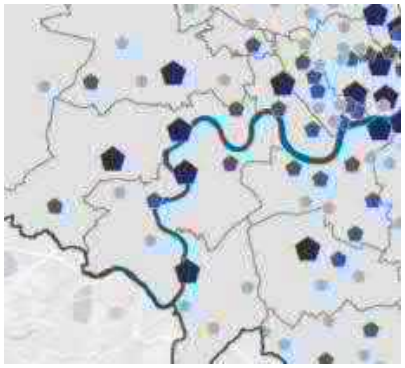
CURRENT DEMAND - POPULATION

Population
LSOAs -
Census 2011



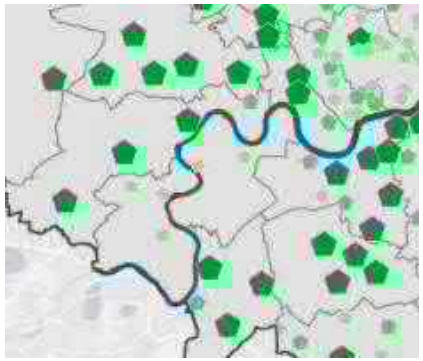
FUTURE DEMAND: DEVELOPMENT & GROWTH





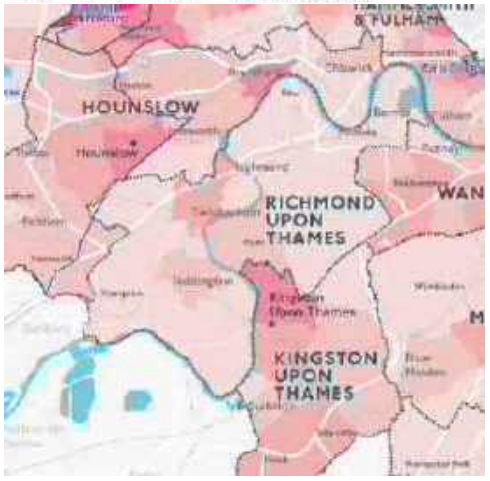
Town Centre Network
Commercial Growth Potential

- High
- Medium
- Low



Town Centre Network
Residential Growth Potential

- High
- Medium
- Incremental

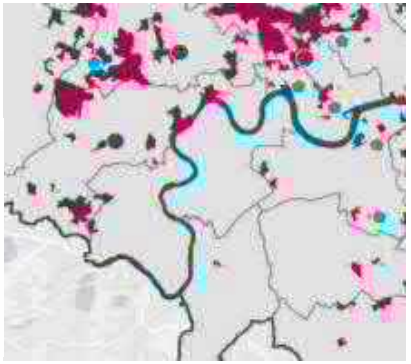


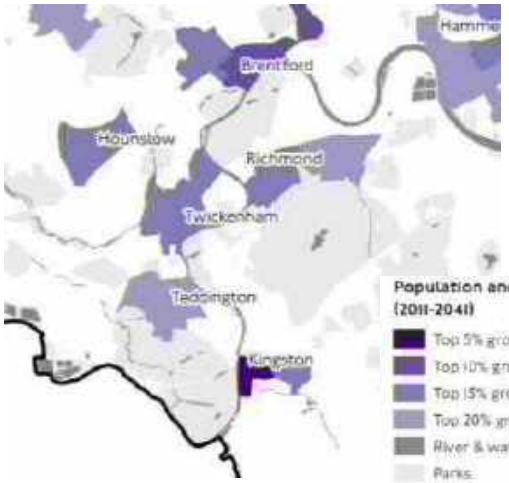
Strategic Areas for Regeneration

- Strategic areas for regeneration

Town Centres in Strategic Areas for Regeneration

- Metropolitan
- Major
- District





Local attractors 1

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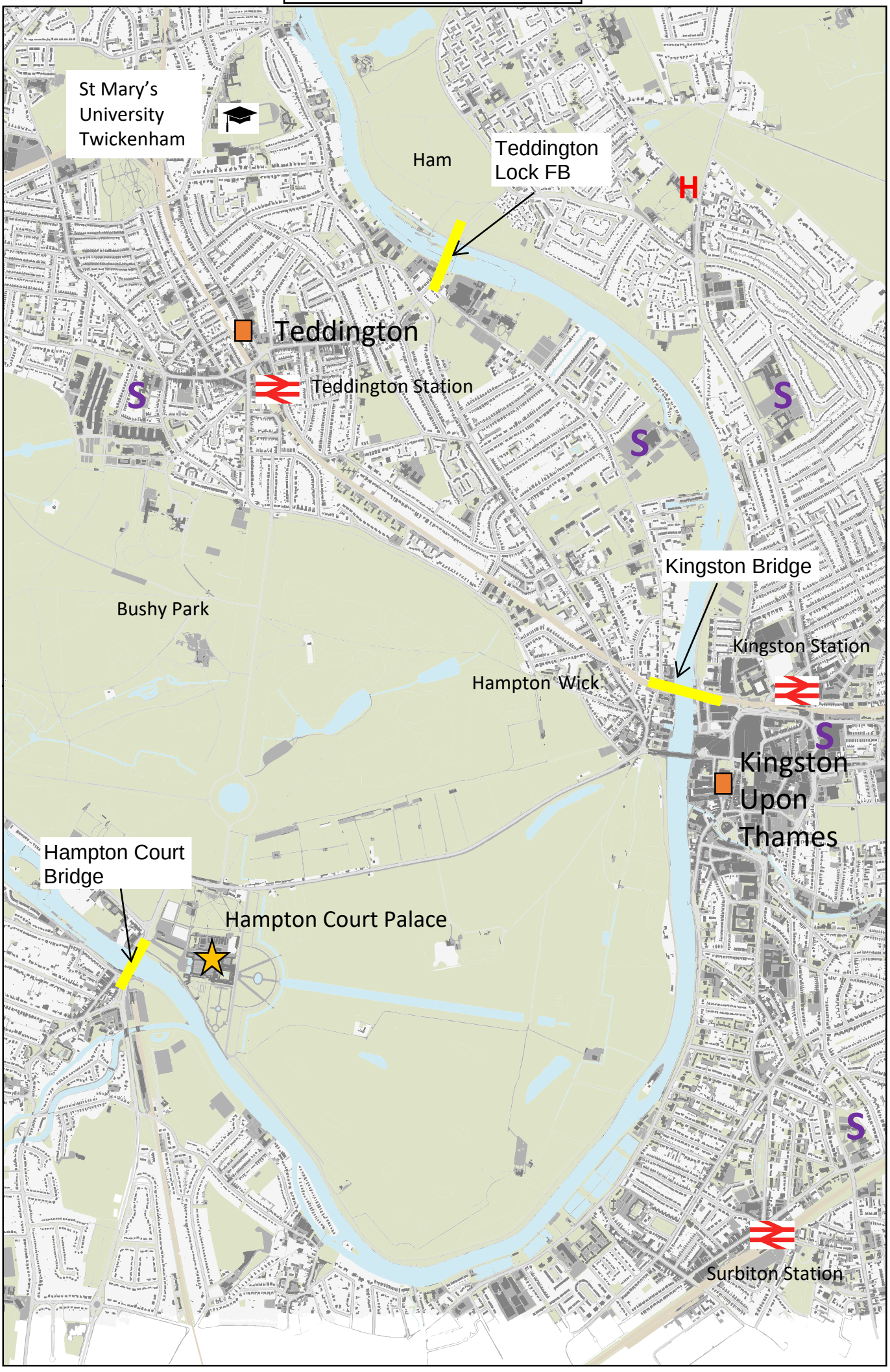
Drawn By:



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Local attractors 2

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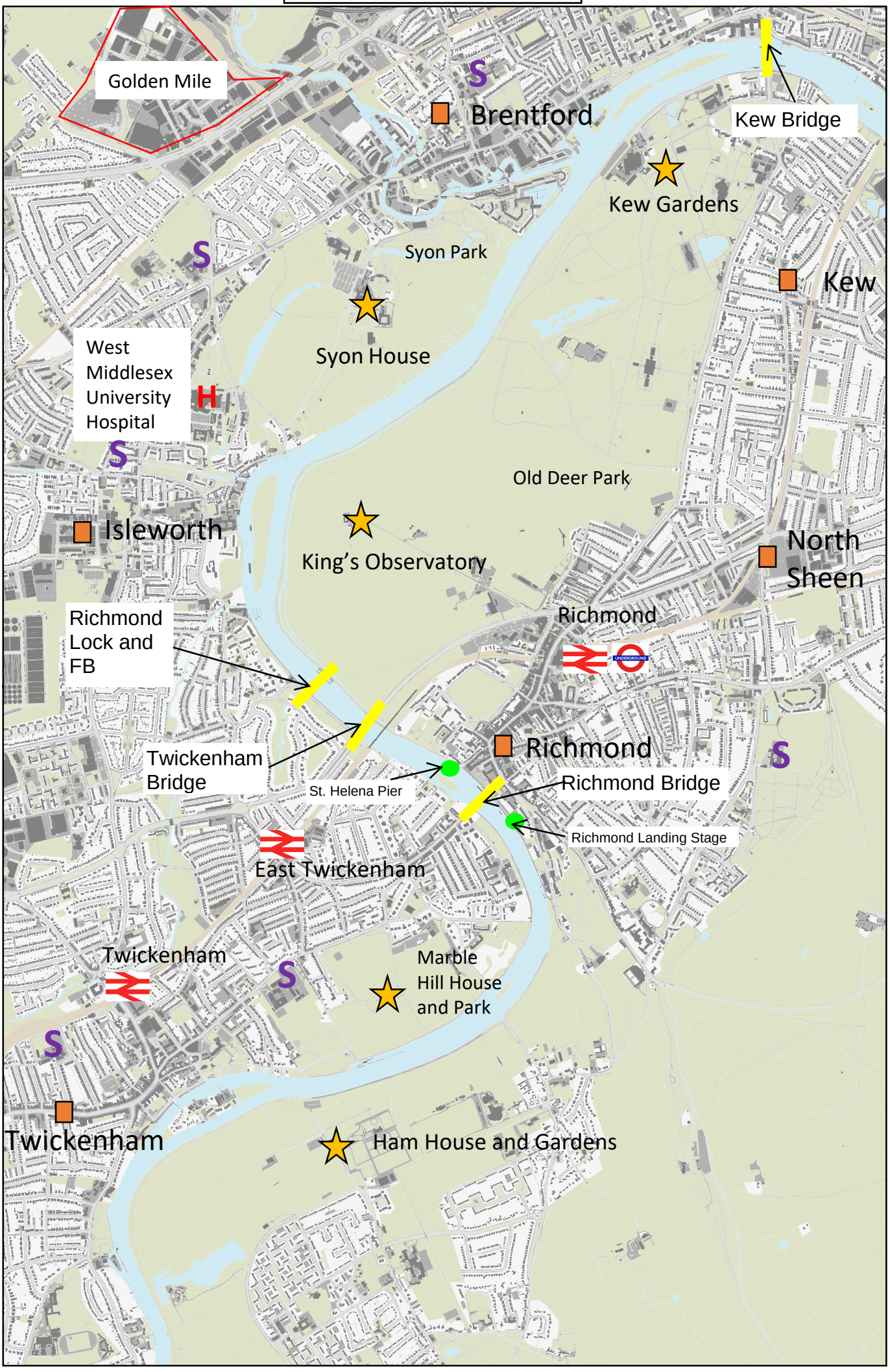

Local attractors 3

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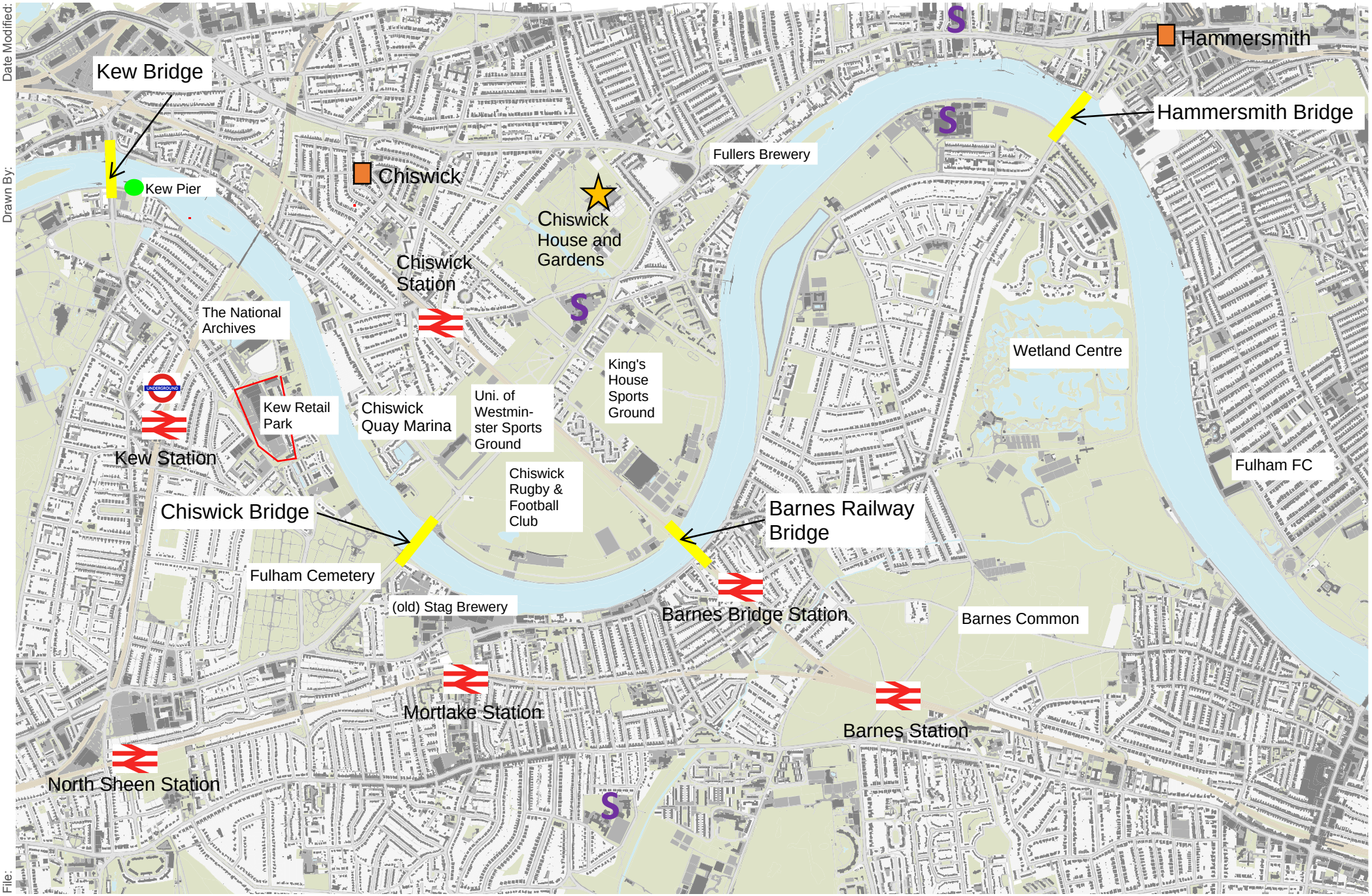


RICHMOND UPON THAMES CYCLE NETWORK MAP

RICHMOND TOWN CENTRE

RICHMOND TOWN CENTRE

within the Borough of Richmond | BOROUGH BOUNDARY | outside the Borough of Richmond

- Main road cycle routes — Routes signed for use by cyclists on a mixture of quiet and busier roads
- Off-road and quiet cycle routes suitable for family groups
- Off-road cycle paths through green spaces — Off-road paths through green spaces
- National Cycle Network Route 4 — National Cycle Network Route 4
- No crossing facility
- Car club bays
- National Rail lines — National Rail lines
- London Overground — London Overground
- District Line — District Line
- Circle Line
- Hammersmith & City line
- Piccadilly Line

0 1/4 1/2 1 Mile
0 1/2 1 Kilometre
Based on Ordnance Survey Street View
Drawn by PWT 25.13 www.rwt.org.uk

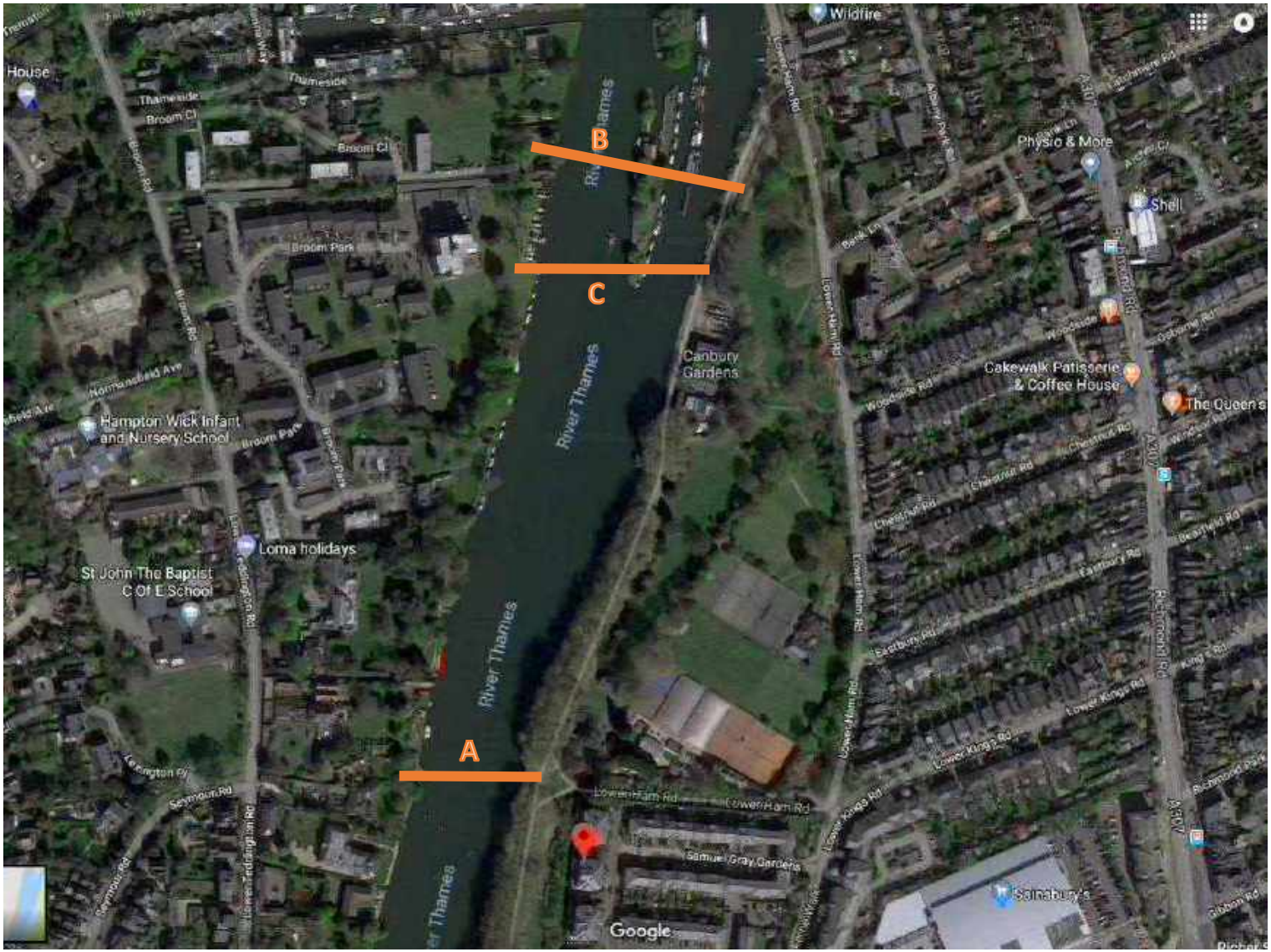
Appendix B

STAGE 2 SPECIFIC SITE ASSESSMENTS

Site location No. 10 - Option C:		
Connecting boroughs	Richmond to Kingston	
Location/ grid ref. Nearest post code	TQ1778970263 TW11 9RT	
Alternative crossing facilities	• 950m north of Kingston Bridge: • Kingston Bridge: 5 span bridge – longest span 18.29m. Height 7.29m. Total length 116m. Width = 24m. • Access: steps from Thames Path or by road • Kingston Bridge: shared-use cycle lanes and footways	
Marine Navigation	• Passing over central island and near to rowing club. • Width of navigation channel spans: 60m & 30m. • Height of navigation channel to be maintained – 7.3m (Similar to Kingston Bridge). • Number of navigation channels to be maintained through structure: 3 channels, 1 No. of pier constructed within centre island, and one at the centre of the longer span. • In-river pier will provide navigation risk and requiring costly impact fenders / protection. • Navigation requirements does not require an opening span.	
Bridge structure considerations	• Length of structure:110m (70+40m) • Structure type: 2 span bridge. • Ramp: long ramps are necessary as the bridge camber can only accommodate up to 1.0-1.5m of navigation height.	
Environment	• No issues with protected vista. • Canbury Gardens is a public space which is maintained by RB Kingston.	
Impact on existing business or private properties	• There will be some impact on adjacent rowing club & riverside moorings. • Few benefits for local shops as few in number as the bridge is between residential areas. • Positive impact on Canbury Gardens café, nearby pub. • Minimal potential for added value development or retail.	
Connectivity	• Access to Lower Teddington Road via Broom Park – a private residential development. Relatively direct route through to Bushy Park/Hampton Court Park Improving the existing cycle route between Bushy Park/Hampton Court Park and Richmond Park by avoiding passing through Kingston town centre	
Adjacent developments or public interests connecting via bridge	<u>At west side of Thames (LB Richmond):</u> • Hampton Wick Station, • St John the Baptist Church of England Junior School and infant and nursery school,	

	• Langdon Park facilities <u>At east side of Thames (RB Kingston):</u> • Kingston Station • North of Kingston residential area • Canbury Gardens facilities including Tennis Centre • Sainsbury superstore	
Key Positives	• Good connectivity through to major attractions of Richmond Park and Hampton Court/ Bushy Park • Additional connection between Hampton Wick and Kingston Stations (both stations are part of Crossrail 2) • Addition connection route between St John the Baptist junior school and north Kensington residential area • Improved access for Richmond side to Sainsbury superstore and tennis club. • Creating a safer cycle route between Bushy /Hampton Court Park and Richmond Park by avoiding passing through Kingston town centre. Relatively direct connection through to Bushy /Hampton Court Park. • Relatively far away from existing bridges • Large expanse of green space (private) on west side for bridge ramp • Canbury Gardens is a public space which is maintained by RB Kingston	
Key Negatives	• Minimal potential for added value development or retail • Access to Lower Teddington Road via Broom Park – a private residential development. • Pier provides navigation risk and requiring costly impact fenders / protection. • There will be some impact on adjacent rowing club & riverside moorings.	
RECOMMENDATION: **TAKE FORWARD AS PART OF STAGE TWO DETAILED ASSESSMENT** Recommendation made largely based on the key positives identified above.		
Key to Positives/ Negatives: Minor positive Major positive Minor negative Major negative		

Proposed bridge location map:

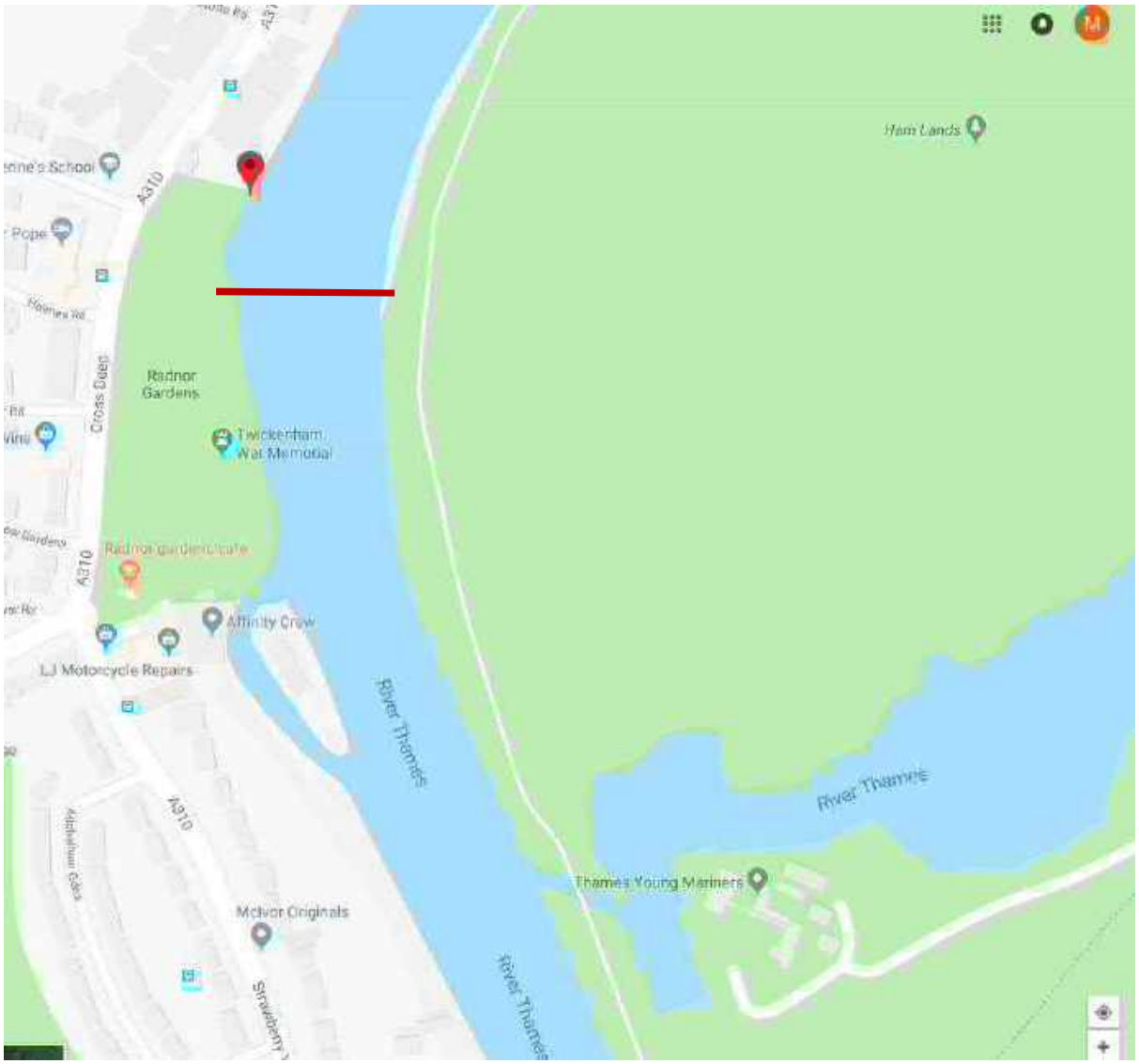


Site location No. 13		
Connecting boroughs	Richmond to Richmond	
Location/ grid ref. Nearest post code	TQ1603972663 TW1 4RB	
Alternative crossing facilities	• Proposed location, 1800m north of Teddington Lock Footbridge. • Teddington Lock Footbridge: Consists of two separate bridges across the Thames situated just upstream of Teddington Lock. There is a small island between the bridges. • The western bridge consists of a suspension bridge crossing the weir stream and linking the island to Teddington. The eastern bridge is an iron girder bridge crossing the lock cut and linking the island to Ham on the bank (height 5.6m). • Steps and ramped access on both side of bridge.	
Marine Navigation	• Width of navigation channel: 70m • Height of navigation channel to be maintained – 5.6m (Similar to Teddington Bridge east span). • Number of navigation channels to be maintained through structure: 3 channels with 2 No. in-river piers. • Piers form navigation risk and requiring costly impact fenders / protection. • Navigation requirements does not require an opening span.	
Bridge structure considerations	• Length of structure required:90m • Structure type: Cable stay bridge with no piers or 3 span bridge. • Ramp: long rams are necessary as the bridge camber can only accommodate up to 1.5m of navigation height.	
Environment	• Twickenham War Memorial Grade 2 listed structure in Radnor Garden located close to the proposed bridge west ramp. • Context sensitive treatment required for the east ramp and approx. 570m connection through Ham Lands to Riverside Drive. Ham Lands is a Local Nature Reserve and Site of Metropolitan Importance for Nature Conservation. • No issues with protected vista or landmarks.	
Impact on existing business or private properties	• No compulsory purchase anticipated as the bridge connects Radnor Gardens at west embankment to Ham Lands at east side. • No direct benefits for local shops as few in number/some distance away as the bridge is between the green spaces. • Positive impact on Radnor Gardens café. • Some potential for added value retail on west side.	
Connectivity	• Connects the eastside residential area to Strawberry Hill Station and Twickenham Town Centre. • Connects westside to Ham Lands and Richmond Park to the east, and can tie in to proposed Ham Quietway.	

	• New link required across Ham Lands to tie into road network on Riverside Drive.	
Adjacent developments or public interests connecting via bridge	<u>At west side of Thames (Richmond Borough):</u> • Strawberry Hill Station, • St Mary's University (existing + new development), • Teddington Football Academy • Newland House Public School • St Catherine's Independent School • Strawberry Hill residential area (south of Twickenham) • Twickenham town centre <u>At east side of Thames (Richmond Borough):</u> • Ham Lands and nature reserve • Ham common residential area • Ham House • Thames Young Mariners Club • St Richard's C of E Primary School • Meadlands Primary School • Grey Court School	
Key Positives	• Good connectivity through to major attractions of Richmond Park and from east to rail station and town centre to west • Both side of bridge are in Richmond. Radnor Gardens and Ham Lands are public land. • Relatively far away from existing bridges • Large expanse of green space (public) on west and east side for bridge ramp • Some potential for added value retail on west side	
Key Negatives	• Twickenham War Memorial Grade 2 listed structure in Radnor Garden located close to the proposed bridge west ramp. • Context sensitive treatment required for the east ramp and approx. 570m connection through Ham Lands to Riverside Drive. Ham Lands is a Local Nature Reserve and Site of Metropolitan Importance for Nature Conservation. • New link required across Ham Lands to tie into road network on Riverside Drive.	
RECOMMENDATION: **TAKE FORWARD AS PART OF STAGE TWO DETAILED ASSESSMENT** Recommendation made largely based on the key positives identified above.		
Key to Positives/ Negatives: Minor positive Major positive Minor negative		

Major negative

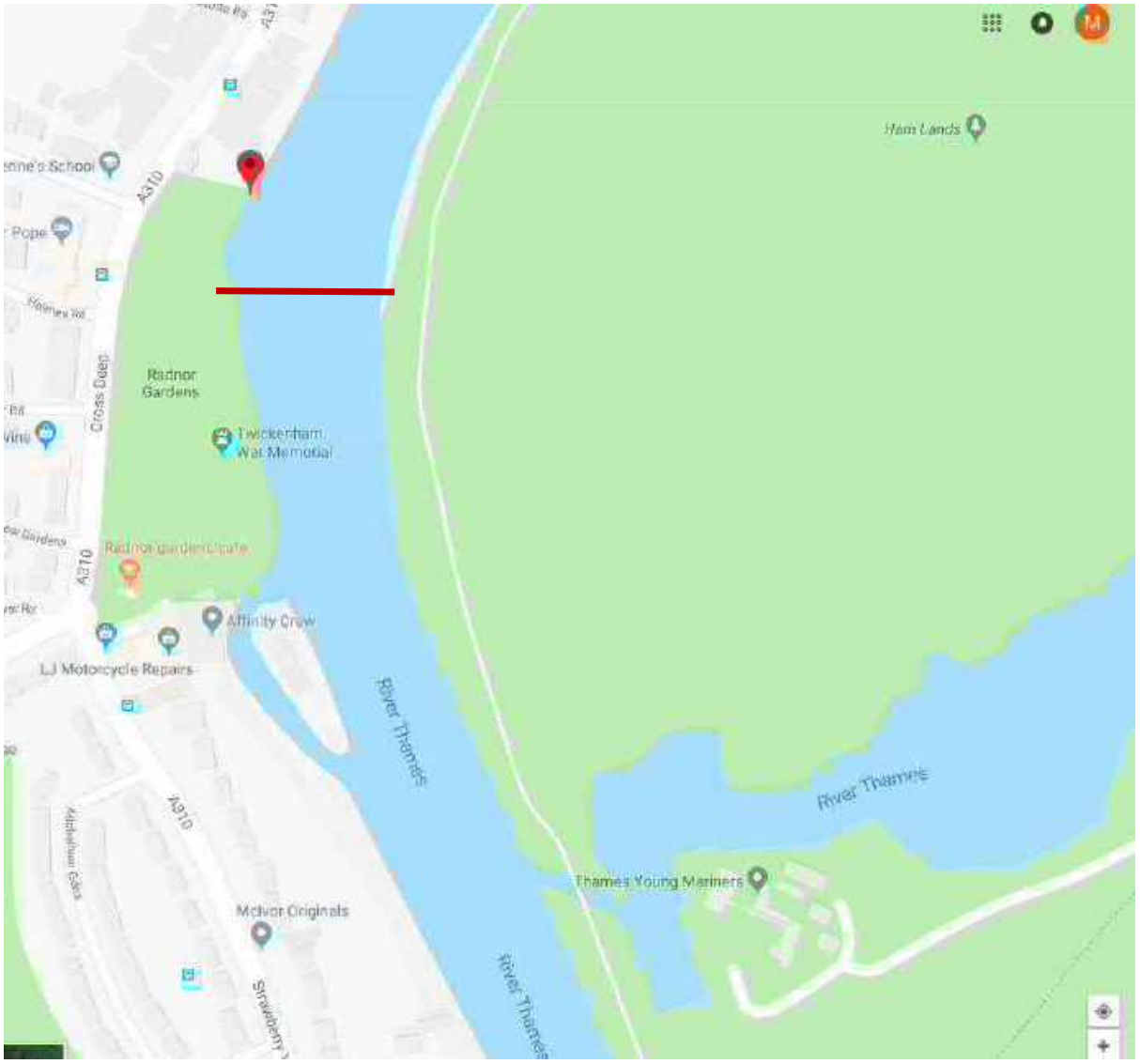
Proposed bridge location map:



Site location No. 15		
Connecting boroughs	Richmond to Richmond	
Location/ grid ref. Nearest post code	TQ1693773243 TW1 3DJ	
Alternative crossing facilities	• Proposed location, 2000m south of Richmond Bridge and 2500m north of Teddington Lock Footbridge. • Richmond Bridge: is a 91m stone arch bridge which can be accessed via steps from Thames Path or by road. • Teddington Lock Footbridge: Consists of two separate bridges across the Thames. The western bridge consists of a suspension bridge crossing the weir stream and linking the island to Teddington. The eastern bridge is an iron girder bridge crossing the lock cut and linking the island to Ham on the bank (height 5.6m). Stepped and ramped access on both side of bridge.	
Marine Navigation	• Width of navigation channel: 75m • Height of navigation channel to be maintained – 5.6m (similar to Teddington Bridge east span). • Number of navigation channels to be maintained through structure: 3 channels with 2 No. in-river piers. • Piers form navigation risk and requiring costly impact fenders / protection. • Navigation requirements does not require an opening span	
Bridge structure considerations	• Length of structure required: 90m • Structure type: Cable stay 3 span bridge. • Ramp: long rams are necessary as the bridge camber can only accommodate up to 1.5m of navigation height.	
Environment	• Eel Pie Island, home to a local nature reserve, lies to the west of the proposed bridge. • East and West Area are prone to flooding and longer ramps may be required to avoid these areas. • No issues with protected vista or landmarks.	
Impact on existing business or private properties	• No compulsory purchase anticipated for the either landing as Ham Street Car Park, is council owned land and so is Orleans Gardens. • No direct benefits for local shops as few in number/some distance away as the bridge is between the green spaces. • Positive impact on Ham House and Gardens and Orlean Gardens. • Some potential for added value retail on east side.	
Connectivity	• Connects the eastside residential area to Twickenham Station and Twickenham Town Centre.	

	• Connects westside to Ham and Ham nature reserve. • Proposed bridge ties into existing links, Ham St to the east and Riverside to the west.	
Adjacent developments or public interests connecting via bridge	<u>At west side of Thames (Richmond Borough):</u> • Orleans Park School • Orleans Gardens • Twickenham Stadium • Twickenham residential area • Twickenham town centre <u>At east side of Thames (Richmond Borough):</u> • Ham Lands and nature reserve • Ham common residential area • Ham House and Garden • Ham Polo Club • Ham & Petersham Rifle and Pistol Club • St Richard's C of E Primary School	
Key Positives	• Good connectivity through to major attractions of Twickenham Stadium and Ham House and Gardens • Both side of bridge are in Richmond. Ham Street car park is public land. • Relatively far away from existing bridges • Large expanse of green space on west and east side for bridge ramp • Some potential for added value development or retail on east side	
Key Negatives	• East and West Area are prone to flooding and longer ramps may be required to avoid these areas.	
RECOMMENDATION: **TAKE FORWARD AS PART OF STAGE TWO DETAILED ASSESSMENT** Recommendation made largely based on the key positives identified above.		
Key to Positives/ Negatives: Minor positive Major positive Minor negative Major negative		

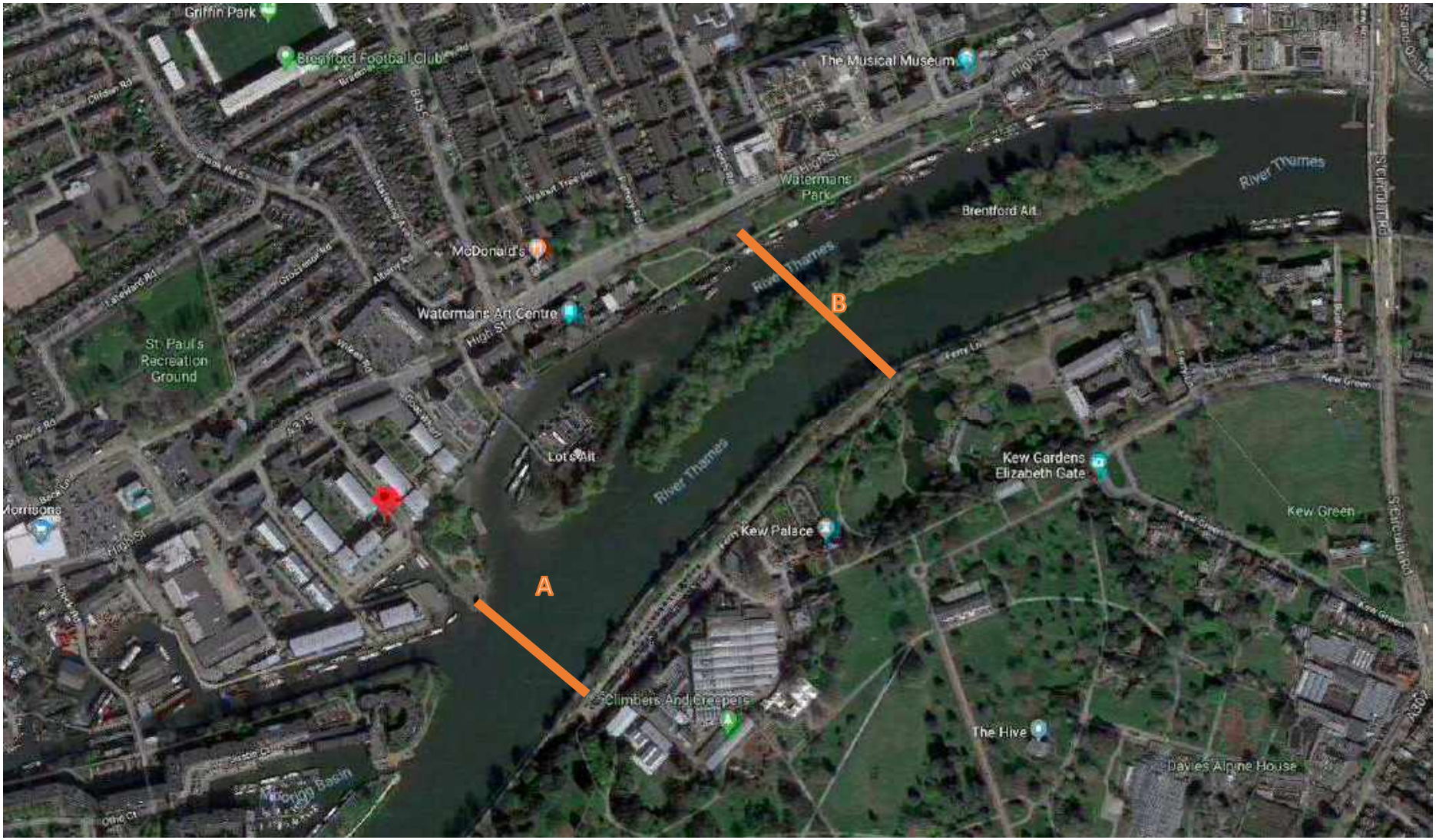
Proposed bridge location map:



Site location No. 21 - Option A:		
Connecting boroughs	Richmond to Hounslow	
Location/ grid ref. Nearest post code	• TQ1812977462 • **TW8** 0AW • Connecting Ferry Wharf on the north side to Thames Path/car park at south side close to the north side of Kew Gardens.	
Alternative crossing facilities	• 700m west of Kew Bridge: • Kew Bridge: 3 span arch bridge – longest span 41.0m. Height 5.5m above Mean High Water Spring (MHWS). • Kew Bridge: shared use footway/cycle lanes and steps from Thames Path or access by road	
Marine Navigation	• Width of navigation channel: 100m • Height of navigation vertical clearance to be maintained – Height 5.5m above MHWS (Similar to Kew Bridge). • Number of navigation channels to be maintained through structure: 1 channels and no pier due to location of River Brent and Brentford Marina.- TBC at subsequent stage of feasibility work. Assume two piers for consistency of costs. • Navigation requirements does not require an opening span.	
Bridge structure considerations	• Length of structure:125m • Structure type: Cable state bridge. • Ramp: long rams are necessary to provide navigation vertical clearance as the bridge camber can only accommodate up to 1.5m of navigation height.	
Environment	• There is a Grade 2 listed building located 40-50m north of the structure. It will not be affected by the proposed bridge ramp. • No issues with protected vista or landmarks. • Context sensitive design required due to proximity to Kew Gardens. • Southside landing site – potential constraints as car park and grass verge are private land (Kew Gardens). Potential for cycle boardwalk	
Impact on existing business or private properties	• Likely compulsory purchase of private land anticipated on north side. • Disused public space to be used for the north ramp. • Local shops, restaurants, art centre and Brentford Town Centre are positively affected, as is Kew Gardens to the east.	
Connectivity	• Connects southside residential areas to Brentford town centre and Golden Mile businesses to the north. • Connects to proposed Cycle Superhighway 9 which will run along Kew Bridge Road. Can avoid Kew Bridge.Links to Syon Park • Connects southside to Brentford town centre • Connects northside to Kew Gardens	

	• Connections through Ferry Lane required (private road) to access public network (Kew Green)	
Adjacent developments or public interests connecting via bridge	**At north side of Thames (Hounslow Boro.):** • Brentford Station • Brent ford residential area • Watermans Art Centre • Syon Park • Saint Paul's Recreation Ground • Golden Mile businesses • Various new development and growth areas **At south side of Thames (Kingston Boro):** • Kew Gardens • Kew Garden Station • Bessant Drive retail park • Kew residential area • The National Archives	
Key Positives	• Local shops, restaurants, art centre and Brentford Town Centre are positively affected, as is Kew Gardens to the east. • Some potential for added value retail on north side. • Disused public space to be used for the north ramp. • Connects southside residential areas to Brentford town centre and Golden Mile businesses to the north. • Connects to proposed Cycle Superhighway 9 which will run along Kew Bridge Road. Can avoid Kew Bridge.Links to Syon Park • Connects southside to Brentford town centre • Connects northside to Kew Gardens	
Key Negatives	• Southside landing site – potential constraints as car park and grass verge are private land (Kew Gardens). • Connections through Ferry Lane required (private road) to access public network (Kew Green) • Likely compulsory purchase for land on north site	
RECOMMENDATION: **TAKE FORWARD AS PART OF STAGE TWO DETAILED ASSESSMENT** Recommendation made largely based on the key positives identified above.		
Key to Positives/ Negatives: Minor positive Major positive Minor negative Major negative		

Proposed bridge location map:

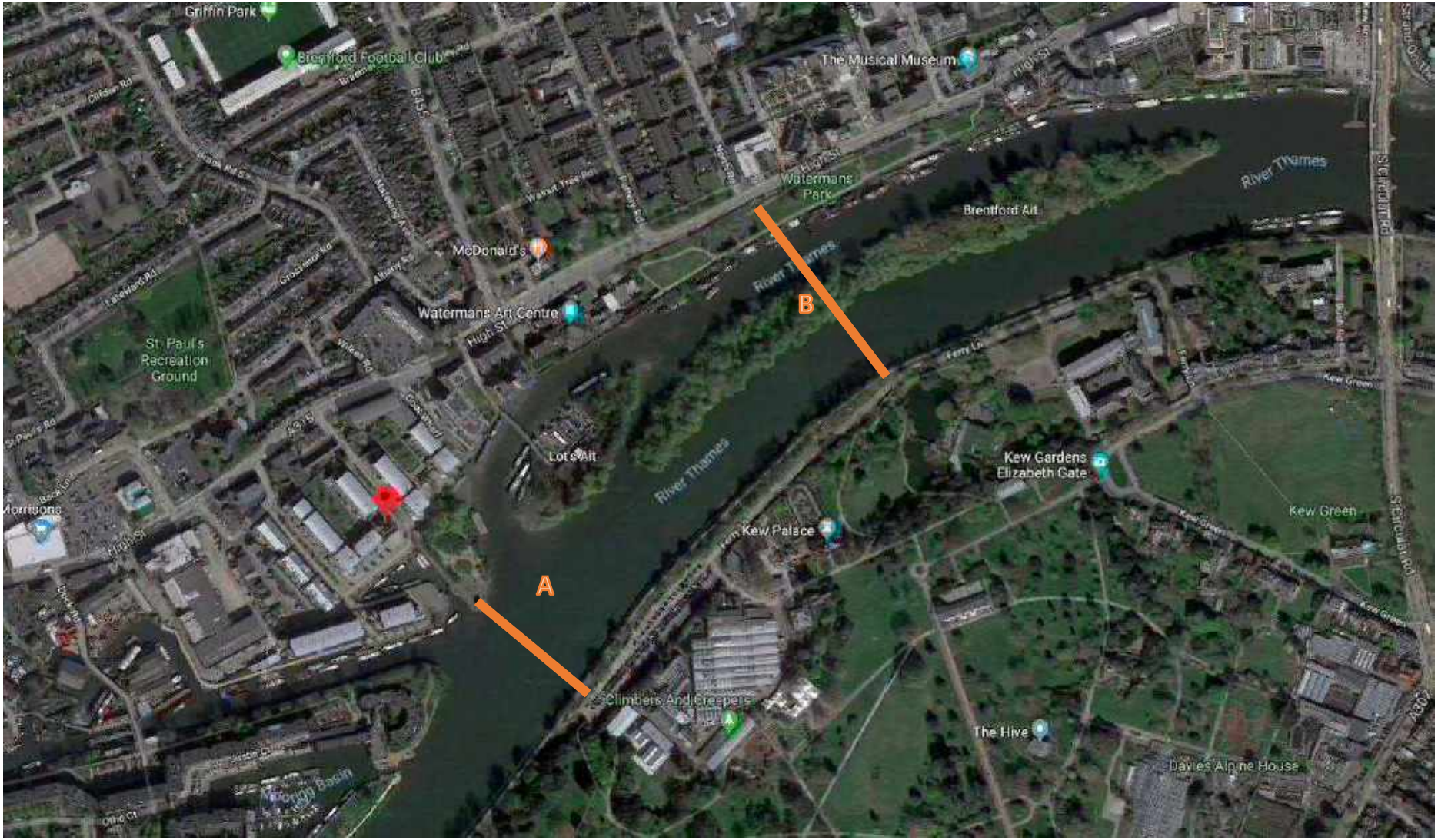


Site location No. 21 - Option B:		
Connecting boroughs	Richmond to Hounslow	
Location/ grid ref. Nearest post code	• TQ1833177732 • TW8 0DS • Connecting Watermans Park on the north side to the Thames Path to south side adjacent to Kew Garden via centre island (Liu Ke Park).	
Alternative crossing facilities	• 500m west of Kew Bridge: • Kew Bridge: 3 span arch bridge – longest span 41.0m. Height 5.2m above Mean High Water Spring (MHWS). • Kew Bridge: shared use footway/cycle lanes and steps from Thames Path or access by road	
Marine Navigation	• Width of navigation channel: 40m & 60m • Height of navigation vertical clearance to be maintained – Height 5.2m above MHWS (Similar to Kew Bridge). • Number of navigation channels to be maintained through structure: 2 channels with 1 No. pier within centre island. The existing navigation channels will not be affected. • As the proposed pier is not located in the Thames, navigation risks and costly impact fenders are eliminated. • Difficult to achieve required navigation vertical clearance due to ramp length. However there are adequate space for the ramps at both side of the structure. • Navigation requirements does not require an opening span.	
Bridge structure considerations	• Length of structure:2 No. 90 spans =180m overall length • Structure type: Cable stay bridge • Ramp: long rams are necessary as the bridge camber can only accommodate up to 1.5m of navigation height.	
Environment	• There is a Grade 2 listed building located 100m north east of proposed north ramp. It will not be effected by the bridge ramp. • No issues with protected vista or landmarks. • Context sensitive design required due to proximity to Kew Gardens. • Southside landing site – potential constraints as grass verge is private land (Kew Gardens). Potential for cycle boardwalk	
Impact on existing business or private properties	• No compulsory purchase of private land anticipated. • Local shops, restaurants, art centre and Brentford Town Centre are positively affected, as is Kew Gardens to the east. • Some potential for added value retail on north side.	
Connectivity	• Connects southside residential areas to Brentford town centre and Golden Mile businesses to the north. • Connects to proposed Cycle Superhighway 9 which will run along Kew Bridge Road. Can avoid Kew Bridge. Links to Syon Park	

	• Connects southside to Brentford town centre • Connects northside to Kew Gardens. • Connections through Ferry Lane required (private road) to access public network (Kew Green)	
Adjacent developments or public interests connecting via bridge	**At north side of Thames (Hounslow Boro.):** • Brentford Station • Brent ford residential area • Watermans Art Centre • Syon Park • Saint Paul's Recreation Ground • Golden Mile businesses • Various new development and growth areas **At south side of Thames (Kingston Boro):** • Kew Gardens • Kew Garden Station • Bessant Drive retail park • Kew residential area • The National Archives	
Key Positives	• Local shops, restaurants, art centre and Brentford Town Centre are positively affected, as is Kew Gardens to the east. • Some potential for added value retail on north side. • Connects southside residential areas to Brentford town centre and Golden Mile businesses to the north. • Landing area to north side is on public land. • Wide verge on southside for landing area (compared to 21A), • Connects to proposed Cycle Superhighway 9 which will run along Kew Bridge Road. Can avoid Kew Bridge.Links to Syon Park • Connects southside to Brentford town centre • Connects northside to Kew Gardens	
Key Negatives	• Moorings on north side of river • Ownership and protection status of island are unknowns at this stage • Southside landing site – potential constraints as grass verge is private land (Kew Gardens). Large mature trees on verge. • Connections through Ferry Lane required (private road) to access public network (Kew Green)	
RECOMMENDATION: **TAKE FORWARD AS PART OF STAGE TWO DETAILED ASSESSMENT** Recommendation made largely based on the key positives identified above.		
Key to Positives/ Negatives: Minor positive		

Major positive Minor negative Major negative	

Proposed bridge location map:



Site location No. 10 - Option A:	
Connecting boroughs	Richmond to Kingston
Location/ grid ref. Nearest post code	TQ1781769968 KT2 5UZ
Alternative crossing facilities	650m north of Kingston Bridge Kingston Bridge: 5 span bridge – longest span 18.29m. Height 7.29m. Total length 116m. Width = 24m. Access: steps from Thames Path or by road Shared-use cycle lanes and footways.
Marine Navigation	Width of navigation channel: 65m Height of navigation channel to be maintained – 7.3m (Similar to Kingston Bridge). Number of navigation channels to be maintained through structure: 3 channels for 2 No. piers. Piers will act as navigation risk and require costly impact fenders. Difficult to achieve required navigation clearance due to ramp length. Navigation requirements does not require an opening span.
Bridge structure considerations	Length of structure:75-80m Structure type: Cable stay bridge Ramp: long rams are necessary as the bridge camber can only accommodate up to 1.5m of navigation height.
Environment	There is a listed structure located 40-50m south of structure at west side of river bank which is not effected by proposed bridge. No issues with protected vista or landmarks.
Impact on existing business or private properties	Compulsory purchase of prestige houses required to accommodate ramps and connection to the main road at east side of the bridge. Minimal benefit to local shops as few in number as the bridge is between the residential areas.
Connectivity	No existing link connecting river to Lower Teddington Road – approx. 100m Improving the existing cycle route between Bushy Park/Hampton Court Park and Richmond Park by avoiding passing through Kingston town centre.
Adjacent developments or public interests connecting via bridge	At west side of Thames (LB Richmond): • Hampton Wick Station, • St John the Baptist Church of England Junior School and infant and nursery school, • Langdon Park facilities At east side of Thames (RB Kingston): • Kingston Station • North of Kingston residential area • Canbury Gardens facilities including Tennis Centre • Sainsbury superstore

Key Positives	• Additional connection between Hampton Wick and Kingston Stations (both stations are part of Crossrail 2) • Addition connection route between St John the Baptist junior school and north Kensington residential area • Improved access for Richmond side to Sainsbury superstore and tennis club/courts. • Creating a safer cycle route between Bushy /Hampton Court Park and Richmond Park by avoiding passing through Kingston town centre. • Relatively far away from existing bridges
Key Negatives	• No major route or Public Right of Way connection to west. • Compulsory purchase of prestige houses required to accommodate ramps and connection to the main road at west side of the bridge. • Difficult to achieve required navigation clearance due to ramp length. • Minimal benefits for local businesses from increased demand possibility for development. • Piers provide navigation risk and requiring costly impact fenders

RECOMMENDATION:

DO NOT PROCEED WITH LOCATION – NO FURTHER ASSESSMENT REQUIRED

Recommendation made largely based on the following:

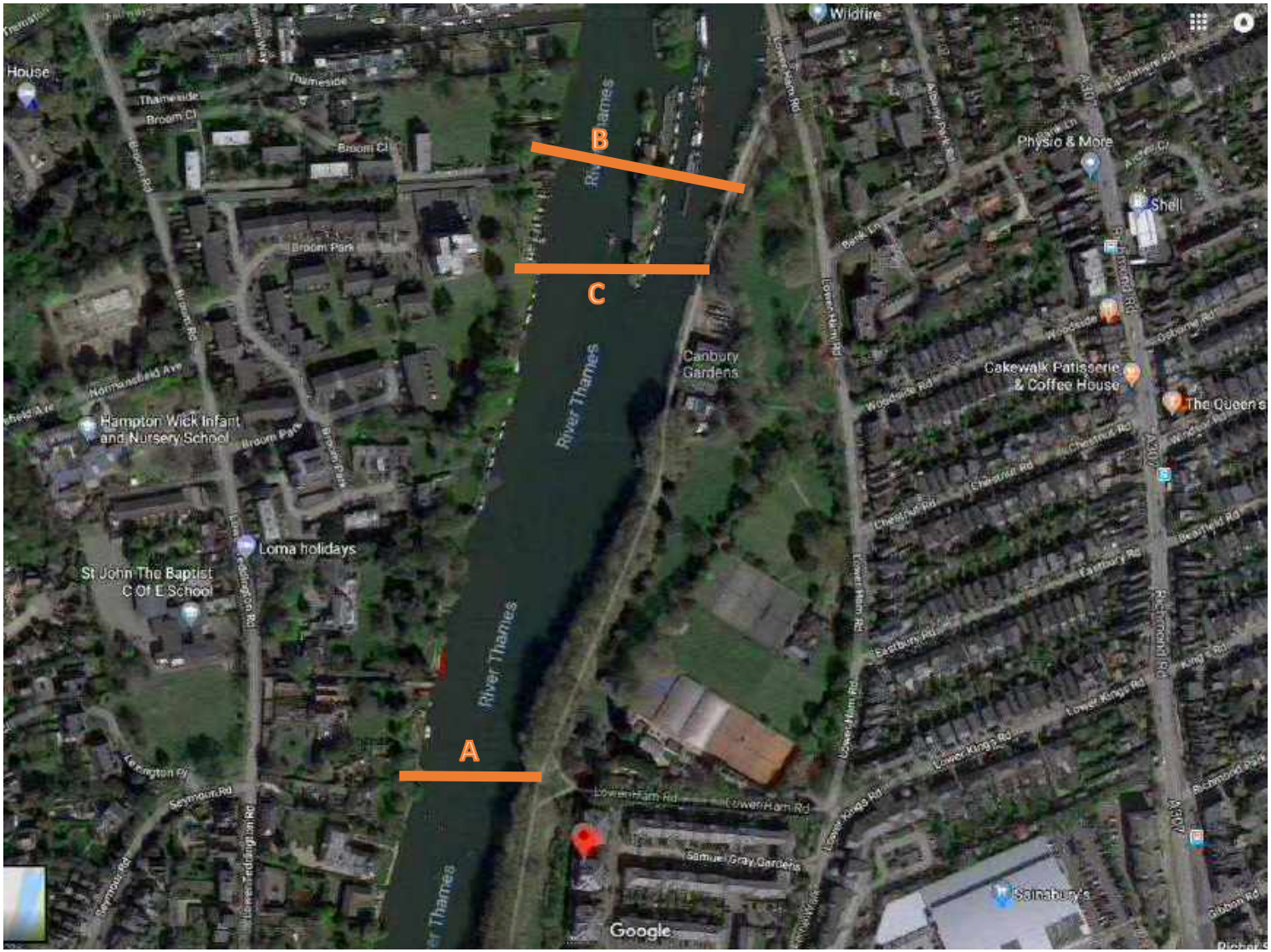
Major negatives:

- Compulsory purchase of prestige houses required to accommodate ramps and connection to the main road at west side of the bridge.
- No major route or Public Right of Way connection to west.

Key to Positives/ Negatives:

- Minor positive
- Major positive
- Minor negative
- Major negative

Proposed bridge location map:

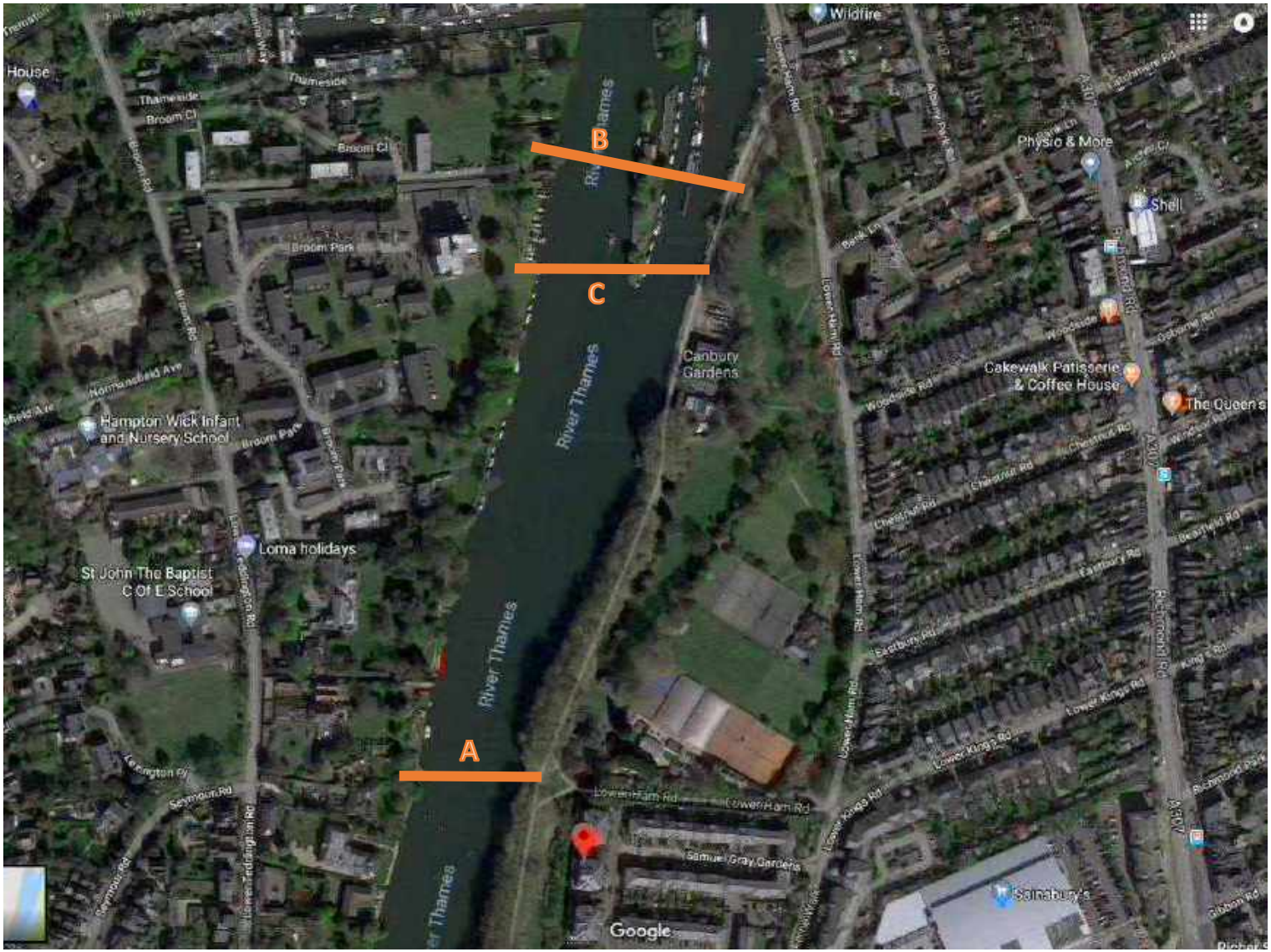


Site location No. 10 - Option B:	
Connecting boroughs	Richmond to Kingston
Location/ grid ref. Nearest post code	TQ1790270260 KT2 5AU
Alternative crossing facilities	1000m north of Kingston Bridge: Kingston Bridge: 5 span bridge – longest span 18.29m. Height 7.29m. Total length 116m. Width = 24m. Access: steps from Thames Path or by road Shared-use cycle lanes and footways.
Marine Navigation	Passing over central island and near to rowing club. Width of each navigation channel crossed: 35m & 45m. Height of navigation channel to be maintained – 7.3m (Similar to Kingston Bridge). Number of navigation channels to be maintained through structure: 2 channels with 1 No. of pier at centre island. . Pier at centre island will not create navigation risk and avoid costly impact fenders / protection. There will be significant impacts on adjacent boathouse (Grade 2 listed structure), nearby rowing clubs, and centre island. Difficult to achieve required navigation vertical clearance due to ramp length if ramps are not located over foreshore / quay areas. Navigation requirements does not require an opening span.
Bridge structure considerations	Overall length of structure:90m Structure type: 2 span bridge. Ramp: long rams are necessary as the bridge camber can only accommodate up to 1.0-1.5m of navigation height.
Environment	The boathouse (Normansfield Boathouse) is a Grade 2 listed structure. No issues with protected vista. Canbury Gardens is a public space which is maintained by RB Kingston.
Impact on existing business or private properties	There will be significant impacts on adjacent boathouse and rowing club and centre island. Also on riverside moorings. Minimal benefit to local shops as few in number as the bridge is between the residential areas.
Connectivity	Broom Close access to boathouse – is a private access road. Alternative link – Thameside (90m set back from river) – also a private access road. Indirect route through to Bushy Park/Hampton Court Park Improving the existing cycle route between Bushy Park/Hampton Court Park and Richmond Park by avoiding passing through Kingston town centre
Adjacent developments or public interests connecting via bridge	<u>At west side of Thames (LB Richmond):</u> • Hampton Wick Station,

	• St John the Baptist Church of England Junior School and infant and nursery school, • Langdon Park facilities <u>At east side of Thames (RB Kingston):</u> • Kingston Station • North of Kingston residential area • Canbury Gardens facilities including Tennis Centre • Sainsbury superstore

Key Positives	• Additional connection between Hampton Wick and Kingston Stations (both stations are part of Crossrail 2) • Addition connection route between St John the Baptist junior school and north Kensington residential area • Improved access for Richmond side to Sainsbury superstore and tennis club. • Creating a safer cycle route between Bushy /Hampton Court Park and Richmond Park by avoiding passing through Kingston town centre. • Relatively far away from existing bridges • Canbury Gardens is a public space which is maintained by RB Kingston.
Key Negatives	• Major impacts on adjacent boathouse (Grade 2 listed structure). • Accommodating necessary long rams next adjacent to boathouse will be challenging. • Low impact on local businesses or little opportunity for facilitating new development. • No Public Right of Way connection to Broom Road and indirect route through to Bushy Park/Hampton Court Park • Difficult to achieve required navigation clearance due to ramp length.
RECOMMENDATION: **DO NOT PROCEED WITH LOCATION – NO FURTHER ASSESSMENT REQUIRED** Recommendation made largely based on the following: Major negatives: • Major impacts on adjacent boathouse (Grade 2 listed structure).	
Key to Positives/ Negatives: • Minor positive • Major positive • Minor negative • Major negative	

Proposed bridge location map:



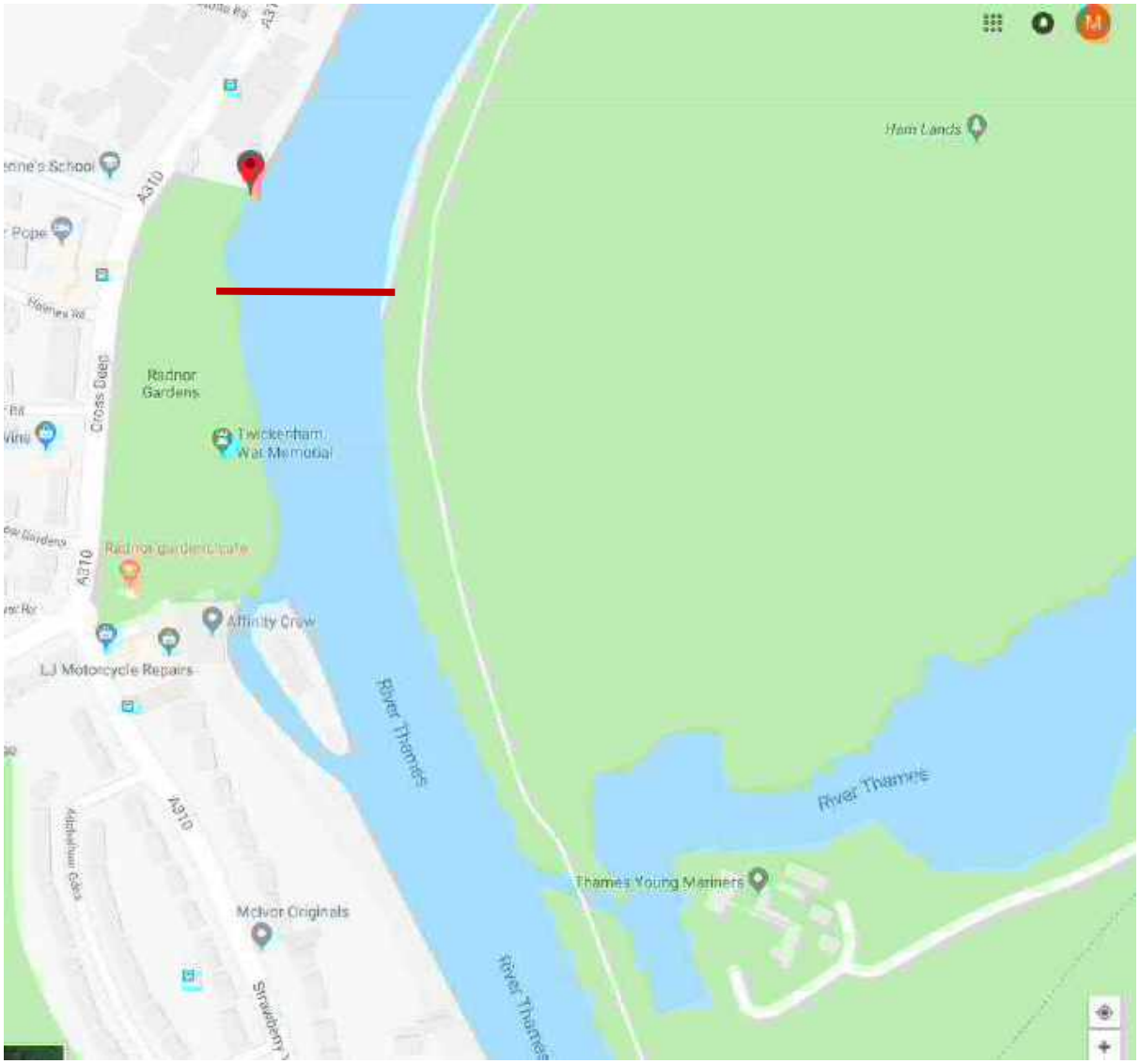
Site location No. 15:	
Connecting boroughs	Richmond to Richmond
Location/ grid ref. Nearest post code	TQ1693773243 TW1 3DJ
Alternative crossing facilities	• Proposed location, 2000m south of Richmond Bridge and 2500m north of Teddington Lock Footbridge. • Richmond Bridge: is a 91m stone arch bridge which can be accessed via steps from Thames Path or by road. • Teddington Lock Footbridge: Consists of two separate bridges across the Thames. The western bridge consists of a suspension bridge crossing the weir stream and linking the island to Teddington. The eastern bridge is an iron girder bridge crossing the lock cut and linking the island to Ham on the bank (height 5.6m). Stepped and ramped access on both side of bridge.
Marine Navigation	• Width of navigation channel: 42m north, 45m south • Passing over central island and near to moorings and Eel Pie Boatyard. • Height of navigation channel to be maintained – 5.5m: similar to Richmond Bridge 3rd span (Teddington Footbridge is 5.6m, Snapper Bridge to Eel Pie Island is 2.9m) • Number of navigation channels to be maintained through structure: single span either side of island. • Navigation requirements do not require an opening span.
Bridge structure considerations	• Length of structure required: 140m (relatively long) • Structure type: Cable state bridge • Ramp: long rams are necessary to provide navigation vertical clearance as the bridge camber can only accommodate up to 1.5m of navigation height.
Environment	• Conservation area, wildlife/habitat on Eel Pie Island • North and south areas are prone to severe flooding. Longer ramps may be required to avoid these areas to the south. • Difficult to gain addition height to the north to avoid flooding areas • No issues with protected vista or landmarks. • Vista down to Radnor Gardens spoilt (this is mentioned in the Thames Strategy)
Impact on existing business or private properties	• No compulsory purchase anticipated for the southern landing as Ham Lands is council owned land. • Compulsory purchase may be required for the northern landing point. • Some direct benefits for local shops. • Positive impact on Ham House and Gardens and Orlean Gardens. • Limited potential for added value development or retail.
Connectivity	• Connects the southside Ham residential area to Twickenham Station and

	Twickenham Town Centre. • Connects northside town centre and residential areas to Ham and Ham nature reserve. • Proposed bridge ties into existing links to the north. Upgraded cycle/pedestrian link required along Thames Path to the south.
Adjacent developments or public interests connecting via bridge	At north side of Thames (Richmond Borough): • Orleans Park School • Orleans Gardens • Twickenham Stadium • Twickenham residential area • Twickenham town centre At south side of Thames (Richmond Borough): • Ham Lands and nature reserve • Ham common residential area • Ham House and Garden • Ham Polo Club • Ham & Petersham Rifle and Pistol Club • St Richard's C of E Primary School
Key Positives	• Good connectivity through to major attractions of Twickenham Stadium and Ham House and Gardens • Both side of bridge are in Richmond. Ham Street car park is public land. • Relatively far away from existing bridges • Large expanse of green space on south side for bridge ramp
Key Negatives	• Difficult to gain addition height to the north to avoid flooding areas. • Compulsory purchase may be required for the northern landing point. • Length of structure required: 140m (relatively long) • Conservation area, wildlife/habitat on Eel Pie Island
RECOMMENDATION: **DO NOT PROCEED WITH LOCATION – NO FURTHER ASSESSMENT REQUIRED** Recommendation made largely based on the following: Major negatives: • Difficult to gain addition height to the north to avoid flooding areas. • Compulsory purchase may be required for the northern landing point. • Insufficient land for ramp on northern landing site. • Conservation area, wildlife/habitat on Eel Pie Island	

Key to Positives/ Negatives:

- Minor positive
- Major positive
- Minor negative
- Major negative

roposed bridge location map:



Site location No. 22:	
Connecting boroughs	Richmond to Hounslow
Location/ grid ref. Nearest post code	TQ1941077542 TW9 3BG Connecting the Thames Path at the north side to Thames Path at the south side adjacent to allotments passing over Oliver's Island.
Alternative crossing facilities	400m south east of Kew Bridge. Kew Bridge: 3 span arch bridge – longest span 41.0m. Height 5.2m above Mean High Water Spring (MHWS). Hammersmith Bridge: shared use footway/cycle lanes and steps from Thames Path or access by road**.**
Marine Navigation	Width of navigation channel: 50m & 40m Height of navigation vertical clearance to be maintained – Height 5.4m above MHWS (Similar to Kew Bridge and Kew Railway Bridge). Number of navigation channels to be maintained through structure: 2 channels with 1 No. pier located within centre island. The existing navigation channels will not be effected. As the proposed pier is not located in the Thames, navigation risks and costly impact fenders eliminated. Difficult to achieve required navigation vertical clearance due to ramp length. However there are inadequate space for the ramps at north side of the structure. The ramp to be supported by piles over the foreshore along the Thames footpath. Navigation requirements does not require an opening span.
Bridge structure considerations	Length of structure:2 No. 80m spans = 160m span Structure type: Cable state or lattice girder bridge with one pier over the centre island. Ramp: long rams are necessary as the bridge camber can only accommodate up to 1.5m of navigation height.
Environment	More than 8 No. of listed structures located at the north side of the proposed bridge. No issues with protected vista or landmarks.
Impact on existing business or private properties	Use of allotment land required to south side. Compulsory purchase of residential properties needed to connect to Bushwood Road, or use of Priory Park Tennis Club land to access Forest Road. Alternatively (location shown below), bridge located on north side of Oliver's Island with south landing side on/next to residential car park with access through Kew Green. Compulsory purchase of residential property required on north side to provide adequate access to Thames Road. Likely rights to light and intrusion issues with bridge landing to north side. Minimal benefits to local shops and facilities as few in number.
Connectivity	Lack of existing direct access from bridge landing sites at north and south to existing road network. Thames Path to northside is No Cycling.

	Good connectivity through existing network to south through to wide network links. Significant severance issues to north created by railway line which means circuitous route to main network. M4 also creates severance to network to north.
Adjacent developments or public interests connecting via bridge	**At north side of Thames (Hounslow Boro.):** • Gunnersbury and Chiswick Stations • Chiswick residential area • Strand on the Green Recreation Ground • Grove Park Primary School • Strand-on-the-Green Infant School **At south side of Thames (Richmond Boro):** • Kew Garden • Kew Gardens Station • Kew residential area
Key Positives	• Connects Chiswick area to Kew Gardens/ Kew, avoiding Kew Bridge • Connects northside to major employer: National Archives • Number of navigation channels to be maintained through structure: 2 channels with 1 No. pier located within centre island.
Key Negatives	• More than 8 No. of listed structures located at the north side of the proposed bridge. • Use of allotment land required to south side. Compulsory purchase of residential properties needed to connect to Bushwood Road, or use of Priory Park Tennis Club land to access Forest Road. • Alternatively, bridge located on north side of Oliver's Island with south landing side on/next to residential car park with access through Kew Green. • Compulsory purchase of residential property required on north side to provide adequate access to Thames Road. • Likely rights to light and intrusion issues with bridge landing to north side. • Minimal benefits to local shops and facilities as few in number. • Thames Path to northside is No Cycling. • Significant severance issues to north created by railway line which means circuitous route to main network. M4 also creates severance to network to north.

RECOMMENDATION:

DO NOT PROCEED WITH LOCATION – NO FURTHER ASSESSMENT REQUIRED

Recommendation made largely based on the following:

Major negatives:

- Use of allotment land required to south side. Compulsory purchase of residential properties needed to connect to Bushwood Road, or use of Priory Park Tennis Club land to access Forest Road.
- Compulsory purchase of residential property required on north side to provide adequate access to Thames Road.
- Likely rights to light and intrusion issues with bridge landing to north side.

- Minor positive
- Major positive
- Minor negative
- Major negative

Proposed bridge location map:

Site location No. 28:	
Connecting boroughs	Richmond to Hammersmith and Fulham
Location/ grid ref. Nearest post code	SW13 8AH
Alternative crossing facilities	600m south east of Hammersmith Bridge (Grade 2 listed structure): Hammersmith Bridge: 3 span suspension bridge. Height 3.5m above Mean High Water Spring (MHWS). Hammersmith Bridge: No Cycle Lanes, so cyclists must use narrow carriageway. Bridge has narrow footways. Steps from Thames Path.
Marine Navigation	Width of navigation channel: 150m Height of navigation vertical clearance to be maintained – Height 5.2m above MHWS (Similar to Putney Bridge at south side). Number of navigation channels to be maintained through structure: 4 channels with 3 No. intermediate piers. The bridge is followed by 4 span Putney Bridge. Piers provide navigation risk and requiring costly impact fenders / protection. Difficult to achieve required navigation clearance due to ramp length. However there is inadequate space for the ramps at east side of the structure. The ramp to be supported over the piling along the Thames footpath. Navigation requirements does not require an opening span.
Bridge structure considerations	Length of structure required: 200m Structure type: multi-span lattice girder bridge. Ramp: long rams are necessary as the bridge camber can only accommodate up to 1.5m of navigation height. Due to narrow walkway at the east and west side the proposed bridge ramp should be along the footpath supported by piles over the foreshore along the Thames footpath.
Environment	No listed structure located in close vicinity of proposed bridge. No issues with protected vista or landmarks. The east ramp will reduce the lighting and Thames visibility of the adjacent houses.
Impact on existing business or private properties	Compulsory purchase of residential property required on east side to provide adequate access to Rainville Road. Access through private land to the west required to access Wyatt Drive. Minimal benefits to local shops and facilities as few in number.
Connectivity	Lack of existing direct access from bridge landing sites at north and south to existing road network. Good accessibility from Barnes and areas to the west over the Thames through to Earls Court and areas to the east, providing much quicker, safer and more pleasant alternative to using Hammersmith Bridge/travelling through Hammersmith. Alternative site to north (shown below) provides good landing site to

	west on 'Metropolitan Open Land', with direct access to local network. However, similar constraints to other location in terms of lack of through route to network. New development to the east presents even more of a constraint than older properties for the other bridge location to the south.
Adjacent developments or public interests connecting via bridge	**At west side of Thames (Richmond Boro.):** • London Wetland Centre (nature reserve) • Barnes Common • Barn Elms Sports Trust • Barnes Station and residential area • Barn Elms Sports Trust • St Paul's Independent or Preparatory School **At east side of Thames (Hammersmith and Fulham Boro):** • Hammersmith and Fulham Residential area • Hammersmith Station • Charing Cross Hospital
Key Positives	• Good accessibility from Barnes and areas to the west over the Thames through to Earls Court and areas to the east, providing much quicker, safer and more pleasant alternative to using Hammersmith Bridge/travelling through Hammersmith. Hammersmith bridge has no cycle lanes and the carrirageway is narrow.
Key Negatives	• Width of navigation channel: 150m • There is inadequate space for the ramps at east side of the structure. The ramp to be supported over the piling along the Thames footpath. • The east ramp will reduce the lighting and Thames visibility of the adjacent houses • Compulsory purchase of residential property required on east side to provide adequate access to Rainville Road. • Minimal benefits to local shops and facilities as few in number. • Lack of existing direct access from bridge landing sites at north and south to existing road network. • Alternative site to north (shown below) provides good landing site to west on 'Metropolitan Open Land', with direct access to local network. However, similar constraints to other location in terms of lack of through route to network. New development to the east presents even more of a constraint

RECOMMENDATION:

DO NOT PROCEED WITH LOCATION – NO FURTHER ASSESSMENT REQUIRED

Recommendation made largely based on the following:

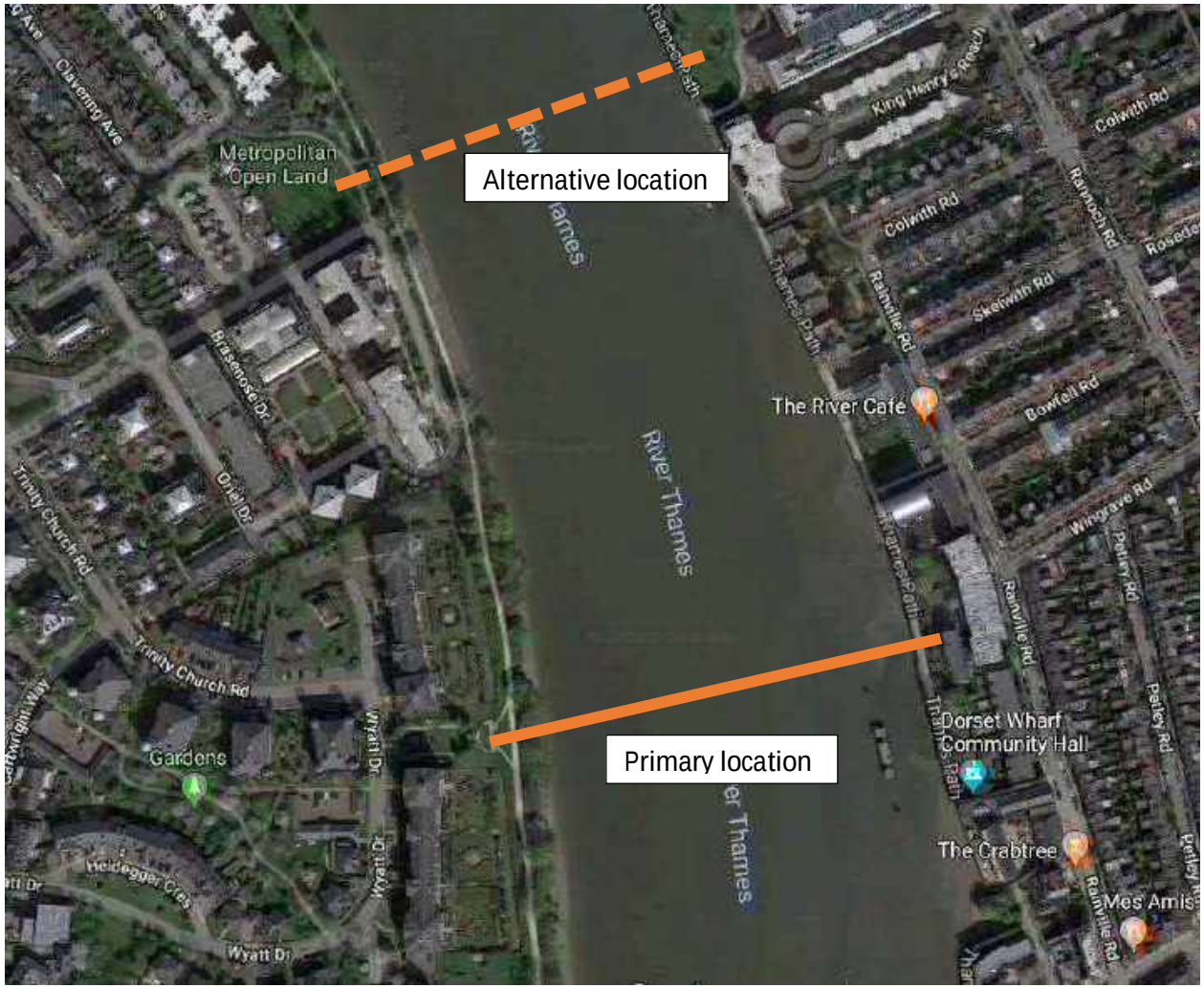
Major negatives:

- Compulsory purchase of residential property required on east side to provide adequate access to Rainville Road.
- Lack of existing direct access from bridge landing sites at north and south to existing road network.
- Alternative site to north (shown below) provides good landing site to west on 'Metropolitan Open Land', with direct access to local network. However, similar constraints to other location in terms of lack of through route to network. New development to the east presents even more of a constraint

- Minor positive
- Major positive
- Minor negative
- Major negative

Proposed bridge location map:

Listed structures map:



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