



London Water Recycling Strategic Resource Option Teddington DRA Site Appraisal Report

October 2023

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1. Introduction

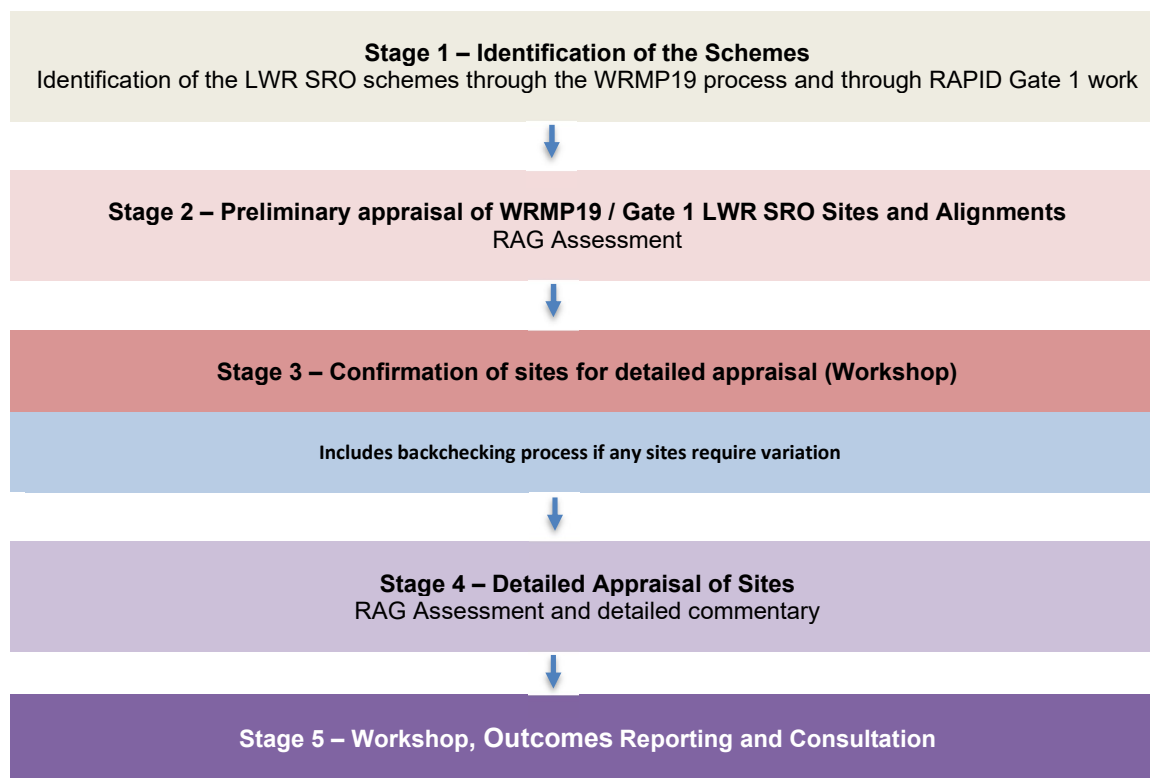
Purpose of this report

- 1.1 The London Water Recycling (LWR) Strategic Resource Option (SRO) is being investigated by Thames Water (TW) as part of a formal 'gated' process, supported and overseen by the Regulators Alliance for Progressing Infrastructure Development (RAPID), comprising Ofwat, the Environment Agency (EA) and the Drinking Water Inspectorate (DWI).
- 1.2 The LWR SRO initially comprised four potential schemes:
 - Beckton Water Recycling
 - Mogden Water Recycling
 - Mogden South Sewer Sewage Treatment Works (STW) and Recycling
 - Teddington Direct River Abstraction (TDRA)
- 1.3 This document reports on the outcomes of the appraisal process undertaken for the TDRA, and is structured as follows:
 - Section 1 summarises the appraisal methodology;
 - Section 2 summarises Stage 1 of the appraisal process and the identification of the LWR SRO;
 - Section 3 summarises the Stage 2 appraisal process for TDRA and the key outcomes;
 - Section 4 summarises Stage 3 of the process and the outcomes of a workshop held to review the Stage 2 outcomes and identify shortlisted sites for appraisal under Stage 4;
 - Section 5 summarises the process and outcomes for Stage 4 of the process; and,
 - Section 6 summarises the outcomes of Stage 5 and the next steps.

Summary of Appraisal Methodology

- 1.4 The purpose of the overarching appraisal methodology is to consider, in a consistent way, the land use, environmental, engineering and land assembly opportunities and constraints associated with all potential sites and their route corridors for all of the LWR SRO schemes. The methodology is applied to each of the LWR schemes, and the outcomes will be reported individually as each process completes.
- 1.5 Figure 1 summarises the overarching appraisal methodology that would be applied to each individual LWR SRO scheme.

Figure 1 Appraisal Methodology



- 1.6 **Stage 1** is represented by initial work undertaken to inform options appraisal work undertaken through the preparation of Thames Water's Water Resource Management Plan 2019 (WRMP19) and, subsequently, as part of Gate 1 of the RAPID process for the LWR SRO. This work identified a series of potential water recycling options that could serve London, and the general route or corridor likely to be necessary between the point of water recycling, and the point of discharge into the water supply network.
- 1.7 **Stage 2** builds on Stage 1 by applying core land use, planning and environmental criteria to indicate whether Stage 1 sites and routes should be retained, or removed. Stage 2 focusses on criteria drawn from overarching national policy objectives or derived from engineering requirements and known environmental limitations that could inform the Project's design.
- 1.8 Land uses include consideration of sites for advanced water recycling plants; tertiary recycling plants; pipeline tunnelling drive, intermediate and reception shafts; pipeline trenching and pipejacking sites, routes and supporting shaft sites; pumping stations and below ground ancillary plant; screens; discharge points and abstraction points.
- 1.9 This stage identifies sites options considered by the appraisal team as most likely to be able to accommodate development, and those least likely to be able to do so and which should therefore not be carried forward.
- 1.10 A 'RAG' grading process is applied to each criterion, and a brief commentary is provided documenting the opportunities and constraints that have been identified.
- 1.11 **Stage 3** takes the form of a project workshop to review the outcomes of Stage 2 to enable agreement of identified options, sites and alignments that should undergo further appraisal. It also aids the identification of sites or areas of concern that either have the potential to be mitigated through further appraisal or, if necessary, replaced with suitable alternative approaches.
- 1.12 **Stage 4** of the process undertakes a detailed qualitative assessment of the outcomes of Stage 3,

applying a more detailed set of criteria topics and objectives, with a RAG grading utilised again, and including consideration of the likelihood of securing necessary mitigation for impacts.

- 1.13 **Stage 5** of the process involves consideration of the findings of Stage 4 by the appraisal team via a workshop, from which the appraisal outcomes are confirmed and reported. This includes the identification, where possible, of the initial preferred sites and their associated potential alignment considered to represent the most feasible emerging means of delivery for each option appraised, in this case for the TDRA Project. The outcomes of Stage 5 are presented in a report (this report) for further consideration, including through consultation.
- 1.14 The full methodology for the appraisal process is set out in the LWR SRO – Site Appraisal Methodology report.

2. Stage 1: Identification of LWR SRO Schemes for Appraisal

- 2.1 **Stage 1** is represented by work undertaken through Thames Water's WRMP19 and more recently as part of Gate 1 of the RAPID process for the LWR SRO.
- 2.2 WRMP19 and RAPID Gate 1 work established four potential schemes for recycling of further treated effluent to aid the development of drought resilience in London's drinking water supply system. In particular, as part of the RAPID Gate 1 process, sites and potential alignments were identified using an initial desk-based assessment of engineering, environmental, planning and property designations and constraints.
- 2.3 The locations of the intake and outfalls associated with those initial schemes was driven by the need to be connected to existing Thames Water wastewater treatment assets, to connect into existing water storage, treatment and supply infrastructure, and to be able to maximise resilience across the wider Thames Water network. As part of identifying the key infrastructure and sites for each scheme at Gate 1 the associated hydrodynamic effects of the intake and outfall locations for each were modelled, including through consultation with the Environment Agency, to refine the locations and minimise environmental impacts.
- 2.4 In particular, the RAPID Gate 1 process explored further the initial concepts for all identified LWR schemes, including their key start and end points and potential means of conveyance from point to point to identify via engineering feasibility testing, strategic environmental assessment, planning consent review, programme testing and key stakeholder dialogue on the potential concept designs and options. These were verified through the Gate 1 process for feasibility and confirmed for further investigation under Gate 2 of the RAPID process and beyond, where appropriate.
- 2.5 As shown on Figure 2 below, the schemes that made up the London Water Recycling SRO as considered under RAPID Gate 1 included:
- Beckton Water Recycling
 - Mogden Water Recycling
 - Mogden South Sewer STW and Recycling
 - TDRA
- 2.6 The remainder of this report presents the application of the appraisal methodology to the TDRA Project, which is summarised briefly below.

Figure 2 London Water Recycling SRO Gate 1 Schemes**TDRA Project**

- 2.7 Treated final effluent from Mogden Sewage Treatment Works (STW) would be subject to an additional 'tertiary' stage of treatment at a new plant on the Mogden STW site. The recycled water would be transferred to a discharge location upstream of Teddington Weir. The recycled water would directly compensate flows taken from a new abstraction on the River Thames, upstream of the discharge. The abstracted water would be pumped into the nearby Thames Lee Tunnel (TLT) for transfer to Lockwood Reservoir in the Lee Valley.
- 2.8 As part of this Project, consideration was given during Stage 1 to both a tunnelled and a pipeline option for the conveyance system between the STW and the River Thames, sharing many similarities, e.g. the same start point and infrastructure at Mogden STW, the same outfall and intake requirements, and the same need to connect to the TLT, although the size of and approach to construction for each option would differ.
- 2.9 Under a pipeline option, the conveyance pipeline would be sized to reflect the volume of flow intended to be transferred, in this case representing a 1.8m internal diameter pipeline able to convey flows of 75Ml/d. A pipeline at this scale would need to be supported by intermediate shafts inserted at intervals of approximately 1,000m, with an approximate total conveyance length of between 4 and 5km. Recognising the likely need for some shorter lengths of pipeline bore in response to the availability of surface sites for shaft construction, a pipeline variant for TDRA would be expected to require up to 6 intermediate shafts to support pipeline construction.
- 2.10 For a tunnelled option to represent a beneficial change, an assumed internal diameter for the tunnel of 3.5m had been assumed, representing an increase in scale beyond that needed to convey the recycled water volume to facilitate the need for fewer intermediate shafts and resulting in the likely need for just one or two intermediate shafts.

3. Stage 2: Preliminary Appraisal of WRMP19 / Gate 1 TDRA Sites and Alignments

Broad Project Definition

3.1 Although the full detailed design for the TDRA Project is yet to be developed the Project is expected to comprise the following:

- at Mogden STW located in the London Borough (LB) of Hounslow:
 - a Tertiary Treatment Facility (TTF) with a peak output of 75Ml/d of recycled water; and
 - a recycled water drop shaft and conveyance pipeline;
- located at sites and below ground in the LB of Hounslow and the LB of Richmond Upon Thames:
 - up to six intermediate shafts at sites located at no more than approximately 1km intervals between Mogden STW and the River Thames upstream of Teddington Weir; and
 - a recycled water transfer pipeline between Mogden STW and the River Thames upstream of Teddington Weir;
- a drop shaft located adjacent to the riverbank of the River Thames upstream of Teddington Weir, located in the LB of Richmond Upon Thames;
- an outfall connection pipe, associated lifting pumps and switchgear, valve chambers and outfall discharge structure operating to a maximum of 75Ml/d located adjacent to and within the riverbank of the River Thames upstream of Teddington Weir, located in the LB Richmond Upon Thames;
- an abstraction intake structure including screens, associated switchgear, and conveyance pipeline located close to the outfall structure and operating to a maximum abstraction rate of 75Ml/d located in the LB of Richmond Upon Thames and / or the Royal Borough of Kingston Upon Thames;
- a drop shaft, raw water pipeline and connection shaft to the TLT located within the Royal Borough of Kingston Upon Thames, and
- works associated with the permanent provision of accesses, utilities, landscaping and environmental mitigation necessary for the Project.

Key Parameters

3.2 A number of key parameters have informed where the Project can be located and how it can be connected between its main construction sites to enable conveyance of recycled water flow to the River Thames, and conveyance of abstracted raw water flow to the TLT. These have continued to inform the Project and its site appraisal process and are set out below.

Tertiary Treatment Facility

3.3 A start point in this regard is to site the TTF, which is required to enable the further treatment of final effluent, within the STW itself. This reduces the distance that final effluent must be transferred prior to its treatment to generate recycled water, allows any by-products to remain and be managed within the STW, and removes the need for an additional offsite location on which to site the TTF.

3.4 Furthermore, it presents the option for the TTF to treat final effluent from the STW in non-drought circumstances prior to the release of that effluent to the Thames Tideway as per existing discharge provisions, thereby improving the water quality within the Tideway in non-drought conditions as well as during drought conditions.

Intake and Outfall Structures

- 3.5 Abstraction of water from the River Thames through the intake and discharge of recycled water through the discharge needs to be combined with a number of key factors which influence the identification of suitable sites, including:
- ensuring that the flow being abstracted is raw freshwater, rather than saline tidal water;
 - seeking to minimise the overall construction demands of the Project by siting the freshwater abstraction as close as is practicable to both Mogden STW and to the TLT raw water main;
 - locating the abstraction plant in sufficiently close proximity to the new discharge location for the balancing flow achieved through the discharge of recycled water; and,
 - locating the recycled water discharge point within an area of the freshwater river, above Teddington Weir, but downstream of the abstraction where sufficient mixing of water can be achieved.
- 3.6 In this regard, the land subject to appraisal south of Burnell Avenue upstream of Teddington Weir represents the closest opportunity through which all of these objectives can be met.

TLT Connection

- 3.7 To achieve Project completion, i.e. the conveyance of balanced raw water abstraction into the TLT for onwards conveyance to the Lee Valley reservoirs prior to treatment and supply across London, a number of key parameters relating to the TLT have been incorporated into the site appraisal process, including:
- a need to ensure that any construction works in close proximity to the TLT do not undermine the structural integrity of the TLT;
 - a need to ensure that the point of connection and length of raw water conveyance are minimised to reduce construction impacts, and
 - a need to avoid consideration of sites within the Richmond Park Special Area of Conservation.
- 3.8 This has led to the limited identification of shaft construction opportunities along the short length of the TLT that runs towards the Lee Valley from the point of abstraction, which have been appraised further.

Intermediate Shafts

- 3.9 An essential component for pipeline or tunnel conveyance delivery between Mogden STW and the discharge outfall location on the River Thames is the provision of intermediate shafts. The design and scale of intermediate shafts are directly linked to the scale of the conveyance to which they relate, with each shaft providing construction access, and health and safety support as part of their primary function.
- 3.10 At the scale of pipeline proposed (1.8m internal diameter) the following key design limits are required to be followed in the siting of intermediate shafts:
- intermediate shaft sites need to be accessible, relatively level and suitably sized to facilitate construction and use;
 - shaft sites should no more than approximately 1,000m apart; and
 - shaft diameters should be circa 10m diameter.
- 3.11 In turn, and when combined with the location of the sites that are to be linked together (Mogden STW / outfall discharge site / raw water abstraction site) and the need to ensure that construction requirements and impacts are minimised as far as practicable, these provisions direct, and to a certain degree, limit the search area in which intermediate shafts are searched for.

Conveyance alignment and sizing parameters

- 3.12 Due to the size of the conveyance pipeline required (1.8m internal diameter) installation of that pipeline

as a shallow trenched construction would necessitate considerable earthworks along its potential route to be able to create a suitable width of safe work site to achieve an appropriate depth of installation, assuming that installation did not clash with existing buried utilities and infrastructure. Such works would be expected to utilise existing road corridors between Mogden STW and the discharge / abstraction location, and therefore would lead to full road closures section by section whilst construction occurred.

3.13 Given the impacts of such an approach, the probable lack of feasibility due to clashes with other infrastructure and the availability to utilise pipejacking at depth to achieve the same diameter of conveyance pipeline, a shallow method of construction was not appraised further.

3.14 The ability for the conveyance pipeline to be constructed at depth enables the conveyance alignment to be more direct from point to point, subject to meeting engineering parameters. This approach was taken to identifying, reviewing and refining the potential intermediate sites in preference to other alternative options, which included:

- larger bore tunnel, fewer shafts: use of a large bore conveyance tunnel would bring with it the ability to increase the spacing between each necessary intermediate shaft. Bearing in mind the short overall length of the conveyance between Mogden STW and the River Thames increasing the internal diameter of the bore to create a tunnel of 3.5m internal diameter would mean that each length of tunnel bore could reach approximately 2km in length, which in turn could reduce the number of intermediate shafts to between one and two shafts. However, this approach was not appraised further as it would in turn give rise to:
 - construction of a tunnel (3.5m internal diameter) using a tunnel boring machine significantly in excess of what is required to convey the proposed 75MI/d flows;
 - the use of a substantially greater volume of construction material than is needed for the correctly sized 1.8m internal diameter tunnel to convey 75MI/d flows, estimated as amounting to a doubling of the volume of construction materials;
 - the generation of approximately 250% more spoil than would be associated with the correctly sized tunnel, including taking into account the removal of between four and five shafts from the Project; and
 - the generation of approximately 200% more HGV movements for both construction and spoil movements.
- 1.8m internal diameter pipeline following surface road alignments: whilst a conveyance pipeline alignment that follows surface road alignments could be identified this was not appraised further as it would:
 - require the location of intermediate shafts every 1,000m (or less) within and / or adjacent to the public highway leading to partial and full road closures;
 - require an additional five to ten intermediate shafts to be installed where road alignments are curved (e.g. Twickenham Road / London Road / Riverside Drive / Dukes Avenue / Beaufort Road / Burnell Avenue) to facilitate the resetting of the tunnel boring machine and enabling the machine to navigate the alignment curvature being followed at the surface, leading to an increase in construction impacts; and,
 - increase the overall conveyance length by approximately 1.5km, in turn increasing associated construction material demand, spoil generation and HGV numbers.

3.15 Notwithstanding the approach taken, achieving an alignment that delivers an intermediate shaft site every 1,000m has not been possible due to the availability of suitable surface sites. As a result, it is anticipated that up to six intermediate shaft sites are likely to be required, for which a number of combinations within broadly similar overall alignments or corridors have been appraised.

Stage 1 Alternative Options

- 3.16 Alternative abstraction and discharge options were also considered and rejected as part of reviewing the Stage 1 outcomes, as described further below.

Alternative raw water abstraction site

- 3.17 An essential provision of the Project is its ability to connect with the TLT to take river water to the Lee Valley reservoirs.
- 3.18 A key driver in achieving this provision is to ensure that the amount of construction associated with the connection between abstraction and the TLT is minimised, to in turn reduce the associated land use and environmental impacts. Accordingly, the search for abstraction and connection sites has been greatly informed by the location of both the freshwater River Thames and the TLT. We have particularly looked where the two features converge, and the availability of land that is suitably sized, level, open and accessible to facilitate construction over the fewest sites necessary.
- 3.19 There are only two points at which the TLT and the freshwater River Thames converge, the first at the start of the TLT at Hampton and the second approximately 400m upstream of Teddington Weir.
- 3.20 The availability of river frontage land around Hampton is limited to locate the required Project infrastructure. Open land to the east and within Bushy Park Royal Park and Hampton Court is of sufficient size; however, this carries greater land use constraint due to the Royal status and associated land and heritage designations.
- 3.21 Furthermore, the location at Hampton was also not considered suitable due to there being insufficient distance for any recycled water discharged at this location to mix fully with river water before reaching at least one existing raw water intake site downstream of the discharge. These being either the Hampton intake itself if the discharge is upstream of the TLT intake and/or the Surbiton intake which is downstream of Hampton. In the event there is not enough distance for the water to mix with river water before being abstracted, the Project would require greater levels of treatment to comply with drinking water standards. That would mean full advanced treatment of the water being discharged would likely be required. In addition to the increases in carbon, cost and environmental impacts that would arise due to the operation of an advanced water recycling facility, there is not enough space at Mogden STW to accommodate such a facility. Additional land, outside of the Mogden STW site, would be required to accommodate the water recycling facility along with further conveyance pipelines for effluent and recycled water flows. This would give rise to further increases in the environmental and land use impacts of the Project.

Alternatives for discharging recycled water

- 3.22 A direct discharge of recycled water periodically into the TLT, which also transfers river water from Hampton to the Lee Valley, would mix two water sources (i.e. tertiary treated recycled water and river water) which would not be supported by existing regulatory practice.
- 3.23 In this scenario the Project would require greater levels of treatment of the final effluent to comply with drinking water standards compared to environmental standards for discharging into the River Thames. Drinking water is self-evidently treated to a far higher standard than that required by the environmental legislation covering discharges to rivers – although the latter is still rigorous, these permit limits are distinct and different. As a result, any discharge directly into the TLT would require full advanced treatment at Mogden STW and further treatment to drinking water standards following blending with other water in the TLT and reservoir. This would result in significant increases in carbon, cost and environmental impacts owing to the need to treat water twice and for additional land outside of Mogden STW to locate the necessary full advanced treatment facility.
- 3.24 As the abstraction of raw water is a key component of the Project and will, as a result, remove water from within the river channel above Teddington Weir, to ensure overall volumes in this general stretch

of the river are maintained to required levels during drought conditions it is necessary to ensure that the discharge enters the river above Teddington Weir. Discharge below the Weir would not enable this balancing effect to be achieved because this would lead to a potential lowering of the river level above Teddington Weir when abstraction takes place, increasing stress on the environment and in the worst case impacting the fish passes on Teddington Weir.

- 3.25 In summary, at Stage 1 of the site options appraisal it was concluded that the Project would require an abstraction of river water and discharge of recycled water just upstream of Teddington Weir, close to the TLT and downstream of other water intake sites on the River Thames. This has fed into the Project concept design and forms the parameters within which the infrastructure will sit and the detailed site appraisal undertaken.
- 3.26 A summary of initial Project information that has informed the appraisal is also provided in Appendix 1.

Process

- 3.27 Between December 2021 and June 2022 each team of professionals (engineering, environment, planning and property) evaluated each site and conveyance alignment previously identified under Stage 1 through desktop surveys and applying professional judgment to the data and information collected on the site in relation to an agreed set of criteria (Criteria for the Preliminary Appraisal – see Table 3 within the LWR Site Appraisal Methodology report).
- 3.28 Results from the Stage 2 appraisal process were recorded in a matrix for the TDRA Project, which considered the use of sites for each of the relevant purposes identified in the paragraphs above.
- 3.29 Each criterion within the appraisal was assigned a RAG (Red-Amber-Green) classification, depending on the discipline-based judgment of the significance of that criterion for each site. In addition to the RAG appraisal against individual criteria, an overall RAG value (for each professional discipline) was assigned to each site. For all sites assigned an overall Red or Amber value, mitigation to try and reduce the overall RAG value was identified where possible and recorded.

Key issues

- 3.30 The TDRA Project is located in a highly built-up and constrained area with very limited areas of available development land, or sites that are not otherwise earmarked for development benefitting from planning applications or permissions, or otherwise constrained by other land use planning designations.
- 3.31 There are other key issues and constraints that are common to all the sites and are discussed below under four topic areas: engineering, environment, planning (including noise and transport), and property issues.

Engineering

- 3.32 At this stage potential sites were assessed to determine whether the site size and shape, and any existing features and site access could constrain the use of the site.
- 3.33 The locations for the intermediate shafts and land for construction sites, have been chosen in consideration of the following:
- area of land available;
 - ease of access for construction vehicles and transportation of material;
 - distances between shafts;
 - minimising impact to surrounding areas; and,
 - nature of the land and its current use for ease of procurement.
- 3.34 The feasibility of alignments at this stage are still subject to further examination of:

- the hydraulics of the pipeline;
- route geology;
- the topographic nature of the ground surface above;
- constraints posed by existing underground infrastructure along the pipeline; and,
- detailed checking of other underground assets to ensure that there are no clashes will need to be carried out.

3.35 The outcome from any of the above factors could alter the pipeline alignment, following detailed appraisal at Stage 4.

3.36 Access to the site, both for the construction and for inspection / maintenance purposes during the operational phase is a further issue to consider.

3.37 A key issue that would restrict the use of the site is if it is located distant from any main transportation modes, therefore limiting the type and ability of transport access to it. It is preferable for the site to be located near a major road or rail route, or near / adjacent to the River Thames. However, the use of water freight is itself restricted by the availability of suitable jetties, and material handling infrastructure, and the availability of suitable reception sites.

Environment

3.38 The TDRA Project as described in Appendix 1 and informed by the parameters set out above is subject to various environmental constraints, which have the potential to restrict the use of sites for a drop shaft, intermediate shaft, abstraction intake or outfall.

3.39 Statutory international or national ecological designations such as Special Protection Areas (SPAs), Special Area of Conservation (SAC) and Sites of Special Scientific Interest are 'red' constraints due to their level of policy protection and control. 'Amber' level constraints, are statutory designated sites at a local level (Local Nature Reserve) or where the site is within proximity to an international or national statutory designation¹.

3.40 National designations, such as the presence of listed buildings or scheduled monuments on the site, are considered 'red' constraints, whereas those designated by regional or local authorities, such as conservation areas, are considered 'amber' constraints.

3.41 Similarly, national landscape or townscape designations are considered 'red' constraints, again due to their level of policy protection and control, for example through the national planning policy. However, as these comprise Areas of Outstanding Natural Beauty or National Parks, none exist in this part of London. Regional designations, such as Strategic Views, are considered 'amber' constraints.

3.42 Any permanent loss of property or community assets, or a construction impact on more than 100 properties, and statutory ecological receptors within 50m, are considered 'red' constraints. Any temporary loss of properties, or community assets, or impacts on between 10 and 100 properties, and statutory ecological receptors within 50m, are considered 'amber' constraints.

Planning

3.43 The TDRA Project as described in Appendix 1 and informed by the parameters set out above is subject to various planning constraints, which have the potential to restrict the intended use of the sites being appraised.

3.44 Due to the demand for development land in London, and the high density at which land is generally utilised, opportunities to acquire sites that are free from existing uses and ready for development are

¹ Local wildlife sites identified by Local Planning Authorities (e.g. Site of Importance for Nature Conservation) are considered at Stage 4 as these are non-statutory designations.

both infrequent and, when available, quickly acquired. Furthermore, the use of land may be restricted if it is designated or safeguarded in the development plan for a particular use. This includes land that is designated for regeneration purposes.

- 3.45 Land that has already been granted planning permission and sites where development is underway or due to commence imminently have the potential to be more difficult to obtain in planning terms and may require further investigation or mitigation to ensure the acceptability of their use within the Project. As such they were graded as a higher risk to reflect this position. At this stage a distinction in the grading was not made based on the sensitivity or use type of the proposed development.
- 3.46 The existing use of a site, its associated site clearance requirements (tree and vegetation clearance, removal of structures, plant and buildings, re-routing of existing means of access, relocation of existing services and utilities), and displacement of existing land uses will also affect the planning considerations of the suitability of each site. This may restrict the use of the site for any of the proposed uses.
- 3.47 Given the densely developed nature of the search area, there is the potential for development to impact on sensitive land uses directly or indirectly (e.g., through construction noise), such as housing, community facilities, schools, leisure areas, open space, and rights of way. When appraising the sites, neighbouring land uses have been carefully considered.
- 3.48 Green Belt is protected by national and local planning policy, which formally restricts the majority of development in those areas, so as to retain openness and to prevent coalescence. Most visual impacts will be during the construction phase, with the final development most likely to be at, or below ground level. Notwithstanding this, any above ground land within the Green Belt (and / or Metropolitan Open Land) which is required during the construction and / or operational phase is designated as a 'red' constraint.
- 3.49 Public open space and recreational sites are often protected by planning policies that formally safeguard the land for that purpose. Most of the land required for an intermediate shaft is required only for a temporary period of time, after which most of that land can be returned to its former state. The permanent land take for an intermediate shaft site is therefore likely to be small compared to the space required during construction and there may therefore be options for mitigation to be provided to offset the temporary loss of open space.
- 3.50 Where sites exist on Common Land, the separate requirements of the Common Lands legislation have also been taken into account. Sites that are Common Land will be designated as a 'red' open space constraint. At this stage the need for Common Land Consent will not be considered in detail and will be addressed further if Common Land sites require detailed appraisal under Stage 4 of the process.

Property

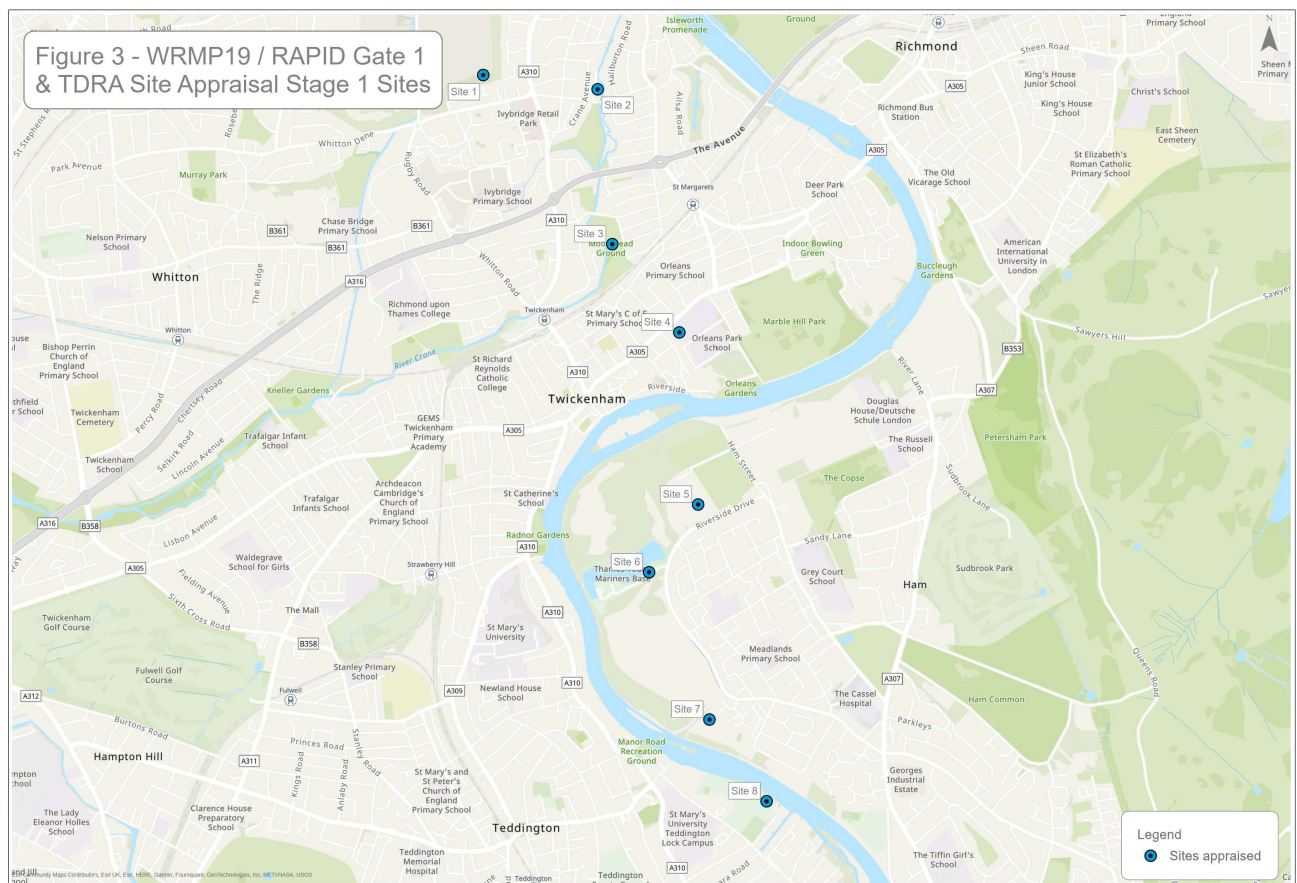
- 3.51 Elements of the route and sites considered during the site selection process may affect Water Industry Act 1991 Schedule 13 protected party interests, whose infrastructure and operational land is subject to statutory protection. Works affecting these parties will be subject to engineering consents and legal documentation which agree to the proximity of Thames Water's asset and provide adequate insurance liability. Depending on the likely impact on the third-party infrastructure, affected sites would be subject to either 'red' or 'amber' constraints.
- 3.52 There is no statutory support for the acquisition of Crown land affected as part of a Project. A site's use will need to be consented via agreement and as such could be considered an 'amber' constraint.
- 3.53 Where sites exist on Common Land the separate requirements of the Common Lands legislation have therefore been considered.
- 3.54 Other land may be identified which is subject to other legislation or supported by statutory protection. Design and due process will dictate whether mitigation can be provided, or alternative route / site selection is required.

- 3.55 For the sites within Thames Water's ownership, it is expected that there would be minimal risk or financial cost in relation to land acquisition. Sites not in Thames Water ownership have, to varying degrees, both land acquisition risks and financial costs associated with their potential future development.

TDRA Initial Review

- 3.56 The first key step was to undertake an initial review of the potential site areas that were identified through Stage 1 for the TDRA Project, as shown below on Figure 3. Through this it was recognised that some initial sites identified at that stage could prove challenging to deliver due to issues raised through criteria associated with one or more appraisal disciplines, or through increased knowledge in respect of the Project itself.

Figure 3 WRMP19 / RAPID Gate 1 & TDRA Site Appraisal Stage 1 Site Options



Orleans Park School and Ham Street Car Park

- 3.57 In particular, a site identified at Orleans Park School, south Twickenham, was judged to be both too constrained physically and its use during construction to be too great an impact upon the function of the school itself that an alternative intermediate shaft location was identified as being needed.
- 3.58 This led to a desk-based review to identify a replacement area for the provision of an intermediate shaft for the TDRA pipeline option in proximity to the River Thames along with possible sites or combinations of sites using google maps and GIS data. A key parameter in this regard was the need to maintain the engineering design requirement of creating a break point, an intermediate shaft, every 1,000m of tunnelled pipeline construction.
- 3.59 Through this process a potential site located on the south bank of the River Thames at Ham Street Car Park was identified. Whilst 500m further away from the preceding shaft site identified at Moormead and Bandy Recreation Ground, the Ham Street Car Park site continued to enable pipeline construction to maintain compliance with its 1,000m bore length parameter.
- 3.60 Accordingly, the Orleans Park School site was removed from further consideration, and the link between Twickenham and Ham was adjusted to focus on a pipeline alignment between Moormead and Bandy Recreation Ground and Ham Street Car Park.
- 3.61 During the course of the Stage 2 appraisal undertaken during Gate 2 of the RAPID process three further adjustments were identified:
- Concerns regarding the emerging use and status of Northcote Recreation Ground;
 - identification of site options at Riverside Drive, Ham; and,
 - confirmation through environmental modelling that the TDRA discharge outfall and abstraction intake could be located on the same bank of the River Thames.

Northcote Recreation Ground and Ivybridge Retail Park Car Park

- 3.62 Whilst desk-based reviews of the Northcote Recreation Ground site identified that it was in a state of disrepair, research relating to the planning status of the site indicated that proposals existed for the landscape and habitat enhancement of the site to create the Northcote Nature Reserve. As timelines for the delivery of such improvements were not known at the time of the desk-based Stage 2 appraisal the decision was taken to widen the search for a potential alternative location for the first intermediate shaft site for the pipeline.
- 3.63 Through this search the potential to make use of land within the Ivybridge Retail Park Car Park was identified and brought into the Stage 2 site appraisal process.
- 3.64 As this potential site would adjust the pipeline alignment 340m to the west of its previous alignment towards Northcote Recreation Ground two variations of the TDRA alignment between Mogden STW and the River Thames close to Teddington Weir and Lock were mapped, ensuring that the alignment and distance between each shaft site continues to be as efficient as possible.

Identification of site options at Riverside Drive, Ham

- 3.65 A provision of the Gate 1 / Stage 1 TDRA concept was to include intermediate shaft sites on land to the west of Riverside Drive playground (930m to the south west of Orleans Park School) and within the Thames Young Mariners outdoor adventure facility located on Riverside Drive in Ham (470m south-west of the land to the west of Riverside Drive playground). The objective of these two sites and their alignment was to enable the pipeline to traverse the built-up area of Ham and enable access to the identified river outfall and river abstraction sites located upstream of Teddington Weir, again without passing beneath the built-up area of Ham.
- 3.66 During the course of the Stage 2 appraisal it was identified that, subject to further investigation under Stage 4 of the appraisal, it may be possible for the Gate 1 assumption of avoidance of passing beneath

the built-up area of Ham to be revised to allow the pipeline tunnel bore to pass more directly towards the outfall and abstraction sites using an alignment that does pass beneath the built-up area of Ham.

- 3.67 To facilitate an appropriate comparative appraisal of the two potential options between Ham Street Car Park and the outfall and abstraction sites, i.e. to traverse the built up area of Ham or to bore beneath, an additional site was brought into Stage 2 of the appraisal process, located within the Ham Playing Fields Car Park on Riverside Drive.
- 3.68 Both of these alternatives would then aim to reach the next site in sequence, identified as being within Ham Lands Local Nature Reserve (LNR) located close to Riverside Drive.

Ham Lands Intermediate Shaft location

- 3.69 The Gate 1 concept design used to inform Stage 1 of the appraisal included an indicative shaft position within Ham Lands LNR.
- 3.70 An initial review of the location of this site and the characteristics of land further to the east / north-east of it adjacent to Riverside Drive indicated that the appraisal site should be relocated to an alternative location able to minimise its impacts upon the LNR. Although still within Ham Lands LNR, the relocated site reduces the requirement to remove trees, and is located within lower value habitat, that will re-establish over shorter timescales. This site was subsequently identified and renamed as 'Ham Lands, west of Riverside Drive'.

TDRA outfall and intake location

- 3.71 A key provision for the TDRA Project is to achieve a degree of separation between the outfall and the intake points whilst still ensuring both were located in close general proximity to achieve the necessary balance in water levels at the site of abstraction.
- 3.72 As part of the Gate 1 / Stage 1 concept this had been achieved by identifying an initial site for the abstraction plant (intake) as close as practicable to its recipient asset, the TLT water main, on the south bank of the River Thames adjacent to open space at Burnell Avenue approximately 350m upstream of Teddington Weir. The corresponding outfall for the TDRA pipeline from Mogden STW was then indicated to be positioned on the opposite [north] bank of the River Thames within the grounds of the Lensbury Hotel, approximately 200m upstream of Teddington Weir.
- 3.73 Whilst this approach achieved an initial need for separation between the outfall and intake that would be necessary to ensure the Project could meet necessary permitting and regulatory requirements; it also required these two key elements of the Project to be constructed in close proximity to one another but at two separate sites.
- 3.74 However, during the process of reviewing the Stage 1 information and preparing to undertake the Stage 2 appraisal, the environment team were able to confirm that, subject to continuing to achieve an appropriate degree of separation between outfall and intake, there were no permitting or regulatory reasons why both structures could not be sited on the same riverbank, and therefore form part of a single construction site.
- 3.75 With sufficient space identified at the Burnell Avenue site to accommodate both the discharge infrastructure and the abstraction infrastructure, including their construction and operational requirements, and recognising the maturity and density of tree growth along the Lensbury's river bank, and the presence of greater stretches of lighter vegetation on the Burnell Avenue south bank, the Burnell Avenue site was selected for continued appraisal for the provision of both assets. The Lensbury Hotel site was removed from further consideration.
- 3.76 The connection of the abstraction plant to the TLT water main continued to be taken at the nearest available point, which had been identified as via a new shaft and connection to be positioned within open space and woodland to the south of Northweald Lane adjacent to Burnell Avenue open space.
- 3.77 Following this change the appraisal considered the use of open space land to the south of Burnell

Avenue across two parcels to aid ongoing appraisal:

- Land to the south of Burnell Avenue (west): pipeline reception site; connection pipeline to outfall; outfall discharge to River Thames; and,
- Land to the south of Burnell Avenue (east) 'South of Northweald Lane': river abstraction intake plant; connection pipeline to TLT water main connection shaft; connection to TLT.

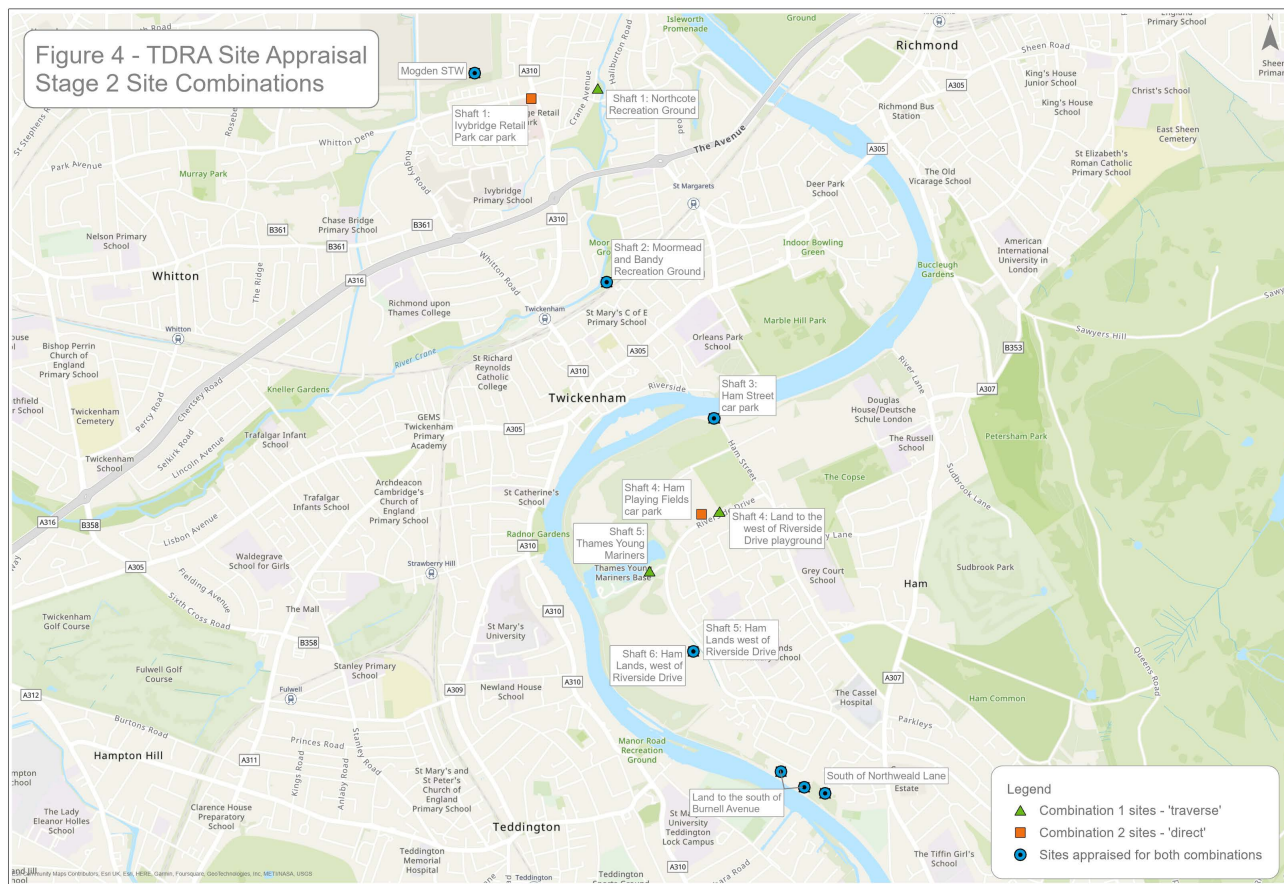
Site combinations for Stage 2 Appraisal

3.78 The outcomes of the review of the Gate 1 / Stage 1 TDRA Project concept summarised above helped to establish two clear combinations of sites for appraisal under Stage 2 of the site appraisal methodology process:

- one which could traverse around Ham by providing for shaft locations that would avoid pipeline construction beneath the built-up area of Ham; and,
- a second more direct combination which identifies potential shaft locations that would facilitate pipeline construction beneath the built-up area of Ham.

3.79 The two combinations are listed below and shown on Figure 4:

- Combination 1 'Traverse':
 - Mogden STW (water recycling / pipeline drive site)
 - Shaft 1: Northcote Recreation Ground (intermediate shaft)
 - Shaft 2: Moormead and Bandy Recreation Ground (intermediate shaft)
 - Shaft 3: Ham Street Car Park (intermediate shaft)
 - Shaft 4: Land to the West of Riverside Drive Playground (intermediate shaft)
 - Shaft 5: Thames Young Mariners (intermediate shaft)
 - Shaft 6: Ham Lands, west of Riverside Drive (intermediate shaft)
 - Land to the south of Burnell Avenue (pipeline reception site / discharge outfall)
 - South of Northweald Lane (river abstraction site / TLT connection site)
- Combination 2 'Direct':
 - Mogden STW (water recycling / pipeline drive site)
 - Shaft 1: Ivybridge Retail Park Car Park (intermediate shaft)
 - Shaft 2: Moormead and Bandy Recreation Ground (intermediate shaft)
 - Shaft 3: Ham Street Car Park (intermediate shaft)
 - Shaft 4: Ham Playing Fields Car Park (intermediate shaft)
 - Shaft 5: Ham Lands, west of Riverside Drive (intermediate shaft)
 - Land to the south of Burnell Avenue (pipeline reception site / discharge outfall)
 - South of Northweald Lane (river abstraction site / TLT connection site)

Figure 4 TDRA Site Appraisal Stage 2 Site Combinations

Engineering

- 3.80 Overall, the engineering assessment of both of the combinations is largely positive. However, each of the shaft sites are amber rated for working site access, due to small, constrained shaft sites (particularly Combination 1, Shaft 1 – Northcote Recreation Ground), and amber rated for the removal of material, due to the need to use local roads through residential areas.
- 3.81 Shaft 2 (Moormead and Bandy Recreation Ground – both combinations) and the discharge and intake shafts on the River Thames are also amber rated due to their distance to the nearest utility connections.
- 3.82 Both combinations show some small improvements when compared to the Gate 1 / Stage 1 concept with regards to engineering, as they both avoid the constrained shaft site at Orleans Park School.
- 3.83 If reintroduced, the previously identified discharge shaft on the north side of the River Thames at the Lensbury Hotel would require the diversion of buried power lines.

Environment

- 3.84 The environmental outcomes are generally favourable, with the most notable constraints across all sites being those identified for community and property receptors from the construction. This is because all sites are located within Air Quality Management Areas (AQMAs) and all sites may require works overnight, potentially causing noise disturbance issues to those receptors in close proximity.
- 3.85 The discharge and intake sites have additional constraints arising from the small permanent loss of bankside area which is required to accommodate the discharge shaft and intake site within the River

Thames and Tidal Tributaries Site of Importance for Nature Conservation (SINC), and the small permanent loss of public open space in which the intake shaft and associated infrastructure is proposed. Given the requirement for in-river works, infrastructure is required in Flood Zone 3.

- 6.1 Shaft 1 (Northcote Recreation Ground, Alternative 1) is also likely to be within Flood Zone 3, given the creation of the new backwater from the River Crane. This may give rise to temporary increases in flood risk during construction, and also the potential permanent loss of flood zone due to the need for a small area of permanent infrastructure. Use of Shaft 1 (combination 2) Ivybridge Retail Car Park would avoid a flood risk issue.
- 3.86 Both combinations still have several environmental constraints, notably a pipejack section within both routes (between shafts 3 and 4 – both combinations) which is located in close proximity to Ham House Registered Park and Garden, potentially giving rise to the need to consider vibration impacts. In addition, Combination 2 may also intersect a historic landfill either side of the location of its Shaft 1 (Ivybridge Retail Park Car Park). Both combinations will likely give rise to the temporary disruption of public access areas during construction works.

Planning

- 3.87 A number of the intermediate shaft sites and the discharge, intake and TLT connection sites are comprised of land under a combination of planning designations, as summarised below:
- Mogden STW: Local Open Space (landscaping bund)
 - Shaft 1 (combination 1): Northcote Recreation Ground: Metropolitan Open Land (MOL) / open space
 - Shaft 1 (combination 2): Ivybridge Retail Park Car Park: no designations
 - Shaft 2 (both combinations): Moormead and Bandy Recreation Ground: MOL / open space
 - Shaft 3 (both combinations): Ham Street Car Park: MOL / open space
 - Shaft 4 (combination 1): Land to the West of Riverside Drive Playground: MOL / open space
 - Shaft 4 (combination 2): Ham Playing Fields Car Park: MOL
 - Shaft 5: Thames Young Mariners: MOL
 - Shaft 6 (combination 1) / Shaft 5 (combination 2): Ham Lands, west of Riverside Drive: MOL / open space
 - Land to the south of Burnell Avenue (both combinations): MOL / open space
 - South of Northweald Lane (both combinations): MOL / open space
- 3.88 The relationship between each site and these designations will need to be taken into account as part of the design for each site during construction and operation to ensure that the amount and disruption and temporary / permanent land loss is minimised. Any permanent loss of MOL and / or open space will require careful assessment against policy provisions to establish the appropriate approach to be taken.

Property

- 3.89 The majority of the shaft locations and the outfall and intake / TLT connection sites for both combinations are located partially or entirely within public open space which is classified as special category land. As a result, all shaft sites are rated 'amber' in respect of likely acquisition costs. It is only Shaft 5 for the traverse combination and Shaft 4 for the direct combination that are not located within public open space.
- 3.90 Shafts 1 and 4 for the direct combination are assessed as red for the land ownership criteria, due to there being a number of different land interests, increasing the acquisition uncertainty.

4. Stage 3: Confirmation of TDRA Sites for Stage 4 Appraisal

4.1 Following completion of Stage 2 of the appraisal process a Stage 3 workshop was held to consider the outcomes of the Stage 2 appraisal and to confirm whether any sites should be taken forwards to Stage 4 of the appraisal or removed from the appraisal process.

4.2 The workshop considered in turn each of the sites identified as forming part of either TDRA combination 1 'traverse' which aims to provide for shaft locations that would avoid pipeline construction beneath the built-up area of Ham, or combination 2 'direct' which identifies potential shaft locations that would facilitate pipeline construction beneath the built-up area of Ham, as listed below:

- Combination 1 'Traverse':
 - Mogden STW (water recycling / pipeline drive site)
 - Shaft 1: Northcote Recreation Ground (intermediate shaft)
 - Shaft 2: Moormead and Bandy Recreation Ground (intermediate shaft)
 - Shaft 3: Ham Street Car Park (intermediate shaft)
 - Shaft 4: Land to the West of Riverside Drive Playground (intermediate shaft)
 - Shaft 5: Thames Young Mariners (intermediate shaft)
 - Shaft 6: Ham Lands, west of Riverside Drive (intermediate shaft)
 - Land to the south of Burnell Avenue (pipeline reception site / discharge outfall)
 - South of Northweald Lane (river abstraction site / TLT connection site)
- Combination 2 'Direct':
 - Mogden STW (water recycling / pipeline drive site)
 - Shaft 1: Ivybridge Retail Park Car Park (intermediate shaft)
 - Shaft 2: Moormead and Bandy Recreation Ground (intermediate shaft)
 - Shaft 3: Ham Street Car Park (intermediate shaft)
 - Shaft 4: Ham Playing Fields Car Park (intermediate shaft)
 - Shaft 5: Ham Lands, west of Riverside Drive (intermediate shaft)
 - Land to the south of Burnell Avenue (pipeline reception site / discharge outfall)
 - South of Northweald Lane (river abstraction site / TLT connection site)

4.3 The workshop explored the key constraints within each site appraisal as well as any opportunities either to overcome constraints or to achieve any key improvements against any of the appraisal criteria.

4.4 The Stage 2 appraisal for the TDRA Project has identified a number of challenges across engineering, environment, planning and property criteria that will need to be appraised further and addressed through appropriate mitigation embedded into scheme design to enable the Project to appropriately address the issues raised. These include:

- Mogden STW: need to consider the relationship between the construction and operation of the proposed TTF and both the operation of the STW and neighbouring residential land uses to the east of the proposed site.
- Shaft 1 (Combination 1) – Northcote Recreation Ground: the relationship between the proposed temporary construction use of the site and the emerging proposals for reinstatement of the site to nature reserve will need to be monitored, including consideration of a potential alternative site if completed, or consideration of the implementation of reinstatement to nature reserve as part of any use of the site for shaft construction.
- Shaft 1 (Combination 2) – Ivybridge Retail Park Car park: the relationship between the proposed temporary construction use of the site and its existing use as a car park to serve users of the retail

units will require further consideration against detailed engineering and property criteria.

- Shaft 2 – Moormead and Bandy Recreation Ground: the ability to make use of the site will require further appraisal of the existing and future use of the recreation ground and the temporary impacts shaft construction would have, along with further consideration of the most appropriate means of routing vehicles to and from the site during construction.
- Shaft 3 – Ham Street Car Park: use of the site will cause temporary disruption to users of the car park through its temporary occupation in part or whole for a compound to serve construction of the shaft in open space to the west of the parking area. Consideration will need to be given to options for providing temporary replacement car parking during construction. Given the site's location adjacent to the tidal River Thames and the presence of the existing slipway there may be some ability to make use of water freight during construction.
- Shaft 4 (Combination 1) – Land West of Riverside Drive playground: the interface between temporary use of this site during construction, residential properties to the south, users of the sports and amenity facilities to the west and north, and users of the play park to the east including road, pedestrian and cycle use along Riverside Drive will require further assessment.
- Shaft 4 (Combination 2) – Ham Playing Fields Car Park: as an alternative to Shafts 4 and 5 under 'Alternative 1', this site would make use of the Ham Playing Fields car park to construct the intermediate shaft between Shaft 3 at Ham Street Car Park and the intermediate shaft proposed to be located at Ham Lands west of Riverside Drive). Key issues for further appraisal will be the interface this site would have during construction with users of the car park and the amenity land to the north, as well as users, and residents of Riverside Drive.
- Shaft 5 (Combination 1) – Thames Young Mariners: whilst land within the Thames Young Mariners site could offer an opportunity to site an intermediate shaft along an alignment that avoids a tunnel bore beneath the built-up area of Ham, the need for this requires further investigation alongside the suitability of the site in engineering, environmental and planning terms.
- Shaft 5 (Combination 2) / Shaft 6 (Combination 1) – Ham Lands, west of Riverside Drive: the final intermediate shaft site prior to the outfall site, this shaft would be sited as close as practicable to the public footpath and Riverside Drive highway to reduce encroachment into the local nature reserve. Key issues for further appraisal include the impact upon the value of the local nature reserve at this point, impacts upon residential properties to the east and upon users of Riverside Drive.
- Land to the south of Burnell Avenue: due to the nature of the works associated with this site, e.g. likely to include a pipeline reception shaft, connection pipe to outfall, control infrastructure and discharge pipe and infrastructure within the riverbank, combined with a suitably sized compound to facilitate construction, it is recognised that the impacts arising from the use of this site will be very challenging. This will include a need to consider the following further under Stage 4 of the appraisal:
 - Road access;
 - residential amenity;
 - recreational amenity (terrestrial and river);
 - ecology (terrestrial and river); and,
 - visual impacts (construction and operation).
- South of Northweald Lane: similar to the Burnell Avenue site, this location will also see a more intensive range and amount of construction comparative to the intermediate shaft construction sites, with works comprising construction of raw water abstraction infrastructure part within the river and part within the riverbank, a connection pipeline between the plant and the TLT, shafts to support the connection pipeline, control infrastructure, and a connection into the TLT, as well as the ability to locate a suitably sized construction compound. As with the Burnell Avenue site, it is recognised that the impacts arising from the use of this site are likely to be very challenging. This

will include a need to consider the following further under Stage 4 of the appraisal:

- road access;
- residential amenity;
- recreational amenity (terrestrial and river);
- ecology (terrestrial and river);
- visual impacts (construction and operation); and,
- permanent loss of open space and MOL.

- 4.5 It is recognised that some of these issues will be challenging to overcome, particularly during the construction phase of the Project and will require careful design and appropriate investment in mitigation measures to enable the Project to proceed.
- 4.6 Whilst all of the sites appraised for each of the two identified combinations of sites will present a number of challenges either during construction, operation or both, none of the appraisal outcomes reviewed during the Stage 3 workshop were judged by the appraisal team to warrant the removal of any of those sites from further consideration.
- 4.7 It was recognised that through the Stage 4 appraisal process, which would apply a wider range of criteria to each site, each site would be subject to more detailed testing including the ability to mitigate impacts to establish if a site could continue to fulfil a role as part of the Project.

5. Stage 4: Detailed Appraisal of TDRA Sites

Process

- 5.1 It was confirmed from Stages 2 and 3 of the appraisal process that two combinations of sites had performed sufficiently well against a comprehensive list of criteria to recommend further appraisal under Stage 4 of the appraisal process. Stage 4 appraisal followed the process set out in the LWR Site Appraisal Methodology and applied the detailed range of appraisal criteria set out in Table 4 of that report to the sites identified under Stage 3 as reported above.
- 5.2 Stage 4 appraisal followed the process set out in the LWR Site Appraisal Methodology and applied the detailed range of appraisal criteria set out in Table 4 of that report to the sites identified under Stage 3 as reported above.
- 5.3 The appraisal recorded site characteristics, qualitative judgments and outcomes and, assigned a RAG (Red-Amber-Green) classification using the following classification:

RED	Mitigation can be achieved / policy or other land use / environmental issues can be overcome, but will be very challenging.
AMBER	Mitigation can be achieved / policy or other land use / environmental issues can be overcome.
GREEN	Criterion has no implications for site or mitigation can be achieved using good practice measures.

- 5.4 For all Project components assigned an overall Red or Amber value, mitigation to try and reduce the overall RAG value was also considered.

Initial review

- 5.5 The appraisal team re-evaluated the outcomes of the Stage 2 appraisal process and Stage 3 outcomes. As part of this review it was recognised that the outcomes to date had not led to the removal of sites within either potential alignment combination, and that there may be a number of further combinations that would in turn help to identify a different alignment, both for the recycled water and the abstracted river water pipeline.
- 5.6 The appraisal team concluded early during this initial review that the approach to be taken to appraise the options available for the TDRA Project would therefore be better served on a 'sites' basis, whereby each site that had passed through Stages 2 and 3 of the process was subjected to more detailed appraisal to identify its suitability to support the TDRA Project. In turn, the sites that performed strongly through Stage 4 of the process could then be reviewed to identify the best performing combination of sites that would support Project delivery.
- 5.7 As a result, the Stage 4 appraisal considered the sites identified through both Stage 3 of the process and through this additional review, as described further below, for their potential to support the Project, rather than seeking to identify a below ground alignment to which surface sites would need to be connected. As with the outcomes of Stages 2 and 3 of the process, those sites could in turn be potentially grouped into combinations of sites to provide a pipeline alignment.
- 5.8 This approach also recognises that, at this level of appraisal, the below ground challenges and opportunities associated with pipeline construction at circa 20 – 30 metres below ground are likely to be broadly similar irrespective of the combination of surface sites that would be relied upon, whilst the challenges faced at each surface site are typically bespoke to that site and its ability to support the Project.
- 5.9 The additional review undertaken at the start of Stage 4 also considered any changes to the status of each individual site taken through from Stage 3. This additional review identified the need for a number of adjustments, as described below.

Mogden STW

- 5.10 Construction of the Project at the STW would be likely to require removal of a proportion of an amenity bund within the STW site to provide sufficient space.

Shaft 1 Option 1: Northcote Recreation Ground

- 5.11 It was identified during the initial review that the site had been confirmed as a 'Village Green'. Although the site was retained for Stage 4 appraisal it was also recognised that this update to the site's status could impact upon the appraisal outcomes.

Shaft 1 Option 2: Ivybridge Retail Park car park

- 5.12 An absence of 'as-built' data of the retail park introduced concerns that within the Ivybridge Retail Park car park an option to locate the intermediate shaft further south within the car park may not be achievable due to below ground tunnelling impacts upon any piled foundations that may support the retail units. The site was reviewed by the appraisal team and divided into two options: one with a potential shaft location sited in the north of the car park and able to receive a pipeline bore without any below ground interaction with the retail units; and the second in the south of the car park, requiring an ability to bore beneath the retail units.
- 5.13 It was also recognised that with the change in status identified at Shaft 1 Option 1 Northcote Recreation Ground there may be a need for further alternatives to facilitate the first intermediate shaft site, if required. Consequently, land was identified immediately to the west of the retail units on open space land adjacent to Summerwood Road that could act as an alternative in this regard, recognising that it also carried a risk of below ground interaction with the retail units to the east.
- 5.14 As both new sites were either identical in nature to existing alternatives, or very similar to sites already recommended for Stage 4 appraisal, it was agreed that both new sites should be included for consideration in the Stage 4 appraisal process.
- 5.15 Following this review of Shaft 1 the following sites were identified for Stage 4 appraisal:
- Shaft 1 (Option 1): Northcote Recreation Ground
 - Shaft 1 (Option 2): Ivybridge Retail Park car park north
 - Shaft 1 (Option 3): Ivybridge Retail Park car park south
 - Shaft 1 (Option 4): Land between Summerwood Road and Ivybridge Retail Park

Shaft 2: Moormead and Bandy Recreation Ground

- 5.16 It was identified that planning permission had been granted for the redevelopment of an existing clubhouse facility and the introduction of associated pitch markings for the football and cricket clubs at Moormead and Bandy Recreation Ground. In addition, it was not clear, due to other possible adjustments between the potential intermediate shaft sites, if the Stage 2 Moormead and Bandy Recreation Ground shaft location within the centre of the recreation ground would be sufficiently close to Shaft 3. As a result, a possible Shaft 2 Option 2 in the south of the recreation ground was also identified. As this second option shared many of the characteristics of the existing option as appraised under Stage 2, it was agreed that the new site should be included for consideration in the Stage 4 appraisal process.
- 5.17 Following this review of Shaft 2 the following sites were identified for Stage 4 appraisal:
- Shaft 2 (Option 1): Moormead and Bandy Recreation Ground central
 - Shaft 2 (Option 2): Moormead and Bandy Recreation Ground south

Shaft 3: Ham Street car park:

- 5.18 It was recognised through both desk study and site survey that, in response to a number of potential issues identified, there may be a need for further alternatives to facilitate the third intermediate shaft

site if required. The potential for land to the south of the car park to accommodate shaft development was identified for further consideration. This additional site, on land to the south of Ham Street car park and situated within the recreational open space of Ham Lands, was agreed as an alternative site option, and subjected to consideration in the Stage 4 appraisal process.

5.19 The following sites have therefore been appraised for Shaft 3 if required:

- Shaft 3 (Option 1): Ham Street car park
- Shaft 3 (Option 2): Land to the south of Ham Street car park and west of Ham Street.

Shaft 4: Riverside Drive sites:

5.20 As a means of seeking to explore the availability of land to enable a connection of the pipeline as directly as possible to the potential outfall and intake site on land to the south of Burnell Avenue, land at the junction of Riverside Drive and Ham Street (Shaft 4 Option 3) was identified. Due to its similarity with other land in the vicinity, this site was included for consideration in the Stage 4 appraisal process.

5.21 The following sites have therefore been appraised for Shaft 4 if required:

- Shaft 4 (Option 1): Land to the west of Riverside Drive playground
- Shaft 4 (Option 2): Land at Ham Playing Fields car park
- Shaft 4 (Option 3): Land at Riverside Drive and Ham Street

Shaft 5: Thames Young Mariners

5.22 No additional information was identified during the review for Shaft 5. It was recognised that new options for Shaft 4 and Shaft 6 however could impact on the appraisal outcomes or need for Shaft 5. Nevertheless this site was carried forward for Stage 4 appraisal.

Shaft 6: Ham Lands, west of Riverside Drive:

5.23 The initial review in Stage 4 considered if alternative sites to the identified site on Ham Lands, west of Riverside Drive existed within Ham that could provide a direct route between Shaft 3 and the outfall and intake site upstream of Teddington Wier. To this end, sites were identified at Meadlands School, specifically its playing fields; Dukes Avenue; Ham Green and on land adjacent to Thamesgate Close.

5.24 During the initial review it was also identified that land at Ham Green would potentially, subject to implementation of a planning permission, undergo considerable redevelopment. In particular, the masterplan for development indicated an adjustment in the positioning of residential apartment blocks such that an assumed possible link between Riverside Drive to the north (Shaft 4), or Ham Street car park (Shaft 3) and Dukes Avenue could be affected and that this would need to be considered during the appraisal.

5.25 In general terms however, the Project team judged that these sites could, if suitable, provide alternatives to aid a potential reduction in the number of construction sites required or change to the combination of sites that could support the Project. Again, due to their similarity with other land in the vicinity already identified for Stage 4 appraisal, these sites were included for consideration in the Stage 4 appraisal process.

5.26 The following sites have therefore been appraised for Shaft 6 if required:

- Shaft 6 (Option 1): Ham Lands, west of Riverside Drive
- Shaft 6 (Option 2): Meadlands School playing field
- Shaft 6 (Option 3): Land at Dukes Avenue
- Shaft 6 (Option 4): Ham Green
- Shaft 6 (Option 5): Land adjacent to Thamesgate Close

Outfall and abstraction facility south of Burnell Avenue:

- 5.27 Due to their proximity, and the emerging understanding of the need for both sites to make efficient use of available land by sharing compound and storage space, the Stage 4 appraisal combined the outfall and abstraction facility sites into a single site for appraisal. The TLT connection shaft site was also separated from this site to enable further appraisal of options for the connection, as outlined below.

TLT Connection Shaft:

- 5.28 Notwithstanding the outcomes from Stages 2 and 3 of the appraisal to retain the Northweald Lane TLT connection site, the Project team recognised that the site presents a number of challenges. Consequently, and so as part of the initial review the relationship between the TLT alignment and the availability of corresponding surface site opportunities was investigated further.
- 5.29 This review identified a short distance of approximately 1000m between the existing Stage 2 TLT connection site and the Richmond Park Special Area of Conservation to the north east within which an alternative connection site might be located. It also identified that a connection into the TLT via a site located along the TLT's alignment to the south west of the abstraction facility was not considered due to the length of the connection which would be over the recommended 1,000m distance. Other constraints included the need to construct under the river and also close to the TLT which runs predominantly under properties until it reaches Teddington Sports Ground.
- 5.30 Three further potential TLT connection sites were identified for inclusion in the Stage 4 appraisal, one on open space on land to the west of Horsley Drive; a second on a small site comprised of a pocket park and area lawn adjacent to Tudor Drive; and a third, situated in the roadway of Barnfield Avenue at its western junction with Tudor Drive.
- 5.31 The following sites have therefore been appraised for the TLT connection shaft:
- TLT Connection (Option 1): Land South of Northweald Lane
 - TLT Connection (Option 2): Land west of Horsley Drive
 - TLT Connection (Option 3): Land at Tudor Drive
 - TLT Connection (Option 4): Land at Barnfield Avenue

Summary

- 5.32 The full list of sites appraised as part of Stage 4 was confirmed as:
- Mogden STW
 - Shaft 1 (Option 1): Northcote Recreation Ground
 - Shaft 1 (Option 2): Ivybridge Retail Park car park north
 - Shaft 1 (Option 3): Ivybridge Retail Park car park south
 - Shaft 1 (Option 4): Land between Summerwood Road and Ivybridge Retail Park
 - Shaft 2 (Option 1): Moormead and Bandy Recreation Ground central
 - Shaft 2 (Option 2): Moormead and Bandy Recreation Ground south
 - Shaft 3 (Option 1): Ham Street car park
 - Shaft 3 (Option 2): Land to the south of Ham Street car park and west of Ham Street
 - Shaft 4 (Option 1): Land to the west of Riverside Drive playground
 - Shaft 4 (Option 2): Land at Ham Playing Fields car park
 - Shaft 4 (Option 3): Land at Riverside Drive and Ham Street
 - Shaft 5: Thames Young Mariners
 - Shaft 6 (Option 1): Ham Lands, west of Riverside Drive
 - Shaft 6 (Option 2): Meadlands School playing field
 - Shaft 6 (Option 3): Land at Dukes Avenue
 - Shaft 6 (Option 4): Ham Green
 - Shaft 6 (Option 5): Land adjacent to Thamesgate Close
 - Outfall and abstraction facility south of Burnell Avenue
 - TLT Connection (Option 1): Land South of Northweald Lane

- TLT Connection (Option 2): Land west of Horsley Drive
- TLT Connection (Option 3): Land at Tudor Drive
- TLT Connection (Option 4): Land at Barnfield Avenue

5.33 A site plan for each site is provided in Appendix 2.

5.34 Each site was appraised through desktop and site surveys applying professional judgment to the data and information collected on the site in relation to an agreed set of criteria. The remainder of this section provides a summary of those appraisal outcomes by site. The corresponding appraisal summary outcomes and associated summary RAG gradings for each site are set out within Table 1 in Section 6.

5.35 It should be noted that all sites are within local planning authority (LPA) AQMA and all are within predominantly residential or a mix of residential/recreational/retail areas and as such, are in close proximity to receptors which would be sensitive to both air quality and noise issues.

5.36 Furthermore, potential operational effects of the TTF and the intake and outfall sites have been considered as part of the Stage 4 appraisals. Operational effects on environmental receptors are not, however, anticipated at the intermediate sites given the small-scale, ground-level permanent structures that will be result at these locations and the limited potential for disturbance during occasional or periodic maintenances.

Summary of Stage 4 Outcomes

Mogden STW

Engineering summary

5.37 The location of the TTF and start point of the pipeline within Mogden STW minimises offsite development and could take advantage of existing infrastructure. There is limited 'free' space within Mogden STW to locate the TTF and consideration would need to be given to ensuring existing operations at the site remain unaffected. However, through the development of a concept design a number of options exist to locate a TTF within the site.

5.38 The overall RAG rating for the Engineering criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Environment summary

5.39 The site is within Mogden Sewage Works SINC and contains deciduous woodland priority habitat, some of which may require permanent removal from the landscape bund to allow construction of the TTF. A small proportion of the SINC (<0.5ha of the 60ha site) may be impacted during construction and operation, with the majority of works being on areas of existing hardstanding. Protected species surveys have identified the potential for badger, bat and reptiles to be present on site and therefore mitigation packages will be required for these species (e.g. European Protected Species Mitigation Licence for loss of bat roosts). There are several historic landfill sites in the area although these are at a distance (c.250m) therefore impacts are unlikely. Indirect air quality and noise impacts on local communities may need to be mitigated; these are issues for all sites being considered for the TDRA Project.

5.40 The overall RAG rating for the Environment criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Planning summary

5.41 The site is proposed to be located within the boundary of the Mogden STW. Part of the site falls within Local Open Space and a SINC. A small section of land within these designations may need to be used for the TTF infrastructure. The loss of open space and potential impacts upon the SINC will require assessment and may require appropriate mitigation. The construction of the TTF above existing

infrastructure may require its temporary shutdown and measures will be required to ensure that operational efficiency is maintained during this period. The implementation of mitigation measures should mean that dust, noise and vibration impacts can be managed to acceptable levels.

- 5.42 The overall RAG rating for the Planning criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Property summary

- 5.43 The site is owned by Thames Water and there is no special category land.
- 5.44 The overall RAG rating for the Property criteria for this site is Green. The rating is also noted in Table 1 of Section 6.

Transport summary

- 5.45 The site is served by good access links to the A310 and A316.
- 5.46 The overall RAG rating for the Transport criteria for this site is Green. The rating is also noted in Table 1 of Section 6.

Shaft 1 (Option 1): Northcote Recreation Ground

Engineering summary

- 5.47 Northcote Avenue is a difficult site to construct on with a very small footprint and restrictive access. As the site is currently being developed the site would have to be cleared and isolated again from the adjacent river and then reinstated after completion. Demolition may be required to remove buildings at the entrance and the site has a high flood risk.
- 5.48 The overall RAG rating for the Engineering criteria for this site is Red. The rating is also noted in Table 1 of Section 6.

Environment summary

- 5.49 The site is to be designated a LNR and has already been subject to landscaping and biodiversity improvements, which would need to be removed and then reinstated after the works. There is also the potential for the site to be of importance for protected species given the connectivity along the River Crane, e.g. bats, and consideration will need to be given to working methods as in close proximity to two SINCS. The creation of a backwater inlet from the River Crane potentially increases the risk of flooding and may require removal to facilitate Project construction.
- 5.50 The site also provides recreational opportunities for the local community, and there is an interface on the access track to the south with a small business. There will be temporary loss of the recreation space during construction along with potentially localised noise and air quality issues. The loss of newly created habitats, and the complexity of reinstating these on the site is considered to be a significant constraint to its use. The potential for additional benefits over and above reinstatement are considered to be limited with the proposed enhancement plan for the site (from 2017) currently being progressed with construction evident at the site (March 2023).
- 5.51 The overall RAG rating for the Environment criteria for this site is Red. The rating is also noted in Table 1 of Section 6.

Planning summary

- 5.52 The proposed shaft location is currently designated as a small recreation ground within a built-up residential area in the adopted Local Plan. The site is currently being redeveloped into a nature reserve and wildlife sanctuary and has Village Green status. As construction for the TDRA Project is not expected to commence until 2028 it is likely that wildlife habitats will become established and that

during construction these habitats could be negatively impacted.

5.53 The implementation of mitigation measures should mean that dust, noise and vibration impacts can be managed to acceptable levels. The combination of the land uses including Village Green status, nature reserve and the site being an important amenity space make any mitigation challenging.

5.54 The overall RAG rating for the Planning criteria for this site is Red. The rating is also noted in Table 1 of Section 6.

Property summary

5.55 The site is owned by a 3rd party and would need to be acquired through powers or landowner negotiation. The land forms part of a park and public open space; parks and open spaces have special protection against compulsory purchase. If the land is needed permanently, replacement land would need to be provided.

5.56 The overall RAG rating for the Property criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Transport summary

5.57 The site is close to major A-class roads; however, access to these roads from the site is via narrow residential roads with on-street and on-pavement parking. Access to the site is poor with limited and restricted turning circles for construction traffic.

5.58 The overall RAG rating for the Transport criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Shaft 1 (Option 2): Ivybridge Retail car park north

Engineering summary

5.59 Adverse impacts on businesses in the retail park may result from a reduction in car parking spaces during the works; however, this site is suitable for a shaft location with adequate space and good road links adjoining the site. The pipeline would need to pass close to the retail units but not under and a site investigation, review of design of the retail units and settlement assessment is required to confirm the suitability of the site.

5.60 The overall RAG rating for the Engineering criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Environment summary

5.61 The site is not in an area where impacts on ecological receptors are anticipated due to the predominant areas of hardstanding. There are many residential, community and economic receptors in close proximity which may experience temporary adverse effects in their immediate environment including the accessibility of retail units during construction. The difference between this site and Shaft 1 (Option 3): Ivybridge Retail Park car park south is the proximity of the latter site to a community and recreational facility (Bridgelink Centre). Use of Shaft 1 (Option 2): Ivybridge Retail Park car park north would avoid a direct interface with this facility.

5.62 The overall RAG rating for the Environment criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Planning summary

5.63 Construction of a shaft in this location may cause temporary dust, noise and vibration impacts to the adjacent commercial and residential properties, and disruption to the trading of the retail businesses during construction.

5.64 The magnitude of the impacts upon car park function has the potential to be considerable, but it may

be possible to mitigate them to acceptable levels. The implementation of mitigation measures should mean that dust, noise and vibration impacts can be managed to acceptable levels. Post-construction, the effect of the shaft on the site and surroundings is likely to be very minimal.

- 5.65 The overall RAG rating for the Planning criteria for this site is Red. The rating is also noted in Table 1 of Section 6.

Property summary

- 5.66 The land in this site is owned by a 3rd party; the site forms part of a car park. There are no leasehold interests directly on this site but there will be multiple interests from adjacent leaseholders or tenants of the retail units that make up the retail park that will have an interest in the car park. As a result, early engagement is recommended.

- 5.67 The overall RAG rating for the Property criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Transport summary

- 5.68 Access to the site is good, with adjacent A-class roads.

- 5.69 The overall RAG rating for the Transport criteria for this site is Green. The rating is also noted in Table 1 of Section 6.

Shaft 1 (Option 3): Ivybridge Retail car park south

Engineering summary

- 5.70 Adverse impacts on businesses in the retail park may result from a reduction in car parking spaces during the works; however, this site is suitable for a shaft location with adequate space and good road links. The pipeline would need to pass under the retail units and a site investigation, review of design of the retail units and settlement assessment is required to confirm the suitability of the site.

- 5.71 The overall RAG rating for the Engineering criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Environment summary

- 5.72 The site is not in an area where impacts on environmental receptors are anticipated due to the predominant areas of hardstanding. There are many residential, community and economic receptors in close proximity which may experience temporary adverse impacts in their immediate environment including the accessibility of retail units and the Bridgelink Centre during construction.

- 5.73 The overall RAG rating for the Environment criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Planning summary

- 5.74 Construction of a shaft in this location may cause temporary dust, noise and vibration impacts to the adjacent commercial and residential properties, and disruption to the trading of the retail businesses during construction.

- 5.75 The magnitude of the impacts upon car park function has the potential to be considerable, but it may be possible to mitigate them to acceptable levels.

- 5.76 The implementation of mitigation measures should mean that dust, noise and vibration impacts can be managed to acceptable levels. Post-construction, the effect of the shaft on the site and surroundings is likely to be very minimal.

- 5.77 The overall RAG rating for the Planning criteria for this site is Red. The rating is also noted in Table 1 of Section 6.

Property summary

- 5.78 The land in this site is owned by a 3rd party; the site forms part of a car park. There are no leasehold interests directly on this site but there will be multiple interests from adjacent leaseholders or tenants of the retail units that make up the retail park that will have an interest in the car park. As a result, early engagement is recommended.
- 5.79 The overall RAG rating for the Property criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Transport summary

- 5.80 Access to the site is good, with adjacent A-class roads.
- 5.81 The overall RAG rating for the Transport criteria for this site is Green. The rating is also noted in Table 1 of Section 6.

Shaft 1 (Option 4): Land between Summerwood Road and Ivybridge Retail Park

Engineering summary

- 5.82 The site has good road access and would be easy to set up as a working site as it comprises an open grassed area. However, the size of the site is limited and so additional nearby temporary storage sites may be required for example potentially at Mogden STW. The pipeline would also need to pass under the adjacent retail park and the site is marked as a former landfill. There is uncertainty over the geotechnics of the site, which would require a ground investigation study and further design, in order to clarify.
- 5.83 The overall RAG rating for the Engineering criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Environment summary

- 5.84 The site is unlikely to cause impacts to biodiversity, water and heritage receptors given the distance between the site and designations. However, there are a high number of residential receptors in close proximity that may be affected during construction works, which will also cause the temporary loss of open space. The site is overlooked by a number of high-rise buildings to the west which would have a view directly into the site, and for which noise mitigation may be difficult. The site is on/overlaps with the Ivybridge Historic Landfill site and therefore additional mitigation may be required subject to the waste type disposed of at the site. However, the level of development that has been achieved elsewhere on the Ivybridge landfill site would suggest mitigation is possible.
- 5.85 The overall RAG rating for the Environment criteria for this site is Red. The rating is also noted in Table 1 of Section 6.

Planning summary

- 5.86 Construction of a shaft in this location may cause two key short-term impacts that will need to be overcome. These are the temporary loss of the amenity grassland/dog park, and secondly the potential for dust, noise and vibration impacts to the adjacent commercial and residential properties. Disruption to the highway network, including Summerwood Road and Mogden Lane, and the potential impacts on the operation of the H20 bus route will also need to be considered.
- 5.87 Mitigation measures for dust, noise and vibration impacts will require further assessment. Post-construction, the effect of the shaft on the site and surroundings is likely to be limited to very minor visual impacts on the public open space.
- 5.88 The overall RAG rating for the Planning criteria for this site is Red. The rating is also noted in Table 1 of Section 6.

Property summary

5.89 The site is owned by a 3rd party and would need to be acquired through powers or landowner negotiation. The land forms part of a dog walking park and could be considered public open space. Parks and open spaces have special protection against compulsory purchase.

5.90 The overall RAG rating for the Property criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Transport summary

5.91 The site is located between a retail park and residential area and is accessed via a short residential road off Mogden Lane. Access from Chertsey Road to the site is good for vehicles however the short distance on residential roads may have an impact on adjacent residents.

5.92 The overall RAG rating for the Transport criteria for this site is Green. The rating is also noted in Table 1 of Section 6.

Shaft 2 (Option 1): Moormead and Bandy Recreation Ground central

Engineering summary

5.93 Moormead and Bandy recreation ground has significant space for the construction of a shaft, including space for a construction compound and materials storage. The pipeline length to Ham Street Car Park is just over 1000m which is slightly outside the recommended length between shafts for a 1.8 diameter pipeline although undertaking a ground investigation and subsequent design of the tunnel may confirm this is an acceptable distance. The site is surrounded by residential roads with a weight-restricted bridge to the west. To limit the use of residential roads a temporary access track is proposed to be laid across the open space.

5.94 The overall RAG rating for the Engineering criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Environment summary

5.95 The indicative location of the site has been selected to avoid the removal of the sports pitches where possible. The current design avoids the football pitch, but is likely to encroach into the cricket pitch. To mitigate disruption, the ability to accommodate any displaced activities in the southern part of the site or elsewhere in the immediate vicinity would need to be explored including investigations in to construction phasing to determine if construction works can occur outside of particular sporting seasons.

5.96 The site falls within Moor Mead Recreation Ground SINC and is adjacent to the River Crane at St Margaret's (Richmond side) SINC. The majority of habitat under the construction footprint is common low value grassland which can be easily reinstated and will recover over a short time scale, whilst establishing a suitable buffer along the river will protect the watercourse and riparian habitat.

5.97 There are likely to be some temporary effects upon local residents and recreational users of Moormead and Bandy Recreation Ground arising from the construction works and a temporary loss of greenspace and recreational facilities.

5.98 The overall RAG rating for the Environment criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Planning summary

5.99 The site lies within an established recreation ground, designated as an SINC and a public open space that contains sports pitches. There is the potential for impacts on the public use of the recreation ground and sports pitches during construction, and street furniture may need to be removed to create suitable access for construction vehicles. However, the southern half of the recreation ground will still be available to residents with limited impacts and any park furniture could be reinstated. The location

of the shaft near to the recently approved new pavilion building could result in disruption with overlapping construction periods.

- 5.100 A temporary access track along the western side of the recreation ground and construction compound would potentially impact on the amenity of the sports pitches during the construction period but would avoid the majority of the sports pitches being unusable.
- 5.101 The potential impact of construction dust, noise and vibration on neighbouring residential properties and users of the recreation ground will likely need mitigation.
- 5.102 The permanent loss of a very small area (4m²) of MOL will require consideration against MOL policy, as will the loss of public open space. Impacts upon the SINC will require assessment and appropriate mitigation.
- 5.103 The overall RAG rating for the Planning criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Property summary

- 5.104 The site is owned by a 3rd party and forms part of Moormead and Bandy recreation ground which is public open space. If the land is needed permanently replacement land would need to be provided to replace any purchased land.
- 5.105 The overall RAG rating for the Property criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Transport summary

- 5.106 The site is close to a main road at Chertsey Avenue, however the access from the main road to the site is through residential areas with narrow roads and a bridge with a weight limit. Access from residential roads to the east to the site is very narrow.
- 5.107 The overall RAG rating for the Transport criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Shaft 2 (Option 2): Moormead and Bandy Recreation Ground south

Engineering summary

- 5.108 Moormead and Bandy recreation ground has significant space for the construction of a shaft, including space for a construction compound and materials storage. Due to the proximity of the rail line Network Rail will need to be consulted in assessing shaft design. Undertaking a ground investigation and subsequent design of the shaft would assess any potential impacts on the railway.
- 5.109 Access to the site is likely to be from the west through residential roads with a weight-restricted bridge. To limit further potential impacts on other residential roads a temporary access track is proposed to be laid across the open space to the construction site.
- 5.110 The overall RAG rating for the Engineering criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Environment summary

- 5.111 As with Moormead and Bandy Recreation Ground central, the key issue with using the site is the potential loss of recreational facilities during construction works. The tennis courts will remain open; however, there is an interface between the playground and access track which will need to be managed. The site falls within Moor Mead Recreation Ground SINC and is adjacent to the River Crane at St Margaret's (Richmond side) SINC. The majority of habitat under the construction footprint is common low value grassland which can be easily reinstated and will recover over a short time scale, whilst establishing a suitable buffer along the river will protect the watercourse and riparian habitat. The site boundaries in the south-west corner should be reviewed at detailed design stage to ensure a

buffer zone can be implemented.

5.112 There are likely to be some temporary effects upon local residents and recreational users of Moormead and Bandy Recreation Ground, arising from the construction works and a temporary loss and disturbance of greenspace and recreational facilities.

5.113 The overall RAG rating for the Environment criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Planning summary

5.114 The site lies within an established recreation ground, designated as public open space and SINC. There is potential for impacts on the public use of the recreation ground during construction, especially with the need to create a significantly long vehicle access road through the entire open space. Park features including benches and trees may need to be removed to create the access and road. Any park furniture that would need to be removed will be required to be reinstated.

5.115 Routing the access track so that it follows the tree line on the western side of the recreation ground would help to largely avoid the sports pitches and potentially minimise the disruption to the central part of the recreation ground.

5.116 The potential impact of construction dust, noise and vibration on neighbouring residential properties and users of the recreation ground will likely need mitigation.

5.117 The permanent loss of a very small area (4m²) of MOL will require consideration against MOL policy, as will the loss of public open space. Impacts upon the SINC will require assessment and appropriate mitigation.

5.118 The overall RAG rating for the Planning criteria for this site is Red. The rating is also noted in Table 1 of Section 6.

Property summary

5.119 The site is owned by a 3rd party and forms part of Moormead and Bandy recreation ground which is public open space. If the land is needed permanently replacement land would need to be provided to replace any purchased land.

5.120 The overall RAG rating for the Property criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Transport summary

5.121 The site is close to a main road at Chertsey Avenue; however, the access from the main road to the site is through residential areas with narrow roads and a bridge with a weight limit. Access from residential roads to the east to the site is very narrow for construction access.

5.122 The overall RAG rating for the Transport criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Shaft 3 (Option 1): Ham Street car park

Engineering summary

5.123 The site is located in a car park next to the River Thames with relatively good access. Very limited site clearance would be needed to set up the site and reinstate it after completion of the works. There is adequate space to construct a shaft, a construction compound and for material storage.

5.124 The proximity of the River Thames provides a potential flood risk during the works but also offers the opportunity to use barges to reduce construction traffic thereby avoiding vehicle movements on

surrounding roads. The potential to use barges could be used by other shaft sites on the south side of the River Thames.

- 5.125 The overall RAG rating for the Engineering criteria for this site is Green. The rating is also noted in Table 1 of Section 6.

Environment summary

- 5.126 The site is located in close proximity to a LNR and SINC. The use of the site will need to be carefully planned to protect designated areas and retain areas of higher value habitat around the perimeters of the site and avoid degradation. Priority habitats (deciduous woodland and native hedgerows) are present along the boundaries of the site, and potentially provide suitable habitat for birds, bats, badger and stag beetle, and will require mitigation if found to be present.
- 5.127 A full heritage assessment is likely to be required as Ham House Registered Park and Garden is directly to the south, with the Grade II listed building at a greater distance. The entire site is within the Ham House Conservation Area, and parts of the site are located within Archaeological Priority Areas (Thames Foreshore and Bank, and Ham Fields APAs). The site is within a protected view designation; "View from near Ham House to Orleans House". However, the temporary construction impacts are likely mitigatable, and the ground-level permanent infrastructure at the shaft is unlikely to impact the setting given its location within the existing car park.
- 5.128 Although mitigation will be required, the site is not in direct proximity to sensitive receptors for noise. In common with all sites it is located in an AQMA (LB of Richmond upon Thames).
- 5.129 The site offers the opportunity to use barges to move materials to and from the site and reduce HGV movements along Ham Street and the wider road network. The temporary loss of the car park will require mitigation and the likely provision of alternative parking in the vicinity.
- 5.130 The use of the waterfront in this location would involve works within the River Thames and Tidal Tributaries SINC, although the existing concrete structure at the site means that habitats are of limited ecological value. Good practice construction methods and adherence to pollution prevention management measures will be required to avoid deterioration of the aquatic habitats in the River Thames.
- 5.131 The overall RAG rating for the Environment criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Planning summary

- 5.132 Construction in this location is likely to have a temporary impact on the users of the car park and Ham Street, along with local people using the riverside path.
- 5.133 The permanent loss of a very small area (4m²) of MOL will require consideration against MOL policy as will the loss of public open space. Impacts upon any designated areas will require assessment and appropriate mitigation. There is the potential for a number of short-term impacts mainly relating to the loss of public open space, public parking spaces, and public access to the Thames riverside.
- 5.134 Traffic impact on road users along Ham Street will need to be considered carefully, with the adoption of appropriate traffic routing and management to help mitigate potential impacts. The use of water freight could help to reduce HGV movements along Ham Street and minimise potential impacts to users of Ham Street.
- 5.135 The overall RAG rating for the Planning criteria for this site is Red. The rating is also noted in Table 1 of Section 6.

Property summary

- 5.136 The site is owned by a 3rd party, with no special category land. Land forms include public car park and publicly accessible land and would require replacement land for any purchased land and reinstatement

of any areas used. Further investigations would be required into potential restrictions on construction at the riverbank.

- 5.137 The overall RAG rating for the Property criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Transport Summary

- 5.138 The site is adjacent to the River Thames and offers the opportunity to utilise the river for site access thereby minimising traffic movements on residential roads. The site is accessed by road via the A307 and Ham Street which is wide enough for construction traffic; however, it is anticipated that traffic routing and management will be required temporarily during construction.
- 5.139 The footpath along the waterfront would need to be diverted around the construction site temporarily.
- 5.140 The overall RAG rating for the Transport criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Shaft 3 (Option 2): Land to the south of Ham Street car park and west of Ham Street

Engineering summary

- 5.141 The site is located in a field near Ham Street car park near to the River Thames. There is adequate site space to construct a shaft, a construction compound and for material storage during works. The land is flat and mainly grassland.
- 5.142 The proximity of the River Thames means that there is a potential for flood risk and subject to further investigation the ability to move material to and from the site via river transport.
- 5.143 The overall RAG rating for the Engineering criteria for this site is Green. The rating is also noted in Table 1 of Section 6.

Environment summary

- 5.144 The site is predominantly amenity grassland and is directly south of the Ham Lands LNR and SINC. The northern boundary consists of priority habitats (deciduous woodland and hedgerow) and therefore these areas should be clearly demarcated to ensure they are protected.
- 5.145 The site is within the Ham Fields Archaeology Priority Area, and directly west of Ham House Registered Park and Garden and associated listed buildings, although outside the Ham House Conservation Area. Given the proximity of these designations, heritage and archaeological desk-based assessments are likely to be required. To the north and south are protected views and vistas associated with Ham House. The temporary construction impacts are likely mitigatable, and the ground-level permanent infrastructure at the shaft is unlikely to impact the setting, or views and vistas, as it is in context with other urban ground-level infrastructure in the area.
- 5.146 The site is not in direct proximity to sensitive receptors for noise but as with all the sites being considered, the site is in an AQMA.
- 5.147 Numerous recreational and business uses make use of access from Ham Street. The management of HGV movements along Ham Street will need to be carefully planned and communicated to users to mitigate for disruption where possible.
- 5.148 The overall RAG rating for the Environment criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Planning summary

- 5.149 The site would be located on amenity grassland west of Ham Street. Construction of a shaft in this location is likely to cause a number of short-term impacts that may need to be mitigated to acceptable levels, including the potential loss of public open space; dust, noise and vibration impacts to the

adjacent amenity users.

- 5.150 The permanent loss of a very small area (4m²) of MOL will require consideration against MOL policy, as will the loss of public open space.
- 5.151 Traffic impact on road users along Ham Street will need to be considered carefully, with the adoption of appropriate traffic routing and management to help mitigate potential impacts. The use of water freight could help to reduce HGV movements along Ham Street.
- 5.152 Post-construction impacts of the development are likely to be limited to very minor visual impact on the public open space.
- 5.153 The overall RAG rating for the Planning criteria for this site is Red. The rating is also noted in Table 1 of Section 6.

Property summary

- 5.154 The site is owned by a 3rd party and partly unregistered. The land is used as playing fields which is considered public open space. If the land is needed permanently replacement land would need to be provided to replace any purchased land. Further investigation is required to understand the ownership of any unregistered land in the vicinity.
- 5.155 The overall RAG rating for the Property criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Transport summary

- 5.156 The site is accessed by road via the A307 and Ham Street which is wide enough for construction traffic; however, it is anticipated that traffic routing and management will be required temporarily during construction. Subject to further investigation, river access may be possible.
- 5.157 The overall RAG rating for the Transport criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Shaft 4 (Option 1): Land to the west of Riverside Drive playground

Engineering summary

- 5.158 The site is located on open space next to Riverside Drive. The site is elongated and is suitably sized to facilitate a shaft site, site compound and material storage area. Very limited site clearance would be needed to set up the site and reinstate it after completion of the works. The proximity to Shaft 3 offers an opportunity to use barges for construction material.
- 5.159 The overall RAG rating for the Engineering criteria for this site is Green. The rating is also noted in Table 1 of Section 6.

Environment summary

- 5.160 There are no ecological designations or priority habitats on the site and aerial imagery suggests that the site is mown and maintained grassland, of low ecological value. Retention of the scattered trees that border the site and adherence to root protection zones should be undertaken where possible. The site is directly within the Ham Fields Archaeological Priority Area, and therefore archaeological desk studies and assessments would be required ahead of construction to determine presence and mitigation requirements. The site is in proximity to Ham House Registered Park and Gardens and associated Listed Buildings, although construction and operation impacts are considered unlikely.
- 5.161 Residential properties border Riverside Drive and consideration, and possible mitigation would be required for any air quality, noise and vibration impacts predicted from construction works. Potential temporary impacts on access to informal green space, and the nearby playground and allotments

would need to be considered and appropriate mitigation put in place where required.

- 5.162 The overall RAG rating for the Environment criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Planning summary

- 5.163 The site would be located on an area of amenity grassland north of Riverside Drive. Construction of a shaft in this location could cause a number of short-term impacts that need to be mitigated, including, dust, noise and vibration impacts to the adjacent residential properties. The implementation of mitigation measures should mean that any impacts can be managed to acceptable levels.
- 5.164 The temporary loss of open space during construction may also need mitigation. The permanent loss of a very small area (4m²) of MOL will require consideration against MOL policy, as will the loss of public open space.
- 5.165 Potential traffic impacts on residents along Riverside Drive will need to be considered carefully, however, with the adoption of appropriate traffic routing and management potential adverse impacts will likely be mitigated.
- 5.166 Post construction impacts are likely to be limited to a very minor visual impact on the public open space.
- 5.167 The overall RAG rating for the Planning criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Property summary

- 5.168 The site is owned by two 3rd parties, as well as a section of unregistered land. The land in this site is considered public open space. If the land is needed permanently replacement land would need to be provided to replace any purchased land.
- 5.169 The overall RAG rating for the Property criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Transport summary

- 5.170 The road access to the site is along Riverside Drive from Ham Street or Dukes Avenue. Riverside Drive is a residential road and is wide enough for construction vehicles. The proximity to Shaft 3 offers an opportunity to use barges for material movements thereby limiting HGV movements on residential roads.
- 5.171 The overall RAG rating for the Transport criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Shaft 4 (Option 2): Land at Ham Playing Fields car park

Engineering summary

- 5.172 The Ham Playing Fields site is located in the car park next to the playing fields. The site is suitably sized to facilitate a site compound with the adjacent playing fields providing excellent space for storage as required. Very limited site clearance would be needed to set up the site and reinstate it after completion of the works. The proximity to Shaft 3 offers an opportunity to use barges for material movements with vehicle access via Ham Street.
- 5.173 The overall RAG rating for the Engineering criteria for this site is Green. The rating is also noted in Table 1 of Section 6.

Environment summary

- 5.174 The site comprises areas of hardstanding and modified grassland, of low ecological value, but borders

Ham Lands LNR and SINC and an area of woodland (to the west) and a length of priority hedgerow habitat extends along the southern boundary of the hardstanding. This will need to be clearly demarcated to avoid encroachment by the construction works.

- 5.175 The site is >250m from any Listed Buildings and the Ham House Registered Park and Garden and associated Conservation Area, with construction and operation impacts unlikely. As this site is in proximity to the Ham Fields Archaeological Priority Area, further heritage assessment will likely be required, although construction of the existing car park may reduce the potential for archaeological finds.
- 5.176 There may be socio-economic and recreational impacts when using this site. The greatest challenges will be to allow the Kew and Ham Sports Association/Richmond and Kew Football club to maintain operation during the construction phase and potential disturbance of users of Katey's pre-school and nursery with the construction compound occupying the car park and sharing the access road. Other potential impacts may be upon the local community as a result in temporary deterioration in air quality and noise disturbance. It is anticipated that these could be minimised with good practice measures.
- 5.177 The overall RAG rating for the Environment criteria for this site is Red. The rating is also noted in Table 1 of Section 6.

Planning summary

- 5.178 The key issue for this site is the impact to the neighbouring uses caused by the occupation of the car park. With the entirety of the car park included within the site area, parking provision for Ham Playing Fields and Katey's pre-school and nursery would be lost for the duration of the construction period. In addition to the loss of parking provision, both pedestrian and vehicular access to the site would also be lost. Without replacement parking and access, use of these facilities would be considerably impacted during the construction phase.
- 5.179 All surrounding land uses i.e. the nursery, sports uses, stabling uses and adjacent residential properties could also experience impacts from construction activities, in terms of dust, noise and vibration. The implementation of mitigation measures should mean that these can be managed to acceptable levels.
- 5.180 Overall, although post-completion the effect on the existing use would be negligible the significant impact temporarily for the existing and neighbouring uses would result in large disruption.
- 5.181 The overall RAG rating for the Planning criteria for this site is Red. The rating is also noted in Table 1 of Section 6.

Property summary

- 5.182 The site is owned by multiple 3rd parties, acquisition of this land if required would need to be through landowner negotiation or the use of powers. Access to Ham playing field and nursery that occupy the site could be impacted during construction.
- 5.183 The overall RAG rating for the Property criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Transport summary

- 5.184 The road access to the site is along Riverside Drive from Ham Street or Dukes Avenue. Riverside Drive is a residential road and is wide enough for construction vehicles. The proximity to Shaft 3 offers an opportunity to use barges for material movements thereby limiting HGV movements on residential roads.
- 5.185 The overall RAG rating for the Transport criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Shaft 4 (Option 3): Land at Riverside Drive and Ham Street

Engineering summary

- 5.186 The site comprises two areas and is located on open space at the junction between Riverside Drive and Ham Street. The site is elongated but is suitably sized to facilitate a site compound with storage located on the smaller area to the east of Ham Street. Very limited site clearance would be needed to set up the site and reinstate it after completion of the works. The proximity to Shaft 3 offers an opportunity to use barges for material movements.
- 5.187 The overall RAG rating for the Engineering criteria for this site is Green. The rating is also noted in Table 1 of Section 6.

Environment summary

- 5.188 The site is located within Ham Archaeological Priority Area and part of the site is within Ham House Conservation Area. The site is directly west of the Ham House Registered Park and Garden and there are associated Listed Buildings further north along Ham Street. Any temporary construction impacts are likely mitigatable, and the ground-level permanent infrastructure at the shaft is unlikely to impact the setting, as it is in context with other urban ground-level infrastructure in the area. Further heritage assessments will be required if this site is progressed.
- 5.189 Aerial imagery and site survey shows that the site is mown and maintained, with the key habitat being modified grassland of low ecological value. No priority habitats were identified, although one tree was identified as providing bat roosting potential, and scrub clearance would need to be undertaken to avoid impacting breeding birds. Retention of the scattered trees and adherence to root protection zones should be undertaken where possible.
- 5.190 Any potential impacts upon the local community would be temporary from the construction works and may include deterioration in air quality and noise disturbance to residential properties, impacts on the access of the informal green space and disturbance. These are important considerations that may require mitigation.
- 5.191 The overall RAG rating for the Environment criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Planning summary

- 5.192 The shaft would be located on amenity grassland west of Ham Street, whilst land for material storage could be located to the east. Construction of a shaft in this location may cause a number of short-term impacts that need to be mitigated, including the temporary loss of public open space; dust, noise and vibration impacts from construction activities upon the adjacent residential properties; and potential disruption to the trading of the Palm Centre. The implementation of mitigation measures should mean that these potential impacts can be managed to acceptable levels.
- 5.193 The permanent loss of a very small area (4m²) of MOL will require consideration against MOL policy, as will the loss of public open space. Potential impacts upon the MOL will require assessment and appropriate mitigation. Access to the site is likely to be via Riverside Drive, which will need careful consideration to minimise impacts on local residents and the highway network.
- 5.194 Post-construction impacts are likely to be limited to a very minor visual impact on the public open space.
- 5.195 The overall RAG rating for the Planning criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Property summary

- 5.196 The site is owned by a 3rd party, and forms part of public open space. If the land is needed permanently replacement land would need to be provided to replace any purchased land.
- 5.197 The overall RAG rating for the Property criteria for this site is Amber. The rating is also noted in Table

1 of Section 6.

Transport summary

- 5.198 The site is located on two areas of open space at the junction between Riverside Drive and Ham Street. The road access is wide enough for construction vehicles. The proximity to Shaft 3 offers an opportunity to use barges for material movements with vehicle movements to the river along Ham Street for 400m to Ham Street Car Park, therefore limiting HGV movement on surrounding residential roads.
- 5.199 The overall RAG rating for the Transport criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Shaft 5: Thames Young Mariners

Engineering summary

- 5.200 The site is located on space within the Thames Young Mariners site. The site is constrained, bounded by an access road and lake. There are trees around the site that unless removed, make the site difficult to operate in. The proximity of the site to the adjacent lake presents a flood risk and additional protections are required to prevent pollution risk. In addition, the bank stability may be unsuitable for heavy plant.
- 5.201 Although retained from Stages 2 and 3 of the appraisal, further investigation in respect of ground settlement analysis has confirmed that a direct route from Shaft 4 to Shaft 6 is feasible, meaning that Shaft 5 is not required from an engineering perspective. Unless that analysis changes, Shaft 5 is no longer required and the traverse alignment for the pipeline previously identified under Stage 2 of the appraisal can be discounted in favour of a more direct alignment, shaft site availability permitting and on receipt of a ground investigation that confirms ground conditions.
- 5.202 The overall RAG rating for the Engineering criteria for this site is Red. The rating is also noted in Table 1 of Section 6.

Environment summary

- 5.203 The site is located within Ham Lands SINC and surrounded by Ham Lands LNR. The site is within Flood Zone 2 and directly east of the River Thames with connection via the Ham Lake waterbody. The site is also adjacent to the Ham Fields Archaeological Priority Area.
- 5.204 The key issue with the use of this site relates to the potential disruption and disturbance to the businesses and facilities on the Thames Young Mariners site, temporary loss of part of the outdoor space, and the proximity of these receptors during construction and intra-project cumulative disturbance effects. A review of the compound size and layout would need to be undertaken at the detailed design stage to ensure access is retained to the businesses. Residential receptors are located on Riverside Drive who may also be temporarily impacted.
- 5.205 An area of priority woodland habitat on the northern boundary of the site, close to Ham Lake, may be lost and/or works required in direct proximity. Root protection zones would need to be clearly demarcated to avoid and/or minimise deterioration of the habitat. Given the site's location surrounded by woodland, the adjoining land is suitable for badger and roosting bats. The presence of these and other protected species will need to be determined through protected species surveys, and a mitigation strategy developed for incorporation into environmental control documents.
- 5.206 The overall RAG rating for the Environment criteria for this site is Red. The rating is also noted in Table 1 of Section 6.

Planning summary

- 5.207 The site would require shared access with the Thames Young Mariners and the Little Squirrels Forest

School. Careful consideration will be necessary to ensure that movement of construction vehicles does not interfere with the use of the access road and where required, the provision of marshalling to ensure safe movement between oncoming vehicles. The land use on the existing open space will largely be unaffected during the construction phase.

- 5.208 The permanent loss of a very small area (4m²) of MOL will require consideration against MOL policy. Impacts upon the SINC will require assessment and appropriate mitigation.
- 5.209 There may be dust, noise and vibration impacts upon the users of both the Thames Young Mariners facility and the Little Squirrels Forest school, and these could also affect surrounding residential land uses along with access impacts along Riverside Drive. The implementation of mitigation measures should mean that these impacts can be managed to acceptable levels.
- 5.210 Post-construction impacts of the development are likely to be limited to a very minor visual impact on the public open space.
- 5.211 The proposed development at the Thames Young Mariners Centre would likely have minimal impact on the identified shaft site both in terms of site area and construction timing.
- 5.212 The overall RAG rating for the Planning criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Property summary

- 5.213 The site is owned by a 3rd party, with no special category land. Use of 3rd party land would need to be acquired through negotiations with the landowner or the use of powers. Any areas used on a temporary basis would need to be reinstated.
- 5.214 The overall RAG rating for the Property criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Transport summary

- 5.215 The road access to the site is along Riverside Drive from Ham Street or Dukes Avenue. Riverside Drive is a residential road and is wide enough for construction vehicles.
- 5.216 The overall RAG rating for the Transport criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Shaft 6 (Option 1): Ham Lands, west of Riverside Drive

Engineering summary

- 5.217 The site is located on open parkland next to Riverside Drive. There is direct road access to the site along Riverside Drive and to the A307 via Dukes Avenue or Ham Street. The proximity to Shaft 3 offers an opportunity to use barges for construction material with vehicle movements along Ham Street. The site is large, level and open with good access to Riverside Drive.
- 5.218 The overall RAG rating for the Engineering criteria for this site is Green. The rating is also noted in Table 1 of Section 6.

Environment summary

- 5.219 The site has environmental issues across a number of the topic areas being considered. The site is located within Ham Lands LNR and SINC, at the northern boundary next to Riverside Drive. The construction compound would result in the temporary loss of the grassland habitat on site. Although grassland has a relatively short-term regeneration time, compared to deciduous woodland for example, the mitigation strategy may require removal of the topsoil to retain the seedbank, re-seeding with an appropriate mix, and management of the site post-restoration to avoid dominant species typical

of disturbed grounds outcompeting the required planting mix. Suitable stag beetle habitat has been recorded within the site boundary which will either require retention and an exclusion zone around it, or relocation to an alternative location within Ham Lands LNR. Creation of additional stag beetle habitat may be required as part of the mitigation package.

- 5.220 Archaeological assessment, and potential investigations may be required given the site is located in the Ham Fields Archaeological Priority Area. The site is a well-used open space with numerous informal footpaths, some of which would be inaccessible during construction, although there are alternative pathways which could be used. The site is directly west of Riverside Drive, so localised temporary changes to visual amenity, noise and dust issues may be experienced during construction. These will be minimised by good practice measures for the control of dust and noise.
- 5.221 The overall RAG rating for the Environment criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Planning summary

- 5.222 The use of the site would lead to the temporary loss of the existing land use, leading to associated temporary disruption to access through parts of the nature reserve and potential impacts upon the biodiversity value, visual amenity and recreation amenity of the site footprint during construction.
- 5.223 Use of the site may give rise to noise and vibration impacts during construction, including for adjacent residential properties. The implementation of mitigation measures should mean that these impacts can be managed to acceptable levels.
- 5.224 The permanent loss of a very small area (4m²) of MOL will require consideration against MOL policy as will the loss of public open space. Potential impacts upon the LNR will require assessment and appropriate mitigation. Use of Riverside Drive for access is considered appropriate although traffic management measures may be required.
- 5.225 The overall RAG rating for the Planning criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Property summary

- 5.226 The site is owned by a 3rd party, and forms part of Ham Lands LNR which is open space. If the land is needed permanently replacement land would need to be provided to replace any purchased open space land.
- 5.227 The overall RAG rating for the Property criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Transport summary

- 5.228 The site is located on open space and can be accessed from Riverside Drive. Riverside Drive is residential but is wide enough for construction vehicles. The proximity to Shaft 3 offers an opportunity to use barges for material movements.
- 5.229 The overall RAG rating for the Transport criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Shaft 6 (Option 2): Meadlands School playing field

Engineering summary

- 5.230 The site has adequate space for shaft construction; however, access to the site is very poor and it is located in very close proximity to a school and some narrow residential roads.
- 5.231 The overall RAG rating for the Engineering criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Environment summary

- 5.232 The site is located within a school playing field and there are few biodiversity and water receptors that would require mitigation if this site were used. The key effects arising from construction would be the temporary loss of Meadlands School playing fields, the disturbance and potential adverse impact on the wellbeing of pupils and staff at the school during construction, and similar issues to the residential receptors in close proximity, some of whom have a view into the site. The ability to manage the construction programme and develop robust mitigation strategies to minimise noise and air quality issues will be key if this site were to be selected.
- 5.233 The overall RAG rating for the Environment criteria for this site is Red. The rating is also noted in Table 1 of Section 6.

Planning summary

- 5.234 The site is located within a school playing field and therefore there are few ecological, flood/water or historic environment designations or land constraints that would be affected.
- 5.235 The main issues would relate to the temporary loss of Meadlands School playing field, disturbance and disruption to the use of the school, and dust, noise and vibration impacts upon both the school and neighbouring residential properties. Access into the playing field during construction is recognised as difficult due to a very narrow access route to the south, and a narrow access point to the north, both of which are currently fenced off.
- 5.236 The implementation of mitigation measures should mean these impacts can be managed to acceptable levels; however, the nature of potential impacts upon the use of the school are judged to be very challenging to overcome, particularly in view of the compact nature of the site and the school building. Careful consideration will be required to ensure safety and protection of school users with the timing of construction vehicle movements likely to need restrictions.
- 5.237 The overall RAG rating for the Planning criteria for this site is Red. The rating is also noted in Table 1 of Section 6.

Property summary

- 5.238 The site is owned by two different 3rd parties. The land would need to be acquired through powers or landowner negotiation and reinstatement of any area used. The use of this land would likely cause disturbance to the functioning of the school during construction.
- 5.239 The overall RAG rating for the Property criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Transport summary

- 5.240 Access to the site is through narrow residential roads which at certain times of the day are likely to be congested. Working around the school day and providing safe access will impact on the construction programme and likely result in an extended duration of construction.
- 5.241 The overall RAG rating for the Transport criteria for this site is Red. The rating is also noted in Table 1 of Section 6.

Shaft 6 (Option 3): Land at Dukes Avenue

Engineering summary

- 5.242 Land at Dukes Avenue is a small strip of land which is separated by a road and a junction and surrounded by residential properties. Limited space and access are critical factors at this site from an engineering perspective.
- 5.243 The overall RAG rating for the Engineering criteria for this site is Red. The rating is also noted in Table 1 of Section 6.

Environment summary

- 5.244 The site is at a junction within a residential area and there are few environmental designations or land constraints that would have to be mitigated if this site were used. However, although the site makes use of the larger verges at the junction, given the residential setting, there are still properties in proximity to the construction site. These receptors would likely experience adverse impacts from noise, dust and air quality impacts, and deterioration of local views during construction. The footpath that extends along Dukes Avenue would need to be closed, although the pavement extends along the southern side of Dukes Avenue and either side of Broughton Avenue allowing alternative access.
- 5.245 The overall RAG rating for the Environment criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Planning summary

- 5.246 Due to the site's location very close to residential properties and north of the 4-way junction of Dukes Avenue, Beaufort Road and Broughton Avenue there may be dust, noise and vibration impacts and disruption to access and on-street parking. The implementation of mitigation measures may mean that these impacts can be managed to acceptable levels.
- 5.247 Use of the site would also likely require some road closures to facilitate provision of a compound and shaft construction, which will impact on road uses including bus routes and visitors to nearby Meadlands School, as well as residential users.
- 5.248 The careful management of the movements of HGVs and any road restrictions or closures will be very important, however Broughton Avenue and Dukes Avenue benefit from two points of entry which could allow the continued use of residential streets with the construction compound in place via appropriate diversions.
- 5.249 A pedestrian improvements scheme has also recently been implemented and consideration of avoidance and mitigation of any impacts upon this will be required. Post-construction impacts of the development are likely to be limited to a very minor visual impact on the amenity space.
- 5.250 The overall RAG rating for the Planning criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Property summary

- 5.251 The site comprises unregistered land made of adopted highway, verges and footways is assumed to be owned by the local authority. The land would need to be acquired through temporary powers or landowner negotiation.
- 5.252 The overall RAG rating for the Property criteria for this site is Green. The rating is also noted in Table 1 of Section 6.

Transport summary

- 5.253 The site is located on small open space on Dukes Avenue off the A307. The road access to the site along Dukes Avenue is residential but wide enough for construction vehicles. Access to Dukes Avenue can be from either direction limiting potential impacts on local residents.
- 5.254 The overall RAG rating for the Transport criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Shaft 6 (Option 4): Ham Green

Engineering summary

- 5.255 The Ham Green site is in a residential area and surrounded by residential properties. The site is adequately sized for a site compound, storage of materials and shaft construction. There are likely to be a large number of underground utilities in this area that may require diversion.

- 5.256 The overall RAG rating for the Engineering criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Environment summary

- 5.257 The site consists of a mixture of buildings and hardstanding, modified grassland and scattered trees and scrub. There are few environmental designations or land constraints that would have to be mitigated if this site were used.
- 5.258 The site is adjacent to the Ham Archaeological Priority Area and Ham House Conservation Area with a number of Listed Buildings present along Ham Street. As with a number of the shaft site options in proximity to Ham House, any temporary construction impacts are likely mitigatable, and the ground-level permanent infrastructure at the shaft is unlikely to impact the setting, as it is in context with other urban ground-level infrastructure in the area. However, further heritage assessments will be required to determine any mitigation required. The location for the shaft site will require the closure of the play area (noting that the area is already fenced off (September 2023)) which will reduce the availability of recreational facilities in the area unless it can be relocated.
- 5.259 Although there may be an opportunity to construct alongside the current residential development planned for the site, there are a number of sensitive receptors in close proximity, such as schools, youth centre and residential blocks of flats. These receptors may experience adverse impacts from air quality, noise, visual amenity, lighting which would require mitigation. Disruption to local businesses within the immediate vicinity may also occur and require further consideration.
- 5.260 The overall RAG rating for the Environment criteria for this site is Red. The rating is also noted in Table 1 of Section 6.

Planning summary

- 5.261 The key planning risk of this site would be the impacts of construction on the neighbouring uses, with residential properties surrounding the site, and therefore likely to be impacted during the construction period. Grey Court School and Strathmore School are located to the east, and St Richards School to the south-west. Careful consideration will be required to ensure safety and protection of these neighbouring uses with the timing of construction vehicles movements likely to need restrictions.
- 5.262 Post construction there is an opportunity to enhance the south of Ham Green through reinstatement of the open space and play area. Use of the site could also potentially be integrated into the forthcoming regeneration proposals for this part of Ham enabling final reinstatement to contribute to renewed open space.
- 5.263 However, as the construction periods for both the Project and the adjacent regeneration of Ham Green could overlap, there is potential for cumulative impacts, the effects of which could be challenging to manage.
- 5.264 Overall, it is considered that despite the post completion visual impacts being negligible, the impacts on neighbouring uses and the cumulative impacts with the Ham Green redevelopment area could be challenging to mitigate.
- 5.265 The overall RAG rating for the Planning criteria for this site is Red. The rating is also noted in Table 1 of Section 6.

Property summary

- 5.266 The site is owned by a 3rd party and forms part of Ham Green public open space. If the land is needed permanently replacement land would need to be provided to replace any purchased open space land.
- 5.267 The overall RAG rating for the Property criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Transport summary

- 5.268 The road access to the site is via Ham Street which is residential and wide enough for construction vehicles. The proximity to the Shaft 3 site offers an opportunity to use barges for construction material.
- 5.269 The overall RAG rating for the Transport criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Shaft 6 (Option 5): Land adjacent to Thamesgate Close

Engineering summary

- 5.270 The site is located in parkland near to Riverside Drive. There is road access to the site along Riverside Drive and on to an access road leading to Teddington Lock. A further temporary access road would need to be installed linking the construction site to this access road with the removal of trees. The construction area is surrounded by trees and clearance would be required of a number of individual trees that sit in the open space.
- 5.271 The overall RAG rating for the Engineering criteria for this site is Red. The rating is also noted in Table 1 of Section 6.

Environment summary

- 5.272 The development of this site would involve the loss of priority lowland deciduous woodland (moderate condition) to facilitate construction. Protected species are also likely to be present and would require mitigation. The site is located in Ham Lands SINCE.
- 5.273 There is no existing screening that will minimise potential adverse impacts during construction for residents on Thamesgate Close. Localised changes to visual amenity, noise and dust issues may be experienced and will require mitigation if this site is used. Access to the construction site would be along the access road to Teddington Lock and will cut across the adjacent footpath and National Cycle Network route. This will need to be managed to avoid restricting recreational use.
- 5.274 The overall RAG rating for the Environment criteria for this site is Red. The rating is also noted in Table 1 of Section 6.

Planning summary

- 5.275 Access to the site would be taken via an existing access road from Riverside Drive which also provides service vehicle access to the River Thames. It is also immediately adjacent to a public right of way and part of the National Cycle Network route, which in turn is immediately adjacent to a row of residential properties.
- 5.276 The site itself is situated on land designated as MOL and within Ham Lands LNR. Use of the site would require vegetation and trees within the site area to be cleared to allow for access through to the shaft location and for the construction of the shaft. Residential properties within Thamesgate Close are located immediately adjacent to the shaft site.
- 5.277 The implementation of mitigation measures may mean that dust, noise and vibration impacts can be managed to acceptable levels.
- 5.278 The permanent loss of a very small area (4m²) of MOL will require consideration against MOL policy.
- 5.279 The overall RAG rating for the Planning criteria for this site is Red. The rating is also noted in Table 1 of Section 6.

Property summary

- 5.280 The site is owned by a 3rd party, and forms part of Ham Lands LNR which is open space. If the land is needed permanently replacement land would need to be provided to replace any purchased open space land.
- 5.281 The overall RAG rating for the Property criteria for this site is Amber. The rating is also noted in Table

1 of Section 6.

Transport summary

- 5.282 The site is located on open space and can be accessed from Riverside Drive. Riverside Drive is residential but is wide enough for construction vehicles. The proximity to Shaft 3 via Ham Street offers an opportunity to use barges for material movements.
- 5.283 The overall RAG rating for the Transport criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Outfall and abstraction facility south of Burnell Avenue

Engineering summary

- 5.284 The proposed construction site is located on open parkland and adjacent to the River Thames south of Burnell Avenue. Although there are two working sites there is adequate space to form a single compound for both sites with space for storage and plant should this be required. There is also space to provide compound support for the TLT connection shaft sites. Access to the site is via Burnell Avenue but alternatively the location is next to the River Thames so there is a possibility, subject to further investigation, that some construction material could be transported by barge therefore reducing HGV movements.
- 5.285 It is likely a number of utilities would need to be diverted including a high voltage cable. Furthermore footpaths may also need to be temporarily diverted around the construction area. In river works is likely to be behind a coffer dam.
- 5.286 Very limited site set up would be required as the site is level and grassed and can be reinstated on completion of the works.
- 5.287 The overall RAG rating for the Engineering criteria for this site is Green. The rating is also noted in Table 1 of Section 6.

Environment summary

- 5.288 The use of this site for the final shaft, intake and outfall infrastructure will result in the loss of some terrestrial habitat partially within the Ham Lands SINC. Locating the majority of the construction area on the areas of modified grassland will minimise potential adverse impacts on ecology. Where a limited number of trees are required to be removed, replanting with mature stands will reduce the length of time for recovery.
- 5.289 The construction of the intake and outfall has the potential to result in a small loss of riparian habitat, within the River Thames and Tidal Tributaries SINC, although it should be noted the area provides sub-optimal conditions as it is heavily disturbed and most of the bank artificially reinforced, with no evidence of use by riparian mammals. Consideration will need to be given to the in-river construction methods to be used and timings due to the presence of migratory fish species and riparian species in the area. The detailed design of the intake and outfall will also need to be compliant with the latest regulations and good practice guidance, to minimise entrapment of fish and this will ultimately dictate the size of structures.
- 5.290 The site is within the floodplain and works in the immediate vicinity of the river will require a Flood Risk Assessment. Recreational users and businesses on the River Thames will need to be kept informed of the in-river works in particular, and provision made for alternative access points to the river.
- 5.291 The site is within Ham Fields Archaeological Priority Area and within Stevens Eyots and Kingston Thames Riverside Archaeological Priority Area and therefore further archaeological and historic environment assessment will be required to determine the need for intrusive investigations and watching briefs, prior to and during construction.

- 5.292 Potential noise impacts on local communities and impacts on the AQMA during construction will require further assessment and may need to be mitigated, however these are issues for all sites being considered for the Project. Potential noise generated from the fish screens and pumps will need to be considered and assessed, although these are expected to be at very low levels and do not create issues at other sites on the River Thames.
- 5.293 The intake structure will create a localised change to the open character of the river bank and will introduce a permanent structure. Views for the local community and recreational users are likely to be permanently altered in a small section of the river bank although land-based views from Burnell Avenue are likely to be protected and the intake shielded by the topography of the land and careful planting. The permanent infrastructure required will need to be carefully designed to reduce the impacts to the Riverside North Conservation Area, and local character and amenity of the area. The potential to partially bury structures, reinstate similar landscaping and vegetation planting will be key to minimising adverse impacts. Clear marking and signing of the new infrastructure within the watercourse will also be required to avoid navigational concerns.
- 5.294 The overall RAG rating for the Environment criteria for this site is Red. The rating is also noted in Table 1 of Section 6.

Planning summary

- 5.295 The temporary construction compound and permanent infrastructure are all proposed to be located in an area designated as MOL and public open space, which will require mitigation to be put in place, including for biodiversity. Use of the site during construction is likely to require the diversion of existing pedestrian pathways and informal access across the open space area. Construction vehicles will require access along Burnell Avenue, accessed from either Dysart Avenue or Beaufort Road through to Dukes Avenue. There is the possibility to minimise traffic movement by using the river for construction material, subject to further investigation.
- 5.296 Whilst the main construction activities will be separated to some degree from neighbouring residential receptors, use of the site during construction may give rise to dust, noise, vibration and access impacts which will require careful consideration to minimise their impacts and ensure appropriate management during construction. The final intake and outfall structures and other above ground infrastructure will also lead to the permanent loss of small areas of land which are designated as MOL and public open space, and so will require sensitive design in order to be justified against MOL policy, and to ensure that permanent public open space loss is kept to an absolute minimum.
- 5.297 The overall RAG rating for the Planning criteria for this site is Red. The rating is also noted in Table 1 of Section 6.

Property summary

- 5.298 The site including the section of the River Thames is owned by at least two different 3rd parties, with some of it being unregistered although an assumption based on surrounding ownership can be made. The site falls within an area of public open space. If the land is needed permanently replacement land would need to be provided to replace any purchased open space land.
- 5.299 The overall RAG rating for the Property criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Transport summary

- 5.300 The site is located in open space south of Burnell Avenue so access would be via Burnell Avenue to either Dysart Avenue or Beaufort Road to Dukes Avenue and onto the A307. The proximity to the River Thames offers an opportunity to use barges for moving construction material, thereby minimising road vehicle movements. The impact on river traffic through the lock gates would need to be assessed.
- 5.301 The overall RAG rating for the Transport criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

TLT Connection (Option 1): Land south of Northweald Lane

Engineering summary

- 5.302 This site is located close to the construction area for the outfall and intake facility south of Burnell Avenue therefore there is the opportunity to co-located construction compounds to minimise potential impacts and land take. The site is sufficiently far away from the river to be of low flooding risk and the area is level with good access from Burnell Avenue.
- 5.303 The TLT runs under the area, but its exact location would need to be determined. As a pipeline would need to be launched from the intake to the site the pipeline would run close to the TLT, and a new shaft would need to be constructed next to the TLT. This presents a security of supply risk as the TLT is a wedge block tunnel and the presence of driving a pipeline and constructing a shaft next to it provides settlement risk.
- 5.304 The overall RAG rating for the Engineering criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Environment summary

- 5.305 The site will require the removal of some deciduous woodland which may support protected species, although it is noted this site is not priority habitat. Works in proximity to retained woodland may result in habitat degradation and disturbance of species using the area and mitigation and management is likely to be required. Any permanent loss of habitat from the Royal Park Gate Open Space SINC is likely to require compensation. A number of trees, some with Tree Preservation Orders (TPOs) may need to be removed, alongside scrub and screening vegetation. The Project will need to ensure that there is suitable replanting of a greater number of trees than is removed as part of achieving biodiversity net gain. A block of flats directly overlooks the shaft site, with further properties within proximity of the site boundary. These properties may be temporarily impacted by noise, dust, lighting and deterioration of local views during construction. A temporary diversion of the footpath crossing the site will be required to maintain access to the Thames Path.
- 5.306 The overall RAG rating for the Environment criteria for this site is Red. The rating is also noted in Table 1 of Section 6.

Planning summary

- 5.307 The site is located in a SINC and within MOL. It will require the creation of sufficient space within the woodland area south of Northweald Lane, as well as clearing a suitable access route to the site from the adjacent open space south of Burnell Avenue. This is likely to require some tree removal as well as wider vegetation clearance. Any footpaths and tracks located in proximity to either the work site or its access route would need to be temporarily diverted or temporarily stopped.
- 5.308 Residential flats are located in close proximity to the north of the shaft site and may experience dust, noise and vibration impacts during construction. As the site is small a support compound is likely to be required offsite, potentially within the open space to the south of Burnell Avenue, whilst road access to the site would be expected to be from Dysart Avenue and Burnell Avenue. There may be as a result construction impacts from the use of this site upon residential receptors along these roads and, if used, in close proximity to any compound installed in the open space to the south of Burnell Avenue. These would need to be considered alongside the use of that site and those roads for the construction of the outfall and intake and associated infrastructure. Whilst the implementation of mitigation measures should mean that these impacts can be managed to acceptable levels, it is also considered likely to be challenging. The permanent loss of a very small area (4m²) of MOL will require consideration against MOL policy, as will the loss of public open space. Impacts upon the SINC will require assessment and appropriate mitigation.
- 5.309 Due to the range of issues identified the site is considered to be very challenging in planning terms

and the overall RAG rating for the Planning criteria for this site is Red. The rating is also noted in Table 1 of Section 6.

Property summary

- 5.310 The site is owned by a 3rd party. The land within this site is considered to be public open space. If the land is needed permanently replacement land would need to be provided to replace any lost open space land.
- 5.311 The overall RAG rating for the Property criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Transport summary

- 5.312 The site is bounded between properties and the River Thames. A temporary access road would facilitate access to the construction site from Burnell Avenue. Burnell Avenue and Dysart Road are residential roads but wide enough for construction vehicles. The proximity to the River Thames offers an opportunity to use barges for construction material thereby minimising vehicle movements.
- 5.313 The overall RAG rating for the Transport criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

TLT Connection (Option 2): Land west of Horsley Drive

Engineering summary

- 5.314 Land west of Horsley Drive is a small strip of land with a footpath that is a small site surrounded by residential properties. The TLT runs under the area but its exact location would need to be determined. As a pipeline would need to be launched from the intake to the site the pipeline would run close to the TLT, and a new shaft would need to be constructed next to the TLT. This presents a security of supply risk as the TLT is a wedge block tunnel and the presence of driving a pipeline and constructing a shaft next to it provides settlement risk.
- 5.315 In addition, the site is bounded by residential properties in relatively close proximity. Ground investigations would be required to determine if settlement would be a risk. There is limited space for a site compound and the entire footpath would need to be taken over for the works. The site is elongated which restricts movement of materials and plant around for shaft construction. Constructing a new shaft and storage for materials and plant is difficult on such a small site without taking the whole of the site and clearing vegetation either side of the footpath.
- 5.316 The overall RAG rating for the Engineering criteria for this site is Red. The rating is also noted in Table 1 of Section 6.

Environment summary

- 5.317 The site is located in a residential area with limited access routes (Northweald Lane and Horsley Drive) and construction traffic would be routed via small residential roads. Noise, dust and lighting are likely to be issues for local residents, which will be compounded by the reduced ease of access to the Thames Path and Royal Park Gate playground. A temporary alternative footpath serving the same residential area may be difficult to achieve given the layout of the area and lack of other access points. Archaeological investigations would likely to be required given the siting within Archaeological Priority Areas, although the potential for unknown archaeological finds and deposits is considered to be reduced given the construction of the housing estate and footpath.
- 5.318 Vegetation (scattered trees and scrub) along the east and west boundaries may provide commuting and foraging potential for bats, and the area of woodland directly south of the site could be used by other protected species.

- 5.319 The overall RAG rating for the Environment criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Planning summary

- 5.320 The site is adjacent to residential properties to the east and the west and is itself comparatively narrow so is in close proximity to those properties. It occupies open space through which an access path passes, linking the adjacent housing to the River Thames and open space to the south-west and a nearby play area to the south. Vehicle access would need to make use of Horsley Drive to reach the site.
- 5.321 Careful consideration would be needed to identify mitigation for any potential impacts upon residential receptors close to the site, including for dust, noise and vibration impacts. The implementation of mitigation measures should mean that dust, noise and vibration impacts can be managed to acceptable levels. Consideration will also need to be given to the management of construction traffic through the adjacent residential estate, which is likely to be challenging due to the road width. The temporary loss of use and associated access to the River Thames via the access route could be mitigated through the provision of appropriate diversions.
- 5.322 Post-construction impacts of the development are likely to be limited to a very minor visual impact on the open space.

- 5.323 The overall RAG rating for the Planning criteria for this site is Red. The rating is also noted in Table 1 of Section 6.

Property summary

- 5.324 The site is owned by a 3rd party and assumed to be public open space. If the land is needed permanently replacement land would need to be provided to replace any purchased open space land.
- 5.325 The overall RAG rating for the Property criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Transport summary

- 5.326 Access to the site is limited and although close to the A307, access to the site would be through narrow residential roads. The site is small so material deliveries would need to be managed carefully with limited storage space available.
- 5.327 The overall RAG rating for the Transport criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

TLT Connection (Option 3): Land at Tudor Drive

Engineering summary

- 5.328 Tudor Drive is a small site located at a highway junction. An existing TLT shaft already occupies the corner of the site. There is limited space to form a working site so an offsite area is likely to be required. The connection to the TLT presents a security of supply risk as the TLT is a wedge block tunnel, and the presence of driving a pipeline and constructing a connection to it presents a settlement risk. The connection directly into the existing Tudor Drive shaft could avoid direct break into the TLT tunnel wedge block minimising operational risk. This will have to be carefully assessed if taken forward as an option.
- 5.329 The optimum design will be appraised after the receipt of a ground investigation and tunnel inspection. Constructing a new shaft (if required) along with the storage of materials and plant would be constrained on such a small site. This would need to be further assessed if further developed. Another site would need to be used for material deliveries to the site.

- 5.330 The overall RAG rating for the Engineering criteria for this site is Red. The rating is also noted in Table 1 of Section 6.

Environment summary

- 5.331 The site is located at a main junction within a residential area. The site consists of a mixture of hardstanding, modified grassland and scattered trees and scrub. There are few environmental designations or land constraints that would have to be mitigated if this site were used.
- 5.332 The key issue is the proximity to local residents on Tudor Drive and potential noise issues during construction and the loss of an informal recreation space for the duration of the construction works.
- 5.333 Potential air quality impacts on the AQMA through construction works and likely lane closures at a busy junction will also need to be managed.
- 5.334 Construction in direct proximity to the Tudor Estate Local Area of Special Character could result in a temporary deterioration to the immediate area, but no permanent impacts are anticipated given the shaft access hatch is a small change, and will be seen in context with other urban ground-level infrastructure.
- 5.335 The overall RAG rating for the Environment criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Planning summary

- 5.336 The site comprises two distinct parts: an informal or pocket park in the northern half, and managed lawn in the southern half associated with the fire station located immediately to the south of the site. Use of the site would require occupation of both, and construction of the connection shaft in the east of the site close to an existing TLT shaft. Given the site's size it is unlikely that all compound needs will be met on site so an offsite compound will be required to support construction, which could be located within the compound for works associated with the construction of the outfall and intake, or otherwise located at a separate as yet unidentified location.
- 5.337 Use of the site may give rise to access and circulation impacts, both for construction traffic and plant using the site and in respect of the junction between Tudor Drive, Richmond Road and Dukes Avenue, requiring consideration of site access and egress points. This will also need to include consideration of neighbouring land uses, including residential properties on Tudor Drive and Richmond Road, and the fire station located to the south of the site.
- 5.338 Construction may result in temporary localised noise and vibration impacts that may require mitigation. The implementation of mitigation measures should mean that these impacts can be managed to acceptable levels. Use of the site will also remove use of the informal or pocket park for the duration of construction giving rise to local amenity impacts, although careful design of site reinstatement would enable the informal or pocket park use to be fully reinstated post construction.
- 5.339 Post construction impacts are likely to be limited to a very minor visual impact on the open space.
- 5.340 The overall RAG rating for the Planning criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Property summary

- 5.341 This site is owned by three different freeholders, one of which is Thames Water, the others are other 3rd parties. There is also a leasehold interest, and the agreement is with Thames Water. Land owned by other interests including Kingston Fire Station would need to be acquired through negotiations with the landowner or the use of powers.
- 5.342 The overall RAG rating for the Property criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Transport summary

- 5.343 Although the Tudor Drive site is located directly next to the A307 with direct access to a main road, the site presents a number of transport difficulties. The site is small so there is no on site storage available therefore, just in time deliveries would be required and add complexity to the construction with the risk of local traffic disruption.
- 5.344 Traffic management would be required to facilitate access to the site which is on a major junction. The proximity of the adjacent fire station needs to be taken into account when considering access to the site.
- 5.345 The overall RAG rating for the Transport criteria for this site is Red. The rating is also noted in Table 1 of Section 6.

TLT Connection (Option 4): Land at Barnfield Avenue

Engineering summary

- 5.346 Barnfield Avenue is a small site located in the middle of a residential road. The TLT runs under the road and its exact location would need to be determined. As a pipeline would need to be launched from the intake to the site the pipeline would run close to the TLT and a new shaft would need to be constructed next to the TLT. This presents a security of supply risk as the TLT is a wedge block tunnel and the presence of driving a pipeline and constructing a shaft next to it provides settlement risk. In addition the site is bounded by residential properties in close proximity. Ground investigations would be required to determine if settlement would be a risk. There is limited space for a site compound so an offsite compound area would be required to support construction at this site.
- 5.347 The overall RAG rating for the Engineering criteria for this site is Red. The rating is also noted in Table 1 of Section 6.

Environment summary

- 5.348 The site is within a residential area and consists of the road and verges of Barnfield Avenue at the western junction with Tudor Drive, close to Ham Parade. There are few environmental designations or land constraints that would have to be mitigated if this site were used.
- 5.349 The key environmental effects result from the proximity to local residents on Barnfield Avenue and location of the site within an AQMA, with associated potential noise and air quality impacts during construction. There would be no loss of recreational or open space provision when using this site. The site is located within the Tudor Estate Local Area of Special Character and therefore construction could result in a temporary deterioration to the immediate area only, but no permanent impacts are anticipated given the shaft access hatch is a small change, and will be seen in context with other urban ground-level infrastructure.
- 5.350 The overall RAG rating for the Environment criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Planning summary

- 5.351 Although post construction impacts are likely to be minimal, due to the inability to achieve any separation between the construction works, construction compound requirements and adjacent residential properties, there is likely to be major disruption to access and dust, noise and vibration impacts upon those residential properties, including potentially needing to make use of adjacent residential land and the potential need to relocate affected residents. On street parking at this location would also need to be suspended, with movements between the site and Tudor Road requiring careful management to minimise disruption.
- 5.352 The overall RAG rating for the Planning criteria for this site is Red. The rating is also noted in Table 1 of Section 6.

Property summary

- 5.353 This site is owned by a 3rd party but is also an adopted highway; acquisition of the land would be required through negotiations with the landowner and local authority or the use of powers. Use of this site is likely to cause significant disruption to the residents of Barnfield Avenue.
- 5.354 The overall RAG rating for the Property criteria for this site is Amber. The rating is also noted in Table 1 of Section 6.

Transport summary

- 5.355 The site is located close to the A307; however, access to the site is constrained with limited space to store any construction material. Traffic management would be required to facilitate access to the site, and it may require road closures for the duration of the works.
- 5.356 The overall RAG rating for the Transport criteria for this site is Red. The rating is also noted in Table 1 of Section 6.

6. Stage 5: Workshop, Outcomes Reporting and Consultation

Workshop

- 6.1 Following completion of the appraisal by all disciplines an initial workshop was held to discuss the outcomes and the emerging conclusions and recommendations. The main outcome of this workshop was confirmation of the recommendations reached by the Project team and the identification of the sites considered to represent the preferred combination of sites to enable Project delivery, alongside retention of other potential sites in reserve. It also identified those sites considered by the Project team as not warranting further consideration and which should therefore be removed from the Project appraisal.
- 6.2 Two key exceptions within the general outcome described above were:
 - Shaft 3 Option 1 Ham Street car park – identified as requiring further consideration regarding layout, site area, ability to make use of water freight, and wider Project benefits of water freight.
 - TLT Connection Options 1 and 3 – further work identified to establish the balance of preference for either potential site, including through further survey work at Option 1 to identify the relationship between construction access and potential tree loss, and further engineering work at Option 3 to consider further the feasibility of the TLT connection and associated engineering and shaft requirements.
- 6.3 Accordingly, two further workshops were held by the Project team to explore whether any changes to the existing outcomes for each site could be reached through consideration of additional design or mitigation measures, or whether any further surveys or assessments were necessary to aid decision making at this stage.
- 6.4 Further work was carried out to inform Stage 5
 - Engineering and arboricultural site visit of TLT connection Option 1
 - Ecology site visit at Shaft 5 Option 1, Shaft 3 Option 2
 - Engineering investigations for TLT connection Option 3.

Outcomes

- 6.5 The findings from workshops and investigations were combined with the Stage 4 appraisals for all other sites completed to identify the following outcomes and are summarised in Table 1 below.
- 6.6 Table 1 also includes the RAG assessment summary for each discipline and identifies those sites currently considered most able to represent an appropriate combination of sites for the Project (retained as preferred), along with sites that could play a future role should one of those preferred sites not be taken forward (retained as alternative), and those sites that should not be considered further (removed).

Table 1 TDRA Stage 5 Site Appraisal Outcomes

Use	Site	RAG Grading	Appraisal outcome	Outcome Summary
Tertiary Treatment Facility / Drive shaft and start of recycled water conveyance pipeline	Mogden STW	Engineering (A)	Retain as preferred	The location of the TTF and start point of the pipeline within the Mogden STW minimises offsite development and takes advantage of existing infrastructure, although development will need to make careful use of limited space and ensure operations at the site remain unaffected. The use of the site allows construction works to make use of the site's good existing road links. The site is, however, within Mogden STW SINC which contains deciduous woodland priority habitat, some of which may require removal from the landscape bund to allow for construction of the TTF and shaft. A small proportion of the SINC may be impacted during construction and operation, however the majority of works will utilise areas of existing hardstanding. Potential air quality, noise and vibration impacts on local communities will need assessment and potentially mitigation. The site also falls within a Local Open Space designation and appropriate mitigation may be necessary. Mogden STW represents our preferred site for the TTF and start of the recycled water pipeline.
		Environment (A)		
		Planning (A)		
		Property (G)		
		Transport (G)		
Intermediate shaft / recycled water conveyance pipeline Shaft 1	Option 1: Northcote Recreation Ground	Engineering (R)	Remove	Intermediate Shaft 1 Option 1: Northcote Recreation Ground would be likely to give rise to potential significant impacts on its Village Green status, proposed LNR status and its newly created wildlife habitats, and access to the site is very constrained. Given the presence of nearby alternatives, this site has been removed from the process.
		Environment (R)		
		Planning (R)		
		Property (A)		
		Transport (A)		
	Option 2: Ivybridge Retail Park car park north	Engineering (A)	Retain as preferred	Both of the car park sites offer a level and open location and site in which to construct the first shaft for the recycled water pipeline if required. Use of either car park would not be expected to give rise to any ecological impacts, and both also benefit from the ability to take direct access from Twickenham Road. Both sites would also give rise to very similar impacts upon the use of the car park, including access impacts upon other car park users during construction. These impacts will need to be managed and mitigated, along with the impacts from the reduction in car parking spaces that would result from the creation of a construction site and compound within part of the car park and the impacts upon businesses and users that this would give rise to. Both sites could potentially give rise to construction dust, noise and vibration impacts upon nearby receptors, including the retail units and residential areas close to the site, and the community and recreation facility (Bridgelink Centre) to the south. Option 3 would require the pipeline alignment to pass beneath the retail units, for which there is a lack of certainty as to whether this is feasible as details relating to the foundation structure of the retail units are not known at this stage. This factor is also an issue that affects the land between Summerwood Road and Ivybridge Retail Park (Option 4), as the pipeline would need to pass beneath the same retail units. Option 4 also has good access on to Mogden Lane but is adjacent to a number of high-rise buildings which could be impacted upon by elevated noise levels for which mitigation may be difficult, and residents would experience a loss in open space. Use of the site would also temporarily prevent use of the site for local amenity purposes, whilst impacts upon local bus services and deliveries servicing the retail units would need to be considered.
		Environment (A)		
		Planning (R)		
		Property (A)		
		Transport (G)		
	Option 3: Ivybridge Retail Park car park south	Engineering (A)	Retain as alternative	
		Environment (A)		
		Planning (R)		
		Property (A)		
		Transport (G)		
	Option 4: Land between Summerwood Road and Ivybridge Retail Park	Engineering (A)	Retain as alternative	
		Environment (R)		
		Planning (R)		
		Property (A)		
		Transport (G)		

Use	Site	RAG Grading	Appraisal outcome	Outcome Summary
				As it is considered to give rise to marginally fewer impacts during construction, and is accessible for a pipeline alignment with the least identified risk of conflict with adjacent structures, Shaft 1 Option 2 represents our initial preferred site for an intermediate shaft in this area if required.
Intermediate shaft / recycled water conveyance pipeline Shaft 2	Option 1: Moormead and Bandy Recreation Ground central	Engineering (A)	Retain as preferred	Both sites provide level areas on which to construct a shaft on land that comprises of common low value grassland which can be easily reinstated. However, at both sites construction could give rise to impacts upon multiple receptors. Option 1 in the centre of the recreation ground may temporarily impact upon use of the cricket and football pitches which are due to be reinstated, whilst both options may impact on users of the more informal space along the west of the park, as well as users of Hill View Road through the installation of the temporary access route. Noise and vibration impacts may also be generated at both sites, and construction impacts including from dust and surface run off could require management. Both sites are also respectively within and adjacent to the Moor Mead Recreation Ground and River Crane at St Margaret's SINCs, which will require careful consideration including the need to establish a suitable buffer along the river. The sites are also designated as Metropolitan Open Land space, which will require careful consideration. Access is considered to be preferable from the west along Hill View Road, careful consideration of impacts upon road users will be required. Both sites could also give rise to cumulative impacts if the proposed new pavilion is under construction at the same time as shaft works. Option 2 would impact upon pedestrian access across the park between Moor Mead Road and Cole Park Road, in proximity to the existing play areas. Option 2 would also be sited close to the railway line which would require further investigation if progressed. Recognising that both sites would cause temporary disruption for users of the recreation ground, it is considered that Option 1 presents the best opportunity to minimise and manage those impacts and so this represents our preferred site for an intermediate shaft in this area if required.
		Environment (A)		
		Planning (A)		
		Property (A)		
		Transport (A)		
	Option 2: Moormead and Bandy Recreation Ground south	Engineering (A)	Retain as alternative	
		Environment (A)		
		Planning (R)		
		Property (A)		
		Transport (A)		
Intermediate shaft / recycled water conveyance pipeline Shaft 3	Option 1: Ham Street car park	Engineering (G)	Retain as preferred	There is adequate space at both sites to construct a shaft. The proximity of the River Thames could give rise to flood risk at Option 1 and to a lesser degree at Option 2 during construction and this will need careful consideration and potentially mitigation. The proximity to the river may also provide the opportunity to consider the use of barges to transport material and to reduce construction traffic on nearby roads. Use of both sites will need to be carefully planned to retain areas of higher value habitat around the perimeters of the site and avoid degradation. Priority habitats (deciduous woodland and native hedgerows) are present along the boundaries of the sites, and potentially provide suitable habitat for birds, bats, badgers and stag beetles, which will require mitigation if found to be present. A full heritage assessment is likely to be required for both sites as Ham House Registered Park and Garden is directly to the south of both options, with the Grade II listed building at a greater distance. Option 1 is also within the Ham House Conservation Area, and parts of the site are located within Archaeological Priority Areas (Thames Foreshore and Bank, and Ham Fields APAs). Option 2 is outside the Ham House Conservation Area, but within the Ham Fields APA. The temporary construction impacts are likely mitigatable, and the ground-level permanent infrastructure at the shaft is unlikely to impact the setting, in the context of other urban ground-level infrastructure in the area, with Option 1 being within the existing car park.
		Environment (A)		
		Planning (R)		
		Property (A)		
		Transport (A)		
	Option 2: Land to the south of Ham Street car park and west of Ham Street	Engineering (G)	Retain as alternative	
		Environment (A)		
		Planning (R)		

Use	Site	RAG Grading	Appraisal outcome	Outcome Summary
		Property (A)		The use of the waterfront at Option 1 would require works within the River Thames and Tidal Tributaries SINC, although the existing concrete structure at the site is likely to limit any loss of habitat. Although mitigation may be required, neither site is in direct proximity to sensitive receptors for noise, vibration or air quality. Plans for the temporary diversion of the footpath along the riverfront would need to be developed for Option 1. Traffic impact on road users along Ham Street will need to be considered carefully for both sites, with the adoption of appropriate traffic management. The permanent loss of a very small area of Metropolitan Open Land for the shaft access cover following construction will also require careful consideration. Both options may benefit from the ability to make use of river transport although a riverside wharf is better suited for Option 1 which would also make use of the adjoining construction site. Option 1 therefore represents our preferred site for an intermediate shaft in this area if required.
		Transport (A)		
Intermediate shaft / recycled water conveyance pipeline Shaft 4	Option 1: Land to the west of Riverside Drive playground	Engineering (G)	Retain as preferred	Intermediate Shaft 4 Option 2: Land at Ham Playing Fields car Pprk would be likely to give rise to the potential loss of the entire car park during the construction of the shaft with resulting impacts upon existing associated amenity, sports club and business (nursery) uses. Given the presence of nearby alternatives, this site has been removed from the process. Both remaining sites are located on open space on Riverside Drive and are formed of an elongated and suitably sized area able to facilitate a site compound and shaft. Very limited site clearance would be needed. The proximity to Ham Street car park offers an opportunity to use barges for construction material with vehicle movements along Ham Street and limiting movements elsewhere. There are no ecological designations or priority habitats on either site and both sites have a low ecological value. Both sites are located within Ham Fields APA, and therefore archaeological desk studies and assessments would be required ahead of any construction to determine presence of archaeological features and mitigation requirements. Residential properties are located to the south along Riverside Drive and there are nearby recreational and amenity facilities. Key issues that may require mitigating include air quality, noise and vibration impacts during construction, access to the informal green space and disturbance to the use of the playground. Traffic impacts on users of Riverside Drive will need to be considered. The permanent loss of a very small area of Metropolitan Open Land for the shaft access cover following construction will require careful consideration. A key difference between the two sites is the interface that Option 3 will have with Ham Street as well as Riverside Drive if used. Furthermore, Option 3 is located directly adjacent to the Ham House Registered Park and Garden, and within the Ham House Conservation Area, and so may require bespoke mitigation to be agreed with Historic England. As Option 1 is considered to have a lesser highways and heritage impact, this represents our preferred site for an intermediate shaft in this area if required.
		Environment (A)		
		Planning (A)		
		Property (A)		
		Transport (A)		
	Option 2: Land at Ham Playing Fields car park	Engineering	Remove	
		Environment (R)		
		Planning (R)		
		Property (A)		
		Transport (A)		
	Option 3: Land at Riverside Drive and Ham Street	Engineering	Retain as alternative	
		Environment (A)		
		Planning (A)		
		Property (A)		
		Transport (A)		
Intermediate shaft / recycled water	Thames Young Mariners	Engineering (R)	Remove	It has been identified during the course of undertaking Stages 4 and 5 of the appraisal that a more direct pipeline alignment can be achieved beneath Ham, thereby removing the requirement for a shaft site that
		Environment (R)		

Use	Site	RAG Grading	Appraisal outcome	Outcome Summary
conveyance pipeline Shaft 5		Planning (A)		would facilitate the ability to ‘traverse’ Ham via this site. Accordingly it has been removed from the appraisal process.
		Property (A)		
		Transport (A)		
Intermediate shaft / recycled water conveyance pipeline Shaft 6	Option 1: Ham Lands, west of Riverside Drive	Engineering (G)	Retain as preferred	As part of the completion of Stages 4 and 5 of the appraisal process it was recognised that use of Intermediate Shaft 6 Option 2: Meadlands School playing field would likely give rise to potential significant impacts on the school and its playing fields, combined with very limited access into the site and impacts upon neighbouring residential properties. It was also concluded that use of Intermediate Shaft 6 Option 5: Land adjacent to Thamesgate Close would give rise to considerable impacts on users of the adjacent public right of way, cycle route and access road, would require considerable tree loss, and priority habitat, to facilitate site establishment and would also be located in very close proximity to residential properties. Given the presence of nearby alternatives, these two sites have been removed from the process.
		Environment (A)		
		Planning (A)		
		Property (A)		
		Transport (A)		
	Option 2: Meadlands School playing field	Engineering (A)	Remove	Use of Option 1 could potentially impact on nearby residential properties, users of nearby roads, and upon ecology within the site footprint. The site is located within Ham Lands LNR, at the northern boundary, and within Ham Lands SINC. The layout of the construction compound could avoid loss of trees/lowland mixed deciduous woodland and would utilise the grassland habitat in this area. The south-west of the site is bordered by lowland mixed deciduous woodland priority habitat which would need to be demarcated to prevent encroachment. This habitat could potentially support birds, bats and badgers and therefore protected species surveys will need to be completed to confirm if present, and any mitigation requirements. The site is also located in the Ham Fields Archaeological Priority Area. The Option 1 site is a well-used open space with numerous informal footpaths, some of which would be inaccessible during construction, although there are alternative pathways which could be used. The site is directly west of Riverside Drive, so localised changes to visual amenity, noise, vibration and dust issues could be experienced during construction and therefore will need further assessment and potentially mitigation. The permanent loss of a very small area of Metropolitan Open Land for the shaft access cover following construction will require careful consideration.
		Environment (R)		
		Planning (R)		
		Property (A)		
		Transport (R)		
	Option 3: Land at Dukes Avenue	Engineering (R)	Retain as alternative	The Option 3 site at Dukes Avenue is small and although the site utilises highway verge and so avoids conflict with environmental designations, the site is located in close proximity to residential properties giving rise to potential construction noise, vibration and air quality impacts. Use of the site would also be likely to require some road closures to facilitate provision of a compound and shaft construction, which will impact on road uses including bus routes and visitors to nearby Meadlands School, as well as residential users. The same road verge location does however enable good access for construction works. Option 4 at Ham Green is adequately sized for a site compound and storage of materials. Use of the site could be integrated into the forthcoming regeneration proposals for this part of Ham enabling final reinstatement to contribute to renewed open space. However, construction of a shaft in this location may also coincide with the regeneration development and so consideration of cumulative impacts will be important. The Ham Green site is adjacent to the Ham APA and Ham House Conservation Area, meaning specific mitigation may be required to address impacts. Access is through the residential area and whilst both adjacent roads are wide enough it would bring traffic into proximity to other receptors and require access via and adjacent to mixed land uses to the west onto Riverside Drive or to the east onto Ham Street. Use
		Environment (A)		
		Planning (A)		
		Property (G)		
		Transport (A)		
	Option 4: Ham Green	Engineering (A)	Retain as alternative	
		Environment (R)		
		Planning (R)		
		Property (A)		
		Transport (A)		
	Option 5: Land adjacent to Thamesgate Close	Engineering (R)	Remove	
Environment (R)				
Planning (R)				
Property (A)				

Use	Site	RAG Grading	Appraisal outcome	Outcome Summary
		Transport (A)		of the site would lead to temporary loss of open space and construction would take place in proximity to schools, a youth centre and residential properties for which air quality, noise, visual amenity and lighting will need to be considered. Furthermore, diversion of underground utilities is likely to be needed at this location. As it enables the Project to achieve some separation from residential receptors and achieves a good level of access, Option 1 represents our preferred site for an intermediate shaft in this area if required.
Recycled water outfall / recycled water conveyance pipeline reception shaft River water abstraction facilities / TLT conveyance pipeline	Outfall and abstraction facility south of Burnell Avenue	Engineering (G)	Retain as preferred	Although there are two main elements of the Project to be delivered at this site (the outfall and intake) there is adequate space to form a single compound for both with space for storage and plant. There is also space to provide compound support for the TLT connection shaft sites. There is direct road access to the site from Burnell Avenue to Dukes Avenue and to the A307. The site is next to the river and could support construction of a berth to enable transport of materials by the river to reduce transportation of material by road. The public footpath along the river would need to be temporarily diverted during construction. Potential temporary air quality, noise and vibration impacts on local communities will need to be considered and mitigated. The use of this site would lead to a temporary loss of terrestrial habitat, mostly grassland. The site is located in an area of designated public open space and will also require temporary and permanent works within two SINCS; Ham Lands SINC and River Thames and tidal tributaries SINC. Once all permanent above ground structures have been installed the remainder of the site would be reinstated and replanted. Biodiversity impacts will need to be mitigated and biodiversity net gain provided. There would also be some permanent loss of riparian habitat due to the intake and outfall structures on the river bank which will need management and mitigation. All construction works will require careful management to ensure there are no risks of contamination of the River Thames. The permanent above ground infrastructure will lead to the permanent loss of small areas of land which are designated as Metropolitan Open Land and public open space, and so will require sensitive design and to ensure that permanent public open space loss is kept to an absolute minimum. The site is located within an Archaeological Priority Area and further archaeological and historic environment assessment will be required to determine any necessary mitigation measures. Any above ground infrastructure will need to be carefully designed to reduce the impacts to Riverside North Conservation Area and the local character and amenity of the area. The river front and River Thames in this area is regularly used for recreational activities and careful integration and management of the area will be required to minimise impacts during construction. Recognising that this site has a number of sensitivities that will need to be addressed it remains our preferred site for the outfall and abstraction facility.
		Environment (R)		
		Planning (R)		
		Property (A)		
		Transport (A)		
TLT connection / TLT conveyance pipeline	Option 1: Land south of Northweald Lane	Engineering (A)	Retain	As part of the completion of Stages 4 and 5 of the appraisal process it was recognised that TLT Connection Shaft Option 2: land west of Horsley Drive was too small and restrictive in size and shape to facilitate construction of the connection shaft. Given the presence of nearby alternatives, this site has been removed from the process. It was also identified that construction at TLT Connection Shaft Option 4: land at Barnfield Avenue would require full closure of the affected part of Barnfield Avenue and potential
		Environment (R)		
		Planning (R)		

Use	Site	RAG Grading	Appraisal outcome	Outcome Summary
		Property (A)		occupancy of part of private gardens. Given the presence of nearby alternatives, this site has also been removed from the process.
		Transport (A)		
	Option 2: Land west of Horsley Drive	Engineering (R)	Remove	Two options therefore remain under consideration for use as the location of the TLT connection, as no preferred site has yet been identified. The appraisal outcomes for each site are summarised individually below in turn. Option 1 Northweald Lane: Access to the compound and construction shaft site could be via Burnell Avenue. The site is near to the river and therefore river transport might be possible for construction material. Access to the construction site could be via a temporary track across open grassland and through a woodland area. The site will require the removal of some deciduous trees to allow for access and shaft construction. Priority woodland in close proximity to the site might be impacted through habitat degradation and disturbance of species using the area. The site and wider area has the potential to support a number of species including badger, bats, birds and stag beetle so appropriate mitigation will be required.
		Environment (A)		
		Planning (R)		
		Property (A)		
		Transport (A)		
		Option 3: Land at Tudor Drive		Engineering (R)
	Environment (A)			
	Planning (A)			
	Property (A)			
	Transport (R)			
	Option 4: Land at Barnfield Avenue	Engineering (R)	Remove	In particular, a block of flats directly overlooks the shaft site. These properties may be temporarily impacted by noise, dust, lighting and deterioration of local views during construction. A temporary diversion of the footpath crossing the site will be required to maintain access to the Thames Path, which will impact upon the amenity of the woodland. The site is currently retained as one of two alternative sites due to its proximity to the TLT and the river abstraction facility. Further work is required to identify how the construction for the connection would interface with the impacts identified at this site in respect of residential amenity, nature conservation, tree preservation, local amenity, and access. Until that work is further progressed a preferred site option has not been identified. Option 3 Tudor Drive: Access to this site is off a major road where there is a potential risk of pedestrian and traffic disruption. The site is next to a fire station which will need to be taken into account when considering construction activities. There are minimal ecological, water, heritage and land use issues associated with the site. A key issue would be proximity to local residents on Tudor Drive and the potential for dust, noise and vibration impacts during construction. There are potential air quality and noise issues through lane closures and / or traffic management at a busy junction to allow access to the site which will need to be managed and there will be a temporary loss of an informal recreation space for the duration of the construction works. The site is currently retained as one of two alternative sites due to its proximity to the TLT, alongside the alternative TLT connection site south of Northweald Lane. Further work is required to identify how the
		Environment (A)		
		Planning (R)		
		Property (A)		
		Transport (R)		

Use	Site	RAG Grading	Appraisal outcome	Outcome Summary
				construction for the connection would interface with the impacts identified at this site including the size of the site, the sensitivity of the TLT connection and surrounding receptors. Until that work is further progressed a preferred site option has not been identified.

6.7 In summary, the potential preferred combination of sites to enable delivery of the TDRA Project as identified through Stage 5 of the appraisal process is:

- Mogden STW
- Shaft 1 (Option 2): Ivybridge Retail Park car park north
- Shaft 2 (Option 1): Moormead and Bandy Recreation Ground central
- Shaft 3 (Option 1): Ham Street car park
- Shaft 4 (Option 1): Land to the west of Riverside Drive playground
- Shaft 6 (Option 1): Ham Lands, west of Riverside Drive
- Outfall and abstraction facility south of Burnell Avenue
- TLT Connection:
 - Option 1: Land south of Northweald Lane; or
 - Option 3: Land at Tudor Drive.

Next Steps

- 6.8 Completion of Stage 5 of the appraisal represents the first stage in researching, appraising and making initial recommendations in respect of potential sites that could enable the delivery of the TDRA Project. The conclusions presented above, and the appraisal outcomes set out in preceding sections of this report are therefore the initial outcomes of Thames Water's technical appraisal team and so do not represent a firm proposal for development.
- 6.9 The information identified in this report will be subject to consultation and engagement to establish the views of technical stakeholders and the local community with regards to the outcomes of the site appraisal process and in particular the identified preferred sites, sites retained as alternative sites and sites that are recommended to be removed from the process.
- 6.10 Following the initial public engagement process all feedback in respect of the appraisal process for sites and alignments associated with the TDRA Project will be reviewed. Any suggested additional sites or changes to existing sites appraised will be documented and analysed to identify if they are appropriate for appraisal and, if so, whether that should be at Stage 2 of the process or whether due to similarities with existing appraised sites that should be at Stage 4 of the process.
- 6.11 The outcomes of any further appraisal will be used to inform an update to this report and, as appropriate, to the identified potential sites that could enable Project delivery. In turn, these outcomes will help to inform ongoing project development and preparation of material to carry out environmental assessment work and further consultation and engagement.

Appendix 1: Initial Scheme Information

Overview

The information set out in this note summarises initial scheme information relating to the Teddington Direct River Abstraction (TDRA) project to guide the consideration of land as part of the TDRA site appraisal process.

The information in this note is subject to refinement and change and should be used only as an initial guide for appraisal purposes.

Location Requirements

The tunnel alignment is governed largely by the start and end points of the pipeline i.e. Mogden Sewage Treatment Works (STW) and the River Thames upstream of Teddington Weir.

The position of the outfall is driven by its need to be downstream of the intake and associated connection into the Thames Lee Tunnel (TLT) whilst still being close to but above the tidal reach.

Separation between the intermediate shafts is based upon guidance published by the Pipe Jacking Association and assumes an approximate maximum 1,000m distance limit between shafts and trying to follow the most direct alignment between the start and end points from shaft to shaft.

Tertiary Treatment Facilities (TTF)

Space constraints at Mogden STW limit the location for the TTF. One option would be to build the TTF over the footprint of existing storm tanks.

In this scenario, the TTF would be sited on a platform which will be erected above storm tanks 7 and 8 in the south east corner of the STW. The design of the platform would need to minimise any impact on the operation and maintenance of the storm tanks. A detailed Interface Plan would be prepared as the project progresses to ascertain that the scheme will not compromise the operation of Mogden STW.

The TTF would also be provided with its dedicated maintenance lifting equipment.

During consideration of the design requirements for the TTF it was confirmed that the existing STW has sufficient capacity (hydraulic and biological) to accept the projected waste that would arise from the 75MI/d TTF.

Tunnelling and Shafts

Permissible Drive Lengths

The maximum practical drive length depends on several factors such as skin friction, available jacking force, or the nominal diameter of the jacking pipes. Consideration of safe access and egress during construction may limit the practical drive lengths at diameters below 3500mm and will need further consideration.

According to ground conditions and the pipeline internal diameter, the Tunnelling and Pipejacking: Guidance for Designers by the Pipe Jacking Association document provides a guide to select the suitable excavation techniques and drive lengths and in particular it is noted that, for tunnels, drives over 1000m are not considered acceptable unless the pipe/ tunnel is of sufficiently large cross section to allow the contractor to incorporate an access envelope 0.9m wide by 2.0m high within the pipe/ tunnel and clear of services including ventilation ducts and spoil conveyors.

Longer tunnels may be achievable on the provision that appropriate safe access and egress and use of remote method could be adopted, including the possible inclusion of safety refuges. This would need to be further reviewed in collaboration with potential tunnelling contractors.

Vertical Alignment Considerations

- Tunnel alignment has been generally set by the operational / hydraulic requirements of the system.
- Construction in the London Clay is preferred to the overlying layers, subject to confirmation by a detailed ground investigation.
- Vertical alignment of tunnel conveyance to allow for system to drain back to Mogden STW.
- Shaft depth will be dictated by tunnel depth.
- Consideration of hydraulic connectivity would be required to prevent inundation of the tunnel, particularly for crossing of the River Thames.
- Typically, the preference for tunnel drives is to advance tunnelling upwards at an inclined gradient to minimise the potential for ground water to collect at the tunnel face.
- Ground movement at the surface is a function of tunnel depth, reducing with increased cover. It is anticipated that ground movement will not be an issue for the preferred alignment, given the nature of the majority of buildings (i.e., low rise residential dwellings), services and infrastructure along the alignment. However, further consideration of the potential impacts of tunnel induced ground movement would need to be further assessed as part of future design development and on receipt of a ground investigation study.

Horizontal Alignment Considerations

- Tunnel alignment relies on the identification of shafts within areas that can accommodate required working space, suitable access and distance between shafts.
- It is currently assumed that any alignment would be based on straight drives between shafts. However, it is possible to pipejack a curved aligned using position and posture detection, directional control and variation of jacking force. This would need to be further assessed as part of future design development.

Shaft Sizing

The need for shafts and their sizing is based on the requirement to intercept the proposed pipeline and associated infrastructure, construction considerations in terms of tunnel driving and reception of tunnelling equipment, and on operational and maintenance considerations.

Some shafts may be required as operational pumping stations. While circular shafts are the most common, other shapes are also possible using diaphragm/piled techniques, sprayed concrete lining (SCL) or a combination of pre-cast rings and SCL.

The shaft diameter shall be determined by the following factors:

- size and number of tunnel connections
- space requirements for the setup and launch of tunnel boring machines (TBMs) including thrust frames and/or walls
- space requirements to receive and recover TBMs
- for pipejacked tunnels the length of the proposed pipes and the hydraulic ram setup also need to be considered.
- size and arrangement of plant that is to be accommodated as part of the permanent works,
- the need for straight lifts of plant out of shafts and the size and position of access covers
- design of the tunnel eyes
- excavation of the shaft mechanically from within the shaft (i.e., via a mini excavator)

An approximate 10 – 10.5m diameter shaft is considered as being adequate to accommodate these factors alongside the need to intercept a 1.8m ID pipejacked tunnel. Further design work will be undertaken to ascertain the structural sizing of the shaft after the receipt of a ground investigation.

Reinstatement

Following completion of construction all site compound infrastructure will be removed and the sites returned to its existing state and use, or any other agreed final reinstatement as identified through design and consenting.

Operational access to the shaft may be required on an infrequent basis during times of maintenance. To facilitate this access covers measuring approximately 4m² in area will be placed at ground level above the shaft. These covers will be integrated into the final land use as part of reinstatement.

Outfall Structure

A portion of final effluent from Mogden STW would undergo treatment at a new TTF within the Mogden STW. The resulting recycled water would then be transferred via pipeline to a new outfall structure to be located on the River Thames, upstream of Teddington Weir.

This structure is intended to act as an energy dissipator by receiving the recycled water from a pressure pipeline and slowing the speed of the water so that the flow is very slow when it discharges into the river. This is achieved by having a below-ground wide weir that spreads the flow evenly across the width of the structure. The weir also acts as a hard barrier to prevent fish or any backflow from the river entering into the tunnel system.

Construction of the outfall structure would require installation of a temporary steel sheet pile cofferdam extending out into the river. Once the outfall structure has been constructed any excavation will be backfilled so the final ground profile matches existing.

The outfall would be buried in the river bank, constructed from reinforced concrete and would be approximately 10m wide, 4m of which would be visible, angled at approximately 45 degrees to the river flow.

Very little of the outfall structure would be visible from ground level. Only access manhole covers and the path along the river edge would be noticeable.

The outfall would be positioned on the bank of the River Thames approximately 180m upstream of Teddington weir and approximately 170m downstream of the intended Intake structure to the TLT.

Intake Structure

An intake structure is required to abstract water from the River Thames to provide water to the TLT where it can be passed forward for treatment and use.

The intake structure would be constructed from reinforced concrete and be positioned either on the bank of the river, or partially on the bank and partially within the river, approximately 170m upstream of the outfall structure.

The intake structure, including wing walls, would have a width along the riverbank of approximately 38m, with the actual screens being approximately 15m wide, and extend some 4m from the riverbank.

Construction of the intake structure would also require installation of a temporary steel sheet pile cofferdam to allow its construction. The cofferdam would minimise the amount of excavation required and allow the structure to be installed in a safe and efficient manner. The temporary cofferdam could encroach into the river by approximately 10m.

It is intended that the water abstraction rate at the intake would be controlled to match the delivery rate at the outfall to maintain equilibrium.

The intake structure would have a low velocity fine screen and a silt trap to minimise the effect of the abstraction on the river ecology and flow. The low water velocity allows fish to swim away from the screen so they are not drawn into the intake.

The screen and the silt trap are continuously cleaned when in use and washed back into the main river. The intake screens sit in the river flow adjacent to the riverbank to encourage silt and debris to be carried away in the normal flow of the river.

The screens will be positioned on a platform extending out from the riverbank into the river flow. The silt trap and connection pipes and manholes to the TLT will be buried with only manhole covers visible at the surface.

A fenced compound around the structure will be required for security to protect kiosks containing mechanical and electrical equipment on the site.

Thames Lee Tunnel Connection

The TLT is an existing raw water tunnel built in the 1960s using a key wedge block method. This tunnel is currently used to convey water from the River Thames in west London from Hampton Intake to the Lee Valley reservoirs.

Following the discharge into the surrounding reservoirs the water is abstracted and transferred to Coppermills Water Treatment works where it is treated to required standards to be provided as high-quality drinking water to customers throughout London.

To enable the TDRA scheme to connect to the TLT a vertical drop shaft would need to be sunk to the level of the TLT (which is approximately 18m below ground level) and an underground connection made to the tunnel.

Once the water has passed through the intake screen and silt trap the flow will connect, through buried pipework, to the vertical drop shaft connecting to the TLT. A permanent control building or buried structure would be required to be located alongside the drop shaft.

The flow rate will be controlled to match the flow being discharged from the outfall and will be designed to pass a flow of up to 75Ml/d. Valves would control the flow and are electrically controlled.

Mogden STW Construction Compound

A construction compound would need to be located on the south-east section of Mogden STW, some of the main construction equipment includes:

- TBM Control Cabin for tunnel machinery control;
- Muck storage for temporary storage of construction spoil resulting from tunnel and shaft excavations;
- Material laydown area;
- Site cabins with car parking; and,
- area for temporary tower cranes.

Intermediate Shaft Construction Compounds

The size and arrangement of an intermediate shaft compound may vary according to the land area and vehicle access available. Main requirements include:

- sufficient area for vehicle movements;
- space for welfare units;
- construction units; and,
- just-in-time materials storage.

The site would need to be accessed from urban roads with cleaning facilities as required, or from the river if feasible.

Temporary roads on site would need to be able to provide road widths of one lane along with sufficient space for turning and manoeuvring.

In close proximity to the shaft site there would be layout for construction equipment such as:

- a TBM Control Cabin, a TBM power generator, a waste skip and space for a crawler crane
- sufficient space for tunnel pipe segment storage;
- an area for spoil collection; and,
- a site office and welfare cabins as well as a car parking.

Outfall, Intake and TLT Connection Construction Compound

The construction compound for the intake, outfall, TLT connection and associated plant are assumed at this stage to be combined and to be located adjacent to the potential outfall and intake sites south of Burnell Avenue.

A compound for this purpose would be expected to comprise:

- a vehicle access road implemented as a circular track, allowing vehicles to make a complete circuit of the site for two-way traffic;
- car park facilities;
- a site cabin welfare unit and office;
- a motor control centre (MCC) and electrical substation;
- a TBM Control Cabin, a TBM power generator, a waste skip and space for a crawler crane;
- sufficient space for tunnel pipe segment storage;
- a slurry centrifuge process unit; and,
- an area for spoil collection.

When undertaking the works and riverfront pedestrian footpath would need to be temporarily diverted around the working site. On completion of the works the footpath would be reinstated.

Existing buried electrical cables would also be diverted where required.

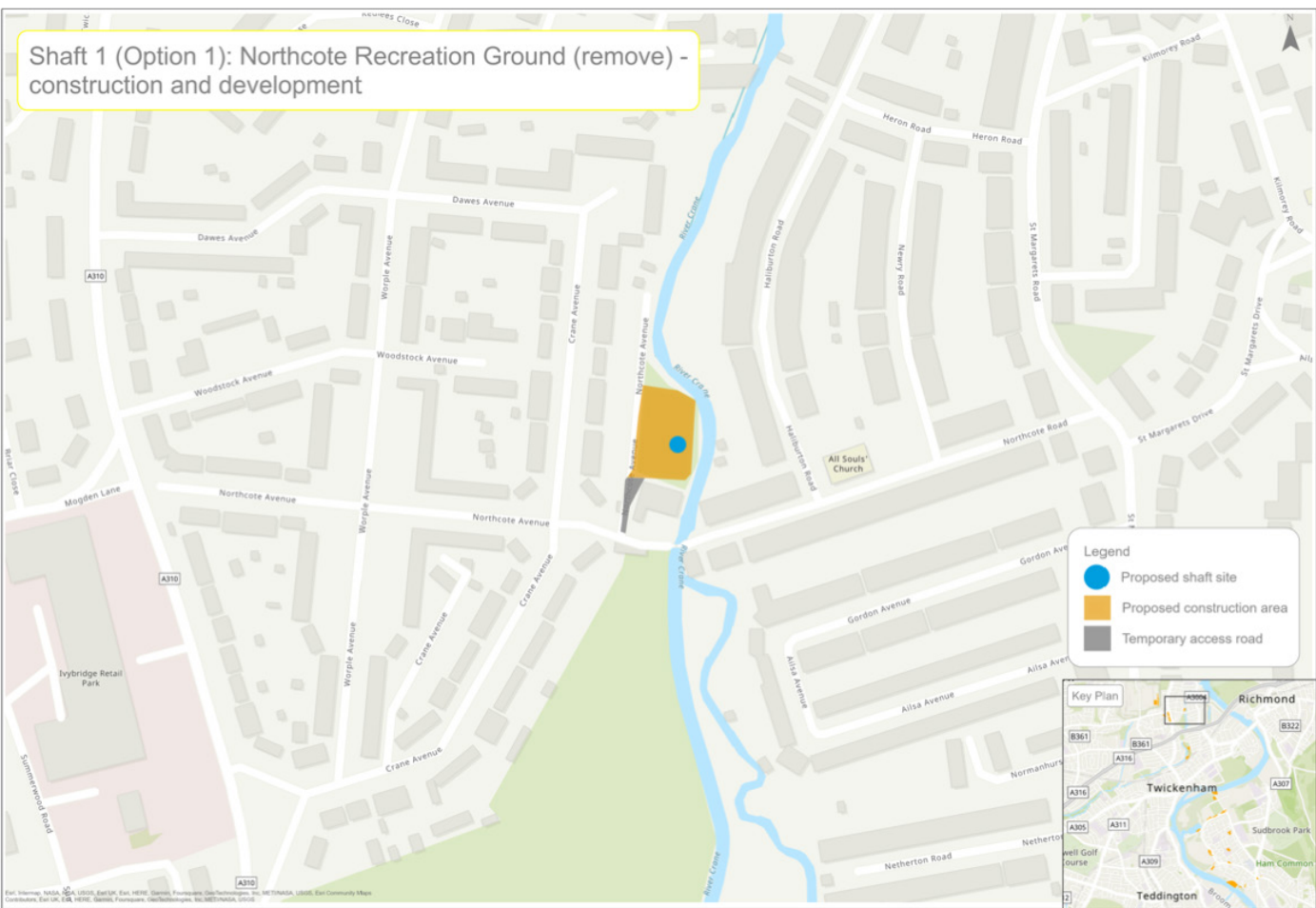
Appendix 2 TDRA Stage 4 Appraisal Site Plans

Mogden STW

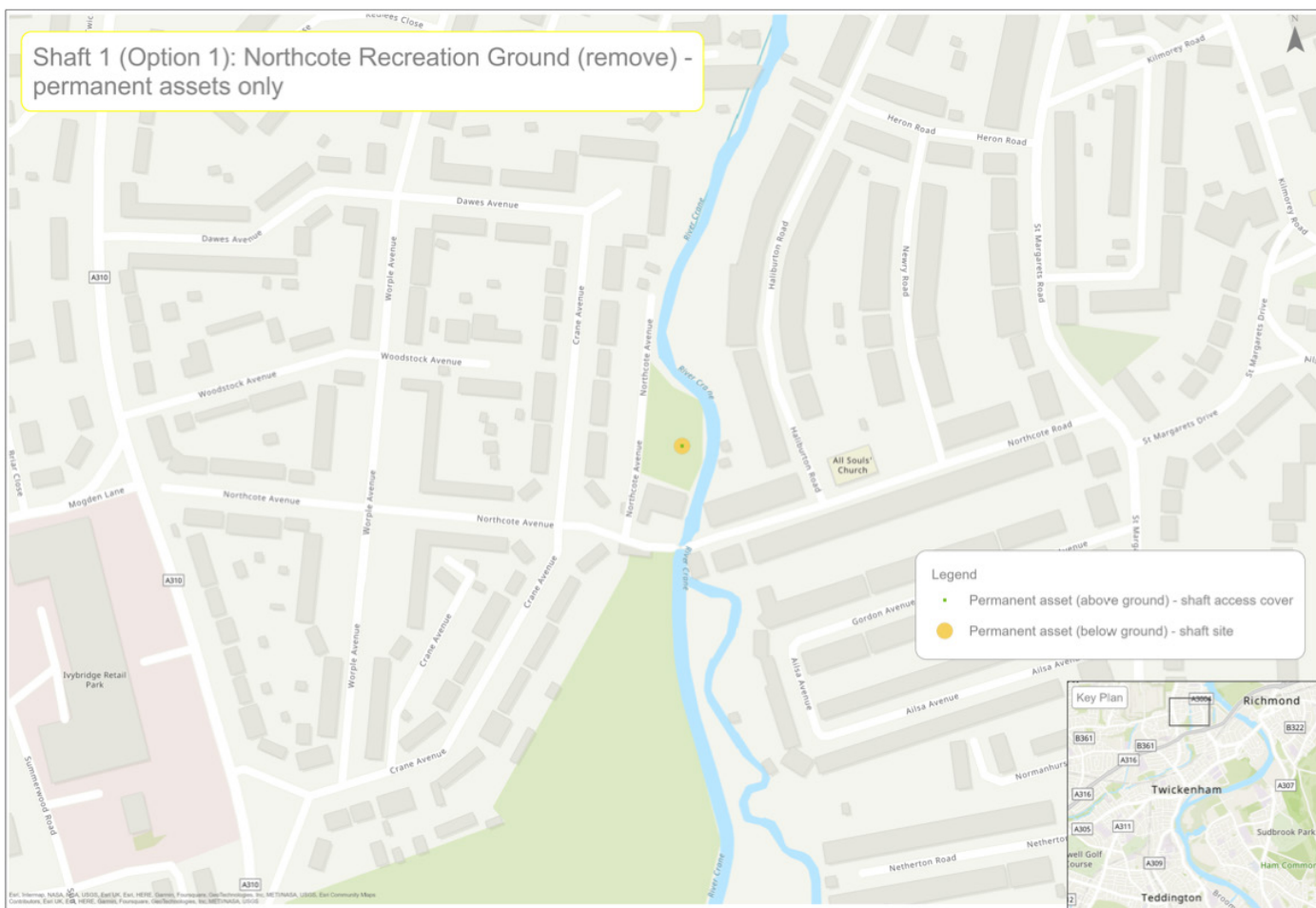


London Water Recycling - Teddington DRA

Shaft 1 (Option 1): Northcote Recreation Ground



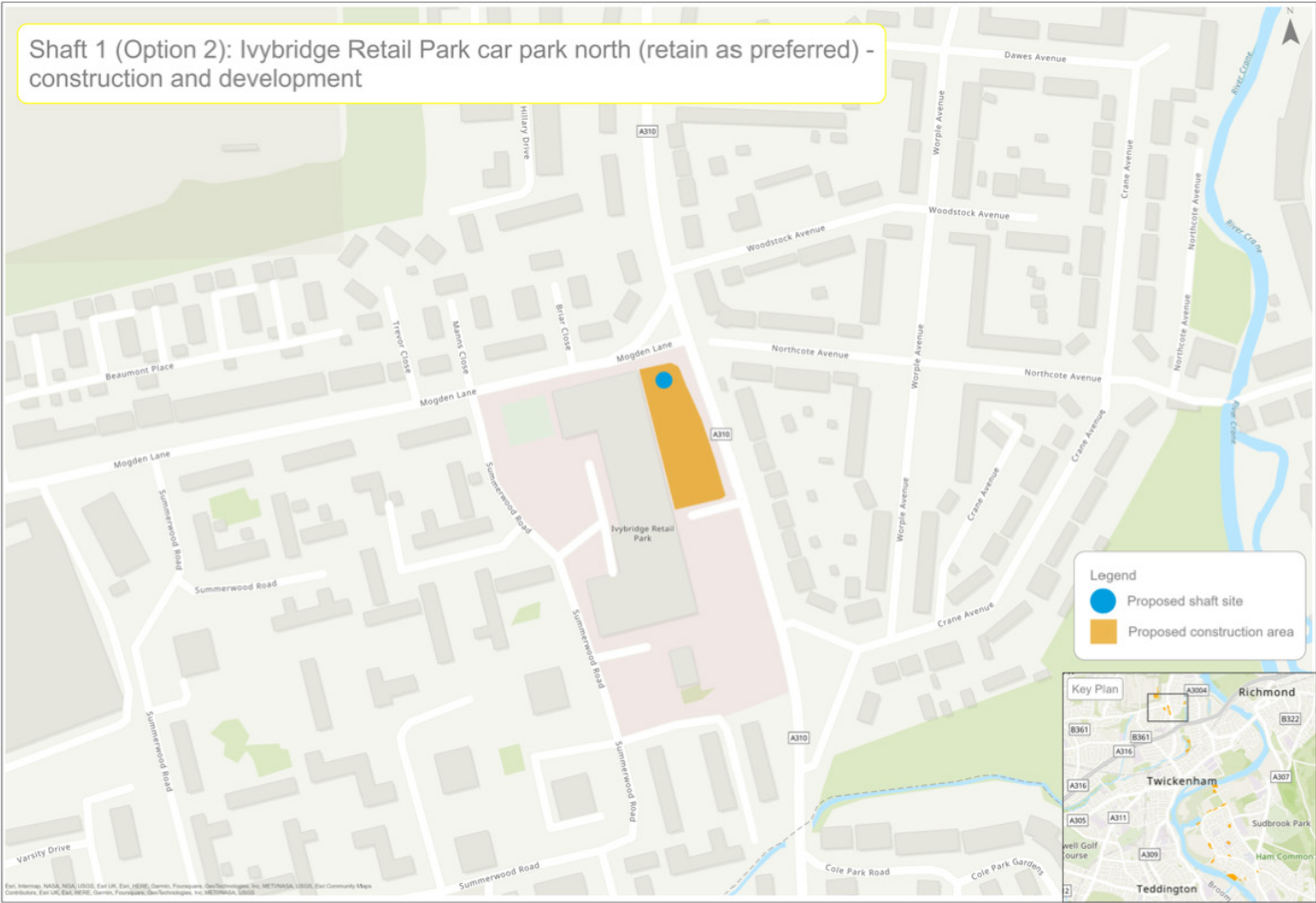
Construction and Development



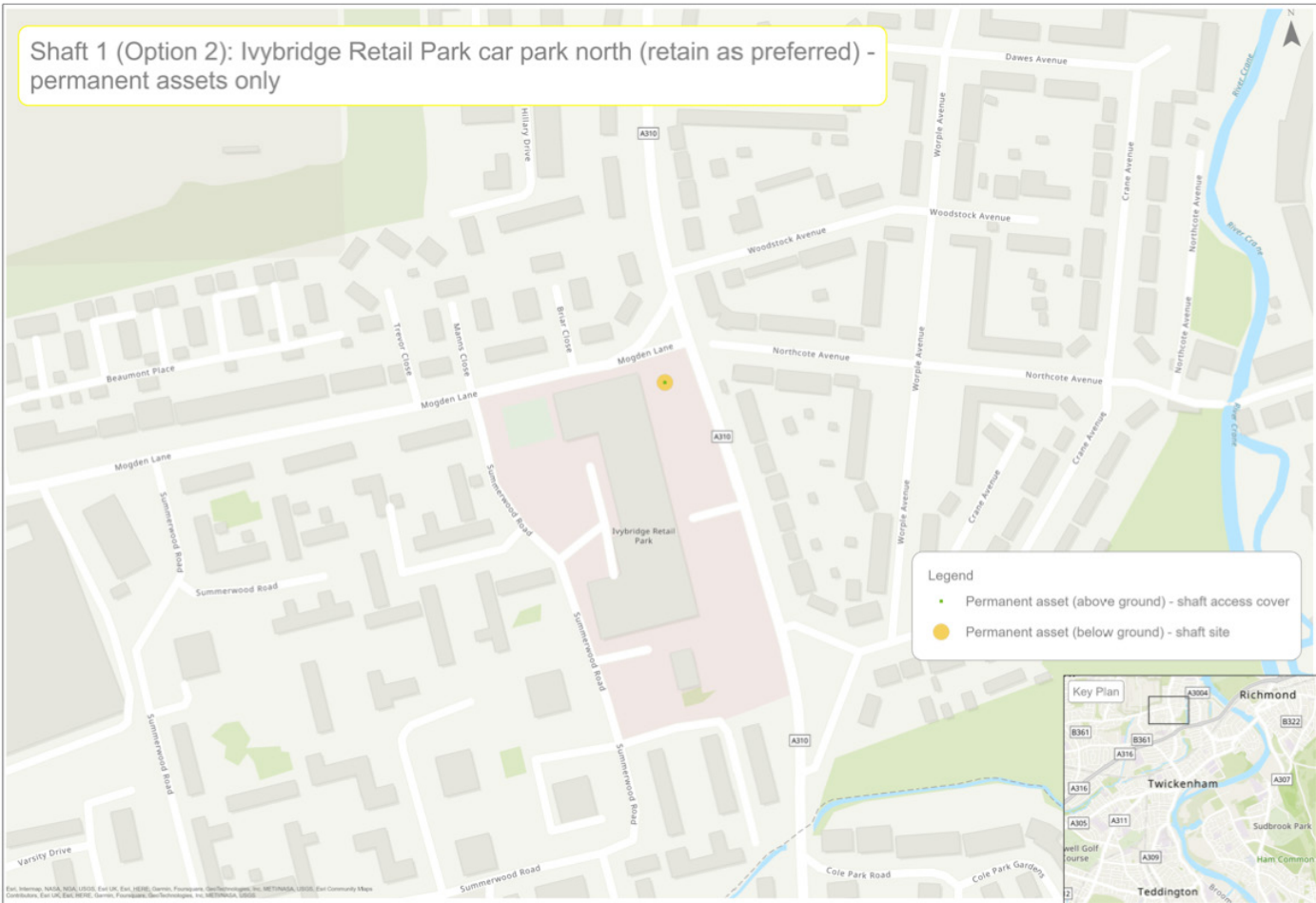
Permanent Assets

London Water Recycling - Teddington DRA

Shaft 1 (Option 2): Ivybridge Retail Park car park north



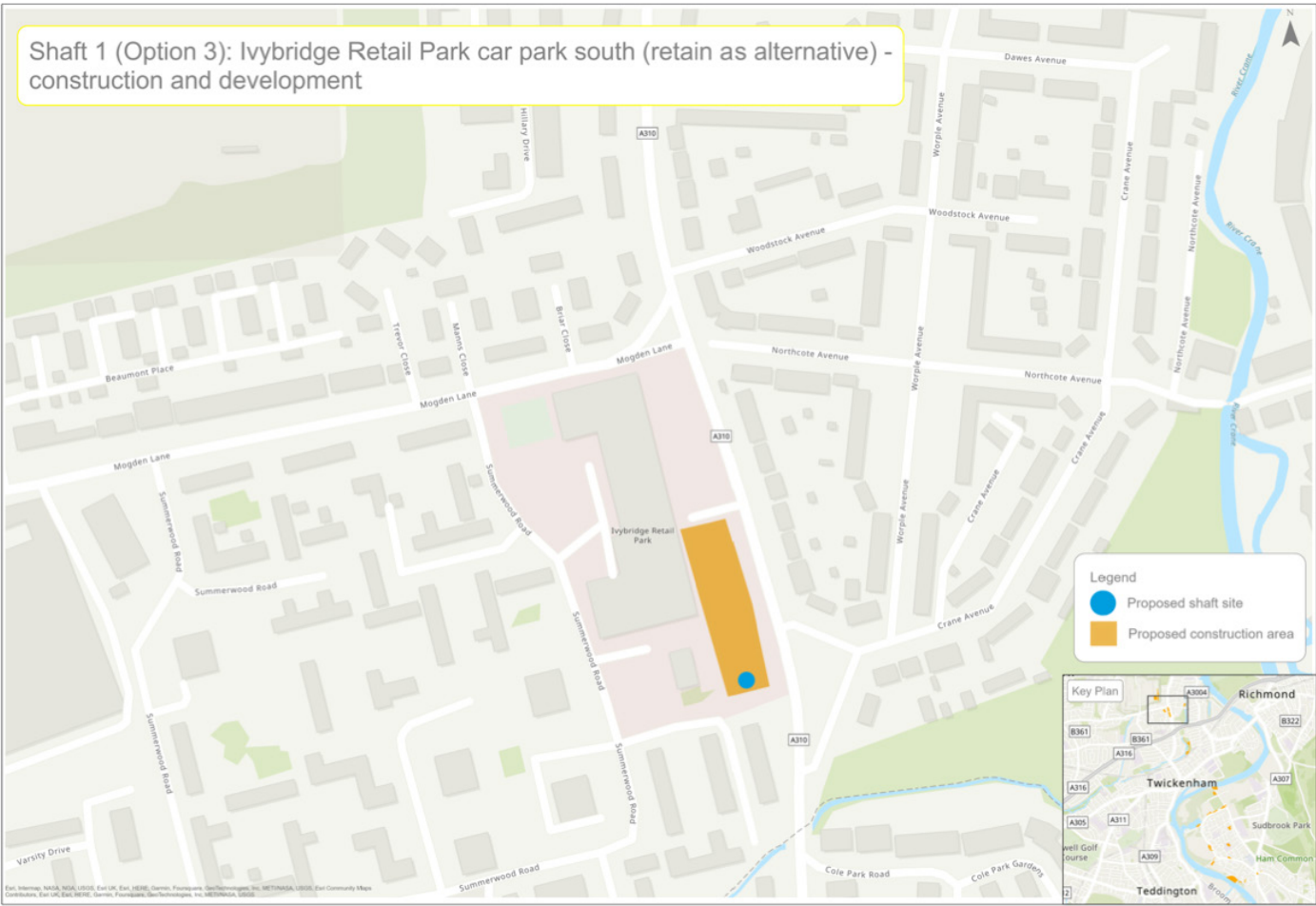
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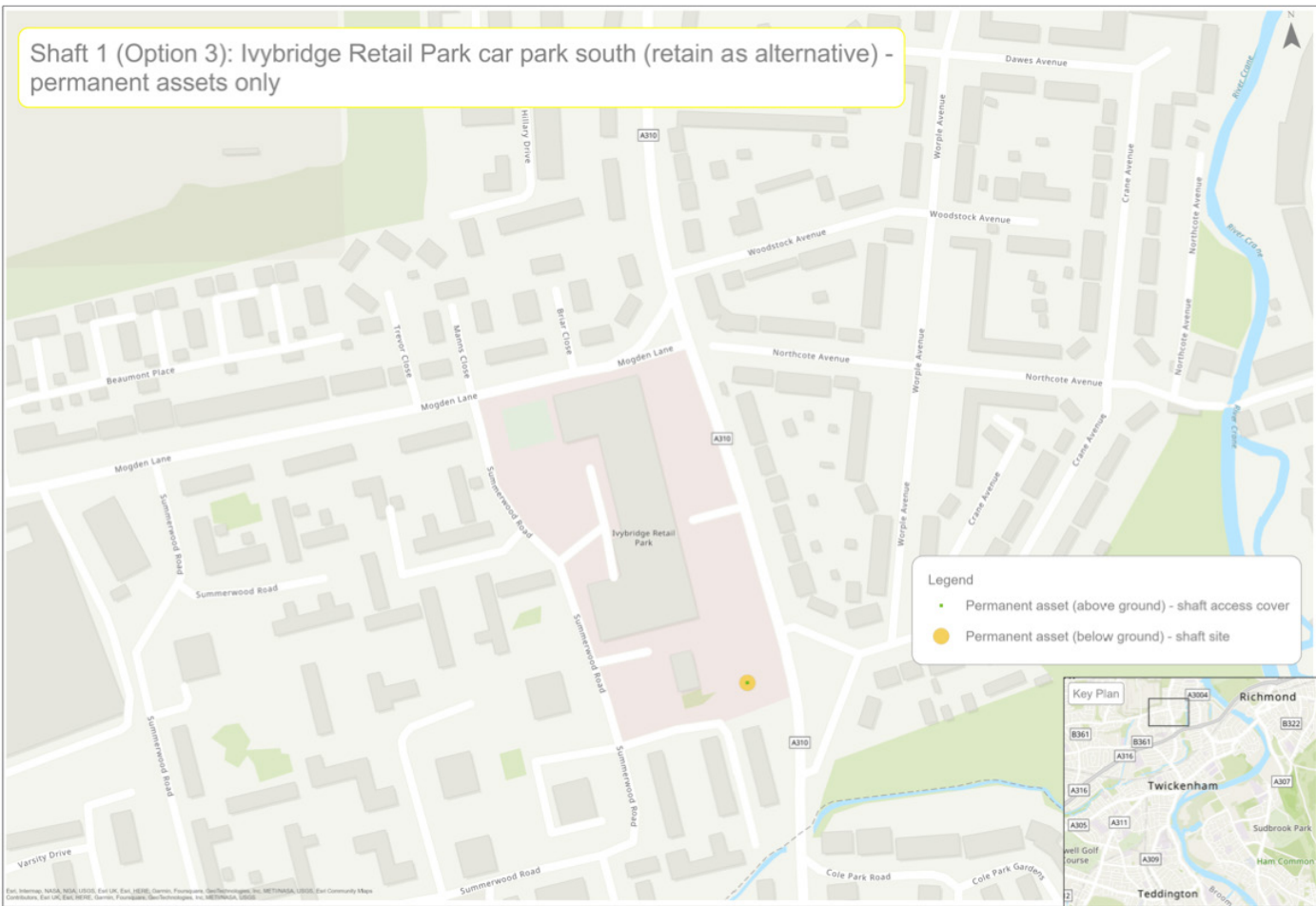
Permanent Assets

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Shaft 1 (Option 3): Ivybridge Retail Park car park south



Construction and Development

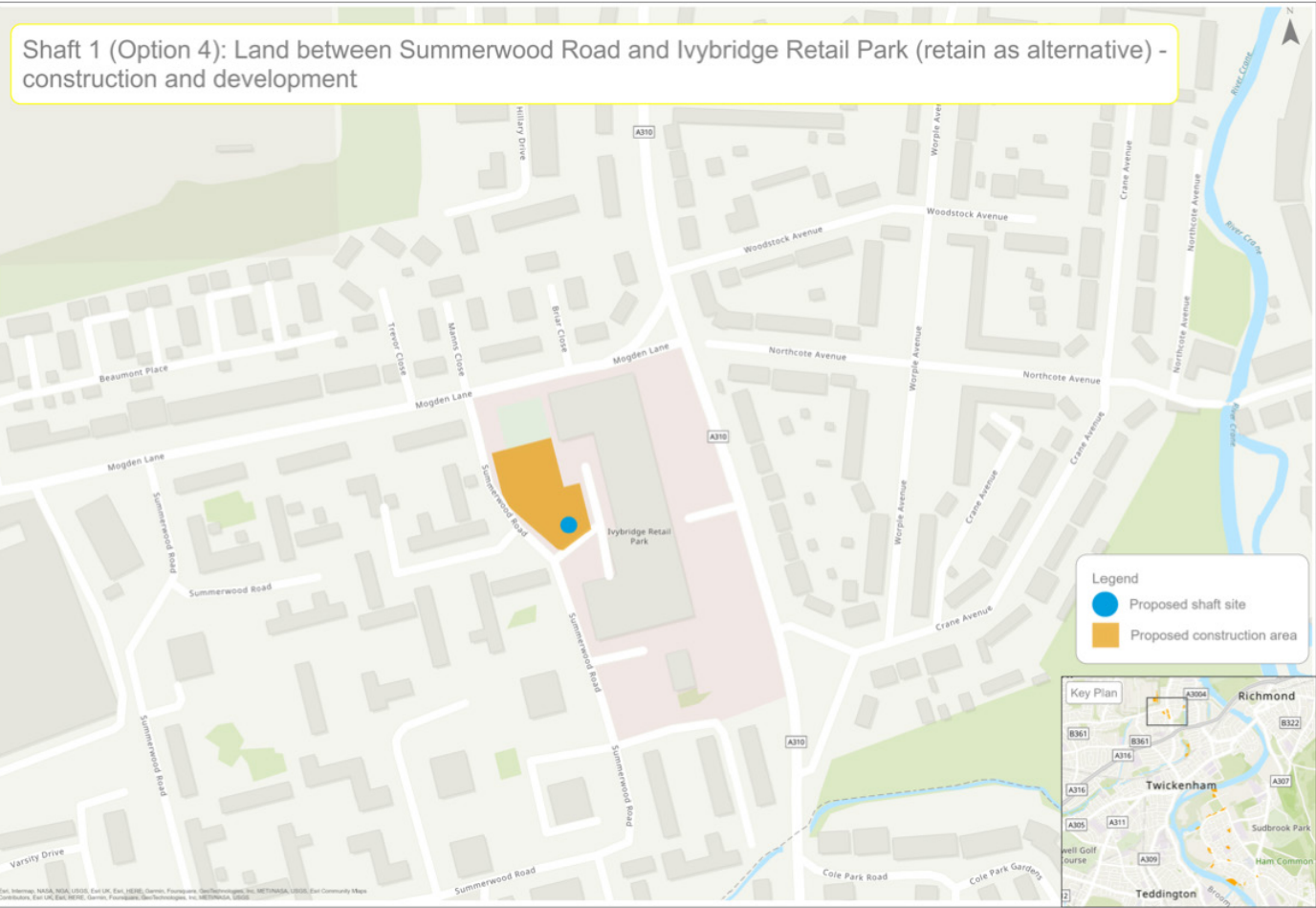


Permanent Assets

London Water Recycling - Teddington DRA

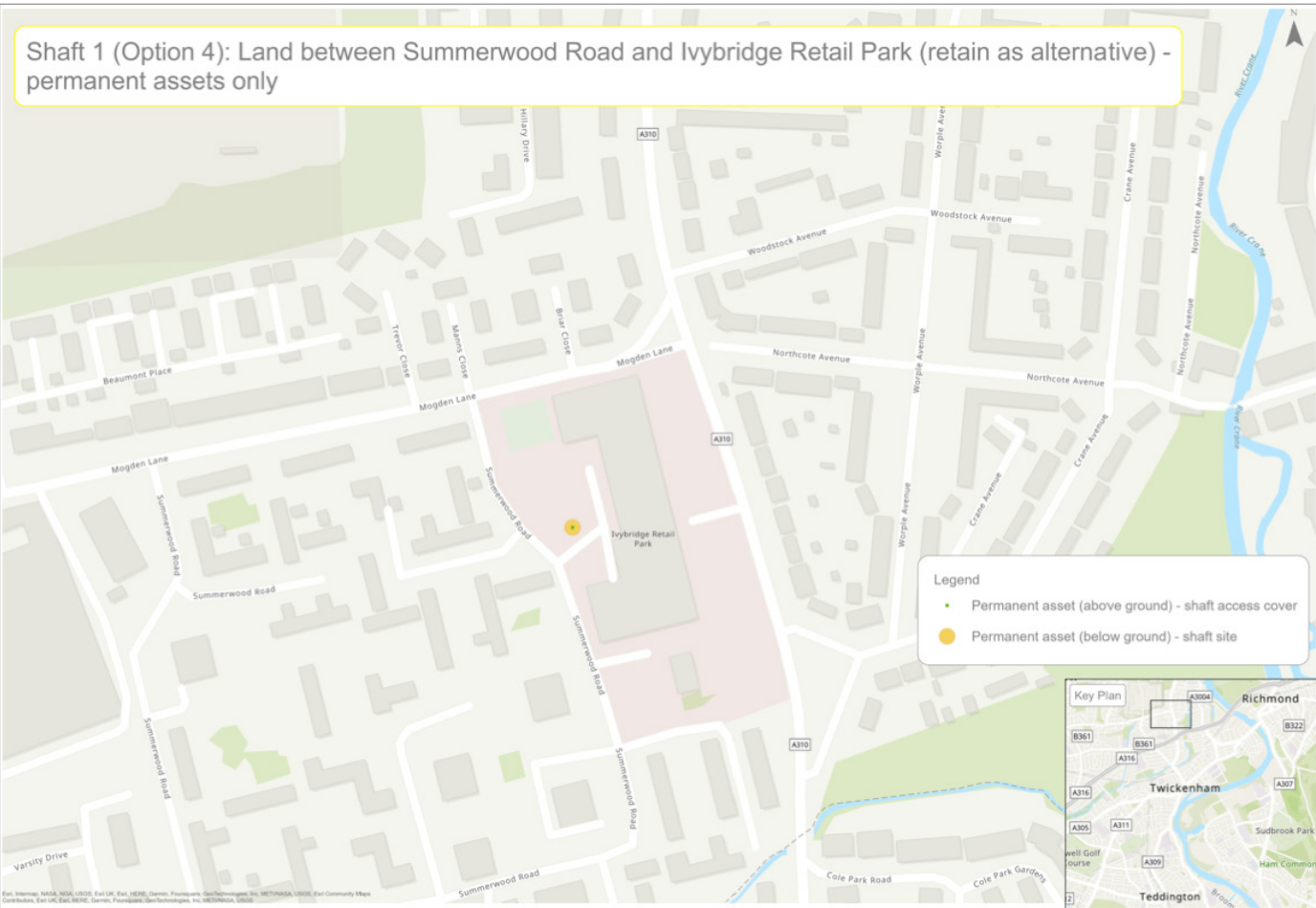
Shaft 1 (Option 4): Land between Summerwood Road and Ivybridge Retail Park

Shaft 1 (Option 4): Land between Summerwood Road and Ivybridge Retail Park (retain as alternative) - construction and development



Construction and Development

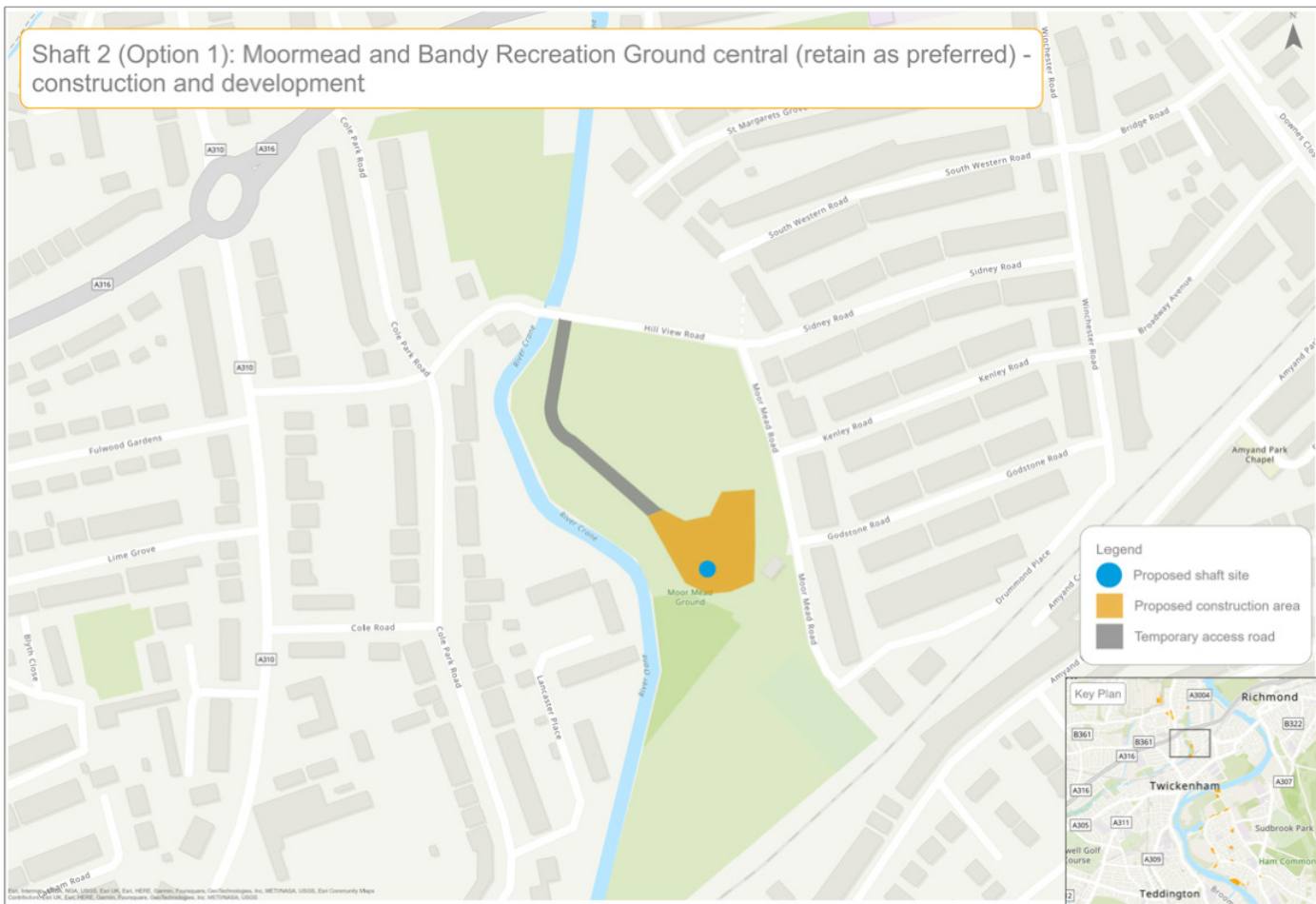
Shaft 1 (Option 4): Land between Summerwood Road and Ivybridge Retail Park (retain as alternative) - permanent assets only



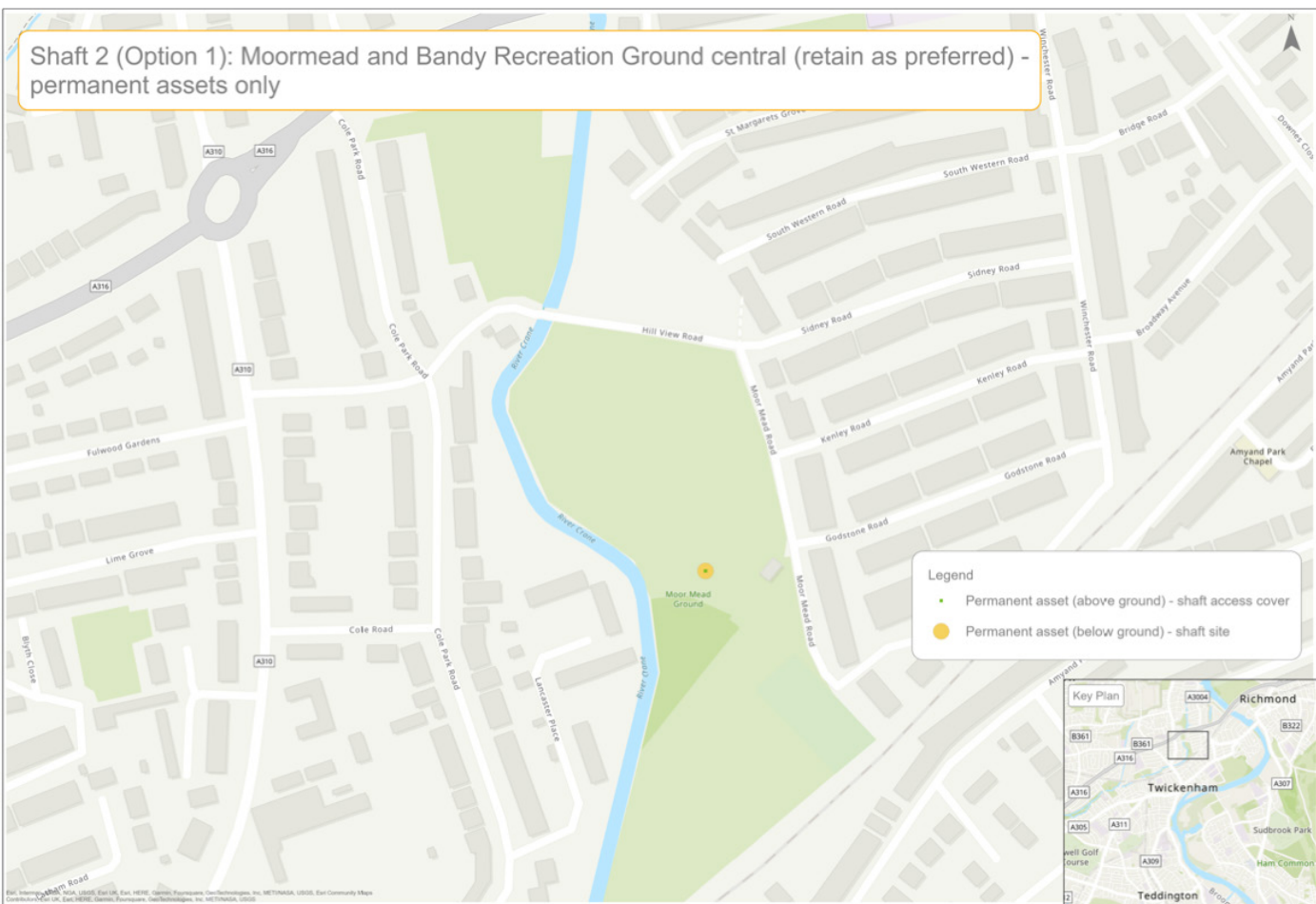
Permanent Assets

London Water Recycling - Teddington DRA

Shaft 2 (Option 1): Moormead and Bandy Recreation Ground central



Construction and Development

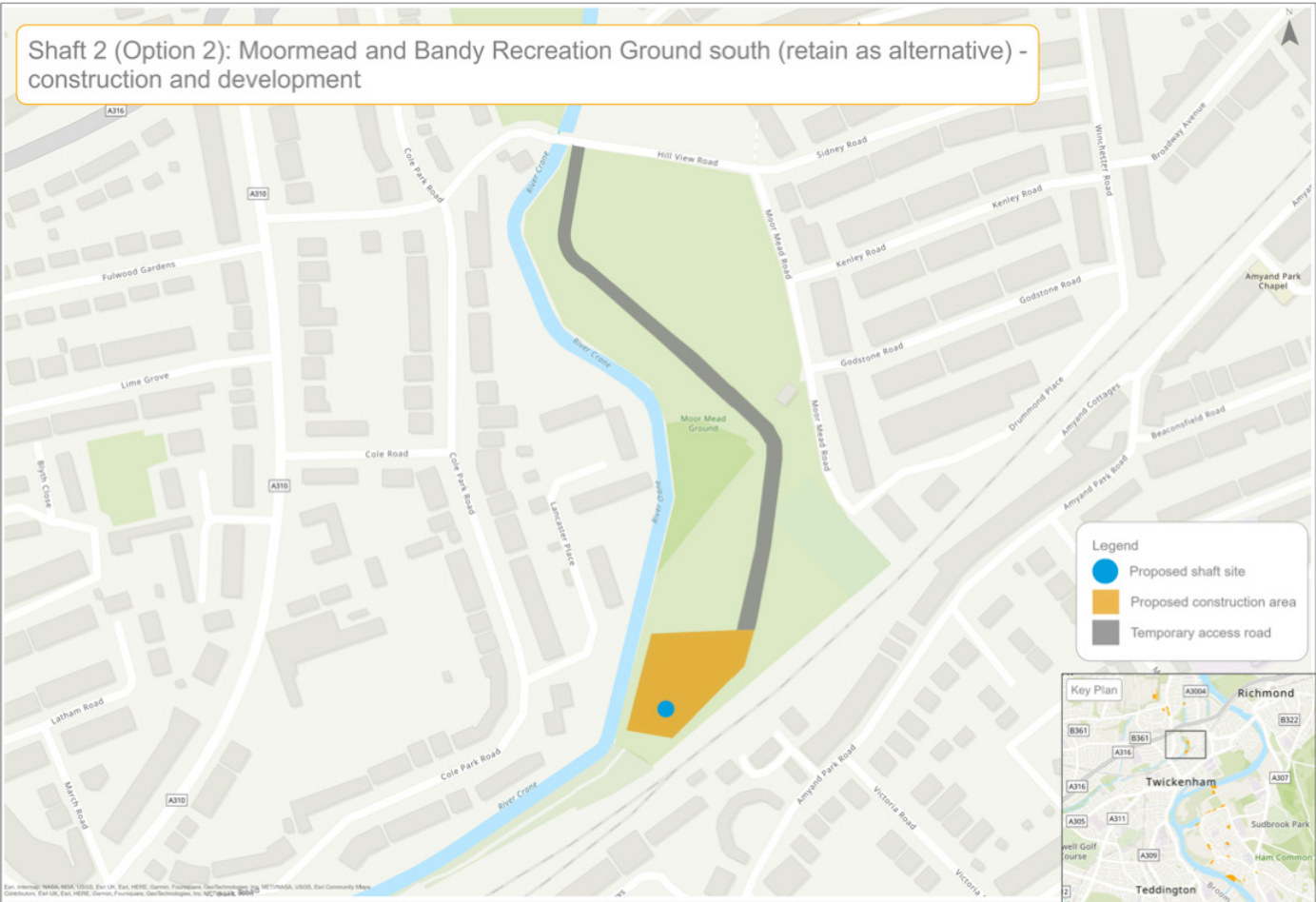


Permanent Assets

London Water Recycling - Teddington DRA

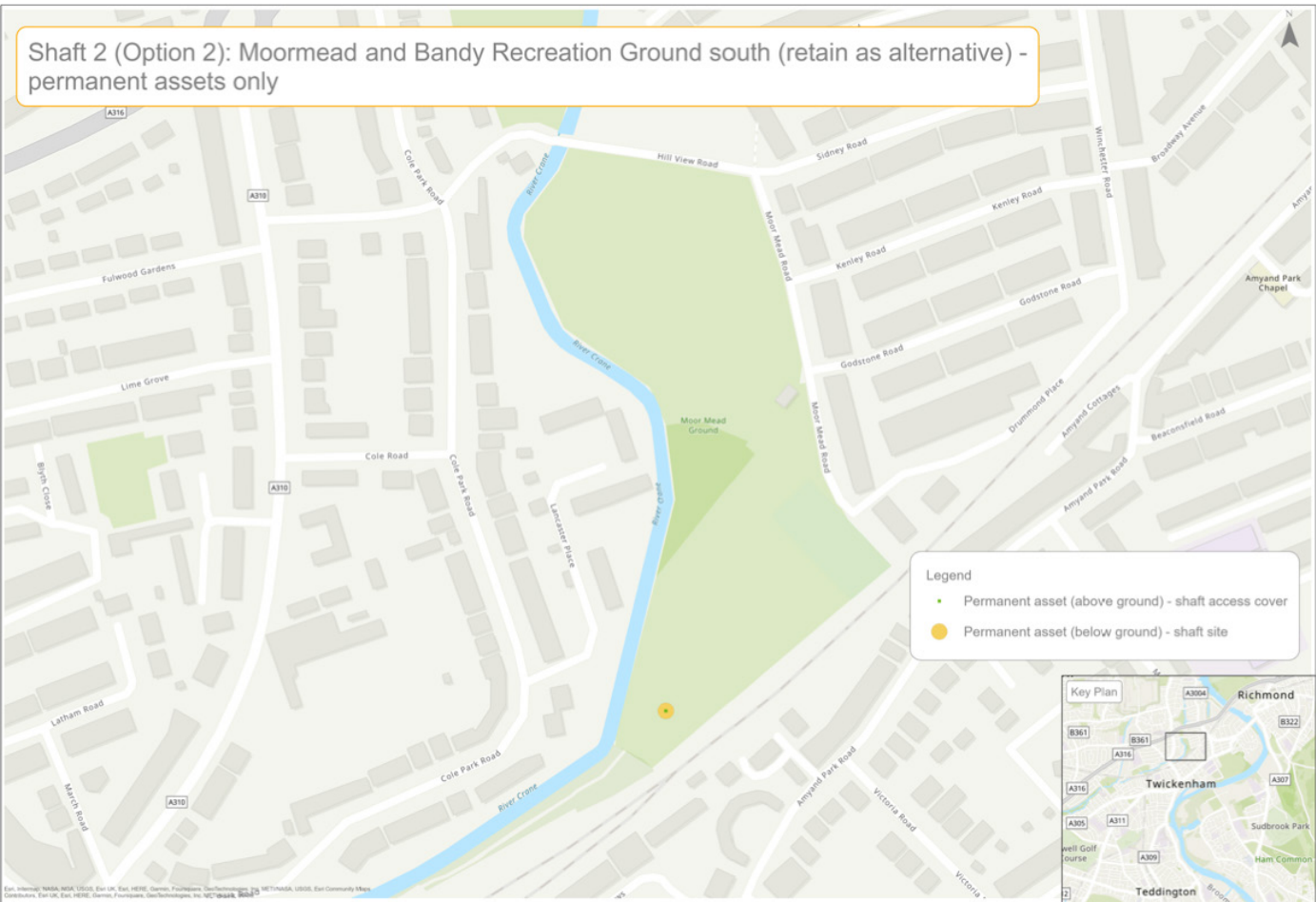
Shaft 2 (Option 2): Moormead and Bandy Recreation Ground south

Shaft 2 (Option 2): Moormead and Bandy Recreation Ground south (retain as alternative) - construction and development



Construction and Development

Shaft 2 (Option 2): Moormead and Bandy Recreation Ground south (retain as alternative) - permanent assets only



Permanent Assets

London Water Recycling - Teddington DRA

Shaft 3 (Option 1): Ham Street car park



Construction and Development



Permanent Assets

London Water Recycling - Teddington DRA

Shaft 3 (Option 2): Land to the south of Ham Street car park and west of Ham Street

Shaft 3 (Option 2): Land to the south of Ham Street car park and west of Ham Street (retain as alternative) - construction and development



Construction and Development

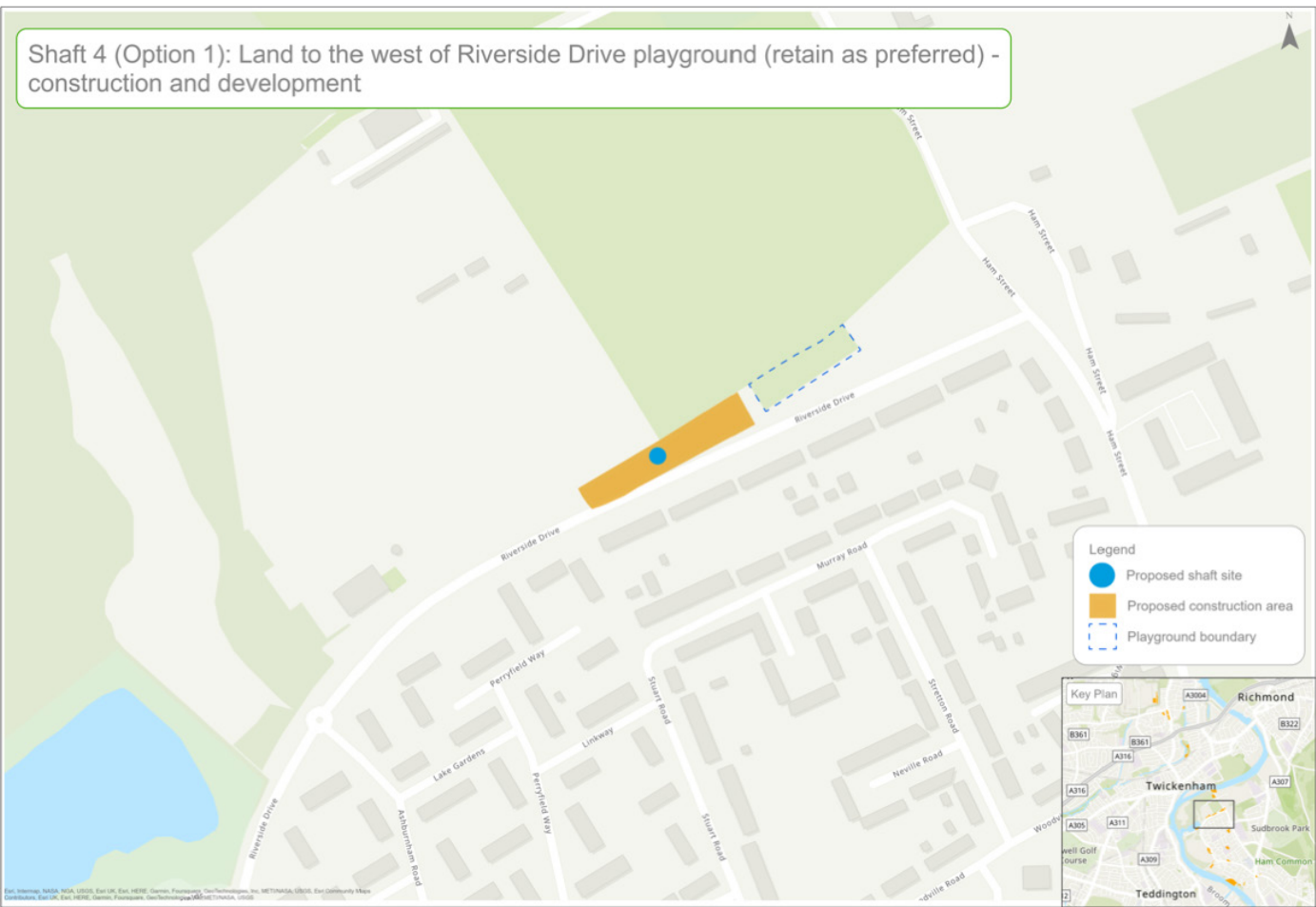
Shaft 3 (Option 2): Land to the south of Ham Street car park and west of Ham Street (retain as alternative) - permanent assets only



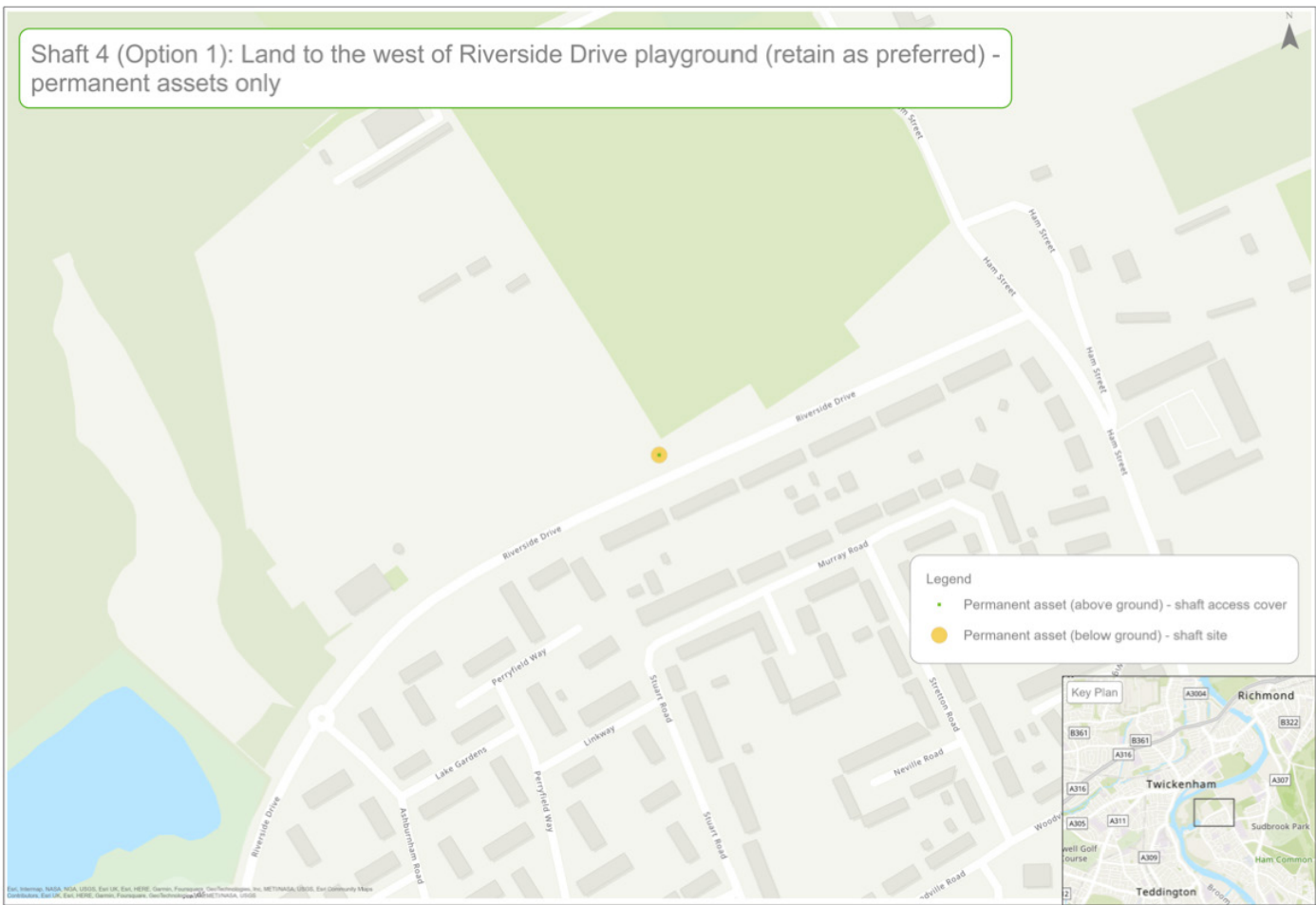
Permanent Assets

London Water Recycling - Teddington DRA

Shaft 4 (Option 1): Land to the west of Riverside Drive playground



Construction and Development



Permanent Assets

London Water Recycling - Teddington DRA

Shaft 4 (Option 2): Land at Ham Playing Fields car park



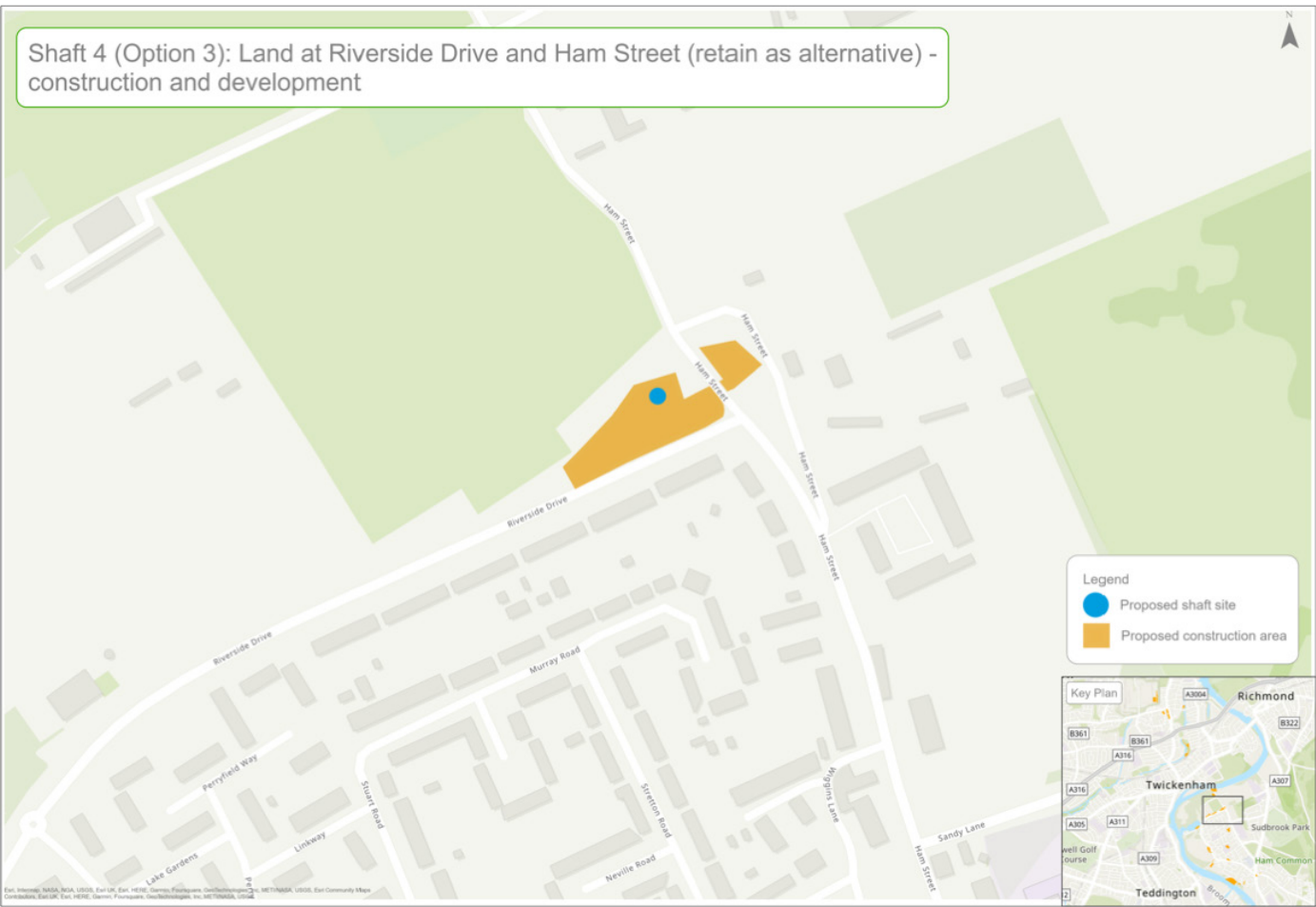
Construction and Development



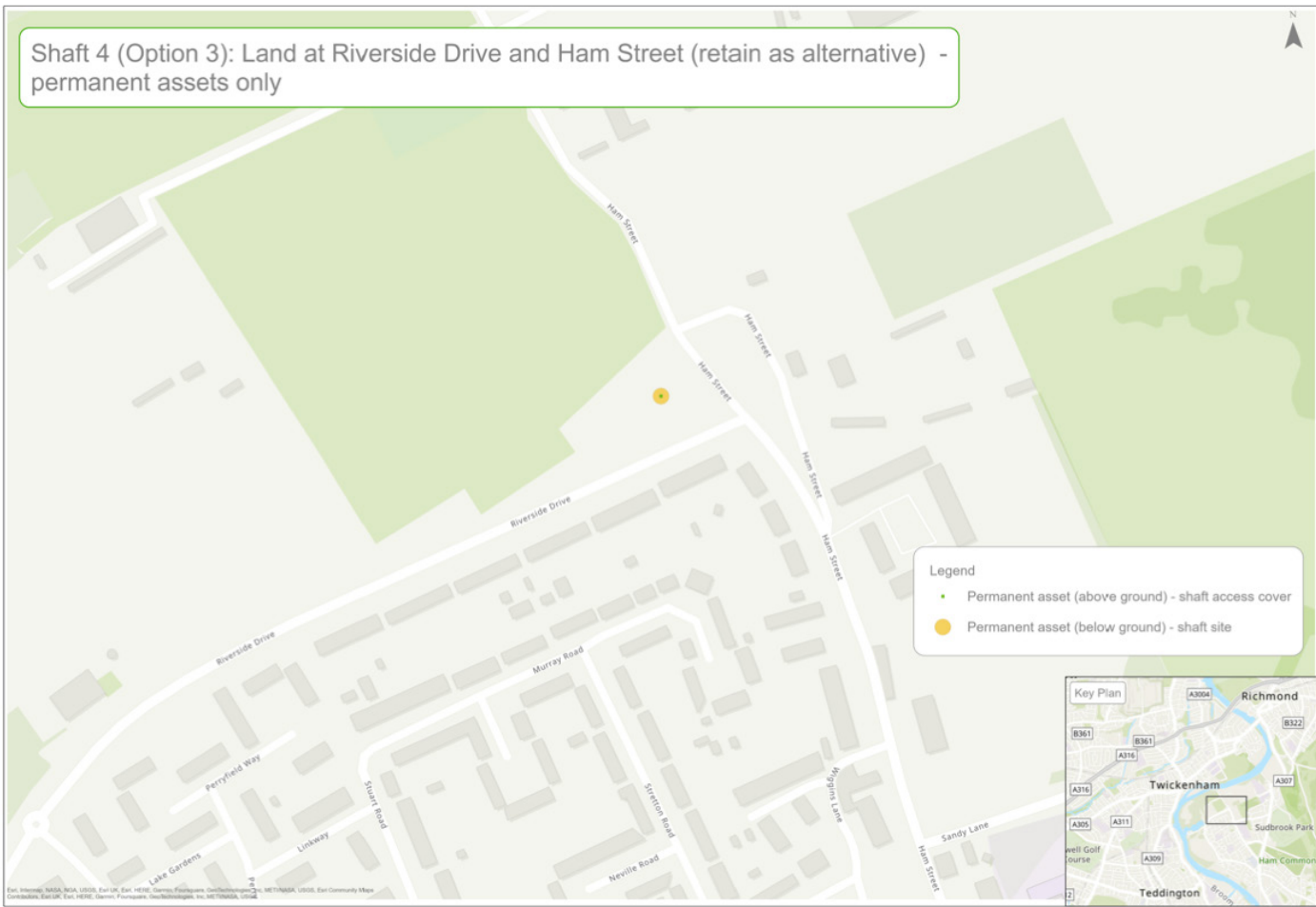
Permanent Assets

London Water Recycling - Teddington DRA

Shaft 4 (Option 3): Land at Riverside Drive and Ham Street



Construction and Development



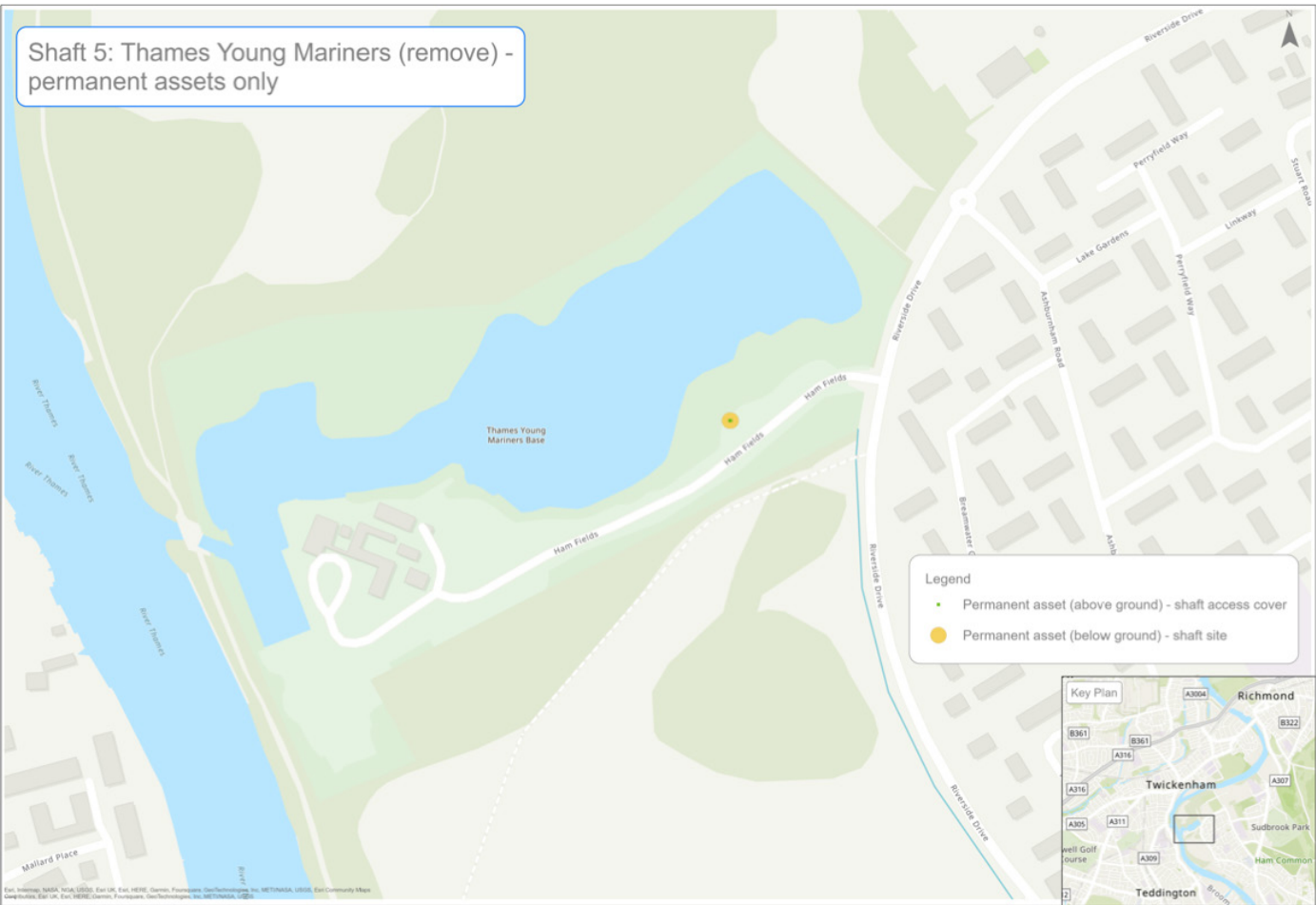
Permanent Assets

London Water Recycling - Teddington DRA

Shaft 5: Thames Young Mariners



Construction and Development



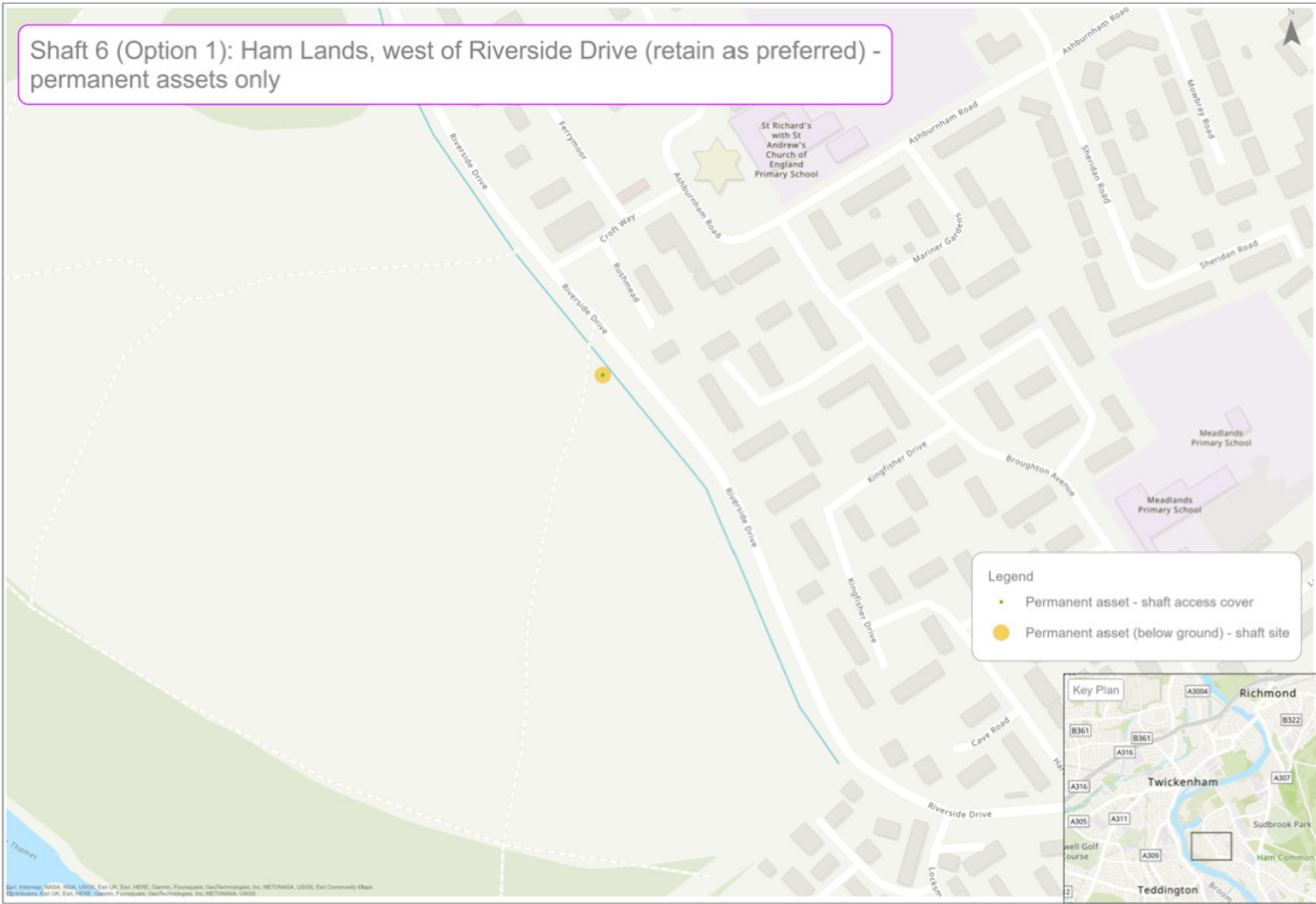
Permanent Assets

London Water Recycling - Teddington DRA

Shaft 6 (Option 1): Ham Lands, west of Riverside Drive



Construction and Development



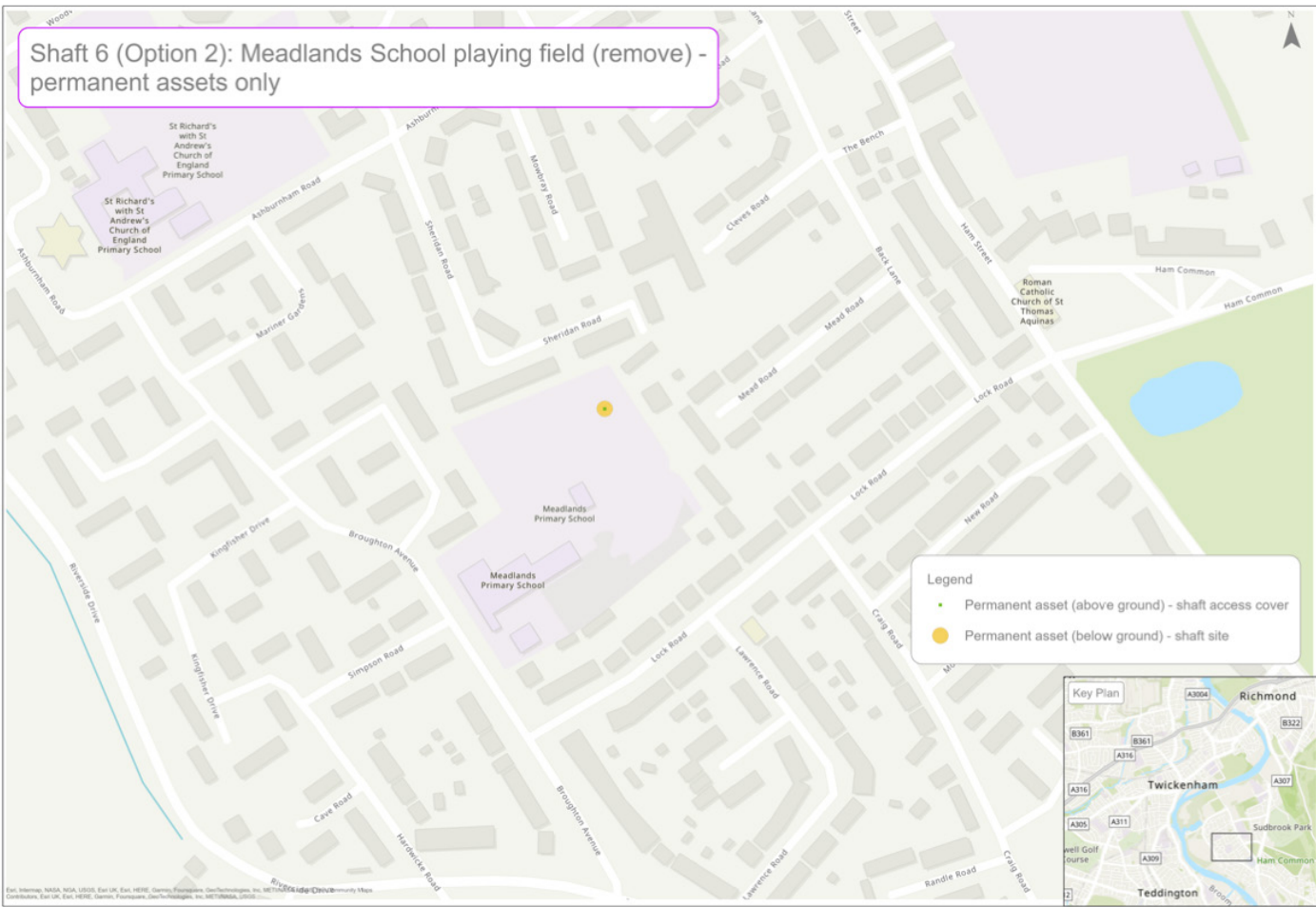
Permanent Assets

London Water Recycling - Teddington DRA

Shaft 6 (Option 2): Meadlands School playing field



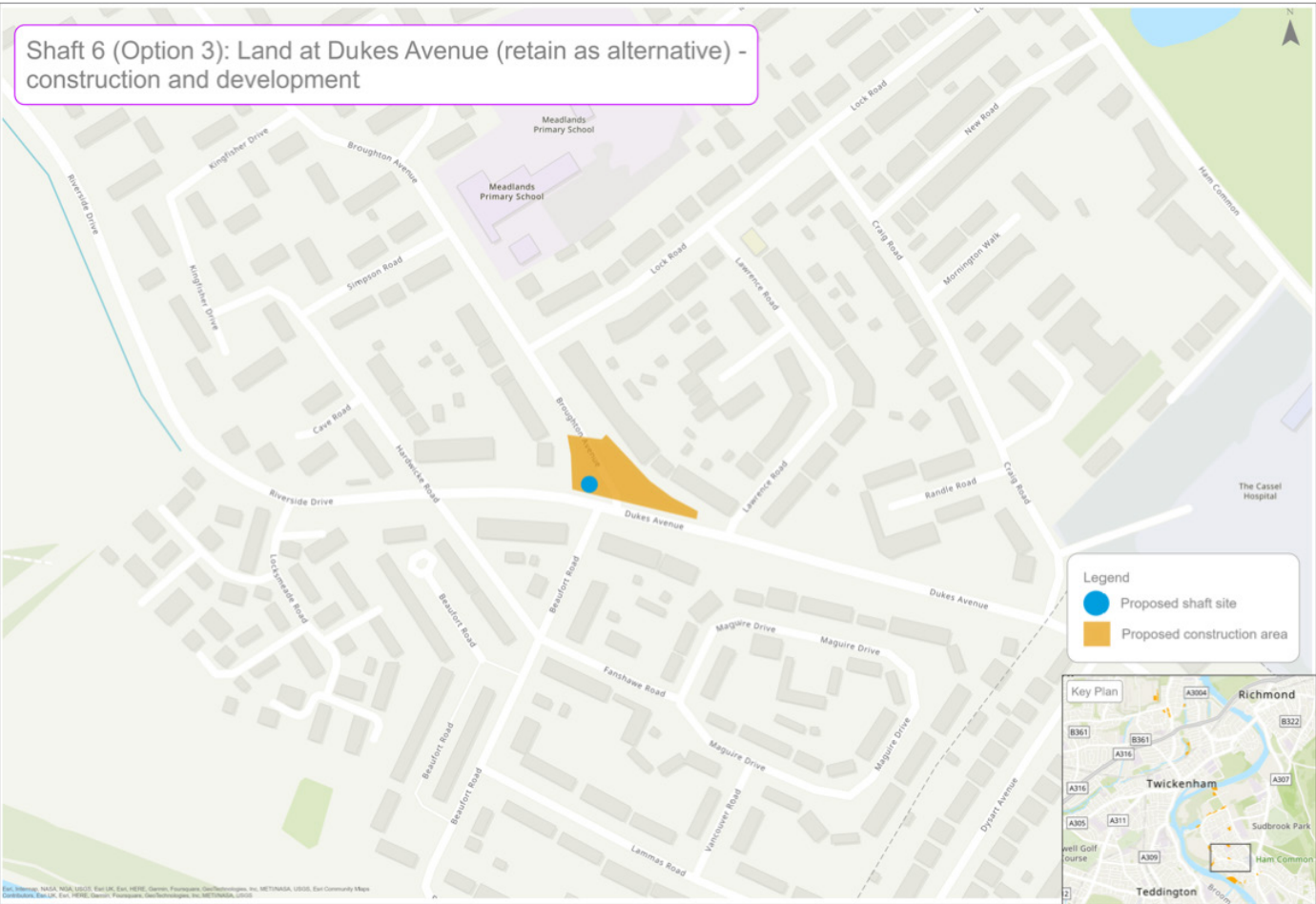
Construction and Development



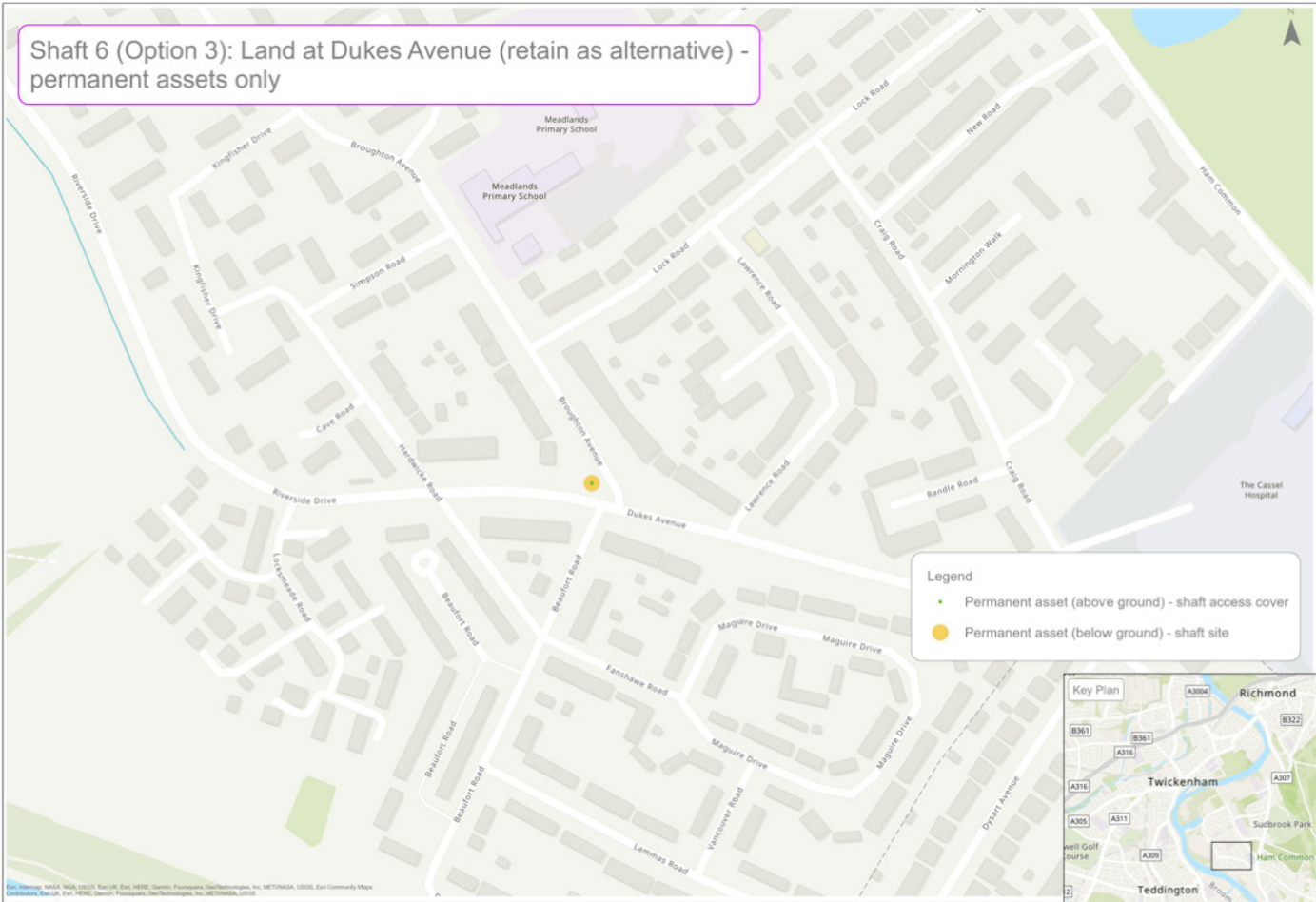
Permanent Assets

London Water Recycling - Teddington DRA

Shaft 6 (Option 3): Land at Dukes Avenue



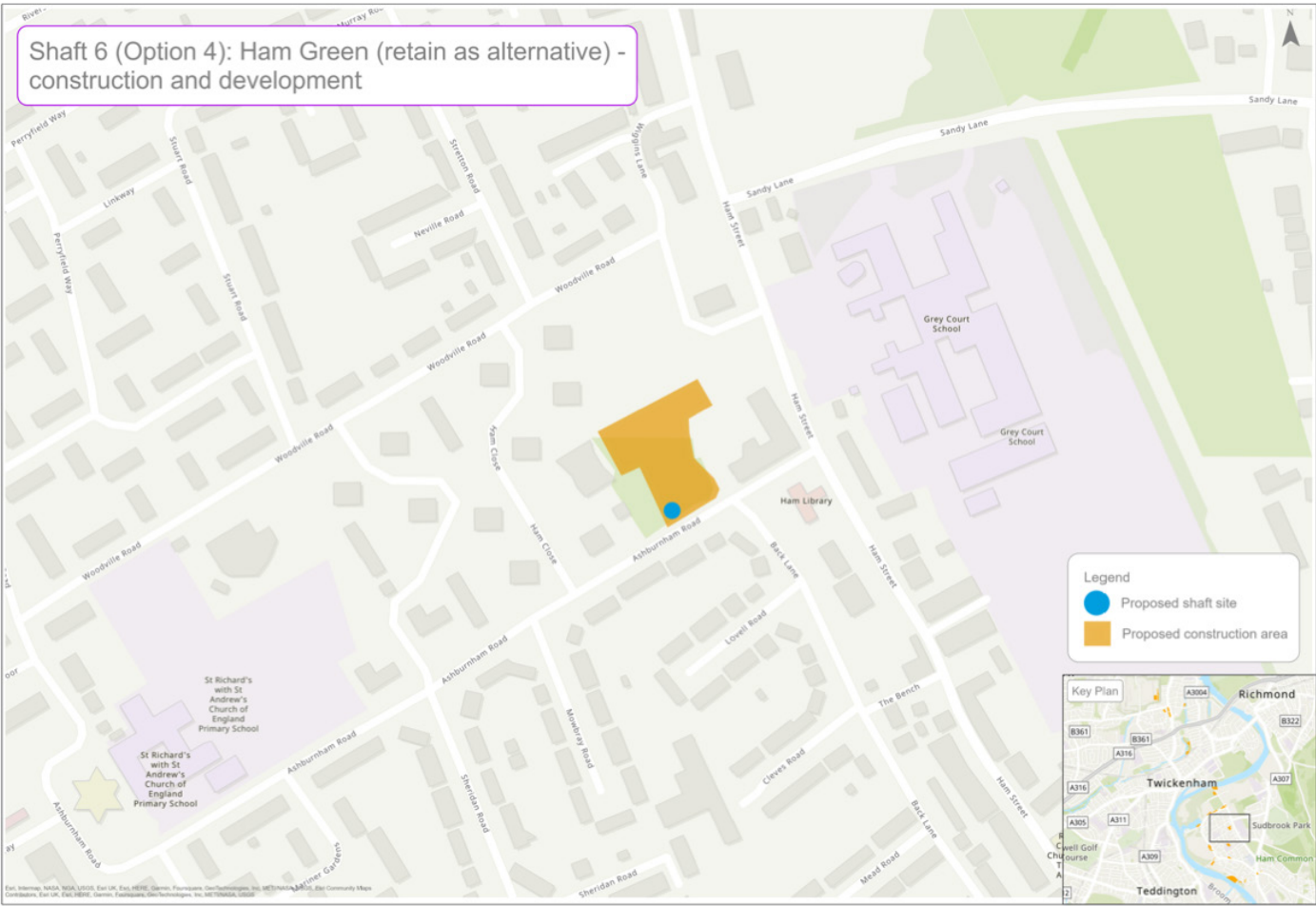
Construction and Development



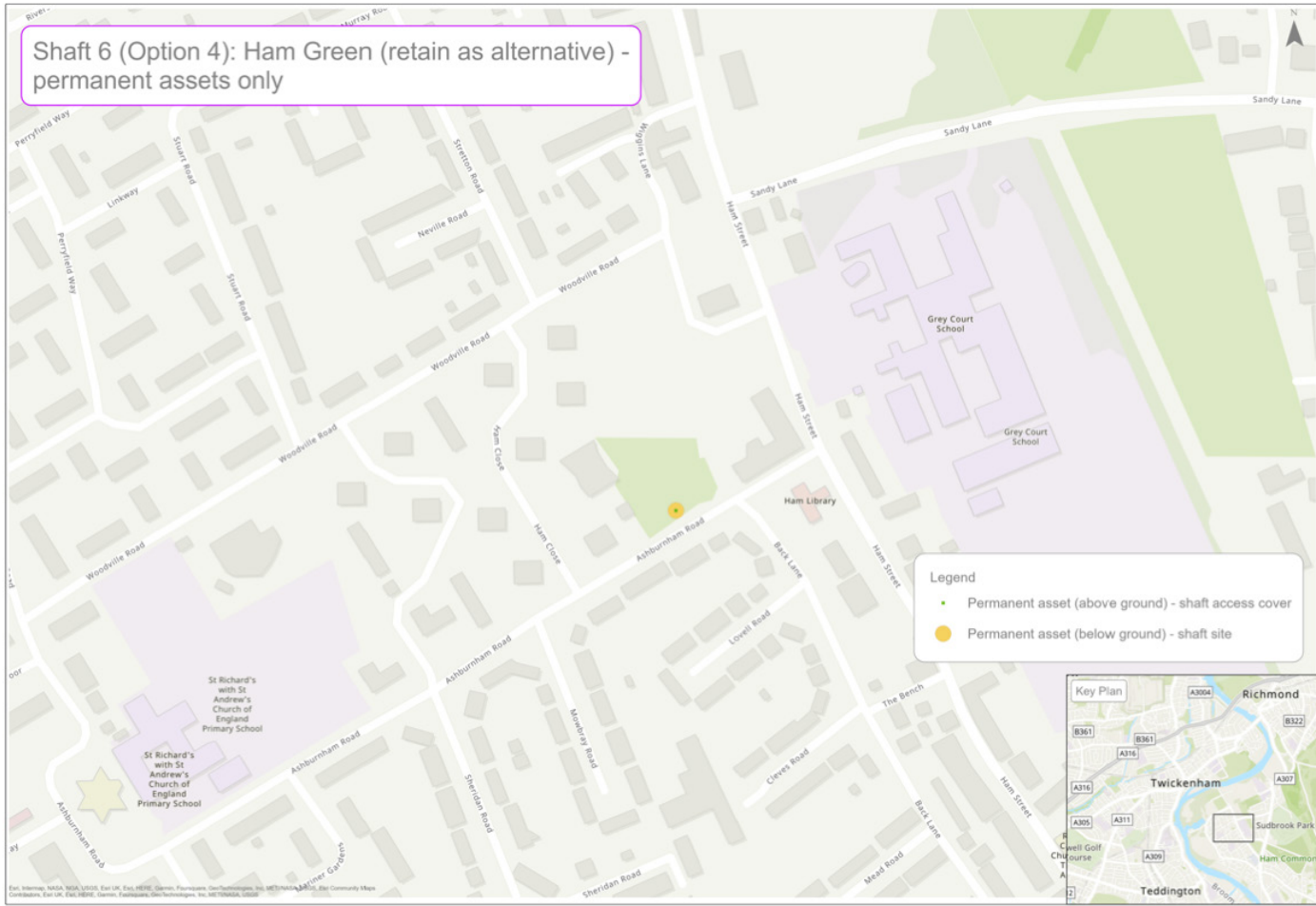
Permanent Assets

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Shaft 6 (Option 4): Ham Green



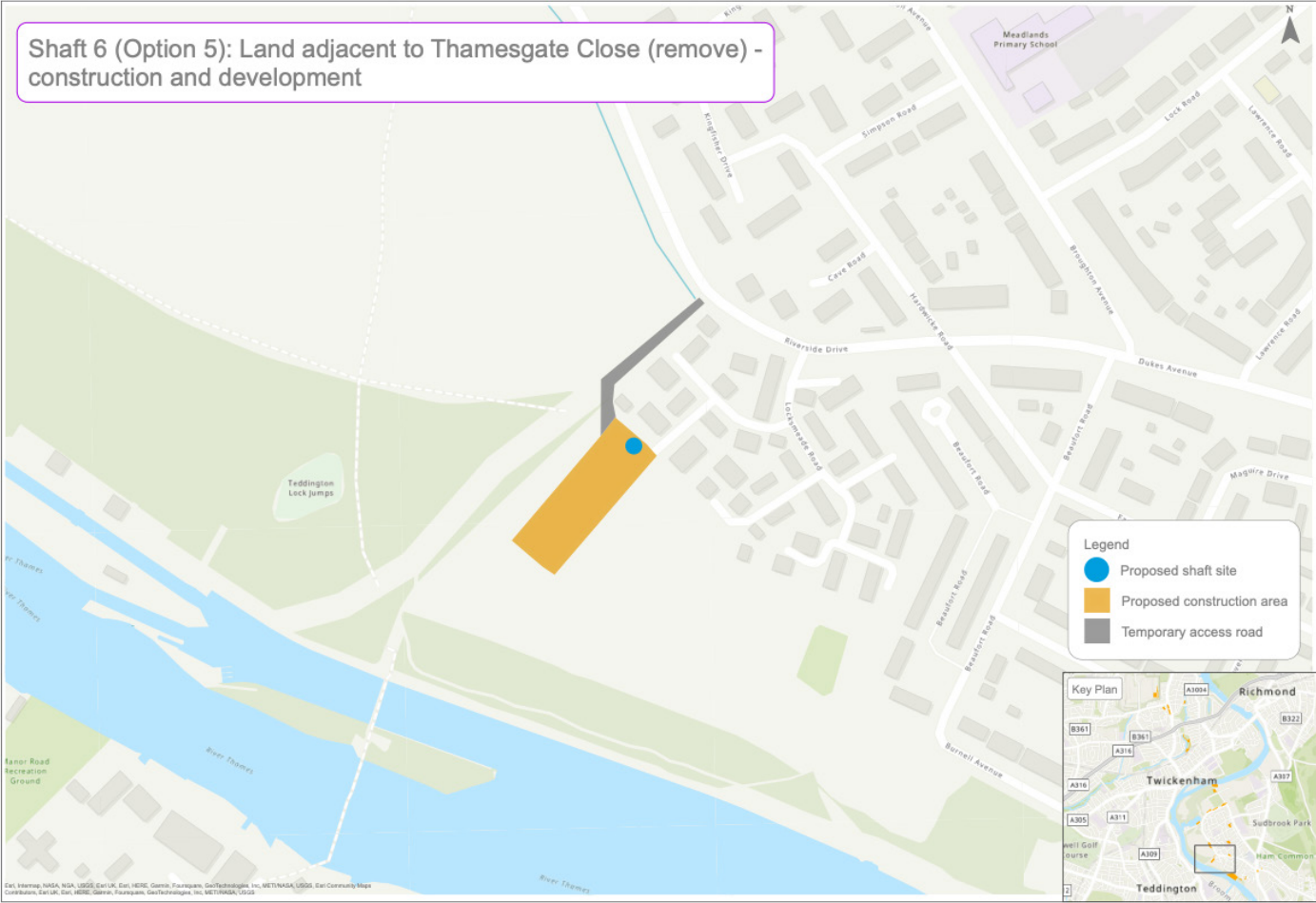
Construction and Development



Permanent Assets

London Water Recycling - Teddington DRA

Shaft 6 (Option 5): Land adjacent to Thamesgate Close



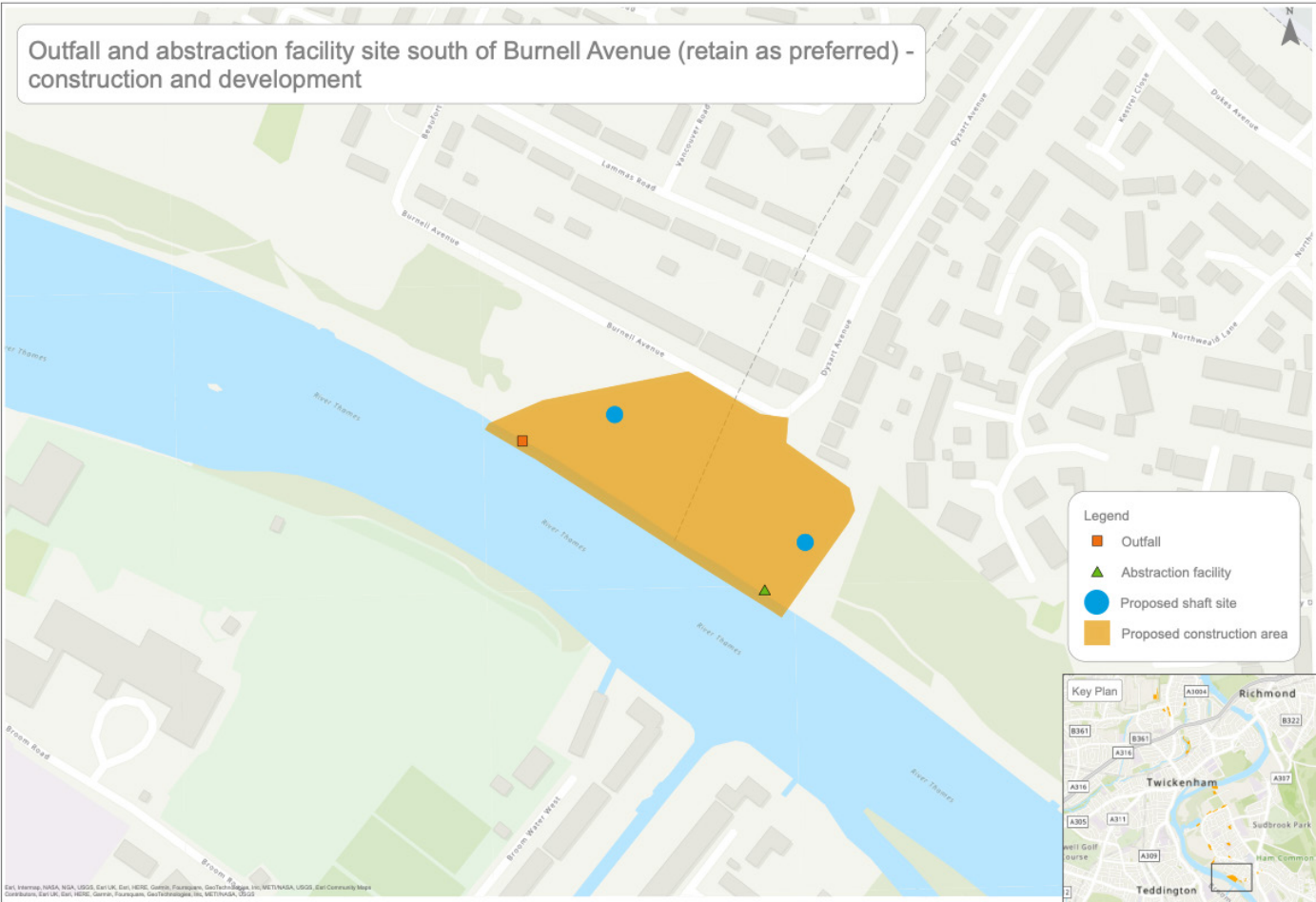
Construction and Development



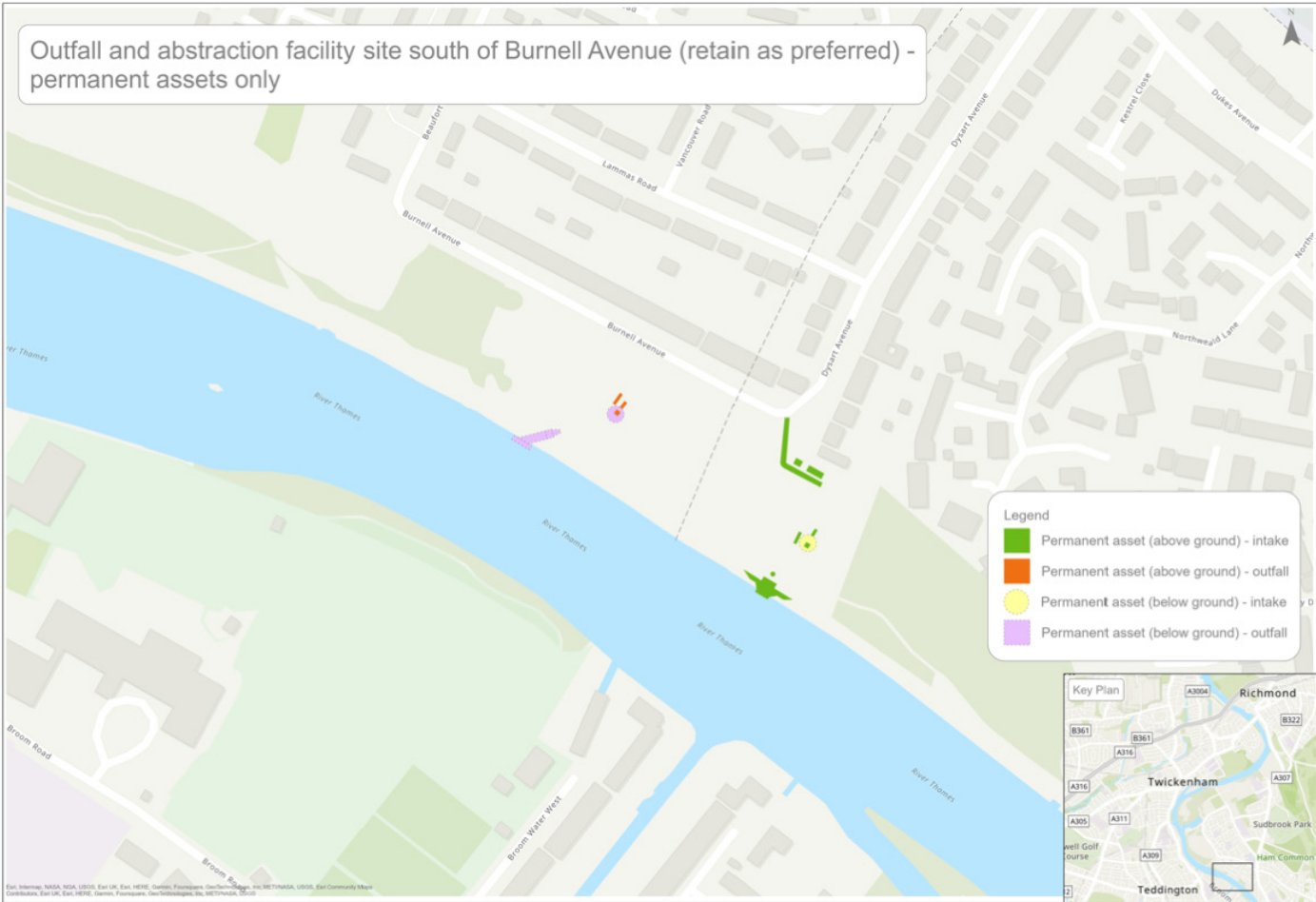
Permanent Assets

London Water Recycling - Teddington DRA

Outfall and abstraction facility site south of Burnell Avenue



Construction and Development



Operational Assets

London Water Recycling - Teddington DRA

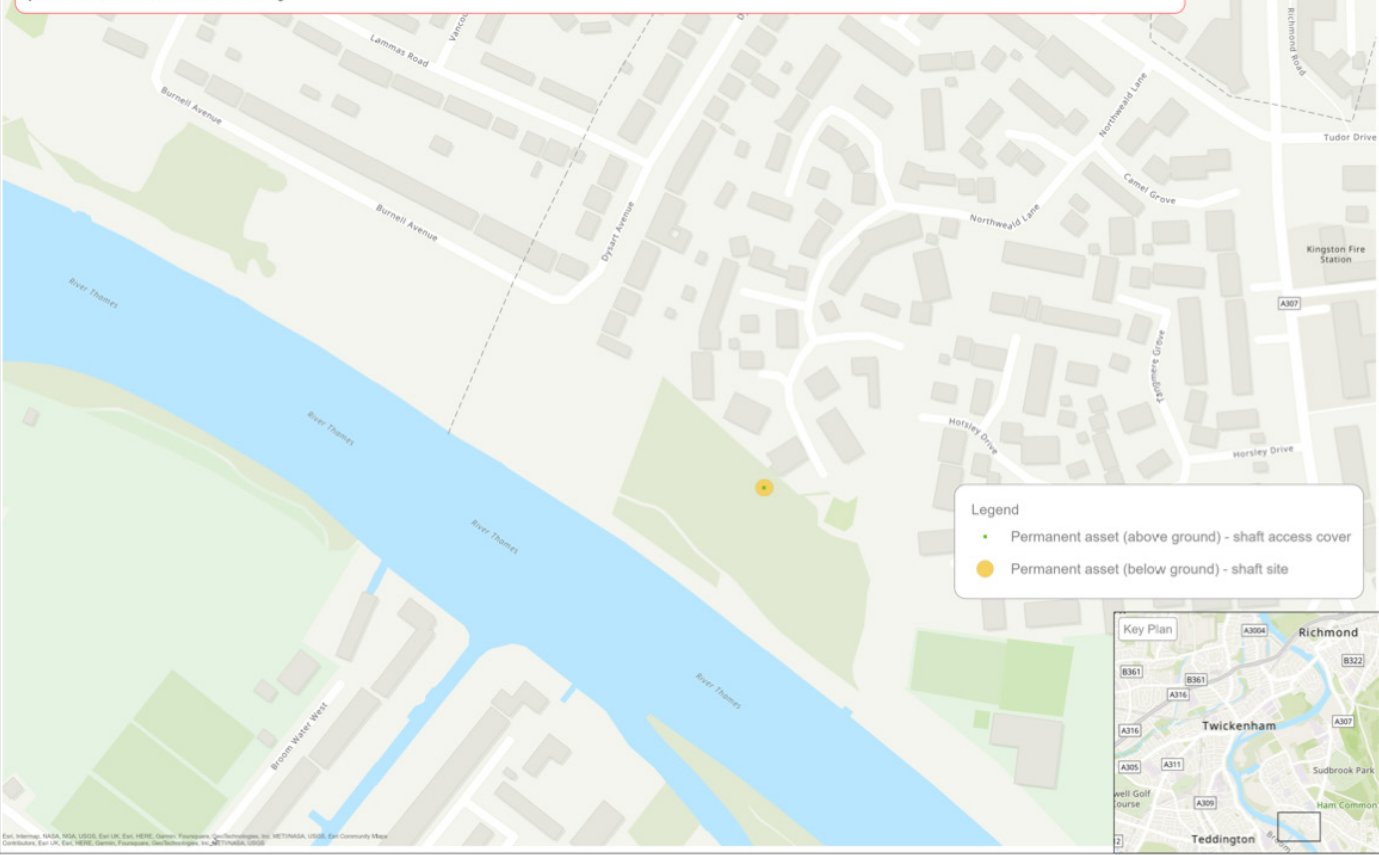
Thames Lee Tunnel Connection (Option 1): Land south of Northweald Lane

Thames Lee Tunnel Connection (Option 1): Land south of Northweald Lane (retain as alternative) - construction and development



Construction and Development

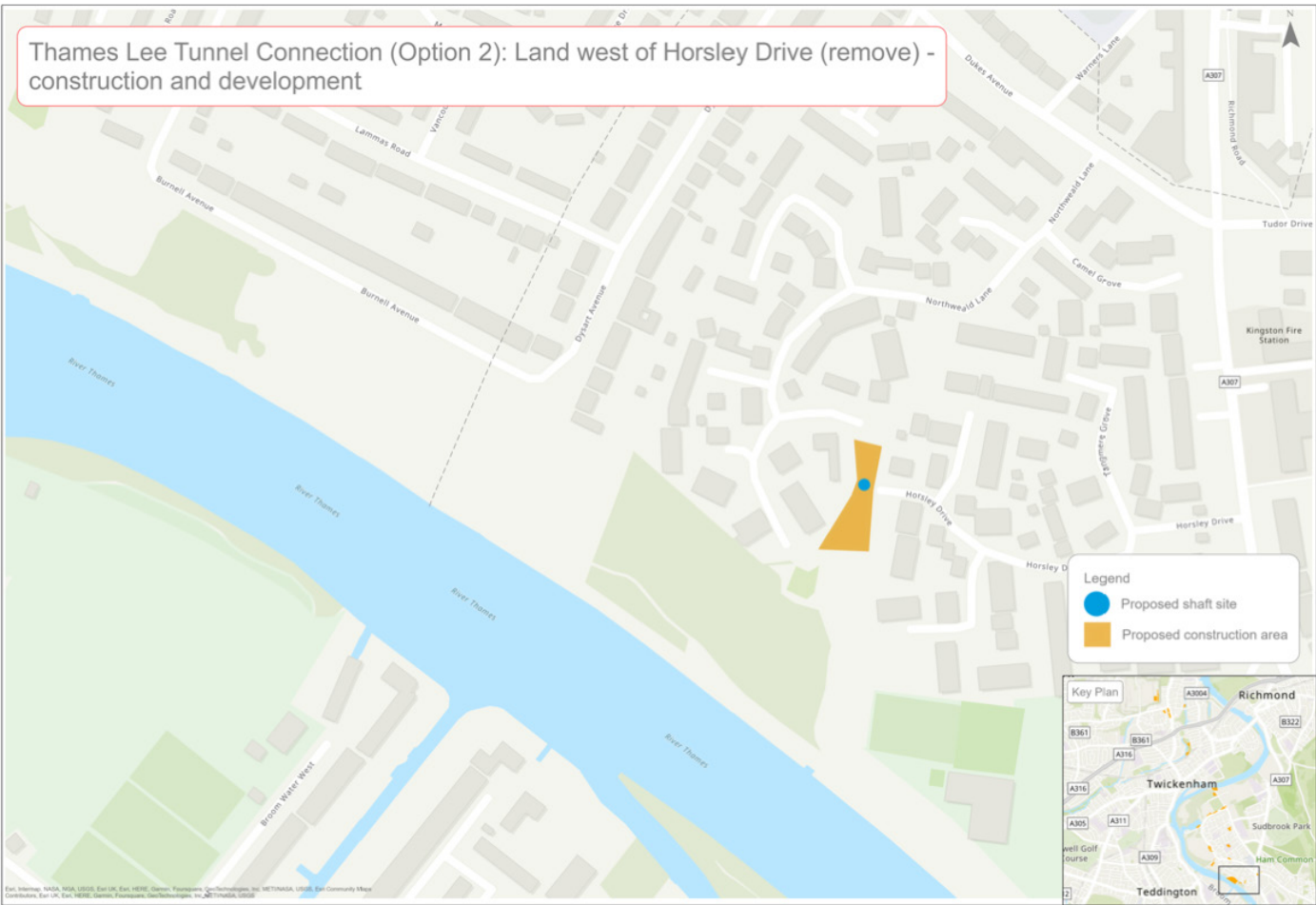
Thames Lee Tunnel Connection (Option 1): Land south of Northweald Lane (retain as alternative) - permanent assets only



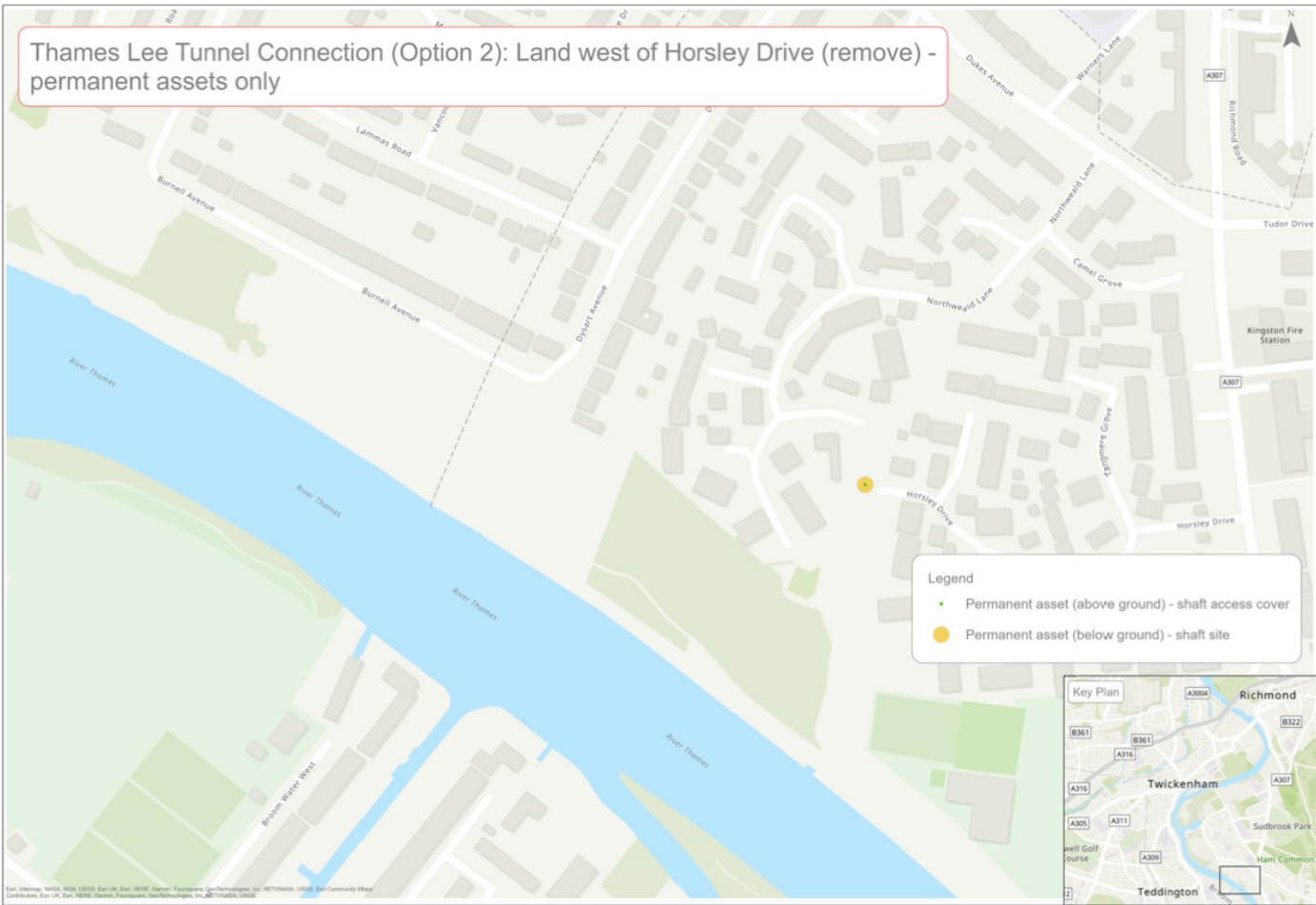
Permanent Assets

London Water Recycling - Teddington DRA

Thames Lee Tunnel Connection (Option 2): Land west of Horsley Drive



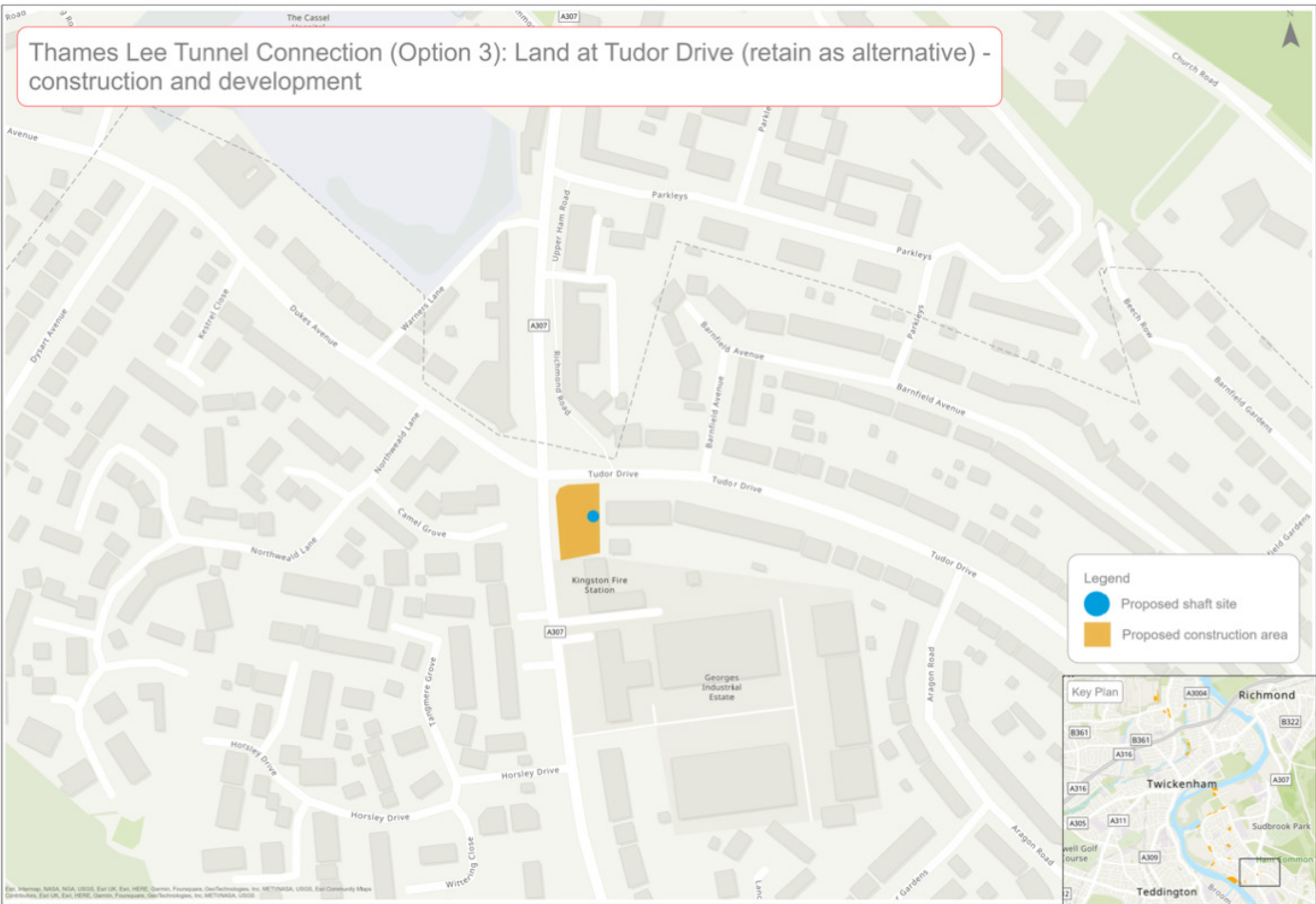
Construction and Development



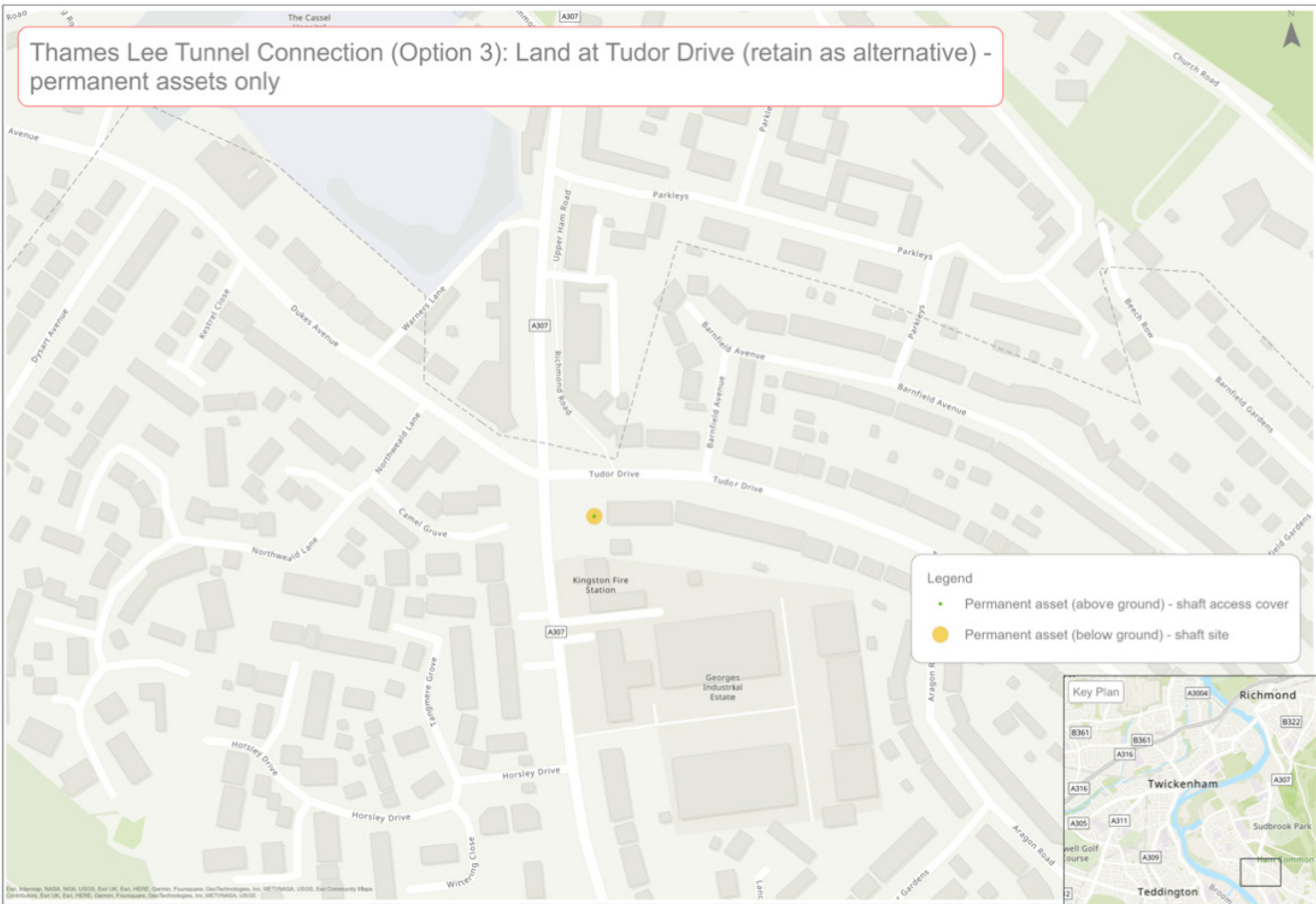
Permanent Assets

London Water Recycling - Teddington DRA

Thames Lee Tunnel Connection (Option 3): Land at Tudor Drive



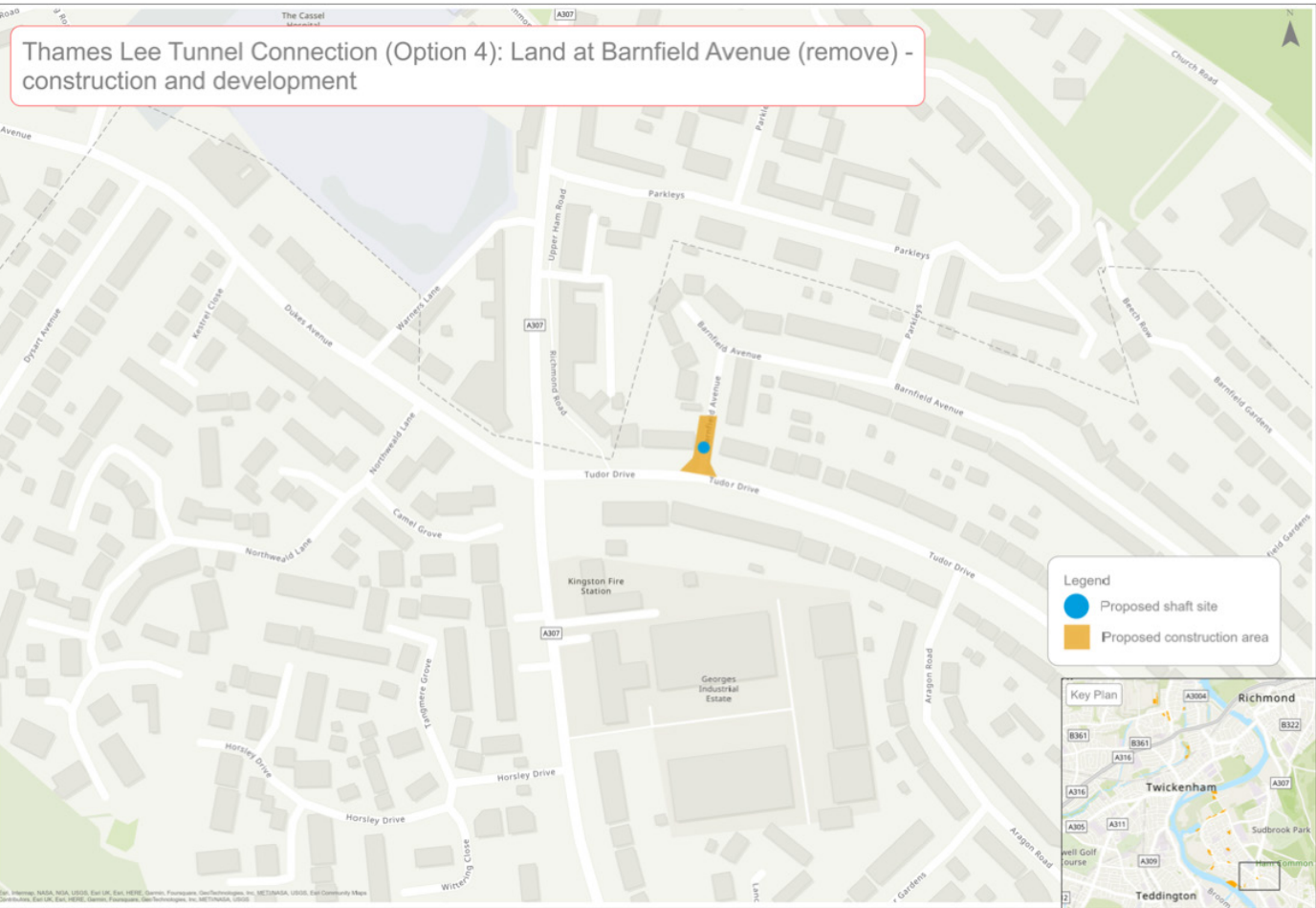
Construction and Development



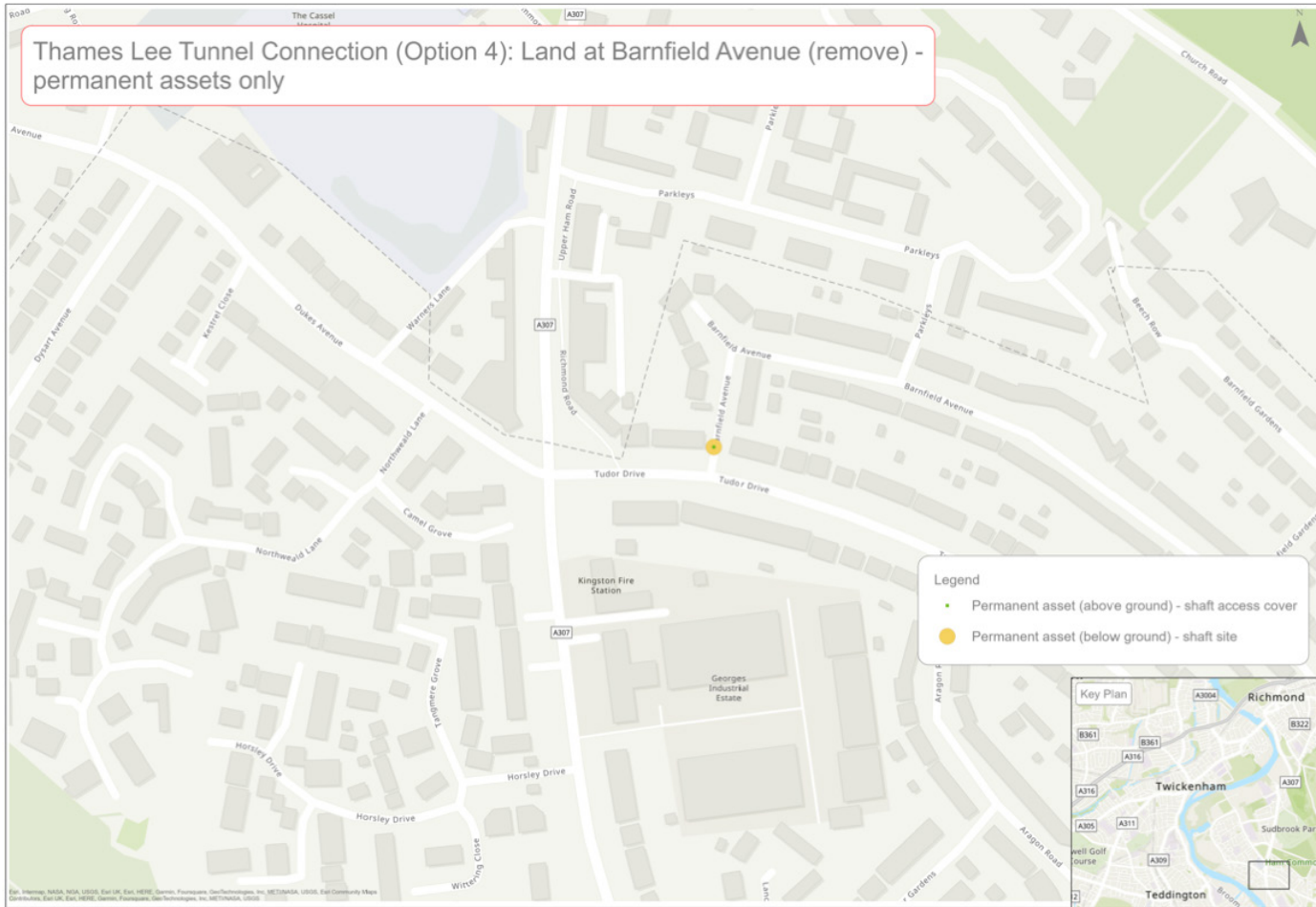
Permanent Assets

London Water Recycling - Teddington DRA

Thames Lee Tunnel Connection (Option 4): Land at Barnfield Avenue



Construction and Development



Permanent Assets