

10.2.4 The Local Air Quality Management Technical Guidance 2016, issued by the Department for Environment, Food and Rural Affairs (Defra) for Local Authorities provides advice as to where the NAQOs apply (Ref 10.7). These include outdoor locations where members of the public are likely to be regularly present for the averaging period of the objective (which vary from 15 minutes to a year). Thus, for example, annual mean objectives apply at the façades of residential properties, whilst the 24-hour objective (for PM₁₀) would also apply within the garden. They do not apply to occupational, indoor or in-vehicle exposure.

EU Limit Values – Air Quality Standards Amended Regulations (2016)

10.2.5 The Air Quality Standards (Amendment) Regulations 2016 amended the Standard Regulations 2010, which implemented the European Union's Directive on ambient air quality and cleaner air for Europe (2008/50/EC), and includes limit values for NO₂ (Ref 10.8). These limit values are numerically the same as the NAQO values but differ in terms of compliance dates, locations where they apply and the legal responsibility for ensuring that they are complied with. The compliance date for the NO₂ EU Limit Value was 1 January 2010, five years later than the date for the NAQO.

10.2.6 Directive 2008/50/EC consolidated the previous framework directive on ambient air quality assessment and management and its first three daughter directives. The limit values remained unchanged, but it now allows Member States a time extension for compliance, subject to European Commission (EC) approval.

10.2.7 The Directive limit values are applicable at all locations except:

- Where members of the public do not have access and there is no fixed habitation;
- On factory premises or at industrial installations to which all relevant provisions concerning health and safety at work apply; and
- On the carriageway of roads; and on the central reservations of roads except where there is *normally pedestrian* access.

Air Quality Objectives

Human Health

10.2.8 The NAQOs for NO₂ and PM₁₀ set out in the Air Quality Regulations (England) 2000 and the Air Quality (England) (Amendment) Regulations 2002, are shown in **Table 10.1**.

10.2.9 The objectives for NO₂ and PM₁₀ were to have been achieved by 2005 and 2004, respectively, but also continue to apply in all future years thereafter. Analysis of long-term monitoring data suggests that if the annual mean NO₂ concentration is less than 60 µg/m³ then the one-hour mean NO₂ objective is unlikely to be exceeded where road transport is the main source of pollution. Therefore, this concentration has been used in this assessment to screen whether the one-hour mean objective is likely to be achieved (Ref 10.7).

Table 10.1: NO₂ and PM₁₀ Objectives

Pollutant	Time Period	Objective
Nitrogen Dioxide (NO ₂)	1-hour mean	200µg/m ³ not to be exceeded more than 18 times a year
	Annual mean	40µg/m ³

Pollutant	Time Period	Objective
Particulate Matter (PM ₁₀)	24-hour mean	50µg/m ³ not to be exceeded more than 35 times a year
	Annual mean	40µg/m ³

10.2.10 The Air Quality Strategy 2007 (Ref 10.3) includes an exposure reduction target for smaller particles known as PM_{2.5}. These are an annual mean target of 25µg/m³ by 2020 and an average urban background exposure reduction target of 15% between 2010 and 2020.

10.2.11 The Ambient Air Quality and Cleaner Air for Europe directive (2008/50/EC) was adopted in May 2008, and includes a national exposure reduction target, a target value and a limit value for PM_{2.5}, as shown in **Table 10.2**. The UK Government transposed this new directive into national legislation in June 2010.

Table 10.2: PM_{2.5} Objectives

	Time Period	Objective	To be Achieved by
UK Objectives	Annual mean	25µg/m ³	2020
	3 year running annual mean	15% reduction in concentrations measured at urban background Sites	Between 2010 and 2020
European Obligations	Annual mean	Target value of 25µg/m ³	2010
	Annual mean	Limit value of 25µg/m ³	2015
	Annual mean	Stage 2 indicative Limit value of 20µg/m ³	2020
	3 year Average Exposure Indicator (AEI) ^(a)	Exposure reduction target relative to the AEI depending on the 2010 value of the 3 year AEI (ranging from a 0% to a 20% reduction)	2020
	3 year Average Exposure Indicator (AEI)	Exposure concentration obligation of 20µg/m ³	2015

Note: ^(a) The 3 year annual or AEI is calculated from the PM_{2.5} concentration averaged across all urban background monitoring locations in the UK e.g. the AEI for 2010 is the mean concentration measured over 2008, 2009 and 2010.

National Policy

National Planning Policy Framework (2018)

10.2.12 The National Planning Policy Framework (NPPF) sets out the Government's planning policies for England and how they are expected to be applied (Ref 10.9). In relation to achieving sustainable development, paragraph 8 states that:

“Achieving sustainable development means that the planning system has three overarching objectives, which are interdependent and need to be pursued in mutually supportive ways (so that opportunities can be taken to secure net gains across each of the different objectives):

...

*c) **an environmental objective** – to contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy.”*

10.2.13 So that sustainable development is pursued in a positive way, at the heart of the Framework is a presumption in favour of sustainable development. Paragraph 11 states that plans and decisions should apply a presumption in favour of sustainable development, which for decision-taking means:

“... d) where there are no relevant development plan policies, or the policies which are most important for determining the application are out-of-date, granting permission unless:

...

ii. any adverse impacts of doing so would significantly and demonstrably outweigh the benefits, when assessed against the policies in this Framework taken as a whole.”

10.2.14 Paragraph 54 on planning conditions and obligations states:

“Local planning authorities should consider whether otherwise unacceptable development could be made acceptable through the use of conditions or planning obligations. Planning obligations should only be used where it is not possible to address unacceptable impacts through a planning condition.”

10.2.15 Paragraph 102 on promoting sustainable transport states:

“Transport issues should be considered from the earliest stages of plan-making and development proposals, so that:

...

d) the environmental impacts of traffic and transport infrastructure can be identified, assessed and taken into account – including appropriate opportunities for avoiding and mitigating any adverse effects, and for net environmental gains; ...”

10.2.16 Paragraph 103 continues to state:

“Significant development should be focused on locations which are or can be made sustainable, through limiting the need to travel and offering a genuine choice of transport modes. This can help to reduce congestion and emissions, and improve air quality and public health.”

10.2.17 Paragraph 170 on conserving and enhancing the natural environment states:

“Planning policies and decisions should contribute to and enhance the natural and local environment by:

e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land stability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans, and...”

10.2.18 Paragraph 180 within ground conditions and pollution states:

“Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development.”

10.2.19 Paragraph 181, also states that:

“Planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and Clean Air Zones, and the cumulative impacts from individual sites in local areas. Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications. Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan.”

Planning Practice Guidance

10.2.20 Planning Practice Guidance (PPG) (Ref 10.10) was first published in March 2014 to support the National Planning Policy Framework. Paragraph 001, Reference 32-007-20140306 (revision date 06.03.2014) of the PPG provides a summary as to why air quality is a consideration for planning:

“... Defra carries out an annual national assessment of air quality using modelling and monitoring to determine compliance with EU Limit Values. It is important that the potential impact of new development on air quality is taken into account in planning where the national assessment indicates that relevant limits have been exceeded or are near the limit... The local air quality management (LAQM) regime requires every district and unitary authority to regularly review and assess air quality in their area. These reviews identify whether national objectives have been, or will be, achieved at relevant locations, by an applicable date... If national objectives are not met, or at risk of not being met, the local authority concerned must declare an air quality management area and prepare an air quality action plan... Air quality can also affect biodiversity and may therefore impact on our international obligations under the Habitats Directive... Odour and dust can also be a planning concern, for example, because of the effect on local amenity.”

10.2.21 Paragraph 002 of the PPG concerns the role of Local Plans with regard to air quality;

“... Drawing on the review of air quality carried out for the local air quality management regime, the Local Plan may need to consider;

- *the potential cumulative impact of a number of smaller developments on air quality as well as the effect of more substantial developments;*
- *the impact of point sources of air pollution...; and*
- *ways in which new development would be appropriate in locations where air quality is or likely to be a concern and not give rise to unacceptable risks from pollution. This could be through, for example, identifying measures for offsetting the impact on air quality arising from new development including supporting measures in an air quality action plan or low emissions strategy where applicable.”*

10.2.22 Paragraph 005 of the PPG identifies when air quality could be relevant for a planning decision;

“... When deciding whether air quality is relevant to a planning application, considerations could include whether the development would;

- *Significantly affect traffic in the immediate vicinity of the proposed development site or further afield. This could be by generating or increasing traffic congestion; significantly changing traffic volumes, vehicle speed or both; or significantly altering the traffic composition on local roads. Other matters to consider include whether the proposal involves the development of a bus station, coach or lorry park; adds to turnover in a large car park; or result in construction sites that would generate large Heavy Goods Vehicle flows over a period of a year or more;*
- *Introduce new point sources of air pollution. This could include furnaces which require prior notification to local authorities; or extraction systems (including chimneys) which require approval under pollution control legislation or biomass boilers or biomass-fuelled CHP plant; centralised boilers or CHP plant burning other fuels within or close to an air quality management area or introduce relevant combustion within a Smoke Control Areas;*
- *Expose people to existing sources of air pollutants. This could be by building new homes, workplaces or other development in places with poor air quality;*
- *Give rise to potentially unacceptable impact (such as dust) during construction for nearby sensitive locations; and*
- *Affect biodiversity. In particular, is it likely to result in deposition or concentration of pollutants that significantly affect a European-designated wildlife site, and is not directly connected with or necessary to the management of the site, or does it otherwise affect biodiversity, particularly designated wildlife sites.”*

10.2.23 Paragraph 007 of the PPG provides guidance on how detailed an assessment needs to be;

“Assessments should be proportionate to the nature and scale of development proposed and the level of concern about air quality, and because of this are likely to be locationally specific.”

10.2.24 Paragraph 008 of the PPG provides guidance on how an impact on air quality can be mitigated;

“Mitigation options where necessary will be locationally specific, will depend on the proposed development and should be proportionate to the likely impact... Examples of mitigation include;

- *the design and layout of development to increase separation distances from sources of air pollution;*
- *using green infrastructure, in particular trees, to absorb dust and other pollutants;*
- *means of ventilation;*
- *promoting infrastructure to promote modes of transport with low impact on air quality;*
- *controlling dust and emissions from construction, operation and demolition; and*
- *contributing funding to measures, including those identified in air quality action plans and low emission strategies, designed to offset the impact on air quality arising from new development.”*

10.2.25 Paragraph 009 of the PPG provides guidance on how considerations about air quality fit into the development management process by means of a flowchart. The final two stages in the process deal with the results of the assessment;

"Will the proposed development (including mitigation) lead to an unacceptable risk from air pollution, prevent sustained compliance with EU limit values or national objectives for pollutants or fail to comply with the requirements of the Habitats Regulations." If Yes:

- 10.2.26 *"Consider how the proposal could be amended to make it acceptable or, where not practicable, consider whether planning permission should be refused."*

Local Policy

Reading Borough Council Local Policy

- 10.2.27 RBC's 'Reading Borough Local Development Framework: Core Strategy adopted in January 2008 as amended in January 2015', sets out how planning and development will achieve the Reading 2020 vision for the town (Ref 10.11). Policy CS34 on 'Pollution and Water Resources' relates to air quality and states:

"Development will only be permitted where it would not be damaging to the environment through air, land, noise or light pollution; ...

"Proposals for development that are sensitive to the effects of air, noise or light pollution will only be permitted in areas where they will not be subject to high levels of such pollution, unless adequate mitigation measures are provided to minimise the impact of such pollution."

- 10.2.28 Policy DM19 in RBC's Sites and Detailed Policy Document requires that development have regard to the need to improve air quality and to reduce the effects of poor air quality (Ref 10.12):

"Development that would detrimentally affect air quality will not be permitted unless the effect is to be mitigated. The following criteria should be taken into account:

- *Whether the proposal, including when combined with the cumulative effect of other developments already permitted, would significantly reduce air quality;*
- *Whether the development is within, or accessed via, an Air Quality Management Area; and*
- *Whether it can be demonstrated that a local reduction in air quality would be offset by an overall improvement in air quality, for instance through reduction in the need to travel.*
- *Where a development would introduce sensitive uses (such as residential, schools and nurseries, hospitals, care facilities) into, or intensify such uses within, an Air Quality Management Area, detrimental effects on that use will be mitigated. Mitigation measures should be detailed in any planning application."*

- 10.2.29 RBC's draft Local Plan will replace the current development plans, such as the Core Strategy, with a new plan setting out how Reading will develop up to 2036 (Ref 10.13). Policy EN15 on Air Quality states:

"i. Development that would detrimentally affect air quality will not be permitted unless the effect is to be mitigated. The following criteria should be taken into account:

- *Whether the proposal, including when combined with the cumulative effect of other developments already permitted, would significantly worsen air quality;*
- *Whether the development is within, or accessed via, an Air Quality Management Area; and*
- *Whether it can be demonstrated that a local worsening in air quality would be offset by an overall improvement in air quality, for instance through reduction in the need to travel.*

ii. Where a development would introduce sensitive uses (such as residential, schools and nurseries, hospitals, care facilities) into, or intensify such uses within, an Air Quality Management Area, detrimental effects on that use will be mitigated. Mitigation measures should be detailed in any planning application. If there are significant detrimental effects that cannot be mitigated, the application should be refused.

iii. Where required, planning obligations will be used to secure contributions to measures to tackle poor air quality or for air quality monitoring."

Reading Borough Council Air Quality Action Plan

10.2.30 The RBC Air Quality Action Plan sets out current and new policies and measures to address air quality issues in order to work toward meeting the air quality objectives for NO₂ (Ref 10.14). The measures are broken down into 'Air Pollution Transport Measures', 'Air Pollution Other Sources', 'Air Pollution Development Control' and 'Air Pollution Other Measures'. Measures within the action plan include:

- *"Continue to implement "Quality Travel for Reading" including a new cycling strategy;*
- *Continue to work with Reading buses to reduce air quality impacts and greenhouse gas emissions per passenger kilometre from the Reading bus fleet, setting targets for emissions reductions;*
- *Investigate mechanisms to reduce the impact of Heavy Goods Vehicles (HGVs) on local air quality in Reading; and*
- *Ensure through the planning process that future development does not result in any future deterioration of air quality where possible."*

10.2.31 The Council has reviewed its existing Air Quality Action Plan which has been in place since 2009, as some of the actions have either been completed or superseded (Ref 10.15). The revised Air Quality Action Plan contains measures to improve air quality across Reading split into two areas: intervention and education/promotion. The Eastern Mass Rapid Transit and East (Thames Valley Park) Park & Ride are included within the intervention measures with the aim of providing sustainable transport improving accessibility of travel to and from Reading whilst minimising congestion and reducing emissions.

Wokingham Borough Council Local Policy

10.2.32 Wokingham Borough Core Strategy was adopted in January 2010 (Ref 10.16). The Core Strategy sets out the vision for how the borough will develop in the period to 2026 and how the council aims to protect and enhance the good quality of the life enjoyed in the borough.

10.2.33 Core Strategy Policy CP1 – *Sustainable development* states that planning permissions will be granted for developments proposals that:

- "1) Maintain or enhance the high quality of the environment;*
- 2) Minimise the emission of pollutants into the wider environment; ..."*

10.2.34 Wokingham Borough Sustainable Environmental Strategy 2010-2020 aim is to *"improve the quality of life, now and for future generations, by respecting our environment and protecting it from the impact of our activities and growth"* (Ref 10.17). The strategic priority *"Take Action - Minimising waste, pollution and greenhouse gas emissions"* strives to improve air quality in the borough in the next 10 years. The borough expects to succeed if, by 2020, *"there are no areas within the borough where nitrogen dioxide concentrations in the air exceed national air quality objectives."*

10.3 Consultation

- 10.3.1 Consultation has been carried out with the Environmental Health Officer (EHO) at RBC to agree the approach to the assessment and obtain the latest air quality monitoring for the Council (email communications 22nd June 2016 and 13th July 2018). The methodology described below was considered acceptable for the assessment.

10.4 Methodology

Study Area

- 10.4.1 For the construction phase assessment, the study area is defined as up to 350 m from the application site boundary in accordance with the Institute of Air Quality Management (IAQM) guidance on the assessment of construction dust effects (Ref 10.18).
- 10.4.2 For the road traffic impacts assessment, roads within 250m of the Site, receptor and monitoring locations and where changes in traffic were significant were included in the modelling.

Baseline Data Collection

- 10.4.3 Information on existing air quality has been obtained by collating the results of monitoring carried out by the RBC. Background concentrations for the site have been defined using the national pollution maps, published by Defra, adjusted using local background monitoring data (Ref 10.19).

Assessment

Construction Impacts

- 10.4.4 The Institute of Air Quality Management (IAQM) has issued revised guidance on the assessment of dust from demolition and construction (Ref 10.18). Within the IAQM guidance, an 'impact' is described as a change in pollutant concentrations or dust deposition and an 'effect' is described as the consequence of an impact.
- 10.4.5 During construction, the main potential effects are dust annoyance and locally elevated concentrations of PM₁₀. The suspension of particles in the air is dependent on surface characteristics, weather conditions and on-site activities. Impacts have the potential to occur when dust generating activities coincide with dry, windy conditions, and where sensitive receptors are located downwind of the dust source.
- 10.4.6 Separation distance is also an important factor. Large dust particles (greater than 30 µm), responsible for most dust annoyance, will largely deposit within 100 m of sources. Intermediate particles (10-30 µm) can travel 200 – 500 m. Consequently, significant dust annoyance is usually limited to within a few hundred metres of its source. Smaller particles (less than 10 µm) are deposited slowly and may travel up to 1 km; however, the impact on the short-term concentrations of PM₁₀ occurs over a shorter distance. This is due to the rapid decrease in concentrations with distance from the source due to dispersion.
- 10.4.7 The IAQM guidance recommends that the risk of dust generation is combined with the sensitivity of the area surrounding the site to determine the risk of dust impacts from construction and demolition activities. Depending on the level of risk (high, medium, low or negligible) for each activity, appropriate mitigation is selected.
- 10.4.8 In accordance with the IAQM, the dust emission magnitude is defined as either large, medium or small (**Table 10.3**) taking into account the general activity descriptors on site and professional judgement.

Table 10.3: Criteria for Dust Emission Magnitude.

Dust Emission Magnitude	Activity
Large	Demolition >50,000 m ³ building demolished, dusty material (e.g. concrete), on-site crushing/screening, demolition >20 m above ground level
	Earthworks >10,000 m ² site area, dusty soil type (e.g. clay), >10 earth moving vehicles active simultaneously, >8 m high bunds formed, >100,000 tonnes material moved
	Construction >100,000 m ³ building volume, on site concrete batching, sandblasting
	Trackout >50 HDVs out / day, dusty soil type (e.g. clay), >100 m unpaved roads
Medium	Demolition 20,000 - 50,000 m ³ building demolished, dusty material (e.g. concrete) 10-20 m above ground level
	Earthworks 2,500 - 10,000 m ² site area, moderately dusty soil (e.g. silt), 5-10 earth moving vehicles active simultaneously, 4 m – 8 m high bunds, 20,000 - 100,000 tonnes material moved
	Construction 25,000 - 100,000 m ³ building volume, on site concrete batching
	Trackout 10 - 50 HDVs out / day, moderately dusty surface material, 50 -100 m unpaved roads
Small	Demolition <20,000 m ³ building demolished, non-dusty material, <10 m above ground level, work in winter
	Earthworks <2,500 m ² site area, non-dusty soil, <5 earth moving vehicles active simultaneously, <4 m high bunds, <20,000 tonnes material moved
	Construction <25,000 m ³ , non-dusty material

Dust Emission Magnitude	Activity
	Trackout <10 HDVs out / day, non-dusty soil, < 50 m unpaved roads

10.4.9 The sensitivity of the study area to construction dust impacts is defined based on the examples provided within the IAQM 2016 guidance (**Table 10.4**), taking into account professional judgement.

Table 10.4: Area Sensitivity Definitions.

Area Sensitivity	People and Property Receptors	Ecological Receptors
High	>100 dwellings, hospitals, schools, care homes within 50 m 10 – 100 dwellings within 20 m Museums, car parks, car showrooms within 50 m PM ₁₀ concentrations approach or are above the daily mean objective.	National or Internationally designated site within 20 m with dust sensitive features / species present
Medium	>100 dwellings, hospitals, schools, care homes within 100 m 10 – 100 dwellings within 50 m Less than 10 dwellings within 20 m Offices/shops/parks within 20 m PM ₁₀ concentrations below the daily mean objective.	National or Internationally designated site within 50 m with dust sensitive features / species present Nationally designated site or particularly important plant species within 20 m
Low	>100 dwellings, hospitals, schools, care homes 100 - 350m away 10 – 100 dwellings within 50 – 350 m Less than 10 dwellings within 20 – 350 m Playing fields, parks, farmland, footpaths, short term car parks, roads, shopping streets PM ₁₀ concentrations well below the daily mean objective.	Nationally designated site or particularly important plant species 20 – 50 m Locally designated site with dust sensitive features within 50 m

Road Traffic Impacts

Sensitive Locations

10.4.10 Relevant sensitive locations are places where members of the public might be expected to be regularly present over the averaging period of the objectives. For the annual mean and daily mean objectives that are the focus of this assessment, the proposed locations are considered to be sensitive receptors. Worst case locations are those closest to busy roads or roads with a significant change in traffic. Of these, locations where more than one road influences air quality or vehicles slow are considered to be the most sensitive.

10.4.11 Based on the above criteria, twelve existing properties have been identified as residential receptors for the assessment. The locations of existing residential receptors were chosen to

represent locations where impacts from road traffic related to the proposed development are likely to be the greatest and where changes in traffic meet specific criteria for assessment (see below). These locations are described in **Table 10.5** and shown in **Figure 10.1 (Appendix E.6)**. Receptors were modelled at a height of 0 m, 1.5 m and 4.5 m, representing basement, ground and first floor exposure.

10.4.12 Apart from receptor R1, no sensitive locations, i.e. residential properties, were identified in close proximity of the Application Site or the TVP P&R site. Bright Horizons Waterside Day Nursery and Preschool is located outside the Reading AQMA approximately 850 m northeast of the Application Site, in Thames Valley Park Drive. The indicative criteria for requiring an air quality assessment includes a change in Light Duty Vehicles (LDVs) flows of more than 100 Annual Average Daily Traffic (AADT) within or adjacent to an AQMA or more than 500 AADT elsewhere (Ref 10.7). The increase in traffic flow brought about by the development on Thames Valley Park Drive are below the thresholds for an assessment to be necessary outside an AQMA (predicted maximum increase of 223 AADT - scenario 3) and, therefore, the impacts on Bright Horizons Waterside Day Nursery and Preschool have been scoped out of this assessment.

10.4.13 Concentrations have also been predicted at one monitoring site, 176 London Road, in order to verify the modelled results (see **Appendix E.4** for further details on model verification).

Table 10.5: Description of receptor locations

Receptor	Location	x	y	Height
R1	Napier Road, Reading RG1 8DF	472538	173871	1.5
R2	Patriot Place (Basement)	472351	173353	0
R3	Elite House, 179 King's Road	472390	173320	1.5
R4	Montpelier House, 165 Kings Road	472446	173306	1.5
R5	284 King's Road	472737	173222	1.5
R6	Crossway Point (Basement)	473023	173218	0
R7	23 King's Road (Basement)	473049	173215	0
R8	239 London Road	473253	173256	1.5
R9	Flat Above 2 Wokingham Road	473158	173170	4.5
R10	Flat Above 106-112 London Road	473071	173157	4.5
R11	14-19 London Road	473013	173139	1.5
R12	147 London Road	472968	173162	1.5

Impact Predictions

10.4.14 The following scenarios have been modelled (see Transport Chapter for more details):

- 2017 existing baseline – for model verification;
- Scenario 1 – Effects of the East MRT scheme Only;
- Scenario 2 – Effects of the East MRT scheme and TVP P&R Combined
- Scenario 3 – Effects of the East MRT scheme with TVP P&R in the Baseline

- 10.4.15 Predictions have been carried out using the ADMS-Roads dispersion model (v4.1). The model requires the user to provide various input data, including the AADT flow, the proportion of Heavy Duty Vehicles (HDVs, i.e. Heavy Good Vehicles and buses), road characteristics (including road width and street canyon height, where applicable), and the vehicle speed. It also requires meteorological data. The model has been run using 2017 meteorological data from Farnborough meteorological station, which is considered suitable for this area (see **Appendix E.1** for model details).
- 10.4.16 AADT flows and the proportions of HDVs, for roads adjacent to the site and relevant receptors, have been provided by the project's transport consultants PBA (see Chapter 9- Transport and Access for more details). Traffic speeds were based on local speed restrictions, taking into account congestion and proximity to junctions. Traffic data used for this assessment has been summarised in **Appendix E.2**.
- 10.4.17 The development opening year is expected to be 2020. Future traffic data for the year 2021 has been combined with 2020 emission factors and background concentrations in order to provide a conservative assessment of the effects of the proposed development as road traffic emissions are predicted to decline with time (see **Appendix E.3** Future Year Emission Factors for further details on the selection of future year NO_x emission factors for this assessment).
- 10.4.18 Traffic emissions were calculated using the Emission Factor Toolkit (EFT) v8.0, which utilises NO_x emission factors taken from the European Environment Agency COPERT 5 emission tool. The traffic data were entered into the EFT, along with speed data to provide combined emission rates for each of the road links entered into the model. Model verification has been carried out utilising 2017 emission factors, background concentrations and monitoring data (see **Appendix E.4**).

Assessment Criteria

Construction

- 10.4.19 The IAQM 2014 guidance recommends that no assessment of the significance of effects is made without mitigation in place, as mitigation is assumed to be secured by planning conditions, legal requirements or required by regulations.
- 10.4.20 Based on the dust emissions magnitude (**Table 10.3**) and the area sensitivity (**Table 10.4**), the risk of dust impacts is then determined (**Table 10.6**), taking into account professional judgement.

Table 10.6: Risk of Dust Impacts

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High	Medium	Low
Medium	Medium	Medium	Low
Low	Low	Low	Negligible

Human Health Impacts

- 10.4.21 The relevant objectives for human health are set out in paragraph 9.2.9, above. There is no official guidance in the UK on how to assess the significance of air quality impacts of existing sources on a new development. The approach developed by Environment Protection UK

(EPUK) and the Institute of Air Quality Management (IAQM) considers the change in air quality as a result of a proposed development on existing receptors (Ref 10.20).

10.4.22 The guidance sets out three stages: determining the magnitude of change at each receptor, describing the impact, and assessing the overall significance. Impact magnitude relates to the change in pollutant concentration; the impact description relates this change to the air quality objective.

10.4.23 **Table 10.7** sets out the impact change descriptors, whilst **Table 10.8** sets out how the changes are assessed in relation to the air quality objectives.

Table 10.7 Impact Magnitude for Changes in Ambient Pollutant Concentrations

Magnitude (% Change in Concentration)	Annual Mean NO ₂ and PM ₁₀ (40 µg/m ³)	Annual Mean PM _{2.5} (25 µg/m ³)	Annual Mean of 32 µg/m ³ equating to 35 days above 50 µg/m ³ for PM ₁₀
Very Large (>9.5%)	≥3.8 µg/m ³	≥2.375 µg/m ³	≥3.04 µg/m ³
Large (>5.5% - ≤9.5%)	>2.2 – ≤3.8 µg/m ³	>1.375 – ≤2.375 µg/m ³	>1.76 – ≤3.04 µg/m ³
Moderate (>1.5% - ≤5.5%)	>0.6 – ≤2.2 µg/m ³	>0.375 – ≤1.375 µg/m ³	>0.48 – ≤1.76 µg/m ³
Small (>0.5% - ≤1.5%)	>0.2 – ≤0.6 µg/m ³	>0.125 – ≤0.375 µg/m ³	>0.16 – ≤0.48 µg/m ³
Negligible (≤0.5%)	≤0.2 µg/m ³	≤0.125 µg/m ³	≤0.16 µg/m ³

Table 10.8 Impact Descriptor for Changes in Concentrations at Receptor

Concentration with the development in place in relation to Objective / Limit Value	Change in Concentration				
	Imperceptible	Small	Medium	Large	Very Large
> 109.5 % (a)	Negligible	Moderate adverse	Major adverse	Major adverse	Major adverse
>102.5% - ≤109.5% (b)	Negligible	Moderate adverse	Moderate adverse	Major adverse	Major adverse
>94.5% - ≤102.5% (c)	Negligible	Minor adverse	Moderate adverse	Moderate adverse	Major adverse
>75.5% - ≤94.5% (d)	Negligible	Negligible	Minor adverse	Moderate adverse	Moderate adverse
≤75.5% (e)	Negligible	Negligible	Minor adverse	Moderate adverse	Moderate adverse

Where concentrations increase the impact is described as adverse and where it decreases as beneficial.

(a) NO₂ or PM₁₀: > 44µg/m³ annual mean; PM_{2.5} >27.5 µg/m³ annual mean; PM₁₀ >35.2 µg/m³ annual mean (days)
(b) NO₂ or PM₁₀: > 40.8 – ≤ 44µg/m³ annual mean; PM_{2.5} > 25.5 – ≤27.5 µg/m³ annual mean; PM₁₀ >32.64 – ≤35.2 µg/m³ annual mean (days)

(c) NO₂ or PM₁₀: > 38 – ≤40.8 µg/m³ annual mean; PM_{2.5} >23.75 – ≤25.5 µg/m³ of annual mean; PM₁₀ >30.4 – ≤32.64µg/m³ annual mean (days)

(d) NO₂ or PM₁₀: >30 – ≤38 µg/m³ annual mean; PM_{2.5} >18.75 – ≤23.75 µg/m³ annual mean; PM₁₀ >24 – ≤ 30.4 µg/m³ annual mean (days)

(e) NO₂ or PM₁₀: ≤30 µg/m³ annual mean; PM_{2.5} ≤18.75 µg/m³; annual mean; PM₁₀ ≤24 µg/m³ annual mean (days)

10.4.24 The IAQM and EPUK approach states that the assessment of significance should be based on professional judgement, taking into account the following factors:

- Number of properties affected by minor, moderate or major air quality impacts and a judgement on the overall balance;
- The magnitude of the changes and the descriptions of the impacts at the receptors i.e. **Tables 10.7** and **10.8** findings;
- Whether or not an exceedance of an objective or limit value is predicted to arise in the operational study area (where there are significant changes in traffic) where none existed before or an exceedance area is substantially increased;
- Whether or not the study area exceeds an objective or limit value and this exceedance is removed or the exceedance is reduced;
- Uncertainty, including the extent to which worst-case assumptions have been made; and
- The extent to which an objective or limit value is exceeded.

10.4.25 Where impacts can be considered in isolation, moderate or major impacts may be considered to be a significant environmental effect, whereas negligible or minor impacts would not be considered significant. The overall effect however, needs to be considered in the round taking into account the changes at all of the receptor locations, with a judgement made as to whether the overall effects are significant or not.

10.5 Baseline Conditions

LAQM

10.5.1 RBC has investigated air quality within its area as part of its responsibilities under the LAQM regime. An Air Quality Management Area (AQMA) has been declared due to exceedances of the annual mean NO₂ objectives. The Reading AQMA comprises Reading town centre and extends out along major roads including the A33 and A327 (**Appendix E.6, Figure 10.1**). The Application Site is located within Reading AQMA.

Monitoring

Nitrogen Dioxide

10.5.2 RBC carries out monitoring of NO₂ concentrations at a number of locations across the borough. The closest and most representative locations are included in **Table 10.9** and shown in **Figure 10.2, Appendix E.6**.

Table 10.9: Measured NO₂ concentrations

ID	Site Type	Within AQMA	Annual Mean (µg/m³)				
			2013	2014	2015	2016	2017
Automatic Site							
AURN Reading New Town	UB	N	27	27	22	34 ^a	29 ^a
Diffusion Tubes							
Kings Oak Flats	R	Y	39	36	31	33	31
276 Kings Road	R	Y	34	36	31	32	32

ID	Site Type	Within AQMA	Annual Mean ($\mu\text{g}/\text{m}^3$)				
			2013	2014	2015	2016	2017
162 London Rd*	R	Y	48	49	46	42	43
419 London Road	R	Y	49	45	41	42	44
Wycliffe Church	R	Y	-	-	-	49	40 ^b
Objective			40				

R= Roadside; UB = Urban Background

*Used for model verification

2013-2016 data taken from the RBC 2018 Annual Status report;

^a Data extracted from AURN network https://uk-air.defra.gov.uk/data/flat_files?site_id=REA5

^b low data capture, 75%.

- 10.5.3 NO₂ measured concentrations at the Automatic Urban and Rural Network Station (AURN) urban background station have been below the objectives for the past 5 years. Given the location of the Application Site, away from major roads, the concentrations are expected to be similar, or lower than the AURN station.
- 10.5.4 Measured concentrations at the London Road monitoring locations, within the AQMA, have regularly exceeded the NO₂ annual mean objective across the 2013-2017 period. There is no clear trend in measured concentrations at the majority of monitoring locations.

Particulates (PM₁₀ and PM_{2.5})

- 10.5.5 PM₁₀ and PM_{2.5} monitoring is carried out using three monitors within the Borough. The closest and most representative location is the AURN station. Data for this site is presented in **Table 10.10**.

Table 10.10: Measured PM₁₀ and PM_{2.5} Concentrations

Site Site ID	Site Type	2013	2014	2015	2016	2017
PM ₁₀ Annual Mean (µg/m ³)						
AURN	UB	13	14	12	13	12
Objective		40				
PM ₁₀ Number of days > 50µg/m ³						
AURN	UB	-	0	0	3	3
Objective		35				
PM _{2.5} Annual Mean (µg/m ³)						
AURN	UB	8	8	6	9	10
Objective		25				

Data taken from the RBC Annual Status Report 2016 (Ref 10.21)

- 10.5.6 PM₁₀ and PM_{2.5} measured concentrations have been below the objective throughout the last 5 years.

Background Concentrations

- 10.5.7 In addition to these measured concentrations, estimated background concentrations for the site have been obtained from the national maps provided by Defra (Ref 10.19) (shown in

Table 10.11). Defra background concentrations were adjusted based on the Reading New Town local background AURN (see [Appendix E.4](#) for further details).

Table 10.11: Annual mean background concentrations ($\mu\text{g}/\text{m}^3$)

Year	Grid reference	Annual Mean ($\mu\text{g}/\text{m}^3$)		
		NO ₂	PM ₁₀	PM _{2.5}
2017	473_173 ^a	28.7	12.0	9.7
	472_173 ^b	30.7	12.0	9.7
2020	473_173	25.4	11.5	9.2
	472_173	27.3	11.5	9.3
Objective		40	40	25

a – DT 162 London Road, AURN, receptors R6 to R11

b – Receptors R1 to R5 and R12.

10.5.8 The background concentrations are well below the relevant objectives.

10.6 East MRT Site (Scenario 1)

Embedded Mitigation

Construction

10.6.1 The following standard low risk mitigation measures from the IAQM 2014 guidance are recommended. These should be included within a Construction Environmental Management Plan (CEMP) and agreed with RBC.

Communication

- Display the name and contact details of persons accountable on the site boundary.
- Display the head or regional office information on the site boundary

Management

- Develop and implement a dust management plan.
- Record all dust and air quality complaints, identify causes and take measures to reduce emissions.
- Record exceptional incidents and action taken to resolve the situation.
- Carry out regular site inspections to monitor compliance with the dust management plan and record results.
- Increase site inspection frequency during prolonged dry or windy conditions and when activities with high dust potential are being undertaken.
- Plan site layout so that machinery and dust causing activities are located away from receptors, as far as possible.
- Erect solid screens or barriers around dusty activities or the site boundary at least as high as any stockpile on site.

- Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period.
- Avoid site run off of water or mud.
- Keep site fencing, barriers and scaffolding clean using wet methods.
- Remove potentially dusty materials from site as soon as possible.
- Cover, seed or fence stockpiles to prevent wind whipping.
- Ensure all vehicles switch off engines when stationary.
- Only use cutting, grinding and sawing equipment with dust suppression equipment.
- Ensure an adequate supply of water on site for dust suppressant.
- Use enclosed chutes and conveyors and covered skips.
- Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use water sprays on such equipment where appropriate.
- Ensure equipment is readily available on site to clean up spillages of dry materials.
- No on-site bonfires and burning of waste materials on site.

Construction

- Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless required for a particular process.

Trackout

- Use water assisted dust sweepers on the site access and local roads.
- Avoid dry sweeping of large areas.
- Ensure vehicles entering and leaving the site are covered to prevent escape of materials.
- Record inspection of on-site haul routes and any subsequent action, repairing as soon as reasonably practicable.
- Install hard surfaced haul routes which are regularly damped down.
- Install a wheel wash with a hard-surfaced road to the site exit where site layout permits.

Operational Effects

- 10.6.2 The buses to be used for the MRT comply with the latest Euro VI emission standards in terms of NO_x emissions.

Assessment of Likely Effects

Construction Effects

- 10.6.3 The main potential effects during construction are dust deposition and elevated PM₁₀ concentrations. The following activities have the potential to cause emissions of dust:

- Site preparation including delivery of construction material, erection of fences and barriers;
- Earthworks including digging foundations and landscaping;
- Materials handling such as storage of material in stockpiles and spillage;
- Construction and implementation of supporting structures; and
- Disposal of waste materials off-site.

10.6.4 Typically, the main cause of unmitigated dust generation on construction sites is from demolition and vehicles using unpaved haul roads, and off-site from the suspension of dust from mud deposited on local roads by construction traffic. The main determinants of unmitigated dust annoyance are the weather and the distance to the nearest receptor.

10.6.5 Based on the IAQM criteria (**Table 10.3**), the dust emission magnitude is considered to be medium. The study area is considered to be of low sensitivity (**Table 10.4**). With the appropriate embedded mitigation corresponding to a low risk site (**Table 10.6**) during the construction phase (**Section 10.6.1**) the construction impacts are described as not significant.

Operational Effects

10.6.6 Predicted concentrations of nitrogen dioxide, PM₁₀ and PM_{2.5} at worst-case existing receptors, both with and without the development in place, are presented in **Table 10.12**.

Table 10.12: Predicted concentrations of nitrogen dioxide, PM₁₀ and PM_{2.5} at existing receptors

Receptor	2020 Annual Mean (µg/m³)								
	NO ₂			PM ₁₀			PM _{2.5}		
	Base	With East MRT	Change	Base	With East MRT	Change	Base	With East MRT	Change
R1	28.8	29.3	0.46	11.8	11.9	0.07	9.4	9.5	0.04
R2	46.6	46.7	0.06	14.8	14.8	0.01	11.2	11.2	0.01
R3	45.8	45.8	-0.06	14.6	14.6	-0.01	11.1	11.1	0.00
R4	38.5	38.4	-0.09	13.4	13.4	-0.01	10.3	10.3	-0.01
R5	33.7	33.6	-0.05	12.7	12.7	-0.01	10.0	9.9	-0.01
R6	39.7	39.6	-0.11	13.6	13.6	-0.02	10.5	10.5	-0.01
R7	39.9	39.8	-0.10	13.7	13.7	-0.02	10.5	10.5	-0.01
R8	39.9	39.9	-0.01	13.6	13.6	0.00	10.5	10.5	0.00
R9	35.9	35.9	-0.01	13.0	13.0	0.00	10.1	10.1	0.00
R10	35.9	35.9	-0.02	13.0	13.0	0.00	10.1	10.1	0.00
R11	35.9	35.8	-0.02	13.3	13.3	0.00	10.2	10.2	0.00
R12	35.7	35.7	-0.02	13.2	13.2	0.00	10.3	10.3	0.00
Objectives	40		-	40		-	25		-

10.6.7 The predicted NO₂, PM₁₀ and PM_{2.5} concentrations in 2020, without and with the proposed development in place, are below the relevant objectives at all existing receptor locations, except at receptors R2 and R3.

10.6.8 Based on the impact magnitude descriptors presented in **Table 10.7**, the changes in annual mean nitrogen dioxide concentrations range from negligible to small. A small change occurs at receptor R1. Negligible changes occur at the remaining receptors. Changes in annual mean PM₁₀ and PM_{2.5} concentrations are described as negligible for all receptors.

- 10.6.9 Using the criteria set out in **Table 10.8**, the impacts are described as negligible for all pollutants at all receptor locations.

Further Mitigation and Enhancement

Construction

- 10.6.10 The assessment concludes that with the implementation of standard low risk mitigation measures set out in **Section 10.6.1**, residual effects during the construction phase are Not Significant following the implementation of embedded mitigation measures. Therefore, no further mitigation measures are proposed.

Operational

- 10.6.11 In overall terms, the operational effects of the proposed development are judged to be not significant. This judgement is made in accordance with the methodology, in particular that the proposed development does not give rise to new exceedances of the air quality strategy objectives and a conservative assessment has been carried out. No additional traffic mitigation measures are therefore required.

Residual Effects

- 10.6.12 The residual operational air quality effects of the proposed development are judged to be not significant. The impact of the proposed development is considered to be Not Significant in relation to human health impacts.

10.7 MRT East and Thames Valley Park & Ride Combined (Scenario 2)

Embedded Mitigation

- 10.7.1 The buses to be used for the MRT comply with the latest Euro VI emission standards in terms of NO_x emissions.

Assessment of Likely Effects

Construction

- 10.7.2 This scenario includes the construction of the TVP P&R in addition to the MRT East. The dust emission magnitude is still regarded as medium and the study area is considered to be of low sensitivity (**Table 10.4**). With the appropriate embedded mitigation corresponding to a low risk site (**Table 10.6**) during the construction phase (**section 10.6.1**) the construction impacts are described as not significant.

Operational Effects

- 10.7.3 Predicted concentrations of nitrogen dioxide, PM₁₀ and PM_{2.5} at worst-case existing receptors, both with and without the development in place, are presented in **Table 10.13**.

Table 10.13: Predicted concentrations of nitrogen dioxide, PM₁₀ and PM_{2.5} at existing receptors

Receptor	2020 Annual Mean ($\mu\text{g}/\text{m}^3$)								
	NO ₂			PM ₁₀			PM _{2.5}		
	Base	TVP P&R plus East MRT	Change	Base	TVP P&R plus East MRT	Change	Base	TVP P&R plus East MRT	Change
R1	28.8	29.3	0.46	11.8	11.9	0.07	9.4	9.5	0.04
R2	46.6	46.7	0.13	14.8	14.8	0.03	11.2	11.2	0.01
R3	45.8	45.8	-0.04	14.6	14.6	0.00	11.1	11.1	0.00
R4	38.5	38.4	-0.11	13.4	13.4	-0.02	10.3	10.3	-0.01
R5	33.7	33.6	-0.08	12.7	12.7	-0.01	10.0	9.9	-0.01
R6	39.7	39.5	-0.16	13.6	13.6	-0.03	10.5	10.5	-0.01
R7	39.9	39.8	-0.16	13.7	13.7	-0.03	10.5	10.5	-0.01
R8	39.9	39.7	-0.24	13.6	13.6	-0.04	10.5	10.5	-0.02
R9	35.9	35.9	-0.06	13.0	13.0	-0.01	10.1	10.1	0.00
R10	35.9	35.9	-0.04	13.0	13.0	-0.01	10.1	10.1	0.00
R11	35.9	35.8	-0.03	13.3	13.3	0.00	10.2	10.2	0.00
R12	35.7	35.7	-0.03	13.2	13.2	-0.01	10.3	10.3	0.00
Objectives	40		-	40		-	25		-

- 10.7.4 The predicted NO₂, PM₁₀ and PM_{2.5} concentrations in 2020, without and with the proposed development in place, are below the relevant objectives at all existing receptor locations, except at receptors R2 and R3.
- 10.7.5 Based on the impact magnitude descriptors presented in **Table 10.7**, the changes in annual mean nitrogen dioxide concentrations range from negligible to small. A small change occurs at receptor R1 and R8, with the change at Receptor 8 being negative. Negligible changes occur at the remaining receptors. Changes in annual mean PM₁₀ and PM_{2.5} concentrations are described as negligible for all receptors.
- 10.7.6 Using the criteria set out in **Table 10.8**, the impacts are described as negligible for all pollutants at all receptor locations, except for receptor R8 which is described as minor beneficial.

Further Mitigation and Enhancement

Construction

- 10.7.7 The assessment concludes that with the implementation of standard low risk mitigation measures set out in **Section 10.6.1**, residual effects during the construction phase are Not Significant following the implementation of embedded mitigation measures. Therefore, no further mitigation measures are proposed.

Operational Effects

- 10.7.8 In overall terms, the operational effects of the proposed development are judged to be not significant. This judgement is made in accordance with the methodology set out in **Section 10.4.6**, in particular that the proposed development does not give rise to new exceedances of the limit values and a conservative assessment has been carried out. No additional traffic mitigation measures are therefore required.

Residual Effects

Construction

- 10.7.9 With appropriate mitigation in place the residual effect of construction is assessed as not significant.

Operational Effects

- 10.7.10 The residual operational air quality effects of the proposed development are judged to be not significant. The impact of the proposed development is considered to be not significant in relation to human health impacts.

10.8 MRT East with TVP P&R in the Baseline (Scenario 3)

Assessment of Likely Effects

Construction

- 10.8.1 In this scenario, the TVP P&R is expected to be already built, and, therefore only includes the construction of the MRT East (as per Scenario 1). The dust emission magnitude is still regarded as medium and the study area is considered to be of low sensitivity (**Table 10.4**). Appropriate mitigation corresponding to a low risk site is therefore required during the construction phase (**Table 10.6**). With appropriate mitigation in place the construction impacts are described as not significant.

Operational Effects

- 10.8.2 Predicted concentrations of nitrogen dioxide, PM₁₀ and PM_{2.5} at worst-case existing receptors, both with and without the development in place, are presented in **Table 10.14**.

Table 10.14: Predicted concentrations of nitrogen dioxide, PM₁₀ and PM_{2.5} at existing receptors

Receptor	2020 Annual Mean (µg/m³)								
	NO ₂			PM ₁₀			PM _{2.5}		
	Base with TVP P&R	TVP P&R plus East MRT	Change	Base with TVP P&R	TVP P&R plus East MRT	Change	Base with TVP P&R	TVP P&R plus East MRT	Change
R1	28.8	29.3	0.47	11.8	11.9	0.07	9.4	9.5	0.04
R2	46.5	46.7	0.20	14.8	14.8	0.04	11.2	11.2	0.02
R3	45.8	45.8	0.04	14.6	14.6	0.01	11.1	11.1	0.01
R4	38.4	38.4	-0.05	13.4	13.4	-0.01	10.3	10.3	0.00
R5	33.6	33.6	-0.03	12.7	12.7	0.00	9.9	9.9	0.00
R6	39.6	39.5	-0.08	13.6	13.6	-0.01	10.5	10.5	0.00
R7	39.9	39.8	-0.08	13.7	13.7	-0.01	10.5	10.5	0.00
R8	39.8	39.7	-0.10	13.6	13.6	-0.01	10.5	10.5	-0.01
R9	35.9	35.9	-0.01	13.0	13.0	0.00	10.1	10.1	0.00
R10	35.9	35.9	0.01	13.0	13.0	0.00	10.1	10.1	0.00
R11	35.8	35.8	0.03	13.3	13.3	0.01	10.2	10.2	0.01
R12	35.7	35.7	0.03	13.2	13.2	0.01	10.3	10.3	0.00
Objectives	40		-	40		-	25		-

- 10.8.3 The predicted NO₂, PM₁₀ and PM_{2.5} concentrations in 2020, without and with the proposed development in place, are below the relevant objectives at all existing receptor locations, except at receptors R2 and R3.
- 10.8.4 Based on the impact magnitude descriptors presented in **Table 10.7**, the changes in annual mean nitrogen dioxide range from negligible to small. Small changes occur at receptors R1 and R2. Negligible changes occur at the remaining receptors. Changes in annual mean PM₁₀ and PM_{2.5} concentrations are described as negligible for all receptors.
- 10.8.5 Using the criteria set out in **Table 10.8**, the impacts are described as negligible for all pollutants at all receptor locations, except for receptor R2 where it is described as moderate adverse. The moderate adverse impact relates with the fact that the predicted concentrations, without or with the development in place, are more than 10% above the 40 µg/m³ annual mean objective for NO₂.

Further Mitigation and Enhancement

Construction

- 10.8.6 The assessment concludes that with the implementation of standard low risk mitigation measures set out in **Section 10.6.1**, residual effects during the construction phase are Not Significant following the implementation of embedded mitigation measures. Therefore, no further mitigation measures are proposed.

Operational Effects

- 10.8.7 In overall terms, the operational effects of the proposed development are judged to be not significant. This judgement is made in accordance with the methodology set out in **Section 9.3.18**, in particular that the proposed development does not give rise to new exceedances of the limit values. Furthermore, a conservative assessment has been carried out with 2021 traffic data combined with background and emission factors for the year 2020. It is anticipated that site clearance will commence in October 2019 and construction of the East MRT will commence in March 2020 (including enabling works and utility diversions), with completion expected in Spring 2023. No additional traffic mitigation measures are therefore required.

Residual Effects

- 10.8.8 Residual effects are summarised in **Table 10.15** below.

Construction

- 10.8.9 With appropriate mitigation in place the residual effect of construction is assessed as not significant.

Operational Effects

- 10.8.10 The residual operational air quality effects of the proposed development are judged to be not significant. The impact of the proposed development is considered to be not significant in relation to human health impacts.

10.9 Monitoring

- 10.9.1 No monitoring is required as no significant adverse effects have been identified.

10.10 Cumulative Effects

Construction

- 10.10.1 Potential cumulative construction effects could occur should construction of additional development sites occur at the same time as the proposed development.
- 10.10.2 Significant cumulative effects are unlikely to occur as each development is anticipated to employ similar dust mitigation techniques such that the individual construction phase effect should be not significant, alone or in combination.

Operational Effects

- 10.10.3 The future year traffic data utilised within the assessment includes committed development in the area (see Transport Chapter for more detailed information). The assessment therefore includes consideration of cumulative impacts arising from committed developments in the area in 2021.

10.11 Summary

- 10.11.1 The air quality effects associated with the construction and operation of the proposed East Reading Mass Rapid Transit Scheme have been assessed.

Construction Effects

- 10.11.2 Construction phase effects are judged to be negligible when appropriate mitigation measures are applied through a Construction Environmental Management Plan (CEMP).

Operation Effects

- 10.11.3 Concentrations of NO₂, PM₁₀ and PM_{2.5} have been predicted for a number of worst-case locations representing existing properties adjacent to the road network impacted by the proposed Development. The Application site is generally located away from sensitive residential receptors, except for Kings Reach Meadows Association (receptor R1).
- 10.11.4 Predicted annual mean concentrations of the named pollutants are below the relevant air quality strategy objectives, except for receptors located at Patriot Place (R2 and R3), whether the development proceeds or not, with and without the TVP P&R and in combination with the TVP P&R.
- 10.11.5 The overall air quality effects of the development are judged to be not significant as the proposed development does not give rise to new exceedances of the air quality objectives.

Table 10.15: Summary of effects

Receptor	Sensitivity	Effect	Magnitude /Spatial extent	Likelihood of Occurrence	Embedded Mitigation	Significance of Effect	Further Mitigation (if required)	Residual Significance of Effect
Construction/demolition								
Existing Residential Properties	High	Dust deposition and elevated PM ₁₀ concentrations	Local	Low	CEMP	Not significant	NA	Not significant
Operation								
Existing Residential Properties	High	Increased NO ₂ , PM ₁₀ and PM _{2.5} concentrations	Local	Low	NA	Not significant	NA	Not significant

11 Hydrology and Flood Risk

11.1 Introduction

- 11.1.1 This chapter has been prepared by PBA to consider the impact of the East MRT scheme in relation to hydrology and the water environment. This chapter provides an overview of the baseline conditions, the potential impacts of the development, and proposed mitigation to address this.
- 11.1.2 The NPPF seeks to ensure that flood risk is taken into account at all stages of the planning process, to avoid inappropriate development in areas at risk of flooding, and to direct development away from areas at highest risk.
- 11.1.3 A site-specific Flood Risk Assessment (FRA) is required for development within Flood Zones 3 'High Probability' or Zone 2 'Medium Probability' of river/sea flooding, and for all proposals that are of an area of 1 hectare or greater in Flood Zone 1 'Low Probability'. Accordingly, an FRA incorporating a surface water drainage strategy, has been prepared to accompany the future planning application, in accordance with relevant national and local planning policy, and should be referred to when reviewing this Chapter (see [Appendix F.1](#)).
- 11.1.4 A comprehensive Water Framework Directive (WFD) Compliance Statement has been compiled to accompany the planning application. This indicates that the proposed works will not detrimentally impact the WFD status/potential of nearby designated water bodies, will not impede their ability to achieve good ecological status/potential, and will not prevent against achieving WFD and River Basin Management Plan (RBMP) objectives. The WFD Compliance Statement is provided in [Appendix F.2](#).
- 11.1.5 In accordance with Regulation 18(5) of the Town and Country Planning (Environmental Impact Assessment) Regulations 2017, as amended, a statement outlining the relevant expertise and qualifications of competent experts appointed to prepare this Environmental Statement (ES) is provided in [Appendix A.5](#).

11.2 Policy Context

Legislation

The Flood Risk Regulations 2009

- 11.2.1 The Flood Risk Regulations 2009 transpose the European Commission (EC) Floods Directive (Directive 2007/60/EC) into domestic law. The regulations require that Preliminary Flood Risk Assessments (PFRAs) are prepared by the Environment Agency (EA) and Unitary/County Authorities (Lead Local Flood Authorities (LLFA)) that identifies areas at significant potential risk of flooding. For these "*significant risk*" areas, hazard maps must be produced and flood risk management plans developed to reduce flood risk.

Flood and Water Management Act 2010 & Sustainable Drainage Systems: Written Statement – HCWS161

- 11.2.2 The Flood and Water Management Act (FWMA) 2010 takes forward some of the proposals set out in three previous strategy documents published by the UK Government: Future Water, Making Space for Water and the UK Government's response to the Sir Michael Pitt Review of the summer 2007 floods. In doing so, it gives the EA a strategic overview of flood risk and gives local authorities responsibility for preparing and putting in place strategies for managing flood risk from groundwater, surface water and ordinary watercourses in their areas.

- 11.2.3 The FWMA 2010 (Schedule 3) proposed the establishment of Sustainable drainage systems (SuDS) Approval Bodies (the SAB) at county or unitary local authority levels. The role of the SAB was envisaged as implementing the recommendations of the Pitt Review (2008) in promoting the use of SuDS within future development.
- 11.2.4 Following a period of consultation, the proposed role of the SAB has been amended, with the promotion of SuDS being incorporated into the planning process. This has been achieved by designating LLFA's as statutory consultees with regards to 'local' sources of flood risk and surface water management. The Ministerial Written Statement HCWS161 details this change in policy, which came into effect in April 2015.
- 11.2.5 The FWMA 2010 also amends Section 106 of the Water Industry Act 1991 (WIA) in respect of the right of connection to a public sewer. The relevant provisions that would have revoked the automatic right of connection and require all new connections to be made via a Section 104 Agreement for foul sewers, following the consent of the SAB for surface water connections, have not been brought in to force. As the role of the SAB has been removed following HCWS161, this process is now subsumed into the planning process under the purview of the LLFA.

Water Environment (Water Framework Directive) (England and Wales) Regulations 2017

- 11.2.6 The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 consolidate, revoke and replace the Water Environment (Water Framework Directive) (England and Wales) Regulations 2003, which transpose the European Union (EU) WFD into national law. The WFD is a wide-ranging piece of European legislation that establishes a new legal framework for the protection, improvement and sustainable use of surface waters, coastal waters and groundwater across Europe in order to:
- Promote sustainable water use;
 - Contribute to the mitigation of floods and droughts;
 - Prevent deterioration and enhance status of aquatic ecosystems, including groundwater; and
 - Reduce pollution.
- 11.2.7 Water management has historically been co-ordinated according to administrative or political boundaries. The WFD promotes a new approach based upon management by river basin - the natural geographical and hydrological unit. River basin management plans, published by the EA and DEFRA, include clear objectives in respect of water quality and pollution control and a detailed account of how objectives are to be met within a prescribed timeframe.

The Environmental Permitting (England and Wales) Regulations 2016

- 11.2.8 The Environmental Permitting Regulations 2016 consolidate and replace the 2010 Regulations and the 15 associated amendments. The permitting regime covers a range of activities that release emissions to land, air or water or that involve waste. The regime covers facilities previously regulated under the Pollution Prevention and Control Regulations 2000 and Waste Management Licensing and exemptions schemes, some parts of the Water Resources Act 1991 (WRA) and the Groundwater Regulations 2009.
- 11.2.9 Schedule 21 relates to water discharge activities and Schedule 25 relates to flood risk activities. Schedule 22 to the Regulations relates to Groundwater activities and the regulations place a duty on regulating authorities to implement the Water Framework Directive and the Groundwater Daughter Drainage Directive and exercise their relevant function to ensure all necessary measures are taken to:

“(a) prevent the input of any hazardous substance to groundwater; and

(b) limit the input of non-hazardous pollutants to groundwater so as to ensure that such inputs do not cause pollution of groundwater (Paragraph 6, Schedule 22).”

The Water Resources Act 1991

11.2.10 The WRA 1991 sets out the responsibilities of the EA in relation to water pollution, resource management, flood defence, fisheries, and in some areas, navigation. The WRA 1991 regulates discharges to controlled waters, namely rivers, estuaries, coastal waters, lakes and groundwater. Discharge to controlled waters is only permitted with the consent of the EA. Similarly, a licence is required to abstract from controlled waters.

The Building Regulations 2010

11.2.11 The guidance document H3 'Drainage and waste disposal' (2015 edition) issued by the Government in respect of the requirements of the Building Regulations 2010 stipulates that rainwater from roofs and paved areas is required to be carried away from the surface to discharge to one of the following, listed in order of priority:

- An adequate soakaway or some other adequate infiltration system, or where that is not reasonably practicable;
- A watercourse, or where that is not practicable; and
- A sewer.

National Policy

11.2.12 The aim of water policy in England and Wales is to protect both public health and the environment by maintaining and improving the quality of natural waters. These include surface water bodies (e.g. rivers, streams, lakes, ponds) and groundwater.

11.2.13 The 2018 NPPF and accompanying PPG sets out the Government's national policy on development and flood risk. The NPPF aims are to ensure that flood risk is taken into account at all stages in the planning process to avoid inappropriate development in areas at risk of flooding and to direct development away from areas of highest risk. In exceptional circumstances where new development is necessary in flood risk areas the policy also aims to ensure it is safe, without increasing flood risk elsewhere, and where possible, reducing flood risk overall.

11.2.14 The NPPF advocates the use of a risk based sequential test, in which new development is directed towards the areas of lowest risk of flooding. The different areas of flooding are defined by the following Flood Zones:

- Flood Zone 1: 'Low Probability' of flooding (less than 1 in 1,000 annual probability of river or sea flooding in any year);
- Flood Zone 2: 'Medium Probability' of flooding (between a 1 in 100 and 1 in 1,000 annual probability of river flooding or between a 1 in 200 and 1 in 1,000 annual probability of tidal flooding in any year);
- Flood Zone 3a: 'High Probability' (1 in 100 or greater annual probability of river flooding or 1 in 200 or greater annual probability of sea flooding in any year); and
- Flood Zone 3b: 'Functional Floodplain' (where water has to flow or be stored in times of flood, usually taken as the area impacted in a flood of 1 in 20 annual probability or greater in any given year).

- 11.2.15 In addition, PPG specifies the type of land use, defined by its flood risk vulnerability, that is appropriate in each Flood Zone. For example, more sensitive developments that would be most severely affected in the event of flooding, such as hospitals, should not be permitted in areas at high probability of flooding, although leisure and tourism developments may be allowed in Flood Zone 3a.
- 11.2.16 In February 2016 the Environment Agency (EA) released new guidance 'Flood risk assessments: climate change allowances'. This provides contingency allowances for potential increases in peak river flow, rainfall intensity and sea level.
- 11.2.17 The peak river flow allowances table provides a range of allowances based on percentile (i.e. the degree of certainty of an event occurring, based on the range of climate change scenarios assessed through scientific investigations). The provided allowances are also subject to the vulnerability classification of the proposed use and the river basin district of the site, although the overriding influence at the site is tidal and therefore the interaction of the sea level rise impacts are the most significant factor when considering the associated flood risk.

Local Policy

Reading Borough Council Core Strategy (2015)

- 11.2.18 RBC's local planning policy is contained within the Local Development Framework 'Core Strategy', adopted January 2008 (with alterations adopted 2015). Policy CS35: Flooding states:

Planning permission will not be permitted for development in an area identified as being at high risk of flooding, where development would reduce the capacity of the flood plain to store floodwater, impede the flow of floodwater or in any way increase the risks to life and property arising from flooding.

- 11.2.19 Emerging local policy for RBC is contained within the Submission Draft Local Plan, which replaces the current development plans, setting out how Reading will develop up to 2036. The Plan was submitted to the Secretary of State in March 2018, and particular reference is given to Policy EN18: Flooding and Drainage, which states:

Development will be directed to areas at lowest risk of flooding in the first instance, following the Sequential and Exceptions Test set out in NPPF, and taking into account the effects of climate change. It will consider flooding from all sources, including fluvial, surface water, groundwater and sewer flooding.

Where development in areas at risk of flooding is necessary, it will not reduce the capacity of the floodplain to store floodwater, impede the flow of floodwater or in any way increase the risks to life and property arising from flooding. Wherever possible, development should be designed to reduce flood risk, both on- and off-site.

Wokingham Borough Council Core Strategy (2010)

- 11.2.20 WBC's local planning policy is contained within Local Development Framework Adopted Core Strategy Development Plan Document' dated January 2010. Policy CP1 – Sustainable Development states:

Planning permission will be granted for development proposals that avoid increasing (and where possible reduce) risks of or from all forms of flooding (including from groundwater).

It is essential that future development is planned carefully... steering it away from areas that are most at risk from flooding and ensuring that it does not exacerbate existing flooding problems.

It is essential that the developer/ applicant consider the possible change in flood risk over the lifetime of the development because of climate change.

SUDS can be used to minimise the risk and impact of flooding. Developers will be expected to provide and fund effective SUDS maintenance regimes. New development should be designed to be resilient to flooding as appropriate.

11.2.21 Both RBC and WBC are defined as a LLFA under the Floods and Water Management Act 2010. The first step of the Flood Risk Regulations is for LLFAs to produce a Preliminary Flood Risk Assessment (PFRA) providing a high-level overview of flood risk from all sources within a local area, including consideration of surface water, groundwater, ordinary watercourses and canals. A PFRA was prepared for each Borough Council and released in June 2011.

11.2.22 The River Basin Management Plan (RBMP) – Thames River Basin District was prepared under the WFD and originally released in December 2009 by the EA/DEFRA as the first of a series of six-year planning cycles. The RBMP was recently updated in December 2015 at the end of Cycle 2 to set out the aims of the subsequent six-year cycle to 2021. The RBMP makes clear that, although there has been great progress in protecting water bodies in the Thames Basin, a range of challenges still remain.

11.2.23 The key issues include:

- physical modification of water bodies;
- pollution from water industry sewage works;
- diffuse pollution from towns, cities and transport;
- changes to the natural flow and level of water;
- negative effects of invasive non-native species rural activities; and
- pollution from rural areas.

11.2.24 At present, because of these issues and the higher environmental standards required by the WFD, only 39 of a total 498 surface water bodies were currently classed (2015) as good or better ecological status.

11.2.25 In order to meet WFD targets, the quality of all water bodies must be protected and enhanced.

11.3 Consultation

11.3.1 As part of the 2017 Planning Application and the 2018 (June) ES Addendum, extensive consultation was completed with the EA to inform the evolution of the design of the Proposed Development in line with the EA's expectations with regards to hydrology and flood risk. The consultation comments and responses are summarised in **Appendix A.9**. Consultation concluded that the information and detail submitted is sufficient, and that the EA no longer object on the grounds of hydrology and flood risk.

11.3.2 A Scoping Report was submitted to RBC and WBC in August 2018, which included an outline of the proposed scope and methodology for the hydrology and flood risk assessment. The Scoping Opinion is included in **Appendix A.8**.

11.4 Methodology

Study Area

11.4.1 The study area for this Chapter is that provided in **Appendix A.5**.

Baseline Data Collection

11.4.2 Existing studies and documents, including evidence base studies undertaken in support of the preparation of the WBC and RBC Core Strategies, and the emerging RBC Local Plan (e.g. Strategic Flood Risk Assessments and Preliminary Flood Risk Assessments), have been reviewed. In addition, the following sources of information have been used to assist with characterising the baseline water environment:

- <https://flood-map-for-planning.service.gov.uk/>;
- <https://flood-warning-information.service.gov.uk/long-term-flood-risk/>; and
- <http://environment.data.gov.uk/catchment-planning>.

11.4.3 As set out in **Section 11.3** above, the EA have been consulted to acquire local/site-specific information on hydrology, flood risk and water resources, to assist with characterising the baseline water environment and to agree the methodology for the technical assessments/analysis required to inform the EIA process. The EA provided 'Product 4' flood risk data (dated July 2016), which includes flood zone maps, historic flood outlines and modelled flood extents.

11.4.4 A topographic survey was completed in April 2016 and this data confirms the existing ground levels across the site.

Assessment

11.4.5 In the absence of 'industry standard' significance criteria for the consideration of hydrology, flood risk and water resources impacts, a qualitative approach, based upon available knowledge, experience and professional judgement, is employed.

11.4.6 The EIA assessment methodology identifies the significance of an effect by firstly considering the sensitivity of the receptor (i.e. its importance and ability to tolerate and recover from change) and, secondly, by considering the likely magnitude of the impact (i.e. its spatial extent and duration). By combining sensitivity and magnitude, the significance of the effect is established. Where significant negative effects are identified, mitigation measures are proposed to reduce the significance.

11.4.7 **Table 11.2** outlines the criteria used to determine receptor sensitivity, which as discussed in **Section 11.4.5**, is based on available knowledge and professional judgement.

Table 11.2: Sensitivity/Value of Receptor

Sensitivity/Value of Receptor	Description	Example
High	Attribute with a high quality and rarity, local scale and limited potential for substitution. Attribute with a medium quality and rarity, regional or national scale and limited potential for substitution. Attribute highly sensitive to change.	Examples include: Receiving watercourse classified as High or Good Ecological status/potential under WFD. Site protected under EU or UK wildlife legislation (Special Area of Conservation (SAC), Special Protection Area (SPA), Site of Special Scientific Interest (SSSI)). Species protected under EU or UK wildlife legislation. Site located within a Groundwater Source Protection Zone (SPZ) inner or outer protection zone (Zone 1), NPPF Flood Risk Vulnerability Classification "Essential Infrastructure" or "Highly Vulnerable" EA current groundwater quantitative and chemical qualities defined as Good. Human receptors (construction workers and future residents).
Medium	Attribute with a medium quality and rarity, local scale and limited potential for substitution. Attribute reasonably tolerant of change.	Examples include: Floodplain providing a moderate volume of storage. Receiving watercourse classified as Good or Moderate Ecological status/potential under WFD. NPPF Flood Risk Vulnerability Classification "More Vulnerable".
Low	Attribute with a low quality and rarity, local scale and limited potential for substitution.	Examples include: EA current river ecological quality defined as Poor / Bad and chemical quality defined as Fail.

	Attribute tolerant of modest change.	Floodplain with limited existing development. Receiving watercourse classified as Poor Ecological status/potential under WFD. NPPF Flood Risk Vulnerability Classification "Less Vulnerable".
Negligible	Attribute of very limited quality and tolerant of substantial change.	Examples include: Floodplain essentially rural in nature, characterised by agricultural land use NPPF Flood Risk Vulnerability Classification "Water Compatible".

11.4.8 The magnitude of change as a result of the Proposed Development has been assessed using the criteria set out in **Table 11.3**.

Table 11.3: Magnitude of impact

Magnitude of Impact	Description	Example
Large	Results in a loss of attribute and/or quality and integrity of the attribute. Following development, the baseline situation is fundamentally changed.	Examples include: Change in ecological and/or chemical qualities of the surface water. Loss of flood storage/increased flood risk. Large change in: - water quality of receiving watercourse; - NPPF Flood Risk Vulnerability Classification; - surface water flood risk; - fluvial flood risk; - water supply volume; and - foul drainage volume.
Moderate	Results in impact on integrity of attribute, or loss of part of attribute. Following development, the baseline situation is noticeably changed.	Examples include: Contribution of a significant proportion of the effluent in the receiving river, but insufficient to change its qualities. Moderate change in: - water quality of receiving watercourse; - NPPF Flood Risk Vulnerability Classification; - surface water flood risk; - fluvial flood risk; - water supply volume; and

Magnitude of Impact	Description	Example
		foul drainage volume.
Small	Results in some measurable change in attribute's quality or vulnerability. Following development, the baseline situation is largely unchanged with barely discernible differences.	Examples include: Measurable changes in attribute, but of limited extent/duration. Small change in: - water quality of receiving watercourse; - NPPF Flood Risk Vulnerability Classification; - surface water flood risk; - fluvial flood risk; - water supply volume; and - foul drainage volume.
Negligible	The impacts are unlikely to be detectable or outside the norms of natural variation.	

11.4.9 The significance of an effect is based upon the sensitivity of the receptor and the magnitude of the impact using the matrix presented at **Table 11.4**. The significance of an effect can be beneficial, neutral or adverse.

Table 11.4: Determining Significance of Effect

		Sensitivity of Receptor			
		High	Medium	Low	Negligible
Magnitude of Impact	Large	Substantial	Major	Moderate	Minor
	Moderate	Major	Moderate	Minor	Negligible
	Small	Moderate	Minor	Minor	Negligible
	Negligible	Minor	Negligible	Negligible	Negligible

11.4.10 For the purpose of undertaking the assessment in accordance with The Town and Country Planning (Environmental Impact Assessment) Regulations 2017 (as amended) (the EIA Regulations), the implemented Directive 2014/52/EU, effects determined to be moderate or greater are considered significant in EIA terms.

11.4.11 Examples of how the significance of an effect (**Table 11.4**) are applied to hydrology, flood risk, and water resources are set out below in **Table 11.5**.

Table 11.5: Examples of significance of effect are applied to Hydrology, Flood Risk and Water Resources

Significance Level	Significance Level Criteria	Typical Examples
Substantial Beneficial	Substantial improvements at catchment scale associated with sites and features of national or regional importance	Fundamental changes to the regional hydrological regime. Fundamental reduction in volume and/or peak discharge of surface water run-off from the Site. Fundamental improvement in surface water quality. Fundamental changes to flow conveyance and floodplain storage.
Major Beneficial	Major improvements at catchment scale	Fundamental changes to the regional hydrological regime. Fundamental reduction in volume and/or peak discharge of surface water run-off from the Site. Fundamental improvement in surface water quality. Fundamental changes to flow conveyance and floodplain storage.
Moderate Beneficial	Improvements at local scale	Moderate changes to the local hydrological regime. Moderate reduction in volume and/or peak discharge of surface water run-off from the Site. Moderate improvement in surface water quality. Moderate changes to flow conveyance and floodplain storage.
Minor Beneficial	Limited improvements at local scale	Some noticeable changes to the local hydrological regime. Some noticeable reduction in volume and/or peak discharge of surface water run-off from the Site. Some noticeable improvement in surface water quality. Some noticeable changes to flow conveyance and floodplain storage.
Negligible	No appreciable impact	No noticeable changes to the local hydrological regime. No noticeable change in volume and/or peak discharge of surface water run-off from the Site. No noticeable changes in surface water quality. No noticeable changes to flow conveyance and floodplain storage.
Minor Adverse	Limited detrimental effects at local scale	Some noticeable changes to the local hydrological regime.

Significance Level	Significance Level Criteria	Typical Examples
		Some noticeable increase in volume and/or peak discharge of surface water run-off from the Site. Some noticeable deterioration in surface water quality. Some noticeable changes to flow conveyance and floodplain storage.
Moderate Adverse	Detrimental effects at local scale	Moderate changes to the local hydrological regime. Moderate increase in volume and/or peak discharge of surface water run-off from the Site. Moderate deterioration in surface water quality. Moderate changes to flow conveyance and floodplain storage
Major Adverse	Important detrimental effects at catchment scale which may become key factors in the decision-making process	Fundamental changes to the regional hydrological regime. Pollution of potable sources of water abstraction. Fundamental increase in volume and/or peak discharge of surface water run-off from the Site. Fundamental deterioration in surface water quality. Fundamental changes to flow conveyance and floodplain storage.
Substantial Adverse	Substantial detrimental effects at catchment scale associated with sites and features of national or regional importance	Fundamental changes to the regional hydrological regime. Pollution of potable sources of water abstraction. Fundamental increase in volume and/or peak discharge of surface water run-off from the Site. Fundamental deterioration in surface water quality. Fundamental changes to flow conveyance and floodplain storage.

11.5 Baseline Conditions

Hydraulic Setting

- 11.5.1 The proposed route is located near the River Thames which flows west to east, to the north of the site. The westernmost end of the proposed route (at the junction with Napier Road) lies approximately 320m south of the watercourse, and the route gets progressively closer to the channel as it moves east until it crosses over the River Kennet at its confluence with the River Thames at Kennetmouth. On the east side of Kennetmouth, the proposed East MRT route runs on the north side of the railway line, alongside the River Thames channel, until it meets the TVP P&R facility.

- 11.5.2 The River Kennet is the second major watercourse in the Reading area. The Kennet flows through the centre of Reading in a north easterly direction, partly as the Kennet and Avon Canal. After passing through Blake's Lock, the River Kennet flows under two railway bridges and the listed Horseshoe Bridge at Kennetmouth before it outfalls into the River Thames via the right bank (from the south).
- 11.5.3 In this location, the Caversham Lakes lie on the north side of the River Thames. These are a series of lakes created by gravel extraction works between Caversham and Sonning Eye. They incorporate a marina and the Redgrave Pinsent Rowing Lake, which opened in 2006.
- 11.5.4 The River Thames passes through Caversham Lock approximately 1.2km upstream of the proposed route, and Sonning Lock approximately 3.5km downstream. Sonning Lock maintains a Standard Head Water Level (SHWL) within the upstream reach at a level of 35.15m Above Ordnance Datum (AOD) for navigation purposes.
- 11.5.5 Baseline conditions relating to groundwater and wider hydrogeology are detailed in Chapter 12 'Land'.

Fluvial

- 11.5.6 The EA 'Flood Map for Planning' shows that the western part of the proposed route lies within Flood Zone 2 'Medium Probability' (between 1 in 100 and 1 in 1,000 annual probability of river flooding). The eastern part of the proposed route lies within Flood Zone 3 'High Probability' (greater than 1 in 100 annual probability river flooding).
- 11.5.7 Analysis of the detailed hydraulic modelling outputs confirms that the proposed East MRT scheme route west of Kennetmouth is unaffected in the 1 in 20 annual probability scenario and is therefore classified as Flood Zone 3a 'High Probability'. The proposed East MRT scheme route east of Kennetmouth would be impacted by the 1 in 20 annual probability flood event with flood levels of approximately 36.5m AOD along the route, indicating flood depths of approximately 500mm. The land east of Kennetmouth is therefore classified as Flood Zone 3b 'Functional Floodplain'.
- 11.5.8 At Kennetmouth the 1 in 100 annual probability flood level is approximately 36.7m AOD, falling to approximately 36.6m AOD near the TVP P&R. This compares to existing ground levels of approximately 36.0m AOD, which indicate maximum flood depths of typically 600-700mm on the land east of the Kennetmouth.
- 11.5.9 The extreme 1 in 1,000 annual probability event has a significant impact on the area, with flooding extending across the majority of the Tesco Extra store and surrounding car park. A maximum flood level of approximately 37.6m AOD is generated in the Napier Road/Tesco Extra area – approximately 450mm higher than the 1 in 100 annual probability flood level. At Kennetmouth the extreme 1 in 1,000 annual probability flood level is 37.0m AOD, falling to approximately 36.6m AOD near the TVP P&R. This compares to existing ground levels at approximately 36.0m AOD, which indicate maximum flood depths of typically 600-700mm.
- 11.5.10 The TVP P&R lies wholly within Flood Zone 1 'Low Probability' and is on land at above 39.0m AOD; significantly above the modelled 1 in 100 annual probability floodplain by approximately 2m.
- 11.5.11 The site is largely undeveloped, with areas classified as Flood Zone 3b 'Functional Floodplain'. According to **Table 11.2**, it is therefore classified as a receptor of **Negligible** sensitivity.

Reservoirs

- 11.5.12 The EA 'Risk of Flooding from Reservoirs' map shows that the Kennetmouth area is located within the floodplain in the event of a breach of Whiteknights Lake (the only designated reservoir in the Reading area), located 1.7km south-east of the site.

11.5.13 However, the risk of flooding from reservoir breach is very small as all large raised reservoirs are inspected and supervised by reservoir panel engineers.

11.5.14 According to **Table 11.2**, Whiteknights Lake is therefore classified as a receptor of **Negligible** sensitivity.

Surface Water

11.5.15 The EA Surface Water Flood Map indicates that the majority of the site is at 'Very Low' (less than 1 in 1,000) risk of flooding from surface water sources, with some isolated areas of 'Low' (between 1 in 1,000 and 1 in 100) risk of flooding from surface water sources.

11.5.16 The proposed route runs over ground currently occupied by scrub/vegetation or landscaping. As such, the natural drainage mechanism would be via infiltration or overland run-off into the nearby watercourses (either directly, or via the local drainage system serving the Tesco car parking area).

11.5.17 The surface water drainage mechanism is tolerant of moderate change, and therefore according to **Table 11.2** it is classified as a receptor of **Low** sensitivity.

Water Quality

11.5.18 The EA Catchment Data Explorer application provides details of the ecological and chemical water body classifications for the WFD designated water bodies within the vicinity of the site, in line with the RBMP for the Thames River Basin District (2015).

11.5.19 The RBMP sets out a Programme of Measures (POM) which need to be undertaken in order for each water body to maintain or reach 'good' status/potential by 2015 in accordance with the WFD with extensions granted where applicable. The plan also sets out the various standards that each water body has to meet in order to be classified as having 'good' status/potential.

11.5.20 The site is situated within three WFD designated water bodies: the Kennet and Holy Brook, Thames (Wallingford to Caversham), and Thames (Reading to Cookham). All water bodies lie within the South Chilterns operational catchment. The site is at the downstream extent of the Kennet and Holy Brook and Thames (Wallingford to Caversham) WFD designated water bodies, and the upstream extent of the Thames (Reading to Cookham) WFD water body.

11.5.21 The Kennet and Holy Brook, Thames (Wallingford to Caversham) and Thames (Reading to Cookham) waterbodies are noted as being 'heavily modified' water bodies (HMWB). These are water bodies which have been significantly physically modified to support various uses which provide valuable social and economic benefits. Removing these modifications would result in major negative effects on the social and economic benefits that these uses bring.

11.5.22 The HMWB designation is therefore applied if achieving good status would require changes to the water body's hydromorphology that would have significant adverse effects on the social or economic activity. HMWB are therefore required to achieve good ecological potential, an objective similar to good status, but which takes into account the constraints imposed by the social and/or economic uses.

11.5.23 The data identifies the Kennet and Holy Brook, Thames (Wallingford to Caversham) and Thames (Reading to Cookham) water bodies to have overall classifications of moderate potential through Cycle 1 in 2009, remaining consistent through to Cycle 2 in 2016.

11.5.24 This is further broken down into ecological potential and chemical status. All water bodies are currently classified as moderate ecological potential, and good chemical status. The Kennet and Holy Brook water body has not yet met its objective of good potential by 2027, however the Thames (Wallingford to Caversham) and Thames (Reading to Cookham) water bodies have achieved their WFD objectives of moderate potential by 2015.

11.5.25 The receiving water bodies, including the Kennet and Holy Brook, Thames (Wallingford to Caversham) and Thames (Reading to Cookham), are currently (Cycle 2, 2016) at moderate potential. According to **Table 11.2**, they are therefore classified as receptors of **Medium** sensitivity.

Baseline Evolution

11.5.26 The hydrological regime may change as a result of the predicted impacts of climate change.

11.5.27 Peak fluvial flows and peak rainfall intensities are predicted to increase as a result of climate change. Should such changes materialise, rates of surface water run-off and flood flows within the River Thames and River Kennet would increase.

11.5.28 The EA guidance 'Flood risk assessments: climate change allowances' (February 2016) provides allowances for increases in peak rainfall intensity of between +20% and +40%, indicating an increased demand on the surface water drainage arrangements and potentially a resultant increase in the flood risk from the receiving watercourse (unless appropriately mitigated).

11.5.29 The FRA considers the potential impact of climate change upon the baseline fluvial regime, in accordance with the EA guidance. 'As discussed in the 'methodology' section, the proposals require consideration of the following peak river flow allowances:

- [Flood Zone 2 \(land west of Kennetmouth\): +35% to +70%; and](#)
- [Flood Zone 3b \(land east of Kennetmouth\): +70%.](#)

11.5.30 PBA has re-run the EA Thames hydraulic model using the new climate change peak river flow allowances.

11.5.31 The modelled 1 in 100 annual probability +35% climate change allowance flood event is marginally less severe than the extreme 1 in 1,000 annual probability flood event (flood levels at Kennetmouth are approximately 80mm lower).

11.5.32 The modelled 1 in 100 annual probability +70% climate change allowance flood event is more severe than the extreme 1 in 1,000 annual probability flood event (flood levels at Kennetmouth are approximately 140mm higher).

11.5.33 In relation to water quality of the Thames and Kennet catchment, in the absence of development, it is anticipated that this would either be maintained or improve in line with the long-term objectives of the RBMP.

11.6 East MRT Site

Embedded Mitigation

11.6.1 The proposals include measures to prevent, reduce and offset significant adverse effects upon hydrology and drainage. These measures are embedded within the design philosophy that underpins the proposals. Being effectively 'built-in' to the proposals from the outset, the assessment of impact significance includes consideration of these measures.

11.6.2 In addition to measures embedded within the design process, development activities and associated effects are also controlled through ensuring legislative compliance and applying industry-standard/best practice (i.e. ensuring that the proposals do not increase flood risk elsewhere, thereby complying with the requirements of the NPPF).

11.6.3 A summary of the mitigation measures embedded/'built-in' to the proposals is set out below:

Construction:

- i. The use of best practice construction techniques and implementation of a Construction Environmental Management Plan (CEMP) to control/mitigate impacts upon hydrology and drainage and demonstrate no detriment to WFD designated water bodies;
- ii. The consenting/permitting process (via the EA and LLFA) and associated method statements for works within the watercourse corridors;

Operation:

- i. Incorporation of flood compensation measures to mitigate the impact of the development on floodplain storage. These measures consist of the following areas of ground lowering, as approved by the EA for the 2018 (June) ES Addendum, to provide compensatory floodplain storage to counter any losses in floodplain storage capacity caused by the Proposed Development (areas will be made good and reseeded/replanted on completion):
 - a. Lowering of an earth embankment to the immediate north-east of the Tesco store;
 - b. Lowering of an earth embankment to the north-west of the Tesco store; and
 - c. A cutting into the embankment at the eastern end of the MRT (where the land rises out of the floodplain near the new P&R site).
- ii. Incorporation of effective design to minimise the 'floodable footprint' of the Proposed Development. This includes construction of the east section as a viaduct over a floodable area, incorporation of flood culverts under the MRT embankment west of Kennetmouth (to maintain hydraulic connectivity into flood storage areas) and setting of bridge soffit levels significantly above reference flood levels and any navigation requirements;
- iii. Provision of a surface water management strategy to control surface water flows for up to and including the 100-year design standard (including an allowance for the predicted impacts of climate change) such that flood risk downstream is not adversely affected (in accordance with national planning policy);
- iv. Surface water management infrastructure designed in accordance with CIRIA C753 'The SuDS Manual' and guidance set out by the LLFA such that the surface water run-off regime replicates that existing prior to development;
- v. Implementation of SuDS 'treatment train' principles as set out in CIRIA C753 to provide pollution control; and
- vi. Enhancements to the River Thames riverbank east of Kennetmouth, including:
 - a. proposed riverside enhancements to include three new short stay mooring platforms; and
 - b. associated marginal planting between the new platforms to 'soften' the riverbank.

11.6.4 In addition, the existing moorings between Kennetmouth and the proposed new riverbank works are on land in third party ownership (WBC and Reading University). The existing moorings at

Kennetmouth are planned to be repaired by a third party, separate to this planning application, to full functionality (a section of the existing river wall in this location has partially failed).

- 11.6.5 The design beneath the viaduct has been amended to include the creation of areas of marshy wetland and grasses, providing an area for seasonal flooding, and a diverse marshy habitat. The design intention is to allow people to see beneath the viaduct, through to the railway embankment, and discourage public access.
- 11.6.6 It is noted that fencing under the viaduct is not included within the scheme design, however it may be delivered in future and should therefore be assessed as the worst-case scenario. However, such measures would be of an open and floodable construction and as such will not have an impact with respect to either flood risk or the water environment.

Assessment of Likely Effects

Construction Phase

- 11.6.7 The eastern part of the East MRT scheme will be constructed within the functional floodplain, while the area west of Kennetmouth is within the floodplain when climate change allowances (+35% and +70%) are considered. Construction works have the potential to affect flood storage and flood flows/flood routing processes as a result of temporary measures to control/manage river flows, construction activities, and earthworks operations within the floodplain. Construction of the East MRT scheme therefore has the potential to increase flood risk locally and temporarily during the construction phase.
- 11.6.8 The use of environmental management controls and procedures as set out in the CEMP will control any temporary effects on flood storage. The implementation of measures set out in the CEMP and as required by any Conditions imposed upon Permits/Consents for works within watercourse corridors will control the potential impacts of construction works upon flood storage and flood flows/flood routing processes such that flood risk locally and downstream is not increased.
- 11.6.9 The sensitivity of the River Kennet and River Thames as receptors, as noted in **Section 11.5** above, is **Negligible**. The magnitude of impact is **Negligible**, given the volume of flood storage available within the Application site in comparison to the overall volume of floodplain storage of the River Thames catchment. According to **Table 11.4**, the significance of effect is therefore **Negligible**. The potential effects of the construction phase on fluvial flood risk are therefore **Not Significant**.
- 11.6.10 The Proposed Development is located approximately 1.7km north east of the closest reservoir. The potential effects of the construction phase are noted to be localised and will therefore not influence the risk of flooding from reservoirs. The sensitivity of the receptor, as noted in **Section 11.5** above, is **Negligible**. The magnitude of impact is **Negligible**, due to the undetectable change in reservoir flood risk. According to **Table 11.4**, the significance of effect is therefore **Negligible**. The potential effects of the construction phase on reservoir flood risk are therefore **Not Significant**.
- 11.6.11 Development works, including earthworks operations, have the potential to impact upon the surface water drainage regime which, in turn, may impact upon sensitive locations in the vicinity of the site.
- 11.6.12 Construction activities will include the clearance of vegetation, topsoil stripping and stockpiling, establishment of compound areas, excavation and site levelling/re-profiling to create development platforms, preparation of site roads and construction of foundations. Compaction of the ground caused by construction plant and an increase in the extent of impermeable

surfaces associated with access roads and compound areas has the potential to impact upon the surface water drainage regime and increase surface water run-off from the site.

- 11.6.13 The potential effects of construction activities upon the surface water drainage/run-off regime will be controlled using measures set out within a CEMP. This includes the provision of temporary measures to intercept and control surface water run-off from worked areas/construction zones, together with the appropriate phasing/delivery of components of the 'permanent' surface water management infrastructure incorporated within the development proposals.
- 11.6.14 The implementation of measures set out in the CEMP and as required by any Conditions imposed upon Permits/Consents for works within watercourse corridors will control the potential impacts of construction works upon flood storage and flood flows/flood routing processes such that flood risk locally and downstream is not increased.
- 11.6.15 The sensitivity of the receptor, as noted in **Section 11.5** above, is **Low**. The magnitude of impact is **Negligible**, due to undetectable change in surface water flood risk following implementation of measures outlined in the CEMP. According to **Table 11.4**, the significance of effect is therefore **Negligible**. The potential effects of the construction phase on surface water flood risk are therefore **Not Significant**.
- 11.6.16 The Application Site forms a very small proportion of the Kennet and Holy Brook, Thames (Wallingford to Caversham) and Thames (Reading to Cookham) WFD water bodies. It is at the downstream-most extent of the Kennet and Holy Brook and Thames (Wallingford to Caversham) water bodies, and in the very upstream extent of the Thames (Reading to Cookham) water body.
- 11.6.17 Construction activities have the potential to give rise to the contamination of surface water and groundwater resulting from spilled hydrocarbons/petrochemicals from construction plant and the mobilisation of silts and contaminants during soil stripping and earthworks operations, potentially leading to increased silt loading in watercourses. There is also potential for an increase in silt and mobilised soil matter to enter the River Kennet and River Thames water courses, all of which could influence the WFD classifications.
- 11.6.18 The use of environmental management controls, best practice construction techniques, and procedures as set out in the CEMP will control diffuse pollution. This could include 'temporary' measures to route surface water run-off from 'worked' areas to a sump/silt trap before discharge to receiving waters so that silt loading does not increase. The potential effects of construction will be temporary and localised in nature, limited to the construction phase, and will not cause detriment to the existing or future WFD potential of the designated water bodies in the vicinity of the site.
- 11.6.19 The sensitivity of the receptor, as noted in **Section 11.5** above, is **Medium**. The magnitude of impact is **Negligible**, due to undetectable change in water quality following implementation of measures outlined in the CEMP and the insignificant size of the Application Site in relation to the catchment areas of the WFD designated water bodies. According to **Table 11.4**, the significance of effect is therefore **Negligible**. The potential effects of the construction phase on WFD designated water bodies are therefore **Not Significant**.

Operation Phase

- 11.6.20 The development incorporates a number of mitigation elements to demonstrate that (i) the impact of the proposals on fluvial floodplain storage and flow routes is minimised, and (ii) additional floodplain storage is provided through ground lowering elsewhere to offset any losses in storage. These are summarised below:
- Flood compensation measures through ground lowering are provided along the route of the East MRT scheme to mitigate the detrimental impact on floodplain storage capacity, resulting in a net gain in storage capacity during the 1 in 100 annual probability plus

appropriate allowances for climate change over the site (see **Appendix F.1** for full details);

- The East MRT embankment on the west side of Kennetmouth incorporates culverts to maintain hydraulic connectivity into the surrounding landscaped areas, which provide a flood storage function in severe flood events (exceeding the 1 in 100 annual probability event); and
- The East MRT scheme is constructed as a viaduct on the east side of the River Kennet, with the floodplain impacts minimised to the small non-floodable mono-pier support structures along this section;

11.6.21 The new EA climate change guidance requires consideration of increases in peak river flow in the range of +35% to +70%. The FRA summarised the basis for mitigation proposals as follows:

- The bridge soffit is over 4m above the 'Upper End' 1 in 100 annual probability +70% climate change allowance scenario flood level and, therefore, significantly in excess of EA requirements in relation to flood risk; and
- The proposed bridge corresponds with the adjacent structures, providing headroom clearance of 6.8m above SHWL at the centre of the navigation channel, exceeding any navigations requirements in this reach of the watercourses.

11.6.22 The impacts of the proposed development were quantified through the incorporation of the proposals (proposed structure and flood compensation mitigation measures) in a 'post-development scenario' version of the River Thames hydraulic model. This confirmed that any impacts are limited to the immediate route of the East MRT scheme and no impacts to dwellings (a maximum detriment of 35mm was located in an isolated location west of Kennetmouth (currently undeveloped), otherwise the main impact was a reduction in flood levels of between 30mm and 90mm within the Tesco car park area, in the 1 in 100 annual probability +35% climate change allowance scenario).

11.6.23 The sensitivity of the receptor, as noted in **Section 11.5** above, is **Negligible**. The magnitude of impact is **Small**, due to the localised minor changes in fluvial flood risk. According to **Table 11.4**, the significance of effect is therefore **Negligible**. The potential effects of the operation phase on fluvial flood risk are therefore **Not Significant**.

11.6.24 The Proposed Development is located approximately 1.7km north east of the closest reservoir. The potential effects of the operation phase are noted to be localised and will therefore not influence the risk of flooding from reservoirs. The sensitivity of the receptor, as noted in **Section 11.5** above, is **Negligible**. The magnitude of impact is **Negligible**, due to the undetectable change in reservoir flood risk. According to **Table 11.4**, the significance of effect is therefore **Negligible**. The potential effects of the operation phase on reservoir flood risk are therefore **Not Significant**.

11.6.25 Full details of the proposed surface water strategy are set out in the FRA (**Appendix F.1**). The technical analysis demonstrates that peak runoff rates are to be limited to no greater than greenfield runoff rates and as such the surface water run-off rates on-site will replicate that which is currently existing, or better.

11.6.26 The sensitivity of the receptor, as noted in **Section 11.5** above, is **Low**. The magnitude of impact is **Small**, due to the localised minor improvements in surface water flood risk. According to **Table 11.4**, the significance of effect is therefore **Minor**, and will be beneficial as a result of the incorporation of SuDS measures. The potential effects of the operation phase on surface water flood risk are therefore **Minor Beneficial**.

11.6.27 The WFD Compliance Statement (**Appendix F.2**) shows that with embedded mitigation measures, the Proposed Development will not negatively impact the surface water or

groundwater WFD designated water bodies, nor their ability to achieve or maintain WFD or RBMP objectives. The proposed method of surface water management, included as an embedded mitigation measure and detailed above, will control surface water quality through the implementation of measures as part of the SuDS treatment train.

11.6.28 The implementation of riverbank improvements (marginal shelves, moorings, native species planting) will provide localised ecological enhancements for the River Thames. These result in habitat creation and a greater diversity of habitats available, and therefore an increase in diversity of species that the Application Site can support. This effect is detailed in the context of the local ecological environment within Chapter 14.

11.6.29 The sensitivity of the receptor, as noted in **Section 11.5** above, is **Medium**. The magnitude of impact is **Small**, due to the localised minor improvements to riverbanks through implementation of marginal shelves and native species planting. According to **Table 11.4**, the significance of effect is therefore **Minor**, and will be beneficial as a result of the habitat creation and native species planting. The potential effects of the operation phase on WFD designated water bodies is therefore **Minor Beneficial**.

Further Mitigation and Enhancement

11.6.30 The Proposed Development includes sufficient embedded mitigation such that additional mitigation, with respect to hydrology and flood risk, is not required.

Residual Effects

11.6.31 With the implementation of embedded mitigation measures and identified mitigation measures delivered through the CEMP referenced above, the residual effects associated with the construction phase of the Proposed Development are **Not Significant**.

11.6.32 With the implementation of embedded mitigation measures as set out above, the residual effects associated with the operation phase of the Proposed Development are **Not Significant**, with a **Minor Beneficial** effect with regards to surface water and WFD water bodies.

11.7 Combined Site (East MRT and TVP P&R)

Assessment of Likely Effects

11.7.1 This section describes the potential effects of the Proposed Development upon hydrology and flood risk during both the construction and operation phases of the combined site (East MRT scheme and TVP P&R). Both adverse and beneficial effects, and their significance, are considered.

11.7.2 The TVP P&R site is in an area classified as Flood Zone 1 'Low Probability' of river flooding and the only notable mitigation measure embedded/'built-in' to the proposals is the surface water management infrastructure to be designed in accordance with CIRIA C753 'The SuDS Manual' and guidance set out by the LLFA such that the surface water run-off regime from the TVP P&R site replicates that existing prior to development. These are discrete to any of the proposed works of the East MRT scheme.

Construction Phase

11.7.3 The TVP P&R site is located in an area classified as at low probability of fluvial flooding. The potential effects for the construction phase of the combined site are therefore consistent with

that of the East MRT Proposed Development with regards to fluvial flood risk, reservoir flood risk and water quality.

- 11.7.4 With regards to surface water flood risk, TVP P&R will be subject to its own CEMP (or similar) to determine how surface water flood risk will be managed on site during the construction phase so that the residual effects of the construction phase are Not Significant. The potential effects of the combined site during the construction phase will therefore be **Not Significant**.

Operation Phase

- 11.7.5 The combined proposed developments will give rise to an increase in the impermeable area within the combined site, thereby having the potential to increase surface water run-off rates to the receiving watercourses (River Thames and River Kennet).
- 11.7.6 In accordance with requirements of the EA and LLFA, the TVP P&R incorporates a surface water drainage strategy, based on on-site attenuation and controlled discharge to the River Thames and to the surface water sewer beneath the A3290. The accompanying FRA (Ref 11-1) states that *"the Proposed Development will discharge at a maximum rate of 5.8l/s for the 1% annual probability rainfall event including an allowance for climate change. In order to ensure surface water discharged to the surface water sewer network is restricted to the greenfield runoff rate, surface water attenuation will be required within the Proposed Development"*.
- 11.7.7 The sensitivity of the receptor for the combined site is consistent with the East MRT receptor noted in **Section 11.5** above, and is considered to be **Low**. The magnitude of impact is **Small**, due to localised improvements to surface water run-off rates in comparison to existing for the combined site. According to **Table 11.4**, the significance of effect is therefore **Minor**, and will be beneficial as a result of the improvement to localised surface water flood risk. The potential effects of the combined site operation phase on surface water flood risk is therefore **Minor Beneficial**.
- 11.7.8 There is the potential for the contamination of surface water entering the receiving watercourses (River Thames and River Kennet), resulting from the flushing of silts and hydrocarbons from areas of hardstanding. However, the implementation of SuDS 'treatment train' principles facilitates the control of diffuse pollution from the TVP P&R site.
- 11.7.9 As referenced in **Section 11.6** above, the implementation of riverbank improvements (marginal shelves, moorings, native species planting) as part of the East MRT Proposed Development will provide localised ecological enhancements for the River Thames. This would result in **Minor Beneficial** potential effects for the East MRT site with respect to WFD designated water bodies. The combined site will have **Minor Beneficial** potential effects consistent with this, due to the TVP P&R site having a **Negligible** magnitude of impact, and thereby not influencing, either positively or negatively, the effects of the combined site.

Further Mitigation and Enhancement

- 11.7.10 The combined East MRT scheme and TVP P&R include sufficient embedded mitigation such that additional mitigation, with respect to hydrology and flood risk, is not required.

Residual Effects

- 11.7.11 Following the implementation of embedded mitigation measures, it is concluded that the residual effects associated with the construction phase of the combined site are **Not Significant**.
- 11.7.12 Following the implementation of embedded mitigation measures, it is concluded that the residual effects in respect of hydrology and flood risk associated with the operation phase of the

combined site are **Not Significant**, with a **Minor Beneficial** effect with regards to surface water and WFD water bodies. The residual effects are summarised in **Table 11.6** below.

11.8 Monitoring

- 11.8.1 On the basis that the construction and operation phases do not result in significant adverse residual effects, there is no requirement for monitoring with respect to hydrology and flood risk. If a flood event were to occur within the Application Site or in the vicinity of the Application Site, the EA and LLFAs should be notified of the date of occurrence, the duration and extent of any standing water, and, if possible, identify the source of flooding (fluvial, surface water, groundwater etc.).

11.9 Cumulative Effects

- 11.9.1 The identified committed development schemes that are being considered within this EIA are all of a nature or scale such that an FRA is required or will already have been undertaken. This would need to comply with NPPF, PPG and other relevant local policies and the final scheme will need to demonstrate that the proposed development does not have any adverse impact on flood risk/surface water runoff rates and water quality.
- 11.9.2 On this basis it is considered that the development of the committed development schemes will not give rise to any likely significant cumulative effects.

11.10 Summary

- 11.10.1 A site-specific Flood Risk Assessment (FRA) and Water Framework Directive (WFD) Compliance Statement have been completed for the Proposed Development. The site is located within Flood Zone 2 'Medium Probability', Flood Zone 3a 'High Probability' and Flood Zone 3b 'Functional Floodplain', and contains a new crossing of a WFD designated water body, which triggers the requirement of an FRA and a WFD Compliance Statement.
- 11.10.2 A Surface Water Drainage Strategy has been produced to define how surface water run-off will be managed within the Application Site.

Baseline

- 11.10.3 The Environment Agency (EA) Flood Zone map and detailed hydraulic modelling indicates the proposed East MRT route on the west side of Kennetmouth lies within Flood Zone 2 'Medium Probability' of the River Thames, defined between a 1 in 100 and 1 in 1,000 annual probability of river flooding.
- 11.10.4 On the east side of Kennetmouth, the route lies in Flood Zone 3b 'Functional Floodplain', until it reaches the Thames Valley Park and Ride site in Flood Zone 1 'Low Probability' (less than 1 in 1,000 annual probability of river or sea flooding). Flood Zone 3b 'Functional Floodplain' is defined as land where water has to flow or be stored in times of flood.
- 11.10.5 The proposed development consists of 'Essential Infrastructure' development which is considered appropriate within Flood Zone 2 and Flood Zone 3a, and acceptable in Flood Zone 3b subject to the Exception Test (ref: (reference National Planning Policy Framework (NPPF) Planning Practice Guidance (PPG) Table 3).

Construction Effects

- 11.10.6 The FRA, Surface Water Drainage Strategy and WFD Compliance Statement conclude that the residual effects during the construction phase are **Not Significant** following the implementation of embedded mitigation measures. The embedded mitigation measures include making use of

best practice techniques, timing of construction works, and the implementation of a robust Construction Environmental Management Plan (CEMP).

Operation Effects

- 11.10.7 The FRA, Surface Water Drainage Strategy and WFD Compliance Statement conclude that the residual effects during operation are **Not Significant** with regards to fluvial flood risk and reservoir flood risk, and **Minor Beneficial** with regards to surface water flood risk and WFD designated water bodies following the implementation of embedded mitigation measures.
- 11.10.8 Embedded mitigation measures include designing the east landing as a viaduct on mono-pier supports to minimise the impact on flood storage, and completion of a flood compensation exercise which results in an overall net gain in storage in the site. The surface water drainage strategy outlines that run-off rates from the site will be set to greenfield run-off rates, meaning run-off from the site will reduce compared to existing, resulting in localised improvements to surface water flood risk. The inclusion of marginal shelf improvements and native species planting result in habitat creation, and an improvement in comparison to existing conditions, which is beneficial to the WFD designated water bodies in the vicinity of the Application Site.

Table 11.6: Summary of Effects

Receptor	Sensitivity	Effect	Magnitude /Spatial extent	Likelihood of Occurrence	Embedded Mitigation	Significance of Effect	Further Mitigation (if required)	Residual Significance of Effect
Construction								
Fluvial	Negligible	Negligible	Localised	N/A	Use of CEMP	Not Significant	N/A	Not Significant
Reservoir	Negligible	Negligible	Localised	N/A	N/A	Not Significant	N/A	Not Significant
Surface water	Low	Negligible	Localised	N/A	Appropriate selection of working practices during construction. Use of CEMP.	Not Significant	N/A	Not Significant
WFD designated water bodies	Medium	Negligible	Localised	N/A	Appropriate selection of working practices and timing of activities during construction. Use of CEMP	Not Significant	N/A	Not Significant
Operation								
Fluvial	Negligible	Small	Localised	N/A	Viaduct structure with mono-piers design and appropriate flood	Not Significant	N/A	Not Significant

Receptor	Sensitivity	Effect	Magnitude /Spatial extent	Likelihood of Occurrence	Embedded Mitigation	Significance of Effect	Further Mitigation (if required)	Residual Significance of Effect
					compensation scheme			
Reservoir	Negligible	Negligible	Localised	N/A	N/A	Not Significant	N/A	Not Significant
Surface water	Low	Small	Localised	N/A	SuDS incorporated, and surface water runoff rates reduced compared to existing.	Minor Beneficial	N/A	Minor Beneficial
WFD designated water bodies	Medium	Small	Localised	N/A	Inclusion of marginal shelf with native species planting	Minor Beneficial	N/A	Minor Beneficial

12 Land

12.1 Introduction

- 12.1.1 This chapter of the ES has been produced by PBA to assess the impact of the East MRT scheme in relation to ground contamination and ground stability. A statement outlining the relevant expertise and qualifications of competent practitioners appointed to prepare this ES is provided in Appendix A.5.
- 12.1.2 This chapter considers the potential direct and indirect effects on human health, the environment and the proposed development with respect to ground contamination and ground stability. In particular, it considers the potential effects from the disturbance of ground contamination on human health and the environment, and the effects of potentially contaminated ground or groundwater conditions on the proposed development. It also recognises the effects of the geological setting of the site in relation to the development and presents an assessment of such hazards being present at the application site.
- 12.1.3 The chapter describes the baseline conditions existing at the application site and surroundings, the potential direct and indirect effects of the ground conditions, the methods used to assess the impacts including embedded mitigation, further mitigation measures required to prevent reduce or offset any significant adverse effects; and the likely residual effects after these measures have been employed.
- 12.1.4 Features referred to within this chapter are presented on Figure 1 in Appendix G.1.
- 12.1.5 As described below, other direct effects of the proposed development on the ground have been excluded from this assessment. The elements excluded from this assessment and the reasons for their exclusion are:
- **Geo Conservation** There are no designated geological or geomorphological sites or features of conservation value in the area affected by the proposed scheme. Given that the proposed development will have no material change on the geology and geomorphology of the application site and its vicinity, there are no likely significant effects. There is no assessment of the impact of the scheme on geo conservation in the ES.
 - **Mineral Resources** Although the River Terrace Deposits represent a potential mineral resource, the application site does not fall within any mineral consent or safeguard area. On this basis, there are no likely significant effects and there is no assessment of the impact of the scheme on mineral resources in the ES.
 - **Unstable Ground** The application site is situated on slightly undulating ground with no noted features with the exception of two disused gravel pits recorded in the eastern part of the application site. The geology and geomorphological setting of the application site is such that the potential for unstable ground to be present is, in general, very low. The presence of the historical gravel pits is not considered to have a significant effect on the ground conditions or the wider environment during either the construction phase or in the

long term. On this basis, there are no likely significant effects and this aspect was scoped out from the ES.

12.1.6 The assessment in this chapter is based on the information in the following reports: -

- East Reading Mass Rapid Transit Scheme Phase 1 Ground Condition Assessment (Contamination and Geotechnical) (PBA, 2017a) provided in **Appendix G.2**;
- East Reading Mass Rapid Transit Scheme Phase 2 Ground Condition Assessment (PBA, 2017b) provided as **Appendix G.3**;
- Thames Valley Park and Ride, Reading, Berkshire Phase 1 Land Contamination Assessment (WSP, 2016) provided as **Appendix G.4**; and
- East Reading Mass Rapid Transit Scheme, an update to PBA Phase 1 and 2 Ground Condition Assessment Reports. Technical Note reference 28791/3504/TN01GEO (PBA, 2018) provided as **Appendix G.5**.
- Ground Investigation Report (Factual) Proposed MRT Scheme, East Reading (ED, 2017) Provided in **Appendix G.6**.

Reference was also made to the Factual Report on A Ground Investigation for Thames Valley Park and Ride, Reading (NCG, 2018).

12.1.7 Government policy on land contamination aims to prevent new contaminated land from being created and promotes a risk based approach to addressing historical contamination. With regard to historical contamination, regulatory intervention is held in reserve for land that meets the legal definition and cannot be dealt with through any other means, including through planning. Land is only considered to be “contaminated land” in the legal sense if it poses an unacceptable risk.

12.1.8 Reference should also be made to other chapters in this Environmental Statement including, but not limited to the **Chapters 10** on Air Quality and **Chapter 11** on Hydrology and Flood Risk respectively.

12.2 Policy Context

12.2.1 Government policy on land contamination aims to prevent new contaminated land from being created and promotes a risk based approach to addressing historical contamination. With regard to historical contamination, regulatory intervention is held in reserve for land that meets the legal definition and cannot be dealt with through any other means, including through planning. Land is only considered to be “contaminated land” in the legal sense if it poses an unacceptable risk.

Legislation

12.2.2 UK legislation on contaminated land is principally contained in Part 2A of the Environmental Protection Act, 1990 (which was inserted into the 1990 Act by section 57 of the Environment Act 1995).

12.2.3 Part 2A was introduced in England on 1 April 2000 and provides a risk-based approach to the identification and remediation of land where contamination poses an unacceptable risk to human health or the environment. The broad approach, concepts and principles behind land contamination management adopted by the Part 2A regime are applied to the determination of planning applications.

12.2.4 The role of the planning system is to control future development and land use. The assessment of risk arising from contamination and remediation requirements should be considered on the basis of both the current and proposed use. Current use includes any use

that has planning permission but is as yet unimplemented. The underlying approach to identifying and dealing with risk and the broad policy objective of safeguarding human health and the environment are similar for both the Planning and Part 2A regimes.

- 12.2.5 The Regulations and Statutory Guidance that accompanied the Act, has been revised with the issue of The Contaminated Land (England) (Amendment) Regulations (SI 2012/263) and the Contaminated Land Statutory Guidance for England (DEFRA, 2012).
- 12.2.6 The guidance includes a definition of 'risk', where a risk is said to be a combination of:
- the likelihood that harm, or pollution of water, will occur as a result of contaminants in, on or under the land; and
 - the scale and seriousness of such harm or pollution if it did occur.
- 12.2.7 The Environmental Damage (Prevention and Remediation) (England) Regulations 2015 (SI 2015/810) provide that, for certain activities, where there is an imminent risk of environmental damage, steps must be taken to prevent such damage, and if environmental damage has already occurred, the operator of the activity must prevent further damage. The duties are backed up with criminal sanctions for breaches of the Regulations.
- 12.2.8 Controlled Waters are rivers, estuaries, coastal waters, lakes and groundwater, but not perched waters. The Environmental Permitting (England and Wales) Regulations 2016 (SI 2010/1154) bring together 12 amendments to the Environmental Permitting (England and Wales) Regulations 2010, as well as amendments made by other legislation. Under the Regulations, groundwater activities relate to inputs of pollutants to groundwater.
- 12.2.9 The Regulations transpose the Groundwater Directive 1980 (hereafter GWD), the Water Framework Directive 2000 (hereafter WFD) and Groundwater Daughter Directive 2006 (hereafter GWDD). The GWD remained in force until its repeal in December 2013.
- 12.2.10 The GWDD was enacted by the Groundwater Regulations (2009), which were subsumed by the Environmental Permitting Regulations (2010) which provide essential clarification including on the four objectives specifically for groundwater quality in the WFD:
- Achieve 'Good' groundwater chemical status by 2015, commonly referred to as 'status objective';
 - Achieve Drinking Water Protected Area Objectives;
 - Implement measures to reverse any significant and sustained upward trend in groundwater quality, referred to as 'trend objective'; and
 - Prevent or limit the inputs of pollutants into groundwater, commonly referred to as 'prevent or limit' objectives
- 12.2.11 The Water Act 2003 (Commencement No.11) Order 2012 amends the test for 'contaminated land' which relates to water pollution so that pollution of controlled waters must now be "significant" to meet the definition of contaminated land.

National Planning Policy

- 12.2.12 Section 15, Paragraphs 178 and 179 of the National Planning Policy Framework (NPPF 2018) describe the policy considerations the Government expects Local Planning Authorities (LPA) to have in regard to land affected by contamination when preparing policies for development plans and in taking decisions on applications. After remediation under planning, as a

minimum, land should not be capable of being determined as contaminated land under Part 2A of the Environmental Protection Act 1990.

- 12.2.13 For planning purposes, the NPPF requires that the assessment of risks arising from contamination and remediation requirements should be considered on the basis of the current environmental setting, the current land use, and the circumstances of its proposed new use. The NPPF stipulates that planning policies and decisions should ensure that “a site is suitable for its new use taking account of Ground Conditions and any risks arising from land instability and contamination. This includes risks arising from natural hazards or former activities such as mining and any proposals for mitigation including land remediation (as well as potential impacts on the natural environment arising from that remediation)”; and that “after remediation, as a minimum, land should not be capable of being determined as contaminated land under Part 2A of the Environmental Protection Act 1990”; and “adequate site investigation information, prepared by a competent person, is available to inform these assessments”..
- 12.2.14 Under the definition ‘Site Investigation Information’ given in the NPPF glossary page 71, “a risk assessment of land potentially affected by contamination, or ground stability and slope stability” is required. This report is commonly called a Phase 1 Ground Conditions and Contamination risk assessment.
- 12.2.15 Guidance on ground condition assessment is given in CLR 11 Model Procedures for the Management of Contaminated Land (DEFRA/EA, 2004), that sets out a process based on a tiered risk assessment with increasing level of detail required to progress through the tiers.
- 12.2.16 The NPPF requires that all investigations of land potentially affected by contamination should be carried out in accordance with “established procedures” using current UK best practice and guidance as given in British Standard 10175 Investigation of potentially contaminated sites – Code of practice (BSI, 2011), British Standard 5930 Code of practice for ground investigations (BSI, 2015), and Contaminated Land Report 11 (DEFRA/EA, 2004) with regard to land contamination. These reports should be prepared by a “Competent Person”, defined on page 65 as “A person with a recognised relevant qualification, sufficient experience in dealing with the types(s) of pollution or land instability, and membership of a relevant professional organisation”.

Local Planning Policy

- 12.2.17 Reference has been made to Policy – CS34: Pollution and Water Resources contained in Reading Local Development Framework Core Strategy Document (adopted 2008 & altered 2015) reads: -
- “Development will only be permitted where it would not be damaging to the environment through air, land, noise or light pollution; where it would preserve or ideally enhance ground and surface water quality; and where existing water resources, sewerage and wastewater treatment infrastructure are adequate to support the proposed development.
 - Proposals for development that are sensitive to the effects of air, noise or light pollution will only be permitted in areas where they will not be subject to high levels of such pollution, unless adequate mitigation measures are provided to minimise the impact of such pollution.
 - Development will be permitted on land affected by contamination where it can be demonstrated, to the satisfaction of the LPA, that the contamination can be satisfactorily remediated so that it is suitable for the proposed end use.”

12.2.18 Reference has been made to the RBC document entitled “Planning Applications Validation Information Requirements Checklists & Guidance” dated December 2016 which states that a Contaminated Land Survey & Report is required

“Where contamination is known or suspected or the development site is in the vicinity of such land, and ground-works are proposed; or, where there is a vulnerable or sensitive end user i.e. Residential, Schools, Nurseries, Hospitals and Allotments. This information is required to determine the existence of contaminated land, its nature and the risks it may pose to the proposed development and whether remedial measures are feasible to satisfactorily reduce the contamination to an acceptable level. A desk study listing current and historic uses of the site and adjoining land, together with a site reconnaissance shall be provided, to determine the likelihood of contamination. In addition, where contamination is known or suspected or the site is in the vicinity of such land, a preliminary conceptual site model (showing all potential pathways between contaminants and receptors – known as pollutant linkages) shall be provided, together with a preliminary risk assessment of these pollutant linkages.”

12.2.19 The Berkshire Guide to Developing Potentially Contaminated Land includes a checklist for information to be included for each phase of investigation.

12.2.20 Wokingham Borough Council (WBC) has published a Contaminated Land Strategy (4th revision) dated October 2015 which contains a section entitled “Dealing with Contaminated Land under the Planning Regime” which states: -

Where potential development sites are identified as lying on within a certain distance of potentially contaminated land the Development Management team will consult with the Environmental Quality team. The team will consider whether further investigation into potential contamination is required and if necessary will recommend that conditions are imposed. The conditions will ensure that an appropriate investigation takes place followed, where necessary, by remediation to ensure that the land is made suitable for its intended use. In certain circumstances the team will recommend refusal of an application if insufficient information on contamination has been provided with the application

The Council has drafted a document entitled ‘A Developer’s Guide to Potentially Contaminated Land’ which will be made available to all developers upon request. This document, to an extent, replaces PPS23 which was withdrawn as part of the Government’s review of planning guidance. It is intended to include the guide as an appendix to a supplementary planning document shortly up for review. All specialist reports submitted to comply with contaminated land conditions will be reviewed by the Environmental Quality Team who will make recommendations as to whether the relevant conditions may be discharged.

Guidance / Best Practice

12.2.21 This ES adopts a tiered approach to ground condition assessment and the assessment is underpinned by the following guidance and/or best practice: -

- Contaminated Land Report 11 (CLR 11) ‘Model Procedures for the Management of Land Contamination’ (DEFRA/EA, 2004);
- BS 5930:2015 “Code of practise for site investigations” (BSI, 2015); and,
- BS 10175:2011+A1:2013 “Investigation of contaminated sites – code of practice” (BSI, 2011).

12.2.22 Where third party reports are used by PBA, any additional commentary regarding the guidance used in such reports is provided.

12.2.23 Position statements describing the EA’s approach to managing and protecting groundwater updating the EA’s Groundwater Pollution Prevention Principles (GP3), were launched on 14 March 2017.

12.3 Consultation

12.3.1 A Scoping Report was submitted to RBC and WBC in August 2018, which included an outline of the proposed scope and methodology for the hydrology and flood risk assessment. The Scoping Opinion is included in Appendix A.8.

12.3.2 The RBC scoping opinion stated:

Regarding ground conditions and contamination, the Council's EP Team is satisfied with the proposed methodology for the contaminated land assessment proposed.

12.3.3 PBA made a request to RBC and WBC for any geoenvironmental related information held by the Council for the application site and its immediate surroundings.

12.3.4 The Senior Technical Officer for Environmental Protection of Reading Borough Council carried out a search on the Council's database with relation to contamination records. The letter refers to a number of records of potential source of contamination including former gas works, steam laundry, gravel pit, biscuit factory, railway sidings, a warehouse and a historical landfill. A copy of the information provided by RBC Environmental Health Department is reproduced in the update to the PBA Phase 1 and 2 Ground Condition Assessment Reports (PBA, 2016 in Appendix G.5).

12.3.5 The Information Services Officer for Wokingham Borough Council carried out a search on the Council's database with relation to contamination records. The letter refers to a record of potential source of contamination associated with the former gravel pit. A copy of the information provided by WBC is reproduced in the update to the PBA Phase 1 and 2 Ground Condition Assessment Reports (PBA, 2016 in Appendix G.5).

12.3.6 PBA made a request to the EA for any geoenvironmental related information held by the EA for the application site and its immediate surroundings. According to the documents provided by the EA the historical landfill at Napier Road has received 'semi-inert materials including; wood, paper, cardboard, plasterboard and plastic and the documents that landfill has a soil cover. A copy of the information provided by the EA is reproduced in Appendix 8 of the Phase 1 report (PBA, 2016 in Appendix G.1).

12.4 Methodology

Study Area

12.4.1 The Study Area for this Chapter comprises the land within the planning application boundary for both the East MRT and the TVP P&R schemes plus the land immediately adjacent to the site (adjoining) for identification of specific current and historic land uses.

12.4.2 Depending on the type of data a search radius of between 250m and 1000m is used depending on the zone of influence, for example only landfill sites within 250m of the site boundary will be identified because gas migration is unlikely over a greater distance.

Baseline Data Collection

12.4.3 Both the East MRT and TVP P&R schemes benefit from Phase 1 ground condition reports (PBA, 2017a and WSP, 2016, appendices 12.2 and 12.4 respectively). The Phase 1 scope of work is summarised below: -

- Site walkover survey of accessible areas, to document the current land use and site setting;

- Review of available historical maps to identify former land uses and potential contaminative activities on and surrounding the site;
- Request for contaminated land information held by RBC and WBC;
- A review of relevant publicly available information relating to hydrological features, hydrogeology, neighbouring land use, ecologically sensitive uses and geology in order to establish the environmental setting of the site;
- The development of a preliminary conceptual site model (CSM) following the source-pathway-receptor contaminant linkage approach; and
- An outline of the environmental risks with respect to ground, groundwater and ground gas conditions, which may potentially arise as liabilities or constraints associated with the development of the site.

12.4.4 The East MRT scheme also benefits from site specific data obtained from an intrusive investigation (PBA, 2017b (**Appendix G.3**)), which comprised: -

- 10 exploratory holes (all located within Zone D).
- Chemical laboratory analysis of 25 soil samples, 5 groundwater and 3 surface water samples.
- The British Geological Survey archives contain records of a number of exploratory holes sunk during two ground investigations in 1986 and 1989 in the vicinity of the application site associated with earlier proposals for a bridge over the River Kennet approximately on the alignment of the current scheme. Copies of borehole records on and in the near vicinity of the site have been reproduced and enclosed in the Phase 1 ground condition assessment (PBA, 2017a) presented in **Appendix G.2**.

Temporal Scope

12.4.5 The assessment has considered the potential for surface and subsurface geological and hydrogeological effects as a result of the proposed development during both the temporary construction phases and operational phase.

Assumptions & Uncertainties

12.4.6 This assessment is in part based on published information which is generic to an area rather than specific to the development site. Where this is the case professional experience has been used to inform the assessment in terms of likelihood and degree of contamination associated with the identified land uses.

12.4.7 Further information on site specific ground conditions may be collected to inform detailed design.

12.4.8 For the purpose of this assessment, it is assumed that any soil and groundwater remediation (if required) is undertaken as a single event as part of enabling works in advance of construction works.

Assessment Methodology

12.4.9 The presence of contamination in land can present risks to human health and the environment, which adversely affect or restrict the beneficial use of land. Without appropriate mitigation, the presence of substances with potential to cause harm to human health, property

or the wider environment may severely limit or altogether preclude development and the beneficial use of land.

12.4.10 The approach adopted for the identification of potential effects associated with ground conditions is to compare an estimated **risk** associated with the proposed development (considering separately the Construction Phase and Operational Phase (including any embedded mitigation in each phase)) with the corresponding estimated risk associated with the existing baseline conditions.

12.4.11 Risk is based on a consideration of both:

- the magnitude of the potential consequence (i.e. severity) taking into account both the potential severity of the hazard and the sensitivity of the receptor.
- the magnitude of probability (i.e. likelihood) taking into account both the presence of the hazard and receptor and the integrity of the pathway.

12.4.12 Details of the methodology used for risk assessment are given in the guidance notes included in the Phase 1 report for the MRT East scheme (PBA, 2017a in **Appendix G.2**). As an overview, for a risk to exist there needs to be one or more hazard – pathway – receptor linkages. Each Conceptual Site Model (CSM) for baseline, construction phase and operational phase considers:

- The principal **hazards**. The contaminants must be present in, on or under the land in a form and quantity that poses a hazard. The potential contamination sources are identified from a review of information on land use. The importance of the land use in terms of anticipated magnitude and extent of contamination is classified in one of five bands with a Very High classification associated with land uses such as hazardous waste landfill sites. The classification banding is presented in Table 1 of the methodology (refer to PBA, 2017a in **Appendix G.2**).
- The classification can be refined if site specific ground condition data is available, as is the case for part of the East MRT scheme;
- The principal **pathways**. The potential exposure and migration pathways between the identified hazard(s) and receptor(s) are identified and can be refined if site specific ground condition data is available; and
- The principal **receptor(s)**. A receptor is something that could be adversely affected by a contaminant, for example, a person, an ecosystem or controlled waters. The assessment considers those receptors identified in statutory guidance (DEFRA, 2012). The importance of the receptor is classified in one of five bands with a Very High classification associated with receptors of national or international importance. The classification banding is presented in Table 2 of the methodology (refer to PBA, 2017a in **Appendix G.2**).

12.4.13 Potential effects are identified using the matrix presented in **Table 12.1**.

Table 12.1: Matrix for Identifying Potential Effect (Based on the change from Baseline Risk)

Risk (Scheme Phase)	Potential Effect					
	Very High	Severe Adverse	Major Adverse	Moderate Adverse	Minor Adverse	Negligible
	High	Major Adverse	Moderate Adverse	Minor Adverse	Negligible	Minor Beneficial
	Moderate	Moderate Adverse	Minor Adverse	Negligible	Minor Beneficial	Moderate Beneficial
	Low	Minor Adverse	Negligible	Minor Beneficial	Moderate Beneficial	Major Beneficial
	Very Low	Negligible	Minor Beneficial	Moderate Beneficial	Major Beneficial	Major Beneficial
		Very Low	Low	Moderate	High	Very High
Risk (Baseline)						

12.4.14 A “Scheme Phase” is the construction phase, the construction phase with mitigation (if required), the operational phase, and the operational phase with mitigation (if required).

12.4.15 For example, if a pollutant linkage is estimated as having a Low risk in the baseline conditions and a High risk during construction phase then of a Moderate Adverse effect would be identified.

12.4.16 Severe, Major and Moderate Adverse Effects are identified as Significant and potentially key factors in the decision making process.

12.4.17 The mitigation measures required to address possible unacceptable risks during both the Construction Phase and the Operational Phase are then identified and the effects of including the mitigation measures in both the construction and operational phases assessed once more through comparison with the baseline. The residual effects are identified by comparing the estimated risk associated with the proposed development with the mitigation measures in place with the corresponding risk associated with the existing baseline conditions

12.4.18 Table 12.2 presents a description for potential effect in respect of the ground conditions drawing upon the generic significance criteria provided in **Table 5.1**.

Table 12.2: Descriptions of Significance of Potential Effect for Ground Conditions

Potential Effect	Example Description for Land
Major Beneficial	Significant reduction in environmental risk to humans or aquatic flora and fauna. Significant improvement in water resources (surface water and groundwater quality and / or flow).
Moderate Beneficial	Moderate, but still significant in an EIA context, reduction in environmental risk to humans or aquatic flora and fauna. Minor, but still significant in an EIA context, improvement in water resources (surface water and groundwater quality and / or flow).
Minor Beneficial	Minor reduction of environmental risk to surface water resources, aquatic fauna, flora or air quality. No appreciable risk to human health (construction workers or end users).

Potential Effect	Example Description for Land
Negligible	No appreciable increase in environmental risk to water resources, aquatic flora and fauna and human health. Any very low negative effects are reversible.
Minor Adverse	Minor environmental risk to surface water resources, aquatic fauna, flora or air quality. No appreciable risk to human health (construction workers or end users).
Moderate Adverse	Local environmental risk to water resources, aquatic fauna and flora, and/ or humans (construction workers and/ or end users) requiring monitoring and local remedial works.
Major Adverse	Significant local environmental risk to water resources, aquatic fauna and flora, and/ or humans (construction workers and/ or end users) giving rise to the possibility of permanent harm and requiring monitoring and more extensive local or site wide remedial works.
Substantial Adverse	Significant regional/national environmental risk to water resources, aquatic fauna and flora, and/ or humans (construction workers and/ or end users) giving rise to permanent harm and therefore requiring extensive monitoring and remedial works.

12.5 Baseline Conditions

12.5.1 For the purposes of this chapter the East MRT scheme has been subdivided into six zones designated A to G (refer to **Figure 12.1** in **Appendix G.1** for zone boundaries) as follows:

- Zone A – A narrow strip of land comprising carriageway, pavements, and associated landscaping along Napier Road leading to Tesco Superstore;
- Zone B – Mostly landscaping, and an access road forming part of Tesco Superstore;
- Zone C – Access roads and car parking areas serving Tesco Superstore and a narrow band of landscaping to the south;
- Zone D – A triangular parcel of land covered with dense vegetation, situated between Tesco Superstore car park and the River Kennet;
- Zone E – The River Kennet flowing from south-west under the Kings Mead railway bridge and the Horseshoe Footbridge to the north-east where it joins the River Thames;
- Zone F – A narrow strip of land situated immediately to the south of the River Thames and north of the Network Rail land; and
- Zone G – A vacant parcel of land covered with scrub and dense vegetation to the west of the A3290 roundabout.

12.5.2 Part of Zone G is within the planning application boundary for the TVP P&R scheme (**Figure 12.1** in **Appendix G.1** also shows these boundaries).

- 12.5.3 This Chapter also considers the land proposed for flood compensation, two parcels of which (referred to as “compensation areas East of Kennetmouth” in **Chapter 12**) are within Zone F and two parcels of which (referred to as “compensation areas West of Kennetmouth” in **Chapter 12**) are north of the Tesco superstore (refer to **Figure 12.1** in **Appendix G.1** for location and boundaries).

Baseline Evolution

- 12.5.4 The ground conditions are unlikely to change should the Application Site will not be developed. Furthermore, any future developments in the area are unlikely to change the statuesque. As such, there are no changes anticipated to the baseline conditions.

Potential Sources of Contamination (PSC)

- 12.5.5 Potential Sources of Contamination are identified based on the known historical and current land use. The PSC identified on each zone and immediately adjacent are summarised below:

- Zone A – south eastern part within area of former railway land (PSC A), northern extent within area of former tanks (PSC B);
- Zone B – within area of former railway land (PSC A), north western part within area of former tanks (PSC B), Tesco refuelling station adjacent to northern boundary (PSC C);
- Zone C – within area of former railway land (PSC A), all except western end within area of historical landfill (PSC D);
- Zone D – within area of former railway land (PSC A), all except eastern end within area of historical landfill (PSC D);
- Zone E – no PSC identified;
- Zone F – no PSC identified;
- Zone G – western half within a historical gravel pit (PSC E), disused Highways compound in the eastern end (PSC F), fly-tipping and sharps (PSC G);
- TVP P&R – northern and western half within a historical gravel pit (PSC E), disused Highways compound in the eastern end (PSC F), fly-tipping and sharps (PSC G), former allotment gardens in south eastern part (PSC H); and
- Flood Compensation West of Kennetmouth – it is understood that the material in the mounds was generated from the Tesco Superstore development and is potentially affected by contamination (PSC I).

- 12.5.6 The following text lists each potential source of contamination identified, together with the assigned relative contamination source importance based on the land use potential to generate contamination.

- PSC A (former railway land and ground level raising) – Contamination Source Importance is Moderate;
- PSC B (former tanks) – Contamination Source Importance is Moderate – it is noted that the Tesco Superstore built in the early 1990s is located on the majority of the former Depot and Tanks;
- PSC C (refuelling station off-site) – Contamination Source Importance is Moderate;
- PSC D (historical landfill) – EA records “semi-inert materials including wood, paper, cardboard, plasterboard and plastic” - Contamination Source Importance is Moderate;
- PSC E (historical gravel pit) – Contamination Source Importance is Moderate;

- PSC F (disused Highways compound) – Contamination Source Importance is Low;
- PSC G (fly-tipping and sharps) – Contamination Source Importance is Low;
- PSC H (allotments) – Contamination Source Importance is Low; and
- PSC I (material from development of Tesco Superstore) – Contamination Source Importance is Moderate.

Potential Contaminants of Concern

- From the available information, the following potential Contaminants of Concern are identified:
- Hydrocarbons (fuels, oils, solvents) – spills and bulk storage
- Poly Aromatic Hydrocarbons – ash and clinker
- Ground Gases – generated by natural Alluvium
- Vapours – could be generated by petroleum impacted soils and waters (worst case localised around the filling station)
- Metals (Arsenic, Cadmium, Chromium, Lead, Mercury) – fill materials of unknown origin
- Inorganic (potentially aggressive ground attacking construction materials) – fill materials of unknown origin
- Asbestos – fill materials of unknown origin

Geology

12.5.7 A summary of the published natural ground conditions from the Phase 1 reports (PBA 2017a and WSP 2016) is presented below: -

- Superficial Geology – Alluvium. The base is typically about 3.5 to 4.0m below ground level (bgl) and described as CLAY and SILT locally peaty or organic with traces of decaying organic matter, flint gravel and shells. Locally with rare layers of peat (up to 2.1m thick).
- Superficial Geology - River Terrace Deposits (RTD). The base is typically about 6.0mbgl and described as SAND and GRAVEL in variable proportion locally with a thin layer of clayey sandy silt
- Solid Geology - White Chalk Subgroup. The base is more than 25.0m bgl and described as White Chalk with flints. Recovered as remoulded chalk with fragments of weak chalk becoming rubbly and blocky with depth.

12.5.8 An extract of the geological map is presented as Figure 12.2 in Appendix G.1.

12.5.9 Superficial Deposits are not recorded across the majority of Zone G (the exception being the very eastern end), the majority of the TVP P&R site (the exception being the eastern end and southern boundary) and the eastern half of Zone F, which includes one of the flood compensation parcels east of Kennetmouth.

12.5.10 Historical records for exploratory holes in Zones C, D and flood compensation area west of Kennetmouth record Made Ground, a number of which have descriptions that include ash and clinker.

12.5.11 A summary of the site-specific ground conditions on Zone D from the Phase 2 report (PBA 2017b) is presented below: -

- Made Ground was encountered at all the locations investigated and was found to comprise principally black, brown and grey SAND with variable proportions of ash and clay and gravel. The gravel size fractions comprised flint, and chalk, and fragments of brick, concrete, glass, clinker and rare cinder. Locally the Made Ground contained cobble size fragments of brick and concrete. The Made Ground was found to be between 1.55 and 2.20 m deep. Olfactory and visual signs of unusual solids and liquids were not noted during the investigation;
- Alluvium was encountered at all the locations where the Made Ground was fully penetrated. The Alluvium was typically found to comprise grey, blue, green and brown CLAY or SILT with sand particles and shell fragments. Locally the Alluvium contained rare flint gravel. Typically, the Alluvium was found to be between about 0.9 and 1.7 m thick extending to between 2.5 and 3.9 m depth, corresponding to reduced levels of between about 32.4 and 35.6 m OD. At one historical borehole (SU77SW310) the Alluvium was found to be 0.2 m thick; and
- The River Terrace Deposits were found to be typically between about 1.5 and 3.6 m thick and locally in the historical borehole (SU77SW81) up to 4.9 m thick. The base of the River Terrace Deposits was encountered between about 5.4 and 8.0 m depth, corresponding to a reduced level of between about 29.5 and 31.9 m OD.

12.5.12 The report also provides the following information: -

- In general, the measured concentrations of potential contaminants are below the selected assessment values appropriate for land use as commercial land use. Asbestos was not detected in any of the 25 soil samples tested.
- The measured concentrations of potential contaminants are in general below the selected assessment criteria for assessing potential groundwater impacts on surface waters and the UK drinking water quality standards.
- The measured concentrations of ground gases indicate slightly elevated concentrations of Carbon Dioxide (maximum recorded concentration of 6.5%v/v) and Methane (maximum concentration of 0.3%v/v) and corresponding depleted oxygen concentrations.

Summary of Baseline Contamination Sources

12.5.13 Potential contamination sources have not been identified on Zones E and F. Without a source of contamination there are no Pollutant Linkages requiring risk assessment.

12.5.14 Potential contamination sources have been identified on the remaining zones (Zones A, B C, D, and G) in the East MRT Scheme, the TVP P&R land and the flood compensation land west of Kennetmouth.

12.5.15 All of the identified historical land uses have been assessed as having a Moderate potential to generate contamination.

12.5.16 Although the site specific ground condition data for Zone D indicates the absence of contamination, the source classification of Moderate has been retained as a worst case assumption that allows for unforeseen ground conditions.

Hydrogeology

12.5.17 Where recorded in the historical borehole records (PBA, 2017a presented in **Appendix G.2**), groundwater strikes were recorded between 1.8 and 4.5 m bgl and rose to between about 0.3 and 2.9 m bgl. During the ground investigation (PBA, 2017b provided as **Appendix G.3**) groundwater was encountered within the Superficial Deposits between 2.0m and 3.6m bgl. On

completion of the fieldwork the recorded groundwater levels were between 1.6m and 2.4m bgl corresponding to reduced level of between about 34.5 and 35.5m OD.

- 12.5.18 The Alluvium and River Terrace Deposits are classified as Secondary A Aquifers. Although the Superficial deposits are not recorded under the majority of Zone G (the exception being the very eastern end), the majority of the TVP P&R site (the exception being the eastern end and southern boundary) and the eastern half of Zone F, which includes one of the flood compensation parcels east of Kennetmouth all the land in both schemes is assessed as having superficial deposits as a worst case assumption.
- 12.5.19 The White Chalk Subgroup which underlies the entirety of combined site is classified as a Principal Aquifer. The White Chalk Subgroup is present at the surface under the majority of Zone G (the exception being the very eastern end), the majority of the TVP P&R site (the exception being the eastern end and southern boundary) and the eastern half of Zone F, which includes one of the flood compensation parcels east of Kennetmouth.
- 12.5.20 The majority of the application site lies within a Source Protection Zone (SPZ) 3 – Total Catchment – the SPZ is associated with abstraction at Reading University situated approximately 2.2km to the south. Although a small part of the western end of Zone G and the TVP P&R scheme are not within the SPZ all the land in both schemes is assessed as being within the SPZ as a worst case assumption.
- 12.5.21 There is an active groundwater abstraction license for the Waterside Centre shown as within the TVP P&R site and approximately 30m north of Zone G. The abstraction identified as Potable. There is one other active license within 1km and a further nine within 2km.

Hydrology

- 12.5.22 Zones D and F are bounded to the north by the River Thames. Zone A is the furthest from the river which is approximately 300m to the north.
- 12.5.23 The River Kennet passes through the application site (Zone E) and joins the River Thames at this location.
- 12.5.24 The River Thames and River Kennet are both classified by the EA as Primary River. Both rivers are identified as Very Good and Good (Grades A and B) Biological and Chemical Quality, respectively. There are no surface water abstraction records within 1km.
- 12.5.25 It is expected that the groundwater in the Alluvium, River Terrace Deposits and the White Chalk Subgroup are in hydraulic continuity with the water in the adjacent rivers.
- 12.5.26 The River Thames and the River Kennet are considered to be highly sensitive controlled water receptors.

Ecological Systems

- 12.5.27 When considering whether an ecological system is a viable receptor requiring assessment the guidance given in Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance (Defra, 2012) has been used. As there are no national and international statutory designations for nature conservation recorded within 2,000m of the site boundary there are no relevant receptors to which significant harm or the significant possibility of such harm could occur. On this basis this receptor is not considered further for contaminated land assessment.
- 12.5.28 It is noted that Zone D and the flood compensation area west of Kennet Mouth are located in a Local Wildlife Site known as “The Coal, Kennetmouth and Kings Meadow East”. For the purposes of this chapter this receptor is identified as being of Low Importance as per the guidance above. Low value receptors will not generate impacts that will be identified as

“Significant”. It should be noted the statement regarding ecological systems does not purport to be an ecological risk assessment.

Property – Crops/Produce and Domestic Animals/Livestock

12.5.29 When considering whether this constitutes a viable receptor requiring assessment the guidance given in Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance (Defra, 2012) has been used.

12.5.30 Neither crops/produce nor domestic animals/livestock are present on or immediately adjacent to the sites. As relevant receptors to which significant harm or the significant possibility of such harm could occur have not been identified this receptor is not considered further.

Property – Buildings (any structure or erection)

12.5.31 When considering whether there are any viable receptors in relation to property that require assessment, the guidance given in Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance (Defra, 2012) has been used. A relevant receptor is one to which significant harm or the significant possibility of such harm could occur.

12.5.32 Whilst it is noted that in the scoping response RBC identified the site as being in an area of local archaeological importance, there are no current international or national building or ancient monument designations identified on or immediately adjacent to the subject sites. It should be noted the statement regarding historic building and ancient monuments does not purport to be a formal assessment.

12.5.33 The future land use will include structures and as such consideration is given to the potential for structural failure, substantial damage or substantial interference with any right of occupation.

Summary of Potential Receptors and Assigned Importance

- The following text summarises the potential receptors considered in this assessment and the assigned sensitivity/value:
- Human Health (Site Users) – Very High
- Human Health (Site Workers) – High
- Shallow Groundwater (Superficial Deposits) – Moderate
- Deep Groundwater (White Chalk Subgroup) – Very High
- Surface Water – Very High
- Property (Buildings) – Low
- Property (Animal or Crop) – Eliminated as a receptor in respect of the baseline assessment but future landscaping is proposed and will be incorporated in the “During Operation” assessment as a receptor of Very Low sensitivity.
- Ecological Systems – although eliminated in Phase 1 for the purposes of the contaminated land assessment, Zone D and the flood compensation land west of Kennet Mouth are located within The Coal, Kennetmouth and Kings Meadow East Local Wildlife Site – and therefore Ecological Systems will be incorporated into this Chapter as a receptor of Low sensitivity.

Risk Assessment for Baseline Conditions

12.5.34 Based on a source-pathway-receptor model, the risks relating to the existing baseline conditions have been assessed in PBA 2017a and 2017b and are summarised in in **Table 12.3**. Criteria for the definition of consequence and likelihood are given in the Phase 1 and Phase 2 ground condition assessment reports (PBA 2017a and 2017b).

Table 12.3: Risk Level for Each Receptor Associated with Land Contamination Baseline Conditions

Receptor	Risk	Justification
Human Health (On Site)	Low	It is assumed that children could access the site, particularly Zone D which is within the local wildlife site. Based on the expected nature and scale of contamination the potential consequence would be Medium. The likelihood of the consequence being realised is considered to be Unlikely given the transient nature of use and limited access to those areas without hardstanding due to dense vegetation.
Human Health (Neighbours)	Low	As above
Groundwater (Shallow)	Low	The Superficial Deposits are designated as Secondary A Aquifers. Based on the expected nature and scale of contamination the potential consequence would be Mild. Leaching is considered possible in areas without hard surfacing and a Low likelihood of the consequence being realised has been assigned. The assignment of Low is justified because there is a pollution linkage and circumstances are possible under which pollution could occur. However, it is by no means certain that even over a longer period such an event would take place, and is less likely in the shorter-term.
Groundwater (Deep)	Moderate	Based on the very high sensitivity/value of the receptor and the expected nature and scale of contamination the potential consequence would be Medium. As there is hydraulic continuity with the overlying aquifer a Low likelihood of the consequence being realised has been assigned. The assignment of Low is justified because there is a pollution linkage and circumstances are possible under which pollution could occur. However, it is by no means certain that even over a longer period such an event would take place, and is less likely in the shorter-term.
Surface Waters	Moderate	Based on the very high sensitivity/value of the receptor and the expected nature and scale of contamination the potential consequence would be Medium. A Low likelihood of the consequence being realised has been assigned because although the receptor is on site/adjacent there is no evidence of direct discharge and run-off is limited by vegetation. The assignment of Low is justified because there is a pollution linkage and circumstances are possible under which pollution could occur. However, it is by no means certain that even over a longer period such an

Receptor	Risk	Justification
		event would take place, and is less likely in the shorter-term.
Property (Buildings)	Low	There are no structures currently present on the Application Site. There is hardstanding, car parking and highways in some areas and where present the potential consequence is assessed as Mild with a Low probability of the consequence being realised.
Property (Animal /Crop)	Very Low	Based on the expected nature and scale of contamination the potential consequence is Mild with the probability of the consequence being realised assessed as Unlikely.
Ecology	Very Low	Based on the expected nature and scale of contamination the potential consequence is assessed as Minor with the probability of the consequence being realised assessed as Unlikely.

12.6 East MRT Site

Embedded Mitigation

- 12.6.1 It is recognised that the development itself will incorporate embedded mitigation measures inherent in the design and also by working within best practice construction guidelines, preventing the release of contamination and therefore negating the majority of the effects.

During Construction

- 12.6.2 Any excavations for the proposed road will result in the removal of a proportion of the ground that may be contaminated, hence resulting in removal of the contamination source. Furthermore, the introduction of hard standing and any imported landscaping soils in parts of the site is likely to limit the contact with the site soils.
- 12.6.3 A CEMP will be prepared, secured by a suitably worded planning condition, for the Proposed Development and this will include specific measures as appropriate, for the protection of controlled waters during construction.
- 12.6.4 Furthermore, the method of construction will include embedded mitigation such as appropriate piling techniques to minimise the risk of mixing of groundwater bodies through the creation of new vertical pathways. This may include the provision of a Foundation Works Risk Assessment (FWRA) which would be undertaken by the contractor once the proposed foundation solutions are known, and the use of EA guidance 'Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination' (EA, 2001). Further embedded mitigation will be incorporated into the outline CEMP to reduce exposure to construction dust and vapour.

Site Workers

- 12.1.1 The risk to site workers during the construction works relates to the risk of skin contact, inhalation and ingestion of contaminated material. In accordance with current health and

safety legislation, the contractor will be required to adopt measures to mitigate the risk to site workers. Such measures will include:

- Informing site workers of the contamination and the potential health effects from exposure through site induction and 'tool box talks';
- The provision of appropriate protective clothing and equipment to be worn by site workers;
- The provision by the contractor of a suitably experienced geoenvironmental engineer either on-call or with a watching brief for the visual and olfactory assessment of the material, and sampling and testing for verification purposes, to adopt measures to manage any unidentified sources of contamination;
- Raising above ground of any temporary accommodation above ground level to allow free ventilation and prevent gas ingress and confined space entry controls including gas monitoring;
- The adoption of good standards of hygiene to prevent prolonged skin contact, inhalation and ingestion of soils during construction; and
- The selection of appropriate methods of working to limit disturbance of contaminated soil, where possible.

Site Users/Neighbours

12.6.5 Measures will be adopted to mitigate the risk to site neighbours associated with air borne or settled dust and gases arising from areas of potentially contaminated land. Such measures will include the selection of appropriate methods to reduce disturbance of the existing near-surface soils, such as the spraying of stockpiles and other large unsealed surfaces to limit the risk of generating air borne dust, and covering of excavated materials undergoing treatment to reduce the release of odours and vapours.

12.6.6 The assessment of dust is covered in detail in **Chapter 10** Air Quality.

Controlled Waters

12.6.7 The principal risk to ground and surface waters during construction will result from the migration of contaminants during enabling works such as the removal of the existing areas of hardstanding and vegetation/top soil clearance and the excavation of soil for the flood compensation. The contractor will be required to adopt measures to mitigate the risk to ground and surface waters associated with contaminated surface water run-off. Such measures will follow the pollution prevention guidelines (CIRIA, 2001).

12.6.8 Any chemicals/fuels introduced to the site during construction will be appropriately stored to prevent uncontrolled release.

12.6.9 Chemical storage locations and stockpiles will be sited away from the river.

12.6.10 Depending on the construction technique used pile foundations may introduce vertical pathways for the migration of contamination. To mitigate this risk, the selection of pile types and the design and construction of pile foundations will be informed by an assessment utilising EA guidance (EA, 2001 - archived). It is expected that a piling risk assessment will be prepared, secured by a suitably worded planning condition

12.6.11 Excavated soils will ideally be reused on-site and will require testing and suitability assessment. This would form part of a site materials and waste management strategy which

would be drafted prior to construction and would focus on the re-use, recycling and reduction of waste spoil.

- 12.6.12 Any additional soil materials that are to be imported to the site will be certified and/or tested in accordance with an agreed earthworks specification to minimise the potential for contaminative materials to be introduced to the site.

Ecology and Wildlife

- 12.6.13 No specific additional measures are required to mitigate potential effects to ecological receptors other than those outlined above and within the Ecology ES Chapter (see **Chapter 14**).

- 12.6.14 During Operation

Site Maintenance Workers

- 12.6.15 Service trenches will be backfilled with suitable materials (without elevated concentrations of contaminants) to minimise the risk to maintenance workers.

Site Users

- 12.6.16 To reduce the potential risk of ingestion and uptake of contaminants by future site users, a layer of clean soil cover will be provided in areas of soft landscaping, if contamination is identified. The depth and form of soil cover required will be agreed with the Local Planning Authority and will depend on the concentrations of the potential contaminants.

Controlled Waters

- 12.6.17 The increased hardcover will reduce the risk associated with infiltration and potential mobilisation/ migration of contaminants.
- 12.6.18 Depending on the type of pile adopted, foundations may introduce pathways for the vertical migration of contamination. To mitigate this risk, the selection of pile types and the design and construction of pile foundations will be informed by an assessment utilising EA guidance (EA, 2001 - archived).
- 12.6.19 The principal risk to soils and controlled waters following construction will result from the potential migration of pollutants associated with uncontrolled/accidental spillages or discharges from the development activities. Measures will be proposed to mitigate against such risk and will follow best practice, such as the use of spill response kits, trapped gulley's, interceptors etc.

Ecology and Wildlife

- 12.6.20 The measures to mitigate the risk to offsite users, ground and surface waters described above will effectively mitigate the risk to ecology and wildlife. The detailed design will include the provision of a suitable thickness of a growing medium in landscaping areas to allow the establishment of plants.

Built Environment

- 12.6.21 The appropriate design of concrete and in ground materials will be specified as part of detailed design and will be sufficient to mitigate the risks of chemical attack and permeation during the lifetime of the completed development.
- 12.6.22 The detailed design will include consideration of potential unstable ground (compressibility) issues to address both total and differential settlement.

Potential Effects

- 12.6.23 The features of the proposed development that are relevant to the assessment of the effects in relation to ground contamination are those that would change the baseline risk associated with a pollutant linkage.
- 12.6.24 The potential effects without any mitigation for the construction phase and the operational phase have been assessed through the continued use of a source-pathway-receptor model.
- 12.6.25 The approach adopted is to identify the risk to each receptor and use Table 12.1 to assign a potential effect based on the identified risk relative to the baseline risk.

Potential Effects During Construction

- 12.6.26 The risks related to the construction phase have been assessed and are presented in **Table 12.4** below with respect to each of the potential receptors identified unless the receptor is eliminated for this phase.
- 12.6.27 The in-ground elements considered during the construction phase are those that are temporary in duration. The permanent placement of the imported materials for ground level raising and piled foundations for the viaduct element are permanent and considered during the operational phase.
- 12.6.28 During construction phase, contamination could be introduced to the site through spillages or losses from temporary chemical/ fuel storage. Any contamination generated in this way is expected to be localised and relatively small scale compared with the potential historical contamination. Furthermore, it is expected that the work will be carried out in accordance with current guidance for construction activities with spill response kits, trapped gulley's, interceptors etc. As such, the assessment does not consider these as separate sources.
- 12.6.29 The construction phase will include enabling works involving vegetation clearance and where necessary top soil removal. In addition, the flood compensation land to the west of Kennetmouth requires a cut (the excavation) of 3,845m³ and the compensation areas in Zone F requires a cut (the excavation) of approximately 600m³.
- 12.6.30 It should be noted that the consequence element of the risk assessment is the same for baseline and for the subsequent phases of development. Only the likelihood (or probability) of the consequence occurring changes. During the construction phase the work will introduce potential contamination sources (temporary refuelling storage) and remove any surface covering exposing the existing ground.

Table 12.4: Construction Phase Risks and Potential Effects (without further mitigation)

Receptor	Assessed Risk	Justification	Potential Effect
Human Health – (Construction Workers) Onsite	Moderate	During construction phase access is restricted. The work will be carried out following the requirements in a Construction Environmental Management Plan (CEMP).	Negligible

Receptor	Assessed Risk	Justification	Potential Effect
		The contractor will be required to adopt measures to mitigate the risk to site workers. Such measures will include: • Informing site workers of contamination • The provision of appropriate protective clothing • The provision of a suitably experienced geoenvironmental engineer • Raising temporary accommodation above ground level to allow free ventilation • The adoption of good standards of hygiene The selection of appropriate methods of working to limit disturbance of contaminated soil, where possible.	
Human Health – Neighbour	Moderate	The probability of an event is increased for some pathways on the basis that the soils will be exposed and there will be greater migration potential. However, the work will be carried out following the requirements and mitigation measures in a CEMP; and The selection of appropriate methods of working to limit disturbance of contaminated soil, where possible.	Negligible
Groundwater Shallow Aquifer	Moderate	The probability of an event is increased to High on the basis that the soils will be exposed allowing greater infiltration and the possibility of leaching. However, the work will be carried out following the requirements in a CEMP; and the selection of appropriate methods of working to limit disturbance of contaminated soil, where possible. The selection of pile types and the design and construction of pile foundations will be informed by an assessment utilising EA guidance. Measures will be proposed to mitigate against potential migration of pollutants	Negligible

Receptor	Assessed Risk	Justification	Potential Effect
		associated with uncontrolled/accidental spillages or discharges from the construction activities.	
Groundwater Deep Aquifer	High	As above.	Negligible
Surface waters	High	As above	Negligible
Property – Buildings	N/A	Currently no structures on the site	N/A
Ecology	Low	As above	Negligible

Operational Phase

12.6.31 The risks related to the development during the operational phase without the implementation of mitigation have been assessed and are presented in **Table 12.5** with respect to each of the potential receptors identified.

Table 12.5: Operational Phase Risks and Potential Effects (without mitigation)

Receptor	Assessed Risk	Justification	Potential Effect
Human Health – onsite	Moderate	The assessed risk is the same as baseline.	Negligible
Human Health – offsite	Low	The assessed risk is the same as baseline.	Negligible
Groundwater – Shallow Aquifer	Low	The assessed risk is the same as baseline for areas of landscaping. For areas of additional hardstanding the potential for infiltration and leaching is reduced and this decreases the likelihood of a pollution event.	Negligible
Groundwater – Deep Aquifer	Moderate	The selection of pile types and the design and construction of pile foundations following the EA guidance will mitigate against the potential for migration of contaminants from the near surface soils to the aquifer at depth.	Negligible
Surface Waters	Moderate	The CSM is the same as that for the baseline.	Negligible
Ecology	Very Low	The CSM is the same as that for the baseline.	Negligible
Property – Buildings	Low	The CSM is the same as that for the baseline.	Negligible

Receptor	Assessed Risk	Justification	Potential Effect
Property – Animal and Crops	Very Low	The CSM is the same as that for the baseline.	Negligible

Further Mitigation and Enhancement

- 12.6.32 The measures proposed to mitigate the identified potential effects of the proposed East MRT scheme related to land contamination are discussed in this section with respect to potential receptors.
- 12.6.33 Further ground investigation will be required as part of the geotechnical design of the Scheme. Any requirement to carry out further site wide geoenvironmental intrusive investigation can be satisfactorily dealt with by incorporation as a condition in any granted Planning Consent and carried out as part of the geotechnical investigation for the Scheme.
- 12.6.34 The information provided by future ground investigations will assist in confirming the nature of the ground conditions at the other parts of the site. Following any additional ground investigations the Conceptual Site Model, and the risk assessments, will be reviewed and if necessary refined. This will enable any remediation or specific mitigation measures in respect of land contamination to be developed and agreed with the regulatory authority and implemented. It is a presumption that all construction activity will commence after full ground investigation has been carried out, in accordance with good practice, statutory controls and in order to meet the intended end use.
- 12.6.35 There is a possibility that sources of contamination may be encountered during the site clearance or ground works that have not been identified to date. Should visual and olfactory examination of any unusual solid materials or liquids encountered during the following construction works identify areas of contamination, specific management procedures will be adopted. These procedures will allow for the short-term storage of the suspected material in stockpiles and/or storage tanks while verification testing for potential contamination is carried out. The storage area will be contained to minimise the potential for contamination to migrate and affect other areas of the site. Once the nature, location and extent of the contamination have been identified appropriate remediation or mitigation measures will be adopted and agreed with the statutory authorities. Although these cannot be identified at this time the main emphasis will be on methods of isolating or treating the affected materials.
- 12.6.36 At this stage specific measures are not required to mitigate potential effects other than those outlined in the embedded mitigation above.

Residual Effects (after further mitigation)

- 12.6.37 The likely risks with mitigation for construction phase and operation phase have been re-assessed through the continued use of a source-pathway-receptor model and a revised CSM. The approach adopted is to identify the risk to each receptor and use **Table 12.1** to assign a residual effect based on the assessed risk post mitigation relative to baseline risk.

During Construction

- 12.6.38 The risks related to the construction phase have been assessed and are presented in **Table 12.6** below with respect to each of the potential receptors identified.

Table 12.6: Construction Phase Risks with Mitigation and Residual Effects

Receptor	Assessed Risk	Justification	Residual Effect
Human Health	Low	Further mitigation measures are not required	Negligible
Groundwater – Shallow Aquifer	Very Low	Further mitigation measures are not required	Negligible
Groundwater – Deep Aquifer	Low	Further mitigation measures are not required	Negligible
Surface Waters	Low	Further mitigation measures are not required	Negligible
Ecology and Wildlife	Very Low	Further mitigation measures are not required	Negligible
Built Environment	-	Receptor not present	-

During Operation

12.6.39 The risks to each of the potential receptors identified during the operational phase have been assessed and are presented in **Table 12.7**.

Table 12.7: Operational Phase Risks with Further Mitigation and Residual Effects

Receptor	Assessed Risk	Justification	Residual Effect
Human Health – onsite	Low	The risk is the same as Baseline. Although the scheme will increase the number of people accessing the site there is an increase in hardstanding and covering created by the imported materials which reduces potential for exposure to the underlying soils.	Negligible
Human Health – offsite	Low	The risk is the same as Baseline.	Negligible
Groundwater – Shallow	Very Low	The increase in hardstanding and covering created by the imported materials reduces the potential for exposure, infiltration and leaching and therefore the probability of the consequence being realised is reduced. Further intrusive investigation will be undertaken to ascertain actual	Negligible

Receptor	Assessed Risk	Justification	Residual Effect
		ground conditions. If contamination is identified with the potential to cause harm to Controlled Water, remediation involving the selective removal of impacted land will reduce contaminant loads causing a permanent benefit.	
Groundwater – Deep	Low	The proposed mitigation for pile design will be protective of the Chalk aquifer. The increase in hardstanding and covering created by the imported materials reduces the potential for exposure, infiltration and leaching and therefore the probability of the consequence being realised is reduced. Further intrusive investigation will be undertaken to ascertain actual ground conditions. If contamination is identified with the potential to cause harm to Controlled Water, remediation involving the selective removal of impacted land will reduce contaminant loads causing a permanent benefit.	Negligible
Surface Waters	Low	The increase in hardstanding and covering created by the imported materials reduces the potential for exposure, infiltration and leaching and therefore the probability of the consequence being realised is reduced. Further intrusive investigation will be undertaken to ascertain actual ground conditions. If contamination is identified with the potential to cause harm to Controlled Water, remediation involving the selective removal of impacted land will reduce contaminant loads causing a permanent benefit.	Negligible
Ecology and Wildlife	Very Low	As a minimum the situation would be the same as baseline. The proposed mitigation in landscaped areas would remove the risk	Negligible

Receptor	Assessed Risk	Justification	Residual Effect
Built Environment	Very Low	The proposed mitigation would remove the risk.	Negligible

12.7 Combined Site (East MRT and Thames Valley Park & Ride)

- 12.7.1 Based on current programme information the advance works for the East MRT scheme (utility diversion and enabling works such as vegetation clearance) will overlap with the end of the construction phase of the TVP P&R scheme.
- 12.7.2 The TVP P&R scheme will be operational during the construction works for the East MRT scheme.

Potential Effects

- 12.7.3 There are no additional potential effects identified for the combined site scenario.

Mitigation and Enhancement

- 12.7.4 There are no additional mitigation or enhancement measures identified for the combined site scenario.

Residual Effects

- 12.7.5 There are no additional residual effects identified for the combined site scenario.

12.8 Monitoring

- 12.8.1 Residual Adverse effects have not been identified, therefore monitoring is not required.

12.9 Cumulative Effects

- 12.9.1 The search of planning applications within the last 3 years using a 1 km radius of the proposed development (as detailed in Chapter 5) returned 29 results, of which 15 are not considered further on the basis that they are for change or use, refurbishment or conversions which either do not include ground disturbance or only minor disturbance. Of the remaining 13 applications 7 are situated at least 0.5 km from the application site and which is considered to be beyond the zone influence for contamination migration for the proposed residential end use.
- 12.9.2 Application 170509 is for a development situated about 0.3 km to the south-west of the application site for the demolition of existing retail units and the construction of multi-story residential development. This application is supported by an intrusive ground investigation and Phase 1 and 2 Ground Condition Assessment.
- 12.9.3 The other proposed developments are situated within the Suttons Business Park. Applications 152354, 161666, 162736 and 171903 are for a development situated approximately between 0.1 and 0.2km southwest of the application site. All of the developments are related to

commercial redevelopments. The applications are supported by intrusive ground investigations and Phase 1 and 2 Ground Condition Assessments.

- 12.9.4 An assessment of the effects of the application scheme with other committed schemes has been undertaken with respect to ground conditions. Given the application scheme has similar geological conditions, the risks both in terms of uncontrolled spillages of fuels etc. during construction and occupation are also present to these developments. Additionally, the planning permissions will have conditions attached requiring appropriate measures to mitigate any potentially adverse ground conditions effects.
- 12.9.5 It is assumed that similar mitigation measures will be incorporated for the developments and as such the effects associated with the redevelopment of the neighbouring sites are considered unlikely to alter the level of the effects identified above.
- 12.9.6 Provided the appropriate mitigation measures recommended are adhered to, the cumulative effects to the environment related to all phases of the development in respect of land contamination are likely to be beneficial to the area.

12.10 Summary

- 12.10.1 An assessment of the ground conditions has been undertaken to identify the likely significant effects of the proposed development on human and non-human receptors in relation to ground contamination.
- 12.10.2 The approach adopted for the identification of potential effects associated with ground conditions is to compare an estimated risk associated with the proposed development (considering separately the Construction Phase and Operational Phase (including any embedded mitigation in each phase)) with the corresponding estimated risk associated with the existing baseline conditions.
- 12.10.3 For a risk to exist there needs to be one or more hazard – pathway – receptor linkages. The potential contamination sources are identified from a review of information on land use. The importance of the land use in terms of anticipated magnitude and extent of contamination is classified in one of five bands with a Very High classification associated with land uses such as hazardous waste landfill sites. The classification can be revised when there is site specific data on ground conditions which there is for part of the Application Site. Parts of the application site are located on brownfield land which at worst are considered to have a Moderate potential for contamination to be present based on historical land use.
- 12.10.4 The receptors considered in the assessment are those receptors identified in statutory guidance (DEFRA, 2012). The importance of the receptor is classified in one of five bands with a Very High classification associated with receptors of national or international importance. Human health, groundwater and the Chalk aquifer and surface waters have all been identified as receptors of high importance/sensitivity.
- 12.10.5 The proposed development can change (increase) the risk associated with ground conditions for a particular pollutant linkage by increasing the probability of a consequence occurring due to the creation of exposure pathways. The proposed development can also impact ground conditions through the introduction of potential sources of contamination such as mobile refuelling facilities.
- 12.10.6 Provided that mitigation measures are adopted the potential effect on sensitive receptors is assessed to be Negligible. Some minor beneficial effects are likely to be realised associated with a reduction in contaminant load if remediation is undertaken. It is considered that cumulative potential adverse effects with respect to ground conditions are not significant. A summary table of effects for the scheme that are related to ground conditions is presented in Table 12.11 below.

Summary Table of Effects

Receptor	Sensitivity	Effect	Magnitude /Spatial extent	Likelihood of Occurrence	Embedded Mitigation	Significance of Effect	Further Mitigation (if required)	Residual Significance of Effect
Construction/demolition								
Human Health (Construction Workers)	High	Moderate	Localised	n/a	See Sections 12.6.2 to 12.6.5	Negligible	None required	Negligible
Human Health (Neighbouring Residents)	Very High	Moderate	Localised	n/a	See Sections 12.6.2 to 12.6.7	Negligible	None required	Negligible
Groundwater (Shallow)	Moderate	Low	Site-wide	n/a	See Sections 12.6.2 to 12.6.4 and 12.6.8 to 12.6.13	Negligible	None required.	Negligible
Groundwater (Deep)	Very High	Moderate	Site-wide	n/a	See Sections 12.6.2 to 12.6.4 and 12.6.8 to 12.6.13	Negligible	None required	Negligible
Surface waters	Very High	Moderate	Site-wide	n/a	See Sections 12.6.2 to 12.6.4 and 12.6.8 to 12.6.13	Negligible	None required	Negligible
Ecology	Low	Low	Site-wide	n/a	See Sections 12.6.2 to 12.6.4 and 12.6.14	Negligible	None required	Negligible

Receptor	Sensitivity	Effect	Magnitude /Spatial extent	Likelihood of Occurrence	Embedded Mitigation	Significance of Effect	Further Mitigation (if required)	Residual Significance of Effect
Operation/maintenance								
Human Health (Future Occupiers)	Very High	Moderate	Localised	n/a	See Sections 12.6.15 to 12.6.16	Negligible	None required.	Negligible
Human Health (Neighbouring Residents)	Very High	Low	Localised	n/a	See Sections 12.6.15 to 12.6.16	Negligible	None required	Negligible
Groundwater (Shallow)	Moderate	Low	Site-wide	n/a	See Sections 12.6.17 to 12.6.19	Negligible	None required	Negligible
Groundwater (Deep)	Very High	Moderate	Site-wide	n/a	See Sections 12.6.17 to 12.6.19	Negligible	None required	Negligible
Surface Waters	Very High	Moderate	Site-wide	n/a	See Sections 12.6.17 to 12.6.19	Negligible	None required	Negligible
Property (Buildings)	Low	Low	Localised	n/a	See Sections 12.6.21 to 12.6.22	Negligible	None required	Negligible
Ecology	Low	Low	Site-wide	n/a	See Sections 12.6.20	Negligible	None required	Negligible

13 Landscape and Visual, including Lighting

13.1 Introduction

- 13.1.1 This chapter provides a landscape and visual baseline report and impact assessment of the proposed East MRT scheme and the TVP P&R.
- 13.1.2 The Landscape and Visual Impact Assessment (LVIA) identifies and assesses the negative and positive effects and significance of change arising from the proposed development on the landscape as an environmental resource in its own right and on people's views and visual amenity.
- 13.1.3 The Landscape Institute / Institute of Environmental Management and Assessment 'Guidelines for Landscape and Visual Impact Assessment', (3rd Edition, 2013) notes in paragraph 1.17, page 9, in reference to the European Union Directive 2011/92/EU:
- "The Directive is clear that the emphasis is on the identification of likely significant environmental effects. This should embrace all types of effect and includes, for example, those that are positive/beneficial and negative/adverse, direct and indirect, and long and short term, as well as cumulative effects. Identifying significant effects stresses the need for an approach that is in proportion to the scale of the project that is being assessed and the nature of its likely effects. Judgement needs to be exercised at all stages in terms of the scale of investigation that is appropriate and proportional. This does not mean that effects should be ignored or their importance minimised but that the assessment should be tailored to the particular circumstances in each case."*
- 13.1.4 The LVIA has been carried out by chartered landscape architects at PBA, a registered practice with the Landscape Institute and a corporate member of the Institute of Environmental Management and Assessment (IEMA). In accordance with Regulation 18(5) of the Town and Country Planning (Environmental Impact Assessment) Regulations 2017, as amended, a statement outlining the relevant expertise and qualifications of competent experts appointed to prepare this Environmental Statement (ES) is provided in **Appendix A.5**.

13.2 Legislation, Policy Context, Guidance and Professional Standards

- 13.2.1 **Chapter 6** sets out legislation and policy context in detail, in relation to the proposed development. In summary, the following policies and professional standards have been referred to in preparing this LVIA. **Figure 12.1, Appendix H.6** illustrates the landscape planning designations applicable to the site and surrounding area.

National Planning Policy Framework, 2018

- 13.2.2 The Revised NPPF was published on 24th July 2018 (NPPF18).
- 13.2.3 The NPPF18 seeks to achieve sustainable development, through the planning system's three overarching economic, social, and environmental objectives. Of particular relevance to landscape/townscape and visual matters is the environmental objective, to "*contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently...*" (**NPPF 2018, Paragraph. 8.c**). Elements relevant to the proposed development, site and associated townscape and visual matters are set out below.

Healthy Communities: Green Infrastructure, Open Spaces and Recreation

- 13.2.4 Paragraph 91 requires planning policies and decisions to achieve healthy, inclusive and safe places which: "*a) promote social interaction...; b) are safe and accessible... for example*

through the use of clear and legible pedestrian routes and high quality public space, which encourage the active and continual use of public areas; c) enable and support healthy lifestyles... for example through the provision of safe and accessible green infrastructure, sports facilities... allotments and layouts that encourage walking and cycling.”

- 13.2.5 **Paragraph 98** states that planning policies and decisions should: “*protect and enhance public rights of way and access, including taking opportunities to provide better facilities for users, for example by adding links to existing rights of way networks including National Trails.*”

Achieving Well-Designed Places

- 13.2.6 **Paragraph 127** of NPPF18 requires planning policies and decisions to ensure that developments: “*a) will function well and add to the overall quality of the area, not just for the short term but over the lifetime of the development; b) are visually attractive as a result of good architecture, layout and appropriate and effective landscaping; c) are sympathetic to local character and history, including the surrounding built environment and landscape setting, while not preventing or discouraging appropriate innovation or change (such as increased densities)... e) optimise the potential of the site to accommodate and sustain an appropriate amount and mix of development (including green and other public space)...; f) create places that are safe, inclusive and accessible and which promote health and well-being, with a high standard of amenity for existing and future users...*”.

Conserving and Enhancing the Natural Environment

- 13.2.7 **Paragraph 170** of NPPF18 sets out how planning policies and decisions should contribute to and enhance the natural and local environment. Elements relevant to this project include:

“a) protecting and enhancing valued landscapes, sites of biodiversity or geological value and soils (in a manner commensurate with their statutory status or identified quality in the development plan);

b) recognising the intrinsic character and beauty of the countryside, and the wider benefits from natural capital and ecosystem services – including the economic and other benefits of the best and most versatile agricultural land, and of trees and woodland.”

Planning Practice Guidance, 2014

- 13.2.1 The UK Government’s Planning Practice Guidance (PPG) (March, 2014) for England remains in place until it is revised following publication of NPPF18. The PPG presents specific guidance on light pollution in Paragraphs 001 – 006 of ID 31. **Table 12.1** sets out how these paragraphs are relevant to the impact assessment of the development, and how each has been considered.

Table 13.1: Review of National Planning Policy Guidance ID31

NPPG ID 31 Paragraph	Relevance to the development
Paragraph 1: When is light pollution relevant to planning? (Reference ID: 31-001-20140306)	There is potential for light from the proposed development to be obtrusive to people and wildlife or detract from the enjoyment of the night sky. Therefore, obtrusive light from the proposed development has been considered further within this assessment.
Paragraph 2: What factors should be considered when assessing whether a development	This assessment considers where, when and how the light shines as the development has the potential to adversely affect the use or enjoyment of nearby buildings or open spaces.

NPPG ID 31 Paragraph	Relevance to the development
proposal might have implications for light pollution? (Reference ID: 31-002-20140306)	The assessment considers the impact of artificial light on sensitive receptors.
Paragraph 3: What factors are relevant when considering where light shines? (Reference ID: 31-003-20140306)	This assessment considers the potential for light intrusion effecting receptors outside the site boundary which can lead to annoyance to people, compromise existing dark landscapes and affect natural systems.
Paragraph 4: What factors are relevant when considering when light shines? (Reference ID: 31-004-20140306)	This assessment considers the potential effects of when lighting is required for the proposed development. This can minimise obtrusive light that can affect wildlife and enjoyment of the night sky.
Paragraph 5: What factors are relevant when considering how much the light shines? (Reference ID: 31-005-20140306)	This assessment considers the minimum requirements to construct and operate the proposed development safely and securely. The Environmental Zone of the site is established to provide there is an appropriate level of lighting for the ambient lighting conditions. Due to the type of development, attention should be given to particular groups (e.g. the safety of pedestrians and cyclists).
Paragraph 6: What factors are relevant when considering possible ecological impact? (Reference ID: 31-007-20140306).	This assessment specifically considers the effects obtrusive lighting may have on wildlife.

Local Policy: Development Plan

Reading Borough Council

Core Strategy (adopted January 2008, altered January 2015), Reading Borough Council

- 13.2.2 **Policy CS7: Design and the Public Realm** states that all development “*must be of high design quality that maintains and enhances the character and appearance of the area of Reading in which it is located*”. Reference is made in this policy to landscape design, the requirement to positively contribute to character and quality of the public realm, to create safe and accessible environments, and for development to be visually attractive as a “*result of good high quality built forms and spaces, the inclusion of public art and appropriate materials and landscaping*”.
- 13.2.3 **Policy CS8: Waterspaces** requires development in the vicinity of waterways, which is deemed to be acceptable, to provide “*appropriate, attractive uses and buildings that enhance the relationship of buildings, spaces and routes and creates a high quality public realm*” as well as positive contribution to the appearance, landscape and character of waterways.

- 13.2.4 **Policy CS28: Loss of Open Space** states that “*Development proposals that will result in the loss of open space or jeopardise its use or enjoyment by the public will not be permitted.*” The policy notes that in exceptional circumstances, development will be permitted where improvements are made to recreational facilities on the remaining open space, and which outweigh the loss of open space. The policy seeks to protect the quality of existing open space.
- 13.2.5 **Policy CS34: Pollution and Water Resources Development** details that development will only be permitted where: “it will not be damaging to the environment through air, land, noise or light pollution”. Proposals for development that are sensitive to the effects of air, noise or light pollution will only be permitted in areas where they will not be subject to high levels of such pollution, unless adequate mitigation measures are provided to minimise the impact of such pollution.
- 13.2.6 Part of the site lies within a designated **Major Landscape Feature**, and is therefore subject to **Policy CS37: Major Landscape Features and Open Space**. This policy states that planning permission will not be granted for development which would “*detract from the character or appearance of areas designated as a Major Landscape Feature*”. The policy seeks to maintain and enhance the visual amenity and natural beauty of the Borough’s open space and landscape areas, and to resist development which results in the loss of existing landscape features or which detracts from character or appearance.
- 13.2.7 **Policy CS38: Trees, Hedges and Woodlands** protects trees, groups of trees, hedges and woodlands from damage or removal. The policy seeks to increase the extent of vegetation cover in the Borough, and to retain and improve the quality of waterside vegetation with reference to its contributions to ecology and landscape character.

Reading Central Area Action Plan (adopted January 2009)

- 13.2.8 **Policy RC14d: Public Realm – King’s Meadow and Coal Woodland** is identified as an Important Area of Public Open Space, which will be protected from development. The policy states: “*...Proposals adjacent to these areas will ensure that access is maintained and, where appropriate, enhanced*”. In addition, the policy requires new development within the central area to include imaginative uses of open space and the public realm, new trees and other planting. Development adjacent or in proximity to waterways is required to “*retain and not impede existing or continuous public access to and along the waterways*”.

Sites and Detailed Policies Document (adopted October 2012, altered January 2015), Reading Borough Council

- 13.2.9 **Policy DM4: Safeguarding Amenity** states that “*Development will not cause a significant detrimental impact to the living environment of existing or new residential properties, in terms of...: Artificial lighting...*”.
- 13.2.10 **Policy DM17: Green Network** includes reference to Local Wildlife Sites (LWS) and requires new development to demonstrate how landscaping is arranged to maintain or link into the existing Green Network.
- 13.2.11 **Policy DM18: Trees** requires new development to improve the level of tree coverage in the Borough, and as well as providing for new tree planting it makes reference to the retention of existing trees.
- 13.2.12 **Policy SA16: Public and Strategic Open Space** protects public recreational open space areas, which are designated as Important Areas of Public and Strategic Open Space, from development.

Managing Development Delivery (MDD) Local Plan (adopted February 2014)

- 13.2.13 **Policy CC03: Green Infrastructure, Trees and Landscaping** refers to the need for development proposals to “...*protect and enhance the Borough’s Green Infrastructure networks, including the need to mitigate potential impacts of new development...*”. In addition, the policy requires a development scheme to integrate with adjoining public open space, and to protect and retain existing trees, hedges and other landscape features. Development schemes need to incorporate “*high quality, ideally, native planting and landscaping as an integral part of the scheme*”.
- 13.2.14 Landscape character, its condition and features that contribute to the landscape, is protected by **Policy TB21: Landscape Character**. The policy requires proposals to demonstrate how they have addressed landscape quality, strategy, sensitivity and key issues identified in the Council’s Landscape Character Assessment.

LED street lighting project

- 13.2.15 RBC has received £6.9m from the Department of Transport’s Challenge Fund towards a programme to upgrade the street lighting in the borough to use energy efficient LED lighting. From April 2016 to March 2018 they replaced 11,329 non-LED street lights, 2,533 old or incompatible columns and 2,578 sign lights. They will also replace 890 powered bollards with solar bollards.

Local Transport Plan 3

- 13.2.16 RBC’s Local Transport Plan 3 (LTP3) covers the period of 2011 – 2026. Within LTP3 it is detailed that the Council seeks to enhance the security of the public realm through lighting, design and other measures.

Wokingham Borough Council

Core Strategy (adopted January 2010), Wokingham Borough Council

- 13.2.17 In **Policy CP1: Sustainable Development**, development proposals are required to “1) *Maintain or enhance the high quality of the environment...*”; “2) *minimise the emission of pollutants into the wider environment*” and to “...10) *Provide attractive, functional, accessible, safe, secure and adaptable schemes.*”

Sustainable Design and Construction: Supplementary Planning Document (SPD) (May 2010)

- 13.2.18 The SPD contains ‘Sustainability Issue 9: Air, Noise and Light Pollution and Land Affected by Contamination’ which states:
- “Where significant impacts from pollution to or from the proposed development is likely or probable, an assessment of existing levels of pollution will be required to be submitted alongside the planning application”.
- 13.2.19 The existing levels of light pollution are to be addressed through this lighting assessment for the proposed development.
- 13.2.20 Measures to reduce light pollution are discussed within the SPD including:

- provision of lighting only where necessary;
- directing light downward, minimising the upward spread of light beyond horizontal;
- ensuring the main beam angle of lights - directed towards a potential observer - is below 70 degrees;
- uniform lighting, avoiding bright and dark spots which interfere with visibility and can cause glare; and
- ensuring lighting systems are energy efficient, by considering energy demand and automated controls.

Managing Development Delivery Local Plan

13.2.21 The Managing Development Delivery (MDD) local plan was adopted in 2014. There are no specific policies relating to lighting.

Appendix 3 of the MDD Local Plan refers to strategic transport projects indicated on Figure 24 of the Local Transport Plan, which includes a proposed highway scheme connecting west into Reading Borough from Thames Valley Park and the proposed Park & Ride facility. Supporting text to Policy SAL09 of the MDD Local Plan (Paragraphs 4.68-4.69) requires development proposals to have regard to the 'Cross Town Link' proposals from Thames Valley Park being pursued by RBC.

Local Transport Plan 3

13.2.22 WBC's Local Transport Plan 3 (WBC LTP3) covers the period of 2011 – 2026 providing details on how the Council intend to improve transport and accessibility over the next fifteen years.

13.2.23 Policy HW9 Street lighting of WBC LTP3 states;

- *"The Council will consider changes to street lighting provision to make them more environmentally friendly without jeopardising the safety of residents"*

13.2.24 The Council will seek to obtain funding to replace outdated lanterns in the Borough with more cost-efficient and environmentally friendly replacements and use the savings to generate funding for replacing old lighting columns. The Council will also work to continue to insist that all new development has remotely monitored street lighting. This enables street lights to achieve energy savings and still provide appropriate levels of lighting.

Part-Night Lighting

13.2.25 WBC has rolled out a "Part-night Lighting" scheme where in which certain street lights are switched off between 0:30am and 5:30am. As part of this scheme, the Council is also upgrading older street lights to use more energy efficient equipment and white lighting (LED's).

Lighting Guidance

13.2.26 Relevant guidance on obtrusive light, ecology and British Standards has been set out below and is considered as part of the Lighting Assessment.

Obtrusive Light

13.2.27 Guidance on obtrusive light is set out within the following guidance documents:

- The Institution of Lighting Professionals (ILP) Guidance Notes for the Reduction of Obtrusive Light, 2011; and
- ILP Professional Lighting Guide 04: Guidance on Undertaking Environmental Lighting Impact Assessments, 2013.

Ecological

13.2.28 Guidance on obtrusive light in relation to bats as issued by the Bat Conservation Trust is listed below:

- Guidance Note 08/18: Bats and artificial lighting in the UK (September, 2018);
- Statement on the Impact and Design of Artificial Light on Bats (May, 2011);
- Landscape and Urban Design for Bats and Biodiversity (2012); and
- Artificial Lighting and Wildlife Interim Guidance: Recommendations to Help Minimise the Impact of Artificial Lighting (2014).

British Standards

13.2.29 BS EN 5489-1:2013 Code of Practice for the design of road lighting – Part 1: Lighting of roads and public amenity areas: Lighting of roads and public amenity areas - defines lighting classes for road lighting aimed at the visual needs of road users, and it considers environmental aspects of road lighting.

13.2.30 Two standards have been used for the lighting design of the proposed development: British Standard EN 5489-1:2013 class C3, for the road junction and car park aspect of the development, and British Standard EN 5489-1:2013 class P5 for the MRT footway/ cycleway lighting.

Professional Standards

13.2.31 The methodology for the LVIA is based on professional experience and the **Landscape Institute / Institute of Environmental Management and Assessment 'Guidelines for Landscape and Visual Impact Assessment' (3rd Edition, 2013)** (GLVIA3).

13.2.32 In accordance with **GLVIA3**, the LVIA considers the effects on landscape (including landscape character) and people's views / visual amenity as separate assessment components. The LVIA has been undertaken with an emphasis on the identification of **likely significant** landscape and visual effects which arise as a result of the Proposed Development, using an approach which is in proportion to the project and nature of likely effects.

13.2.33 In addition, the LVIA methodology takes into account relevant principles set out in the following Natural England and Landscape Institute guidance and technical notes:

- **An Approach to Landscape Character Assessment** (Natural England, Second Version March 2018) https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/691184/landscape-character-assessment.pdf; and
- **LI Technical Information Note 08/2015: Landscape Character Assessment** (LI, February 2016) https://www.landscapeinstitute.org/wp-content/uploads/2016/01/Landscape-Character-Assessment-TIN-08_15-20160216.pdf; and
- **LI Advice Note 01/11 Photography and Photomontage in Landscape and Visual Impact Assessment** (LI, 2011)

<https://www.landscapeinstitute.org/PDF/Contribute/LIPhotographyAdviceNote01-11.pdf>
and its emerging update, Technical Guidance Note, Public Consultation Draft 2018-06-01
<https://www.landscapeinstitute.org/wp-content/uploads/2018/06/draft-tin-2018-XX-photography-photomontage-lvia.pdf>

13.3 Consultation

- 13.3.1 A Scoping Report was submitted to Reading Borough Council and Wokingham Borough Council in 2018, which included an outline of the proposed scope and methodology for the LVIA. A copy of the EIA Scoping Opinion is provided in **Appendix A.8**. A schedule of responses to the Scoping Opinion is provided in **Appendix A.9** to demonstrate where comments have been considered within the LVIA.
- 13.3.2 Prior to the Scoping Report, agreement to the proposed locations of viewpoints for the visual impact assessment was sought from officers at Reading Borough Council and Wokingham Borough Council in April 2017.
- 13.3.3 A response confirming no comment and that the viewpoint locations looked ok, was received on 2nd May 2017 from Reading Borough Council. To date, no response has been received from Wokingham Borough Council in regard to view locations for the LVIA. Details of other consultations are set out in **Chapter 5** and **Appendix A.9**.

13.4 Methodology

- 13.4.1 The PBA methodology used for undertaking the LVIA is set out in detail at **Appendix H.1**. It is based on **GLVIA3**, combined with our professional experience and judgement. The methodology includes details about baseline data collection and the detailed method of assessment.
- 13.4.2 The assessment of landscape and visual effects aims to be as objective as possible, however, as explained in **GLVIA3**:

“Professional judgement is a very important part of LVIA. While there is some scope for quantitative measurement of some relatively objective matters, for example the number of trees lost to construction... much of the assessment must rely on qualitative judgements, for example about what effect the introduction of a new development or land use change may have on visual amenity, or about the significance of change in the character of the landscape and whether it is positive or negative.”

(Paragraph 2.23, page 21, **GLVIA3**)

- 13.4.3 The LVIA has been based on the proposals described in **Chapter 3** of this ES and the application plans, including those in **Appendix A.3**.
- 13.4.4 The assessment of effects makes comparison with the baseline year **2018**, during which time the visual survey was carried out. Baseline conditions for the site are unlikely to change materially up to 2020..
- 13.4.5 This chapter considers effects of the proposed development on:
- landscape character, within which the site is located;
 - landscape elements (the ‘fabric’ or features, which contribute to character);
 - views available to people and their visual amenity, from publicly accessible viewpoints; and

- those sensitive to varying levels of light intrusion, glare and sky glow such as;
 - Existing residents;
 - Motorist, cyclists & pedestrians;
 - The railway;
 - Heritage; and
 - Wildlife.

Study Area

- 13.4.6 The spatial scope of this LVIA was determined through background data review and desktop study combined with visits to the site and surrounding area, to determine the site's existing visual envelope and the extent to which the proposed development is likely to be visible from within the surrounding area. Professional experience of other assessments and site appraisals for this type of development indicates that landscape or visual effects would not be significant beyond 0.5km from the Combined Site boundary.
- 13.4.7 The spatial scope, together with a review of potential visual receptors, guided the selection of representative viewpoints that are included within the visual impact assessment. The locations of representative viewpoints for the visual impact assessment are set out in **Section 2 of Appendix H.1, LVIA Methodology** and shown on **Figure 12.2, Appendix H.6**.
- 13.4.8 Visual receptors identified as having the potential to experience visual effects but which were considered unlikely to experience significant visual effects, were scoped out of the visual impact assessment. These are also detailed in **Section 2 of Appendix H.1 LVIA Methodology**.

Site Appraisal

- 13.4.9 A visual survey, from the selected visual impact assessment locations, of people's views of the site and surrounding area was undertaken in September 2018, by a Chartered Member of the Landscape Institute (CMLI). The purpose of the visit was to undertake the landscape and visual appraisal in relation to the proposed development and was the basis of the assessment of predicted landscape and visual effects.
- 13.4.10 During summer and early autumn months, visual effects of the proposed development may be reduced as a result of intervening trees being in full leaf. It is acknowledged, therefore, that the worst case visual effects would be experienced during winter months, when there are no leaves on trees.

13.5 Baseline Conditions

- 13.5.1 The Combined Site is located to the south of the River Thames and to the north of the Great Western Main Line Railway. The western end of the Combined Site is located south of a retail superstore and car park; and the eastern end lies to the west of the Thames Valley Business Park.
- 13.5.2 The Combined Site is described in detail in **Chapter 2** of this ES. **Figure 12.1 Landscape Planning Context** and **Figure 12.2 Landscape Character**, both in **Appendix H.6**, should be referred to when reading this section.

Landscape Character

13.5.3 Published sources describing relevant landscape character, are:

- Natural England, National Character Area Profile: 115 Thames Valley;
- Wokingham District Landscape Character Assessment, 2004;
- Berkshire Landscape Character Assessment, October 2003; and
- Townscape and Visual Assessment, Appendix 1 of Reading Tall Building Strategy, 2008.

13.5.4 **Figure 12.2, Appendix H.6**, illustrates the landscape character areas which are applicable to the Combined Site and surrounding area.

National Landscape Character

13.5.5 The Combined Site lies within National Character Area 115: Thames Valley. Key characteristics, of relevance to the Combined Site and locality, include:

- Flat and low-lying land;
- The River Thames and its tributaries, streams, lakes, canals and open waterbodies (the result of restored gravel workings);
- Densely populated and developed, but with pockets of woodland, open grassland, parkland, wetlands and meadows which provide escape and tranquillity and include a variety of habitats;
- An urban character;
- Important for recreation by residents and visitors; and
- The Thames Path National Trail runs the length of the NCA, and a variety of activities are enjoyed on the river and other waterbodies.

Regional / Local Landscape Character

13.5.6 The part of the Combined Site which lies to the east of the River Kennet, is situated within landscape character area **B2: Thames River Valley with Open Water, Wokingham District Landscape Character Assessment, 2004**. Key characteristics (page 111 of the Landscape Character Assessment) of relevance to the Combined Site and surrounding area, include:

- *“Small area of river landscape focussed on the presence of the River Thames – a broad navigable river defining the district boundary;*
- *Broad and flat alluvial floodplain landscape with localised pockets of terrace deposits;*
- *Transitional landscape with considerable urban influences due to the neighbouring urban areas and the presence of gas towers, roads and a railway line;*
- *Strong influence of modern and older commercial and industrial buildings...;*
- *Immediate river channel with reinforced banks...; and*
- *Considerable evidence of recreational use including the Thames Path National Trail and water sports with associated facilities including a new watersports building.”*

13.5.7 Landscape quality of **B2: Thames River Valley with Open Water** is identified (page 115 of the Landscape Character Assessment) as being of “*moderate quality as a result of its strong character and moderate condition*”. The landscape is considered to be in “*moderate condition*” with opportunities to make improvements to the value of habitats and repair of buildings and infrastructure. The associated landscape strategy objective is to conserve the positive

characteristics, including the river channel form; and opportunities to “*enhance character and condition to ensure the area remains as an attractive recreational landscape.*”

13.5.8 In addition, landscape sensitivity of **B2: Thames River Valley with Open Water** is identified as being of overall “*low sensitivity*”; however, some aspects of the physical landscape, particularly the river channel and corridor, are noted as being “*highly sensitive to change*”. The text notes that any changes “*should not impact on the character of the Thames*”.

13.5.9 Landscape character area **B: Lower Valley Floor, B4 – Hurley Thames**, (Berkshire Landscape Character Assessment, October 2003) lies adjacent to the East MRT Site (see **Figure 12.2 in Appendix H.6**). Relevant key characteristics include:

- Wide, deep, meandering natural river corridors, including the Thames;
- Deciduous wooded context, which riverbank trees contribute to;
- Considerable recreational use of the landscape including the Thames Path National Trail; and
- Boating activities.

13.5.10 The remainder of the Combined Site which lies to the west of the River Kennet, is situated within townscape character areas published in Appendix 1: Townscape and Visual Assessment of the Reading Tall Building Strategy (Entec, 2008). These are: **Character Area 11: Napier Road** and **Character Area 23: King’s Meadow**.

13.5.11 Key characteristics of townscape character area **11: Napier Road** include:

- Residential and retail land use;
- Tightly packed buildings between the railway line, Napier Road and the River Thames;
- Parking and landscape areas between medium size building blocks, creating a medium scale townscape; and
- Townscape condition and character is of a “*forgotten area*” with a weak townscape character.

13.5.12 Key characteristics of townscape character area **23: King’s Meadow** include:

- Sports ground and river meadows;
- Large townscape scale arising from a large expanse of open meadows;
- Open views across the meadows, northwards, to tree skyline of bankside vegetation identified as a key view (view N); and
- Protected open space.

Landscape Character of the Combined Site

13.5.13 Overall, the Combined Site has a sense of enclosure and a sense of being part of the River Thames corridor through the urban area, with few views out to adjacent areas. Its character is of urban open space and river-edge. There are strong influences from the railway and infrastructure corridor to the south of the Application Site boundary, with views of the railway, moving trains, gantries and overhead cables; which counteracts the calmer and more attractive River Thames to the north of the tow path.

13.5.14 The landscape character of the Combined Site can be described by four distinctive landscape character areas:

- **A: Waterside Amenity:** the eastern sector of the Combined Site, adjacent to the River Thames and extending from the Dreadnought Building eastwards through to the TVP

P&R and beyond. This area is strongly influenced by active recreational use of the Thames, for water sports and boating, and the amenity public open space grassed area. The area adjacent to the River Thames appears well-managed and tidy; and there is a high level of use by walkers, runners and cyclists on the tow-path, in addition to the visitors to Wokingham Waterside Centre and people undertaking water sports and boating activities. This area has a sense of being an active public open space, with few views of urban elements to detract from the river corridor. The TVP P&R comprises an unmanaged and overgrown area of trees and scrub, situated behind the Dreadnought Building and Wokingham Waterside Centre, which is not publicly accessible.

- **B: Central:** adjacent to the River Thames, situated between the Dreadnought Building and the mouth of the River Kennet at its confluence with the Thames. This is a linear and narrow space, which is strongly influenced by views of adjacent urban and infrastructure elements, such as the main line railway and associated gantries and overhead wires, the metal framework of a gas holder, electricity pylons and overhead lines, and Network Rail's metal palisade boundary fencing. This linear space appears unmanaged and unkempt; though it has a high level of active use by walkers, runners and cyclists on the tow-path. There are occasional canal boats moored on the River Thames, near to the mouth of the River Kennet.
- **C: Kennet and Thames Confluence & LWS:** at the confluence of the River Kennet and River Thames and extending west along the LWS and River Thames, north of the Tesco's car park. At the mouth of the Kennet, there are views southwards of the existing Grade II Listed Railway Bridge and attached Accommodation Bridge over the River Kennet and the main line railway, looking towards the urban area (**Chapter 14 Archaeology and Heritage** of this ES considers this in more detail). Graffiti tags are seen on these structures. The LWS comprises a small area of managed woodland which provides some sense of enclosure to the character area, particularly when walking along the tow-path adjacent to the Thames. The LWS is demarked by painted metal railings adjacent to the tow-path, and contains winding tarmac footpaths linking the River Thames tow-path to the Tesco's car park. This character area has a treed and river corridor character, with some detracting influences of graffiti, built form and infrastructure.
- **D: Napier Road:** the western sector of the Application Site, extending from the eastern boundary of the Tesco car park, along the southern edge of Tesco's retail store and fuel station areas, to Napier Road. This area has an urban character, comprising built form, car park areas with semi-ornamental planting, and a scrubby, overgrown and unkempt narrow linear space between the Tesco's area and the main line railway, which is not accessible to the public.

Landform and Watercourses

13.5.15 The Combined Site is located on low lying landform, adjacent to the southern bank of the River Thames which lies to the north of the site and which flows west to east. The proposed route also passes over the mouth of the River Kennet, at its confluence with the River Thames.

13.5.16 To the south, the Great Western Main Line Railway is raised on an embankment.

Land Use

13.5.17 Currently, the Combined Site forms open land that is undeveloped and includes a section which crosses the River Kennet at its confluence with the River Thames.

Existing Vegetation and Tree Cover

- 13.5.18 Broad-leaved woodland is present in the western section of the Application Site which lies within a Local Wildlife Site (LWS) (see **Chapter 14 Biodiversity** for more information), as well as in the TVP P&R. There are also scattered trees throughout the Combined Site.
- 13.5.19 A tree survey for the East MRT Site was undertaken in April 2016, which identified 128 individual trees and 65 tree groups within, or in proximity to, the Application Site boundary. Of these, the survey identified:
- 8 individual trees as Category A (trees of high quality);
 - 56 individual trees and 28 tree groups as Category B (trees of moderate quality);
 - 60 individual trees, 32 tree groups, 5 hedgerow groups and 2 shrubs as Category C (of low quality); and
 - 2 individual trees as Category U, and which cannot be realistically retained regardless of land use.
- 13.5.20 A copy of the East MRT Site tree survey and constraints plan is included at **Appendix H.4**.
- 13.5.21 An outgrown native species-rich hedgerow, which includes trees, is located on the northern boundary of the TVP P&R.
- 13.5.22 Groups of dense and scattered scrub is located within the TVP P&R; though this is not continuous and some clearance of vegetation has recently occurred in relation to the approved TVP P&R preliminary works.
- 13.5.23 Mixed types of grassland were identified by the ecology surveys, in the western area of the East MRT Site, near to Napier Road and the nearby retail superstore.
- 13.5.24 Other vegetation within the Combined Site includes: areas of dense and scattered scrub; semi-improved and amenity grasslands; ruderal vegetation; and shrub (semi-ornamental) planting.
- 13.5.25 A number of individual and group Tree Preservation Orders (TPOs) and a woodland TPO cover trees within the western part of the East MRT Site, along the River Thames, within the LWS and within the Tesco carpark.
- 13.5.26 There are no TPOs upon the eastern part of the Combined Site within the Borough of Wokingham.

Conservation Areas, Listed Buildings and Register of Historic Parks and Gardens of Special Historic Interest

- 13.5.27 The Combined Site does not lie within a Conservation Area.
- 13.5.28 The nearest Conservation Area is Eldon Square, Reading, which lies approximately 0.4km to the south of the Application Site. There is no intervisibility with the Combined Site as a result of intervening built form, the nature of the landform, the main line railway on embankment and vegetation.
- 13.5.29 There are no Listed Buildings within the Combined Site. The nearest Listed Building is the Grade II Listed Railway Bridge and attached Accommodation Bridge, over the River Kennet. These bridges lie adjacent to the southern boundary of the Application Site, and were built as part of The Great Western Railway in the mid-19th century. The Heritage Desk-Based Assessment included in Appendix J.1 of this ES considers Listed Buildings in more detail.

- 13.5.30 Approximately 0.15km to the south of the Application Site is Newton School, which is Grade II Listed. The main line railway on embankment and bridges, together with intervening vegetation, prevents intervisibility with the Combined Site.
- 13.5.31 Other Listed Buildings within 0.5km of the Combined Site boundary, but which do not have intervisibility with the Combined Site due to intervening buildings and vegetation, the nature of the landform and the main line railway on embankment, include:
- Fisherman's Cottage adjacent to the Kennet and Avon Canal, Grade II;
 - 47-48 Kenavon Drive, Grade II;
 - The Pump and Turbine House, Grade II;
 - The Engine House, Grade II;
 - The Screens House, Grade II;
 - Reading Gaol (main building, former HM Prison), Grade II;
 - Church of St. James, Grade II; and
 - King's Meadow Swimming Pool, Grade II.
- 13.5.32 Reading Cemetery, 0.6km to the south of the Combined Site, is listed on the Register of Historic Parks and Gardens of Special Historic Interest (RHPG), as Grade II. The Forbury Garden is also listed on the RHPG as Grade II, and is situated approximately 0.5km to the southwest of the East MRT Site. Intervening built form prevents intervisibility from these RHPGs with the Combined Site.

Scheduled Ancient Monuments (SAM)

- 13.5.33 Reading Abbey (Cluniac and Benedictine Monastery and Civil War earthwork) is a SAM, located 0.5km to the southwest of the Application Site; intervening built form and the main line railway prevents intervisibility with the Combined Site.

Public Rights of Way and National Cycle Routes

- 13.5.34 A Public Right of Way (PRoW), the Thames Path National Trail and National Cycle Routes 4 and 5 (Thames Valley) pass through the Application Site, on the route of the tow-path adjacent to the River Thames. National Cycle Route 4 turns southwards off from the River Thames tow-path and follows the alignment of the River Kennet.

Landscape Value

- 13.5.35 Landscapes may be valued at community, local, or national level, or in some cases at a greater level. Existing landscape planning designations are taken to be the initial guide to value, as shown in **Table 1.4, Appendix H.1 LVIA Methodology**. The value attached to undesignated landscapes also needs to be considered and other factors which influence landscape value, such as landscape or scenic quality, sense of place, rarity, and so forth, are also taken into account as per the detailed criteria in **Table 1.5, Appendix H.1 LVIA Methodology**, for determining landscape value.
- 13.5.36 As part of the baseline review, an assessment of value is made for landscape character areas and the individual elements which contribute to landscape character, which may be affected by the proposed development. Landscape values are set out in detail in the **Landscape Effects Table in Appendix H.2**.

Key Views and Representative Viewpoints

13.5.37 A key or strategic view within central Reading, View N: North-westwards across King's Meadows, is identified in **Reading Borough Council's Townscape and Visual Assessment (Appendix 1, Reading Tall Building Strategy, Entec, 2008)**. This viewpoint is located at the southern edge of King's Meadow recreation ground, near to Napier Road. From that location, however, there is no intervisibility with the Combined Site due to intervening vegetation and buildings. There are no other published or designated key views which apply to the Combined Site or the area within which the Combined Site is located.

13.5.38 As a result of low lying landform, the River Thames, waterbodies between Lower Caversham and Sonning, the railway corridor and vegetation associated with the river and rail corridors, views towards the Combined Site are typically limited to local views. **Figure 12.4 Visual Analysis, Appendix H.6** illustrates the visual enclosure of the Application Site and Combined Site. Local views occur from:

- the River Thames;
- the mouth of the River Kennet;
- open spaces adjacent to the Thames;
- the Thames Path National Trail and National Cycle Network Routes 4 and 5 which follow the tow-paths adjacent to the rivers;
- the mainline railway on elevated embankment;
- the roundabout on the A3290;
- the eastern end of Napier Road and Tesco's car park; and
- within the LWS area.

13.5.39 Representative viewpoints (which represent specific views from a location) and sequential viewpoints (which represent the sequences of views when travelling along the Thames Path National Trail in east and west directions) for the visual impact assessment have been selected following a review of the potential visual receptors, and the likely visibility of the Site from the surrounding area. **Table 12.2** below lists those viewpoints that are considered to be likely to experience significant visual effects, based on the LVIA submitted with the 2017 Planning Application and the 2018 (June) ES Addendum and are therefore proposed to be re-used for the visual impact assessment.

13.5.40 The Townscape and Visual Assessment which forms part of the Reading Tall Building Strategy (Reading Borough Council, 2008, **Appendix 1**) was reviewed as part of the viewpoint selection process for the previous LVIA. The Reading Townscape and Visual Assessment identifies a number of locations from which there are key views within the town. Therefore, locations from where these views may potentially be affected by the proposed development were also selected to form part of the visual impact assessment, as noted in **Table 12.2**.

Table 12.2 Selection of Representative Viewpoints for Visual Impact Assessment

Viewpoint Reference	Location	Reason for Inclusion
Representative View Locations		
1 (previously VP: A in 2017 LVIA)	Footpath at north-east of Tesco car park	Area identified by Reading Borough Council as a 'Major Landscape Feature' (Policy CS37, SA17) and an 'Important Area of Open Space' (Policy RC14)
Sequential View Locations – Thames Path National Trail (assessed travelling east and west)		
A (previously VP4 in 2017 LVIA)	Thames Path National Trail	- Thames Path National Trail - National Cycle Route 4 – Thames Valley - Area identified by Reading Borough Council as a 'Major Landscape Feature' (Policy CS37, SA17)
B (previously VP2 in 2017 LVIA)	Thames Path National Trail, to the north of The Coal woodland	- Thames Path National Trail - National Cycle Route 5 - Area identified by Reading Borough Council as a 'Major Landscape Feature' (Policy CS37, SA17) and an 'Important Area of Open Space' (Policy RC14)
C (previously VP3 in 2017 LVIA)	Thames Path National Trail, east of the Kennet Mouth	- Thames Path National Trail - National Cycle Route 4 – Thames Valley - Area identified by Reading Borough Council as a 'Major Landscape Feature' (Policy CS37, SA17)
D (previously VP:B in 2017 LVIA)	Thames Path National Trail	- Thames Path National Trail - National Cycle Route 4 – Thames Valley
E (previously VP:C in 2017 LVIA)	Thames Path National Trail, north of the Dreadnought building	- Thames Path National Trail - National Cycle Route 4 – Thames Valley
F (previously VP:D in 2017 LVIA)	Thames Path National Trail, near Wokingham Waterside Centre	- Thames Path National Trail - National Cycle Route 4 – Thames Valley
G (previously VP5 in 2017 LVIA)	Open Space between Thames Path National Trail and Thames Valley Park Drive	- Thames Path National Trail - National Cycle Route 4 – Thames Valley

13.5.41 The baseline description for each viewpoint, including information about the type and relative numbers of people likely to be affected, is set out within the **Visual Effects Table in Appendix H.3**, which includes representative photograph panoramas illustrating baseline views.

13.5.42 Views which were scoped out of the LVIA, with the rationale for doing so, are set out in **Table 1.3, Appendix H.1 LVIA Methodology** and **Section 12.6**, below.

Value of Views

13.5.43 All visual receptors are people. The value attached to the views experienced has regard to a number of factors including recognition through the planning designation or heritage assets and the popularity of the viewpoint. **Table 1.9, Appendix H.2 LVIA Methodology** sets out the criteria for determining the value of views from low to high.

13.5.44 As part of the baseline review, an assessment of value has been made for the views and visual amenity which may be affected by the proposed development. These are set out in detail in the **Visual Effects Table in Appendix H.3**.

Lighting Baseline

Desk Based Study

13.5.45 A desktop review of the Application Site and surrounding area was undertaken to identify potential light sensitive receptors and to establish the Environmental Zone classification for the Application Site in accordance with the ILP's Guidance Notes for Obtrusive Light (2011).

13.5.46 The following sources of publicly available information were reviewed:

- Google Street View (accessed October 2018);
- Ordnance Survey Mapping (accessed October 2018); and
- Defra Multi-Agency Geographic Information for the Countryside (MAGIC) Map Application (accessed October 2018).

13.5.47 Although the desk based information enables a framework to be established for the assessment, the aerial photography and Street View are not up to date and therefore cannot be relied upon as being definitive. In addition, the majority of the site is away from the highway network and therefore Street View is not available.

13.5.48 Therefore, in order to have a definitive understanding of the existing lighting conditions of the site a lighting survey was undertaken.

Lighting Survey

13.5.49 A lighting survey was undertaken on 20th April 2017 to establish the existing lighting conditions of the Application Site. The desk based survey, detailed above, identified that the characteristics of the Application Site have not changed since the time of the survey. Therefore, the lighting survey undertaken on this date is considered valid to inform the baseline conditions.

13.5.50 The lighting survey recorded night time views in a series of photographs from pre-determined viewpoints. The viewpoint locations were chosen to represent light sensitive receptors and were based on the locations established in the Landscape and Visual Assessment. A location plan of the viewpoints taken is included as **Appendix H.5 Lighting Assessment**.

13.5.51 The view was studied to record principal lighting features, obtrusive light and comment on light sources not visible in the photographs.

13.5.52 The night time survey was undertaken on Thursday 20th April 2017 between approximately 19:00 and 22:30. The moon phase at the time of the survey was Last Quarter with some cloud coverage and temperatures at 8°C during the night-time survey.

13.5.53 A summary of the existing lighting conditions within and surrounding the Application Site is provided in **Table 12.3**.

Table 12.3: Lighting Conditions Surrounding the Application Site - Sensitive Receptors

Viewpoint No.	Location	Description of Lighting Conditions
1	River Kennet South / Cholmeley Road	Column mounted LED lighting exists along the Kennet & Avon Canal path (5m in height) which illuminates the footpath/cycle path. Light intrusion was observed into the River Kennet channel. White lighting is visible in a northerly direction along the Thames Path. See photo Location 1 in Appendix H.5 Lighting Assessment .
2	Thames Path West of River Kennet Mouth	The level of light is low at this location, due to tree canopy screening from sources along the River Thames such as moored boats and Thames Valley Park. Low level amenity lighting on moored boats across the river was visible, along with distant footpath column lights (LED). Column mounted High Pressure Sodium (HPS) road lights were visible at the Thames Valley Park. Passing trains on the Great Western Mainline provide intermittent light at this location. See photo Location 2 in Appendix H.5 Lighting Assessment .
3	Thames Path East of River Kennet Mouth	A singular LED street lighting column, approximately 5m in height was seen to be the primary light source at Viewpoint 3 which resulted in concentrated white light along the Thames Path. Considerable light intrusion was observed into the River Thames. A white sky glow was visible westerly of the site towards Reading Town Centre. This is likely to stem from LED light as per Policy HW9 - Street lighting (Paragraph 12.3.27). See photo Location 3 in Appendix H.5 Lighting Assessment .
4	Thames Path North of Tesco Extra	Minimal levels of lighting were observed from within the site. Existing car parking / supermarket store lighting from Tesco Extra along Napier Road was observed to be fully screened by well-established vegetation along the River Thames. Lighting was however visible in the distance (eastwards) from Thames Valley Park Drive with an amber glow. This lighting is likely to stem from high pressure sodium lamps. Red lighting was visible from Oracle's office building in distance (red in nature), as part of Thames Valley Park. Orange sky glow, likely to stemming from high pressure sodium lamps, was visible eastwards towards East Reading / Woodley. See photo Location 4 in Appendix H.5 Lighting Assessment .
5	Thames Meadow East of Waterside Centre	Thames Valley Park Drive was observed to be lit by likely to stem from high pressure sodium lamp column street lighting, (approximately 10m in height). The light from these columns intruded onto the Thames Valley floodplain.

Viewpoint No.	Location	Description of Lighting Conditions
		Spherical car park lighting lights from the Wokingham Waterside Centre, directly to the east of the site, were further visible. Along the western horizon, The Blade (an office building in Reading Town Centre) was visible producing a source of white lighting, likely stemming from LED's. A white sky glow was visible westerly of the site towards Reading Town Centre. This is likely to stem from LED light as per Policy HW9 - Street lighting (Paragraph 12.3.27). See photo Location 5 in Appendix H.5 Lighting Assessment.

Sensitive Lighting Receptors

13.5.54 Sensitive lighting receptors that have been considered during the assessment are presented in **Table 12.4**. Sensitive lighting receptors within and immediately around the site have been identified taking into account the recommendations in ILP Guide 04 (2013).

Table 12.4: Sensitive Lighting Receptors

Sensitive Class	Receptors and sensitivity
Existing residents	There are no residential properties in direct proximity to the Application Site. Residents at Luscinia View, to the west of East MRT / Napier Road junction are located 10 metres from the site and are sensitive to light intrusion, glare and sky glow. Residents on Liverpool Road and Cholmeley Road are within 130 meters of the application site although are screened by trees, a gas storage facility and the Great Western Mainline are therefore scoped out of the lighting assessment.
Motorist, cyclists & pedestrians	The following receptors have been identified that are sensitive to the effects of glare: - Napier Road. - A3290/Thames Valley Park Drive. - Users of Thames Path National Cycle Route/Trail. - Users of Kennet & Avon Canal National Cycle Route/ footpath. - River users on River Thames/ River Kennet e.g. boat owners, rowers etc. - Future users of the MRT
Railway	Drivers/users of the Great Western Mainline Railway are sensitive to the effects of glare.

Sensitive Class	Receptors and sensitivity
Heritage	A Grade II Listed Railway Bridge is located 10 metres from the Application Site but is not sensitive to obtrusive light and therefore has been scoped out of the assessment.
Wildlife	The Coal, Kennetmouth and Kings Meadow Local Wildlife Site (LWS), a non-statutory area of nature conservation importance. Bat Assemblage: at least 8 species of bat use the Application Site, whilst activity levels are highest along the River Thames and adjacent woodland/ tree lines. Soprano pipistrelle and common pipistrelle were the most common species of bat recorded. The river corridors are an important foraging/ commuting habitat for bats. Due to the semi-urban setting, the majority of bats are fairly light tolerant although some are not tolerant so light intrusion should be kept to a minimum.

Environmental Zone

13.5.55 The Institution of Lighting Professionals (ILP) Guidance Notes for the Reduction of Obtrusive Light (GN01:2011) sets out exterior lighting controls for Environmental Zones. The Environmental Zone classifications are presented in **Table 12.5**.

13.5.56 The Environmental Zone classification for the Application Site has been undertaken drawing on a desk study of the Application Site and evidence gathered during the site visit. The Application Site is on the fringes of an industrial/ suburban area with each section characterised by different zones, and therefore has been split accordingly.

13.5.57 It is therefore considered that the development western part of the Application Site, (within RBC's boundary) between the East MRT / Napier Road Junction and the Kennet Mouth can be classified to be within **Environmental Zone E3**, suburban, medium district brightness. The eastern section of the Application Site (within WBC's boundary) from the Kennet Mouth to the Thames Valley Park roundabout can be classified within **Environmental Zone E2**, village or relatively dark outer suburban locations.

13.5.58 The ILP provides limitations for obtrusive light for each Environmental Zone in terms of the upward lighting ratio; light intrusion and luminaire intensity (see **Appendix H.5 Lighting Assessment**).

Table 12.5: Environmental Zones for Exterior Lighting Control as Described in the ILP Guidance, 2011

Zone	Surrounding	Lighting Environment	Examples
E0	Protected	Dark	UNESCO Starlight Reserves, IDA Dark Sky Parks
E1	Natural	Intrinsically dark	National Parks, Areas of Outstanding Natural Beauty etc.
E2	Rural	Low district brightness	Village or relatively dark outer suburban locations
E3	Suburban	Medium district brightness	Small town centers or suburban locations

Zone	Surrounding	Lighting Environment	Examples
E4	Urban	High district brightness	Town/city centers with high levels of night-time activity

Baseline Evolution

13.5.59 SSE will be undertaking work to divert underground cables in proximity to the southern boundary of the Combined Site, including works to excavate a cable trench. A plan of the proposed works is included in **Appendix A.1**. Most of the works are within the Application Site. A review of the SSE proposals has concluded that the works are compatible with the proposed East MRT alignment and the diverted SSE Cable. SSE has confirmed that no existing trees will be removed as part of these works and therefore the future baseline is unaffected.

13.5.60 Otherwise, in the absence of the proposed development, environmental conditions at the site are unlikely to materially change from those reported above.

13.6 Not Significant Effects and Scoped Out receptors

13.6.1 The following effects were identified, in the previous LVIA as part of the 2017 Planning Application and the 2018 (June) ES Addendum, as being 'not significant' and therefore will not be considered further within the ES. A factual evidence base has been provided below to support this:

- **National Landscape Character Area 115: Thames Valley:** there would be no significant landscape effects on this national character area as the proposed development would not alter the defining and key characteristics of that National Landscape Character Area;
- **Berkshire County Landscape Area – B4 Hurley Thames:** no direct landscape effects, as the East MRT site is located outside of this landscape character area. The previous assessment in the previous LVIA as part of the 2017 Planning Application and the 2018 (June) ES Addendum, identified that there would be indirect landscape effects as a result of limited and just discernible intervisibility, which would be 'not significant'. The proposed development is expected to result in the same assessment finding and therefore this landscape character area is not to be included in the LVIA and ES;
- **Reading Borough Council Townscape Character Areas – 11 Napier Road and 23 King's Meadow:** the previous LVIA in the previous LVIA as part of the 2017 Planning Application and the 2018 (June) ES Addendum, identified limited direct landscape effects on these character areas, which would be 'not significant'. The proposed development is expected to result in the same assessment findings and therefore these townscape character areas are not to be included in the LVIA and ES;
- **People's view and visual amenity:** people's views and visual amenity from selected view locations were assessed previously in the previous LVIA as part of the 2017 Planning Application and the 2018 (June) ES Addendum. People's views which have been identified as unlikely to result in visual effects, or likely to experience visual effects but which would not be significant, are scoped out for the visual impact assessment. These are listed below in **Table 12.6** with reasoning for being scoped out.

Table 13.6: Scoped Out View Locations

Scoped Out Visual Receptor Location	Reasoning
Reading Cemetery RHPG	Intervening built form prevents views.
Sonning Conservation Area	Intervening vegetation and buildings prevent views.
Eldon Square Conservation Area	Intervening built form prevents views.
Reading Abbey: a Cluniac and Benedictine monastery and Civil War earthwork – Scheduled Monument	Intervening built form prevents views.
Viewpoint N – view north westwards across Kings Meadow Identified as a Key View within Central Reading (Reading Borough Council Townscape and Visual Assessment, 2008)	Intervening vegetation and buildings prevent views.
Towpath south of Kennet and Avon Canal, at end of Cholmeley Road, looking north-east (previous LVIA VP1)	Small elements of proposed development visible beyond existing railway bridges. Previous LVIA identified these effects to be not significant.
Thames and Kennet Marina, view looking south (previous LVIA VP6)	No view of East MRT site- intervening vegetation prevents views.
Entrance to Tesco Supermarket, from Napier Road (previous LVIA VP7)	Previous LVIA identified the visual effects at this location as not significant.
Roundabout on A3290 looking west (previous LVIA VP:E)	No view of East MRT site from this location, view only of the consented Park & Ride scheme.

13.7 Sensitivity of Landscape and Visual Receptors and Lighting Receptors

- 13.7.1 The detailed landscape and visual impact assessments are set out in the **Landscape Effects Table in Appendix H.2** and the **Visual Effects Table in Appendix H.3**. These impact assessments include judgements of receptors' susceptibility to change, which, combined with judgements on the baseline value attributed to receptors, provides an assessment of the overall sensitivity of each receptor. **Appendix H.1 LVIA Methodology** sets out the typical scales of sensitivity and the criteria for determining susceptibility to change. A summary of overall sensitivity to change arising from the proposed development is set out below.

Sensitivity of Landscape Receptors

- 13.7.2 Landscape receptors identified as having a **high sensitivity** to the proposed development are the: major landscape feature designation, important area of open space and public rights of way and cycle routes. This is due to the condition and scenic quality of these features, and their contribution towards recreational activity.
- 13.7.3 All other landscape receptors scoped in to the assessment were identified as having a **medium sensitivity** to the proposed development namely: the district landscape and townscape character areas, local landscape character of the site, landform and watercourses, land use and vegetation and tree cover. These features are in moderate condition, provide some scenic quality valued at a local level, and have partial tolerance to the type of proposed development.

Sensitivity of Visual Receptors

- 13.7.4 Visual receptors at viewpoints VPA, VPB, VPC, VPD, VPE, VPF and VPG are all identified as having a **high sensitivity**. This is due to their location upon the Thames Path National Trail / National Cycle Route, and therefore the number of people using this path, who are engaged in outdoor recreation and likely to be focussed on views of the surrounding landscape.
- 13.7.5 Visual receptors at viewpoint VP1 are identified as having a **medium sensitivity**. This is due to the views or the view composition including some features of interest and having some amenity value, being of a generally attractive composition with little sign of degradation, or reflecting the viewpoint's location in local parks or open spaces, public realm, public streets or on local Public Rights of Way.

Sensitivity of Lighting Receptors

- 13.7.6 **Table 12.7** outlines the impact that the proposed lighting design will have upon lighting receptors identified in **Table 12.4**.

Table 12.7: Impact of proposed Lighting Design on identified Sensitive Lighting Receptors

Sensitive Receptors	Impact of Proposals
Existing residents	The bedroom windows on Luscinia View that face the access junction for the development onto Napier Road are already affected by lighting obtrusion on the existing street lighting. Lighting is in place on the western side of the East MRT / Napier Road junction. The proposed development includes lighting in the same locations as existing, therefore no additional adverse impact is to be expected for the residents of these apartments. SON variety columns will be replaced with LED lighting which will not have a material impact on the residents. The residential properties on Liverpool Road and Cholmeley Road are of sufficient distance away from the development that no lighting obtrusion is likely to reach them. Also, they are already adequately screened.
Great Western Mainline	Lighting is retained within the development boundary and does not approach GW Mainline, therefore train driver's views / sights would not be affected and users of the railway line would be a

Sensitive Receptors	Impact of Proposals
	sufficient distance away from the development to be affected by glare. GW Mainline is raised at a greater height than the height of the luminaires installed so vertical glare is not expected to occur.
Motorist, cyclists & pedestrians	Existing receptors have been identified that are sensitive to the effects of glare: - Napier Road. - A3290/Thames Valley Park Drive. - Users of Thames Path National Cycle Route/Trail. - Users of Kennet & Avon Canal National Cycle Route/ footpath. - River users on River Thames/ River Kennet e.g. boat users, rowers etc. - Future users of the MRT Footway and cycle way users will have a well-lit route which forms an improvement on current conditions where the route is not lit between the Tesco Supermarket and the eastern boundary of the site. Pedestrians and cyclists will have a significantly safer and more secure route than exists currently. The proposed development will include a more direct crossing of the River Kennet especially for cyclists, and divert away from the poorly lit Thames Path. River users unlikely to be using river at night, also no light was observed to spill into River Thames from the lighting modelling undertaken.
Wildlife	Up to 5 lux light intrusion enters the wildlife reserve, which is also classed as a priority Habitat Inventory - Deciduous Woodland. Due to the limitations of the design process, the light intrusion levels do not include the effect of shielding on the luminaires, which could significantly reduce intrusion into the wildlife reserve. Existing lighting in the Tesco car park creates intrusion into the The Coal, Kennetmouth and Kings Meadow LWS, but for the reasons set out within the Ecology Chapter 13 of this ES, it is not considered a significant issue. Minor spill into occurs into the River Kennet, but the level of luminance is under 1 lux at ground level therefore acceptable in relation to BCT guidance – limiting the impact and design of artificial light on bats.

13.8 East MRT Site

Embedded Mitigation

- 13.8.1 Embedded mitigation has been developed through the iterative design process, and are those measures which have become integrated or embedded into the project/scheme design.
- 13.8.2 Standard construction and operational management practices are those which will be adopted for avoiding and reducing environmental effects, such as the use of hoardings or tree protection fencing.

13.8.3 Embedded mitigation measures include standard construction and operational management practices which would be delivered through the CEMP. A summary of the project's embedded mitigation measures described is provided in **Chapter 3** of this ES and also in the separate **Design and Access Statement** which accompanies the planning application. Key primary measures incorporated into the proposed development, in relation to landscape and visual aspects, include the:

- Retention of existing trees and vegetation where practicable, and the protection of trees to be retained in accordance with BS5837:2012;
- Re-routing of services and utilities to the south of the proposed MRT, to enable replacement tree planting to take place to the north of the MRT;
- Height of the proposed bridge element to correspond to that of the listed railway and accommodation bridge, continues to be visible from the tow-path, PRow / Thames Path and river;
- Low-level parapet lighting which removes the need for lighting columns;
- Planting of new native trees and shrubs suitable for the river corridor;
- Selective management and re-planting of the woodland within the LWS to replace trees which require removal, increase diversity to the woodland, and provide additional screening of the MRT embankment and route from locations within the LWS woodland and on the tow-path adjacent to the LWS. This will include selective removal of existing shrubs and groundcover, e.g. removal of non-native species such as Buddleia and the invasive Virginia Creeper, to increase light levels and promote the growth of a more diverse ground flora;
- Retention and enhancement / extension of the existing area of Acid Grassland at the western end of the East MRT route, with scattered new tree planting to create a glade with dappled shade;
- Mooring enhancement with associated new marginal shelf and riverside planting in front of the existing concrete retaining wall at the edge of the River Thames (east of Kennet Mouth);
- Enhancements to the riparian corridor, for example removal of Himalayan Balsam, retention of Lodden Lily;
- Creation of tussocky grassland between the River Thames and the MRT, and wildflower hydro-seeded grassland on the MRT embankment, marshy areas created beneath the viaduct and new marshy planting including Loddon Lily;
- One-column viaduct design and viaduct narrowed by 1m to the east of the River Kennet, with narrowed foundations;
- Relocation and repair of the existing mosaic, provision of new seating and storyboards (public information such as local history and wildlife, and the Thames and Kennet confluence);
- Willow tree T88 east of the Kennet Mouth retained and additional 3 trees retained to the north of the viaduct, east of the Kennet;
- Ivy planting to be installed in a planting trough at the northern edge of the elevated viaduct, and trained to grow downwards in order to green the structure (additional mitigation since the 2018 (June) ES Addendum); and

- Retention of additional two Horse Chestnut trees (T163 and T164) (additional mitigation since the 2018 (June) ES Addendum); and
 - Retention of additional Hawthorn tree (T89) (additional mitigation since the 2018 (June) ES Addendum).
- 13.8.4 The lighting design for the operation scheme has been ecologically informed and will include the following measures to minimise the experience of adverse significant lighting effects, as a result of the proposed East MRT development:
- Lighting columns along the northern extent of the route only;
 - Lighting columns to provide directional lighting to face away from the more sensitive areas (including The Coal, Kennetmouth and Kings Meadow East LWS and Henley Road Pit LWS); and
 - Inclusion of a shield on the back of lighting columns to further reduce any light back spill. Where there are areas which light spills along the southern side of the viaduct, front light shields will also be installed.
- 13.8.5 Further to this, it is important to note that the Lighting Modelling conducted has not accounted for any shield or hoods. As such, the installation of these primary mitigation measures could reduce the level of light spill significantly.

Assessment of Likely Effects

- 13.8.6 The Landscape Effects Table in **Appendix H.2** And the Visual Effects Table in **Appendix H.3** sets out the detailed impact assessments upon landscape and visual receptors. The results are summarised below.

Summary of Landscape Effects During Construction

- 13.8.7 The landscape assessment identified temporary, direct, **adverse** effects during construction:
- with a **major level of significance** upon the local landscape character of the site, land use and relatively short sections of public rights of way and cycle routes; and
 - with a **moderate level of significance** upon the major landscape feature designation, landform and watercourses and vegetation and tree cover.
- 13.8.8 These effects arise from the construction activity, excavations and plant operating within the application site, including the removal of trees to facilitate the development. The effects also arise due to the phased closure, and diversion, of sections of the Thames Path / National Cycle route, for periods of time during the construction period.
- 13.8.9 Temporary, **adverse** effects upon the district landscape and townscape character areas, and upon the Important Area of Open Space were assessed as being either **minor** or **negligible**, and therefore **not significant**.

Summary of Landscape Effects on Completion

- 13.8.10 On completion, the assessment identified long term, direct, **adverse** effects of a **moderate level of significance** upon the major landscape feature designation, local landscape character of the site, land use and vegetation and tree cover.
- 13.8.11 These effects are a result of the East MRT introducing a new land use through the application site and influences the local landscape character, and also the loss of trees to facilitate the proposed development.

13.8.12 No change was identified for the public rights of way and cycle routes on completion, as these will fully reopen along their original routes.

13.8.13 Long term, **adverse** effects upon the district landscape and townscape character areas, the Important Area of Open Space and landform and watercourses were assessed as being either **minor** or **negligible**, and therefore **not significant**.

Summary of Landscape Effects 15 years after planting

13.8.14 15 years after completion, and when planting is expected to have matured, long term, direct **adverse** effects remain of a **moderate level of significance** upon the major landscape feature designation and land use. This is due to the presence of the East MRT, and its route through a small section of the major landscape feature.

13.8.15 A long term, direct **beneficial** effect with a **moderate level of significance** is assessed for the local landscape character of the application site. This is due to planting having established in accordance with the landscape strategy.

13.8.16 Long term, direct **beneficial** effects are assessed with a minor level of significance for vegetation and tree cover and a negligible level of significance for LCA B2 Thames River Valley with Open Water.

13.8.17 As on completion, there remains no change to the public rights of way and cycle routes.

13.8.18 The other features and character areas assessed remain with **not significant** adverse effects, as on completion.

Summary of Visual Effects During Construction

13.8.19 The visual assessment comprises assessment of 'representative viewpoints' which represent specific views from a location; and 'sequential viewpoints' which are a sequence of views when travelling along the Thames Path National Trail in an eastwards and westwards direction.

Representative Viewpoints

13.8.20 A temporary, direct, **adverse** visual effect during construction with a **major level of significance** is assessed for VP1: Footpath at north-east of Tesco car park. This is due to the new footpath being constructed in this area, and the removal of trees within the view.

Sequential Viewpoints along 1.2km section of the Thames Path National Trail

13.8.21 Refer to **Figure 12.3 Sequential Visual Assessment, Appendix 12.6**, which demonstrates the limited extents of the route that these effects apply to.

13.8.22 Travelling **east**, the visual assessment identified temporary, direct, **adverse** effects during construction:

- with a **major to substantial level of significance** for VPC and VPD, due to the limited extent of the effect;
- with a **major level of significance** for VPB; and
- with a **moderate level of significance** for VPA.

13.8.23 There is no view of the East MRT site, when looking east, from VPE, VPF and VPG.

13.8.24 Travelling **west**, the visual assessment identified temporary, direct, **adverse** effects during construction:

- with a **major to substantial level of significance** for VPC and VPD due to the limited extent of the effect;
- with a **major level of significance** for VPB; and
- with a **moderate level of significance** for VPG.

13.8.25 A visual effect with a **minor level of significance**, and therefore **not significant** was identified for VPE.

13.8.26 There is no view of the Application Site, when looking west, from VPA and VPF.

13.8.27 VPC, VPD and VPB are all local views from within the site boundary, the proximity of these to the construction activity within the site, results in high levels of visual change being assessed from these locations.

Summary of Visual Effects on Completion

Representative Viewpoints

13.8.28 On completion a long term, direct, **adverse** visual effect with a **moderate level of significance** is assessed for VP1: Footpath at north-east of Tesco car park. This is due to the loss of trees, views of the new footpath and glimpses of the MRT structure, not yet softened by the new tree planting.

Sequential Viewpoints along 1.2km section of the Thames Path National Trail

13.8.29 Refer to **Figure 12.3 Sequential Visual Assessment, Appendix 12.6**, which demonstrates the limited extents of the route that these effects apply to.

13.8.30 Travelling east, the visual assessment identified long term, direct, **adverse** effects on completion:

- with a **major to substantial level of significance** for VPC and VPD due to the limited effect of development; and
- with a **major level of significance** for VPB.

13.8.31 VPA was assessed as having an **adverse** effect of **minor significance**, and therefore **not significant**.

13.8.32 There is no view of the proposed development within the Application Site, when looking east, from VPE, VPF and VPG.

13.8.33 Travelling west, the visual assessment identified long term, direct, **adverse** effects on completion:

- with a **major to substantial level of significance** for VPC and VPD due to the limited effect of development; and
- with a **moderate level of significance** for VPG and VPB.

13.8.34 A visual effect with a **minor level of significance**, and therefore **not significant** was identified for VPE.

13.8.35 There is no view of the Application Site, when looking west, from VPF.

13.8.36 VPB, VPC and VPD are all local views from the Thames Path National Trail, within the site boundary; the proximity of these to the MRT bridge, results in high levels of visual change being assessed from these locations.

Summary of Visual Effects 15 years after planting

Representative Viewpoints

13.8.37 VP1: Footpath at north-east of Tesco car park, now has a long term, direct, **beneficial** effect, which is of **minor significance (not significant)**. This is due to the new tree planting and management within the Coal Woodland, which has become established, enhances the view and filters views of the MRT structure.

Sequential Viewpoints along 1.2km section of the Thames Path National Trail

13.8.38 Refer to **Figure 12.3 Sequential Visual Assessment, Appendix 12.6**, which demonstrates the limited extents of the route that these effects apply to.

13.8.39 Travelling **east**, the visual assessment identified long term, direct, **adverse** effects remaining 15 years after planting:

- with a **major level of significance** for VPC and VPD; and
- with a **moderate level of significance** for VPB.

13.8.40 VPA was assessed as having an **adverse** effect of **minor** significance, and therefore **not significant**.

13.8.41 There continues to be no view of the proposed development within the Application Site, when looking east, from VPE, VPF and VPG.

13.8.42 Travelling **west**, the visual assessment identified long term, direct, **adverse** effects remaining 15 years after planting with a **major level of significance** for VPC and VPD.

13.8.43 Visual effects with **minor levels of significance**, and therefore **not significant** were identified for VPE and VPG.

13.8.44 VPB is assessed as having a **neutral** effect of **negligible significance (not significant)**, this is due to the loss of existing trees, balanced by the newly planted trees, which have now matured.

13.8.45 There is no view of the Application Site, when looking west, from VPF.

13.8.46 VPB, VPC and VPD are all local views from the Thames Path National Trail, within the Application Site boundary; the proximity of these to the MRT structure therefore results in high levels of visual change being assessed from these locations.

Summary of Lighting Effects During Construction

13.8.47 Effects of lighting during construction should be minimal, as there will be limited night time working outside of agreed standard working hours. The lighting required is predictable for fixed elements of the construction works e.g. the site office, compound and welfare facility. Construction compounds are proposed within the Tesco car park and on the TVP P&R, whilst cranes are required temporarily to construct the bridge.

13.8.48 Task specific lighting to maintain safety around excavation areas, water management areas, and other specific activities will vary according to weather conditions, programme and the

particular tasks being undertaken. Areas in proximity to the rivers near the site may require additional lighting to maintain safety.

Summary of Lighting Effects on Completion

- 13.8.49 The primary effect of lighting once the Proposed Development is operational is from the East MRT/ Napier Road junction. Light intrusion may occur into the residential properties at Luscinia View, although this can be limited by using front and back shields on the luminaires. Column mounted LED lighting will be provided along the length of the scheme. Benefits of using this as opposed to traditional high pressure sodium bulbs is that it is directional, reduces obtrusive light and uses less energy.
- 13.8.50 Minimal light intrusion is anticipated across the Application Site and surrounding areas due to this directional lighting. The effect on the nearby river systems is minimal although in one instance light intrusion was observed into the LWS. This again could be mitigated via the installation of shields.
- 13.8.51 Overall, the development's lighting effects are minimal and are in line with the relevant ILP guidance documents. Further detail on lighting effects and requirements is given in the Lighting Assessment attached as **Appendix H.5**.

Further Mitigation and Enhancement

- 13.8.52 A combined Landscape and Ecology Maintenance and Management Plan (LEMMP) will be secured by planning condition. The purpose of the LEMMP will be to set out the details of specific management and maintenance operations, associated with management of retained vegetation and the establishment and long-term management of proposed planting, as well as details of ecology habitats and species measures on-site and off-site.

Residual Effects

- 13.8.53 The residual landscape and visual effects remain as those set out above in **paragraphs 12.8.37 to 12.8.46** for the assessment of likely effects at 15 years after planting. This is because the further mitigation and enhancement of the LEMMP ensure the long-term management of the proposed planting and therefore the proposed planting can be assumed to continue to be as effective as assessed at 15 years after planting.

13.9 Combined Site (East MRT and TVP P&R)

Embedded Mitigation

- 13.9.1 Embedded mitigation for the Combined Site is as set out above for the East MRT Application Site, plus the consented TVP P&R, which includes proposed tree, hedge and shrub planting.

Assessment of Likely Effects

- 13.9.2 The **Landscape Effects Table in Appendix H.2** and the **Visual Effects Table in Appendix H.3** set out the detailed impact assessments upon landscape and visual receptors. The results are summarised below.

Summary of Landscape Effects During Construction

- 13.9.3 Landscape effects during construction, as a result of the Combined Site (Scenario 2) are assessed as being the same as those set out for the Application Site (Scenario 1) in **paragraphs 12.8.7 to 12.8.9** of this chapter.

Summary of Landscape Effects on Completion

- 13.9.4 Landscape effects on completion, as a result of the Combined Site (Scenario 2) are assessed as being the same as those set out for the Application Site (Scenario 1) in **paragraphs 12.8.10 to 12.8.13** of this chapter, with the exception of the effect on landscape character area B2 – Thames River Valley with Open Water, which is assessed as a long term **adverse** effect which is of a **minor level of significance**.

Summary of Landscape Effects 15 years After Planting

- 13.9.5 Landscape effects 15 years after planting, as a result of the Combined Site (Scenario 2) are assessed as being the same as those set out for the Application Site (Scenario 1) in **paragraphs 12.8.14 to 12.8.18** of this chapter, with the exception of:
- landscape character area B2 – Thames River Valley with Open Water: the landscape effect is assessed as **adverse** and of **minor significance**, therefore remains **not significant**;
 - local landscape character of the Combined Site: the landscape effect is assessed as **adverse** and of **a moderate level of significance**
 - vegetation and tree cover: the landscape effect is assessed as **neutral** and of **negligible significance**, therefore remains **not significant**.

Summary of Visual Effects During Construction

- 13.9.6 Visual effects during construction, as a result of the Combined Site (Scenario 2) are assessed as being the same as those set out for the Application Site (Scenario 1) in **paragraphs 12.8.20 to 12.8.26** of this chapter, with the additional visual effects of:
- VPE Thames Path National Trail, north of Dreadnought Building, eastwards: the visual effect is assessed as being **temporary, adverse** and of a **moderate level of significance**; and
 - VPF Thames Path National Trail, westwards: the visual effect is assessed as being **temporary, adverse** and of a **moderate level of significance**.

Summary of Visual Effects on Completion

- 13.9.7 Visual effects on completion, as a result of the Combined Site (Scenario 2) are assessed as being the same as those set out for the Application Site (Scenario 1) in **paragraphs 12.8.27 to 12.8.34** of this chapter, with additional visual effects assessed upon VPE Thames Path National Trail, north of Dreadnought Building, eastwards; and VPF Thames Path National Trail, westwards. For each of these, the visual effects are assessed as being **adverse** and of a **minor level of significance** which is therefore **not significant**.

Summary of Visual Effects 15 Years After Planting

- 13.9.8 Visual effects 15 years after planting, as a result of the Combined Site (Scenario 2) are assessed as being the same as those set out for the Application Site (Scenario 1) in **paragraphs 12.8.35 to 12.8.43** of this chapter, with the additional visual effects of:
- VPG: Open Space between Thames Path and Thames Valley Park Drive, westwards: the visual effect is assessed as **adverse** and of a **moderate level of significance**;
 - VPE Thames Path National Trail, north of Dreadnought Building, eastwards: the visual effect is assessed as being **neutral** and of a **negligible level of significance**, which is **not significant**; and

- VPF Thames Path National Trail, westwards: the visual effect is assessed as **a benefit** and of a **minor level of significance** which is therefore **not significant**.

Summary of Lighting Effects Combined Site (Scenario 2)

- 13.9.9 The lighting effects for this scenario are expected to be similar to that explained above, but with the addition of the TVP P&R lighting. Since the TVP P&R lighting is only going to be lit during operational hours (07:00-19:00), lighting effects will be minimal and mainly experienced during winter months when daylight hours are shorter.

Further Mitigation and Enhancement

- 13.9.10 Further mitigation and enhancement is as set out in **paragraph 12.8.49** above.

Residual Effects

- 13.9.11 The residual landscape and visual effects for the Combined Site remain as those set out above in the assessment of likely effects at 15 years after planting.

13.10 Monitoring

- 13.10.1 The monitoring of tree protection fencing and any temporary footpath diversions would be required during the construction period and would be secured through planning conditions (details of landscaping conditions to be advised). Achievable landscape and visual mitigation is embedded in the design principles and situated within the site boundaries; therefore, it is assumed that the implementation, maintenance and long-term management of that mitigation would be monitored through the normal planning and post-planning consents, such as planning conditions, and checks that the maintenance and management has been carried out in accordance with those planning conditions.

13.11 Cumulative Effects

- 13.11.1 The definition of cumulative landscape and visual effects was first set out in the 2002 edition of the Guidelines for Landscape and Visual Impact Assessment, and since then has been further refined, in terms of windfarm development, by guidance produced in Scotland, which is used widely and not only in Scotland. The current definitions, as set out in 'Assessing the Cumulative Impact of Onshore Wind Energy Developments', Scottish Natural Heritage (SNH), 2012, are referred to in paragraph 7.3 of the Guidelines for Landscape and Visual Impact Assessment, Third Edition, 2013 (Landscape Institute and IEMA), (GLVIA3) and comprise:

- **Cumulative effects** - 'the additional changes caused by a proposed development in conjunction with other similar developments or as the combined effect of a set of developments, taken together';
- **Cumulative visual effects** - effects caused by combined visibility, which 'occurs where the observer is able to see two or more developments from one viewpoint' and/or sequential effects which 'occur when the observer has to move to another viewpoint to see different developments'; and
- **Cumulative landscape/townscape effects** - effects that 'can impact on either the physical fabric or character of the landscape, or any special values attached to it'.

- 13.11.2 In accordance with the emphasis in EIA, the assessment is required to focus on the cumulative landscape and visual effects which are **likely to be significant**, rather than providing a comprehensive listing of every conceivable cumulative landscape and visual effect

that might occur. The approach must be reasonable and proportional to the proposed development.

13.11.3 Committed developments which have been identified for the consideration of cumulative effects are included in **Appendix A.10** of this ES.

13.11.4 Cumulative landscape and visual assessment considers the effects of the proposal in terms of:

- an extension or intensification of the landscape and/or visual effects of other similar developments;
- 'filling' an area over time with similar development, such that the landscape resource, views and visual amenity are judged to be substantially altered; and
- incremental change arising from the proposal, as a result of successive individual developments.

Cumulative Landscape Effects

13.11.5 In terms of cumulative landscape effects, the following landscape receptors in the LVIA have been scoped out of this cumulative assessment, as they will not be subject to direct effects as a result of the committed developments:

- Major Landscape Feature and King's Meadow and Coal Woodland Important Open Space designations;
- Local landscape character of the site;
- Features of the Application Site and Combined Site:
 - Landform and watercourses;
 - Land use
 - Vegetation and tree cover;
 - Public rights of way and cycle routes.

13.11.6 Potential cumulative landscape effects arise during construction and on completion of the proposed development; and are assessed for landscape character area **B2: Thames River Valley with Open Water**. Construction activity and completion of the committed developments situated within this landscape character area will increase the amount of built form within its urban area; but this is in keeping with key characteristics which include a transitional landscape with considerable urban influences and a strong influence of modern and older commercial and industrial buildings.

13.11.7 The cumulative landscape effects will not alter the landscape character area's key natural and environmental characteristics which relate to the Thames river corridor and associated recreational use. It is considered, therefore, that cumulative landscape effects on **B2 Thames River Valley with Open Water** will be slight adverse, have no greater than a **minor level of significance** and are therefore '**not significant**'.

Cumulative Visual Effects

13.11.8 The LVIA has determined that visual receptors beyond 0.5km from the Application Site or the Combined Site may experience visual changes but that those changes are not likely to result in significant visual effects.

13.11.9 Committed developments references 22. 152354, 23. 161666, 24. 161066, 25.16273 and 29. 171903 (at Suttons Business Park) are located less than 0.5km from the Combined Site

boundary; however, they are situated south of the Combined Site and the main railway line. Intervening landform and vegetation prevent intervisibility with the Combined Site and the Application Site. It is therefore considered that there are no cumulative visual effects with these committed developments.

- 13.11.10 Committed development 28.171445, temporary change of use for up to 45 days a year for Christmas Party Events at King's Meadow is located approximately 0.2km from the Application Site. Because this is a temporary change of use of King's Meadow, and there are existing buildings and trees between the committed development and the Application Site, it is considered that any cumulative visual effects would be **temporary** and **not significant**.
- 13.11.11 The remaining committed developments are located beyond 0.5km from the Application Site and Combined Site, and it is considered that beyond that distance, cumulative visual effects will not be significant.

Cumulative Lighting Effects

- 13.11.12 Given the location of the application site and separation from other committed developments, not likely significant cumulative effects are anticipated in relation to lighting.

13.12 Summary

LVIA Summary

- 13.12.1 A landscape and visual impact assessment (LVIA) was conducted to identify the positive and negative effects, and the significance of those effects, resulting from the proposed development at the Application Site and the Combined Site. Effects upon the landscape as an environmental resource in its own right were considered, in addition to effects upon people's views and amenity.
- 13.12.2 The assessment was undertaken using a methodology based upon the Landscape Institute / IEMA 'Guidelines for Landscape and Visual Impact Assessment' (3rd Edition, 2013) (GLVIA3), combined with professional experience and judgement. The assessment uses 2018 as the baseline year, during which the visual survey of the site and surrounding area was carried out. Three time periods were identified for the assessment of effects: during construction, on completion and 15 years after planting.
- 13.12.3 The LVIA considers two scenarios: Scenario 1: East MRT (Application Site) and Scenario 2: East MRT and the TVP P&R (Combined Site).
- 13.12.4 Overall, the Combined Site has a sense of enclosure and a sense of being part of the River Thames corridor through the urban area, with few views out to adjacent areas. Its character is of urban open space and river-edge. This includes the urban character associated with Napier Road, a small managed woodland between Tesco's car park and the river, the bridges across the Kennet mouth and detracting influences of graffiti, as well as the linear narrow open space to the west of the Dreadnought building. There are strong influences from the railway infrastructure corridor to the south of the Application Site boundary, with views of the railway, moving trains, gantries and overhead cables; which counteracts the calmer and more attractive River Thames to the north of the tow path.
- 13.12.5 Landscape and visual mitigation comprises an integrated landscape and ecology approach, which includes: the retention of existing trees and vegetation where practicable including retention of Willow tree T88, re-routing of services and utilities, considered height of the proposed bridge, low-level parapet lighting which removes the need for lighting columns, new native trees and shrubs, selective management and re-planting of the woodland within the Coal Woodland, enhancement of the existing area of Acid Grassland at the western end of the Application Site, removal of Himalayan Balsam at the river's edge, mooring enhancement with

associated new marginal shelf and riverside planting in front of the existing concrete retaining wall at the edge of the River Thames (east of Kennet Mouth), provision of tussocky grassland and wildflower hydro-seeded grassland, marshy areas beneath the viaduct with new marshy planting including Loddon Lily, one-column viaduct design and the viaduct narrowed by 1m east of the River Kennet with narrowed foundations, relocation and repair of the existing mosaic, provision of new seating and storyboards (public information), and ivy planted along the northern edge of the raised viaduct and trained to grow downwards in order to green the structure.

LVIA Conclusions

- 13.12.6 The proposed development, in both Scenario 1 and 2, will result in temporary (short term) adverse and significant landscape effects during the construction period. The Thames Path National Trail passes through the site, and therefore will be subjected to these temporary adverse effects for a limited section of its much longer route. During construction, adverse, but temporary, changes to landscape features and landscape character within the site are to be expected due to the nature and activity of the construction works required for the proposed developments.
- 13.12.7 On completion, for Scenarios 1 and 2, significant and long term adverse landscape effects occur upon the Major Landscape Feature designation, local landscape character, land use and vegetation and tree cover within the Application Site and Combined Site. For Scenarios 1 and 2, at 15 years after planting which is implemented in accordance with the landscape and ecology strategy, residual significant long term adverse landscape effects remain upon the Major Landscape Feature designation and land use within the Application Site and Combination Site. In Scenario 2, a residual adverse, long term significant landscape effect also remains on the local landscape character of the Combined Site at 15 years after planting. These **local landscape effects** arise from the partial change in use of the Application Site and Combined Site as a result of the proposed developments. A beneficial long term significant and local landscape effect arises 15 years after planting in Scenario 1, upon local landscape character of the Application Site; due to maturing planting and ongoing management of existing woodland and riparian habitats.
- 13.12.8 At 15 years after planting, there are no significant landscape effects on landscape features or landscape character of regional or national importance, which arise as a result of Scenario 1 (East MRT) or Scenario 2 (Combined Site).
- 13.12.9 The LVIA has identified a significant adverse visual effect during construction (short term) and at completion (long term), upon views from VP1: north east of Tesco car park, in Scenarios 1 and 2. This arises due to tree loss and construction of a new footpath. However, at 15 years after planting, there is no significant residual visual effect upon receptor's views from this location.
- 13.12.10 In Scenarios 1 and 2, significant adverse visual effects occur to visual receptor's sequential views from the Thames Path National Trail at locations of VPC, VPD and VPB in both east and west directions, and at VPG looking west only, during construction (short term) and on completion (long term). 15 years after planting, residual significant adverse long term visual effects occur upon visual receptor's sequential views for Scenario 1 and 2 at VPC and VPD in both east and west directions, and VPB looking east only. These visual effects occur upon visual receptors using a limited length of the Thames Path National Trail, which passes through the site, along the river edge and through urban open space that has a number of different characters and urban influences. The visual receptors are therefore in proximity to the proposed developments. The mainline railway and infrastructure corridor is visible in these views, and therefore although the visual impact assessment identifies substantial or clearly noticeable changes to the view composition due to proximity to the proposed development, the changes are not completely out of keeping with the area that the visual receptor is travelling through.

- 13.12.11 The visual effects of the Scenario 1 and 2 proposed developments upon visual receptors using the limited length of the Thames Path National Trail, although significant and adverse, are **local visual effects** which would not alter the integrity of sites or features of national or regional importance.
- 13.12.12 In Scenario 2, additional adverse short term significant visual effects occur to visual receptor's views from VPE and VPF; and 15 years after planting, upon VPG. These additional visual effects arise from a greater area of new development; however, these are also **local visual effects** which would not alter the integrity of sites or features of national or regional importance.

Lighting Summary and Conclusion

- 13.12.13 The Proposed Development will introduce new light sources into a semi-urban environment in the east of Reading. The application site straddles two administrative boundaries; RBC and WBC and therefore two levels of district brightness have been adhered to - ILP Environmental Zone 3 (Suburban) for the western section of the site and ILP Environmental Zone 2 (Rural) for the eastern section of the site.
- 13.12.14 The aspiration is for high lighting standards and that it will seek to be efficient, safe and secure for people utilising the MRT route for walking and cycling, and will be safe for motorists and bus drivers using the proposed junctions onto Napier Road and Thames Valley Drive.
- 13.12.15 The assessment concludes that scenario 1 will introduce some effects to specific locations within the Application Site, notably light intrusion into residential apartments at Luscinia View, and into the LWS site from Tesco Car Park. It is considered that this can be considerably reduced by installing shields and hoods on the luminaires. Other than these two instances, minimal light intrusion is anticipated into the surrounding areas.
- 13.12.16 Scenario 2 is expected to be similar to scenario 1, due to the operational hours of the TVP P&R development not being lit during night time hours. As such, it should not have significant additional effects.

14 Biodiversity

14.1 Introduction

- 14.1.1 This chapter has been prepared by PBA. It contains an ecological impact assessment for the East MRT scheme, and combined with the proposed TVP P&R scheme.
- 14.1.2 A combination of baseline ecological desk study and survey data has been used to inform the scope of the assessments. This has been supplemented by a formal scoping process. Further details pertaining to the full extent of ecological consultation undertaken in relation to the Proposed Development is provided within **Appendix A9**.
- 14.1.3 The approach to assessment accords with the requirements of the Chartered Institute of Ecology and Environmental Management's (CIEEM) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine (September 2018) ('the CIEEM Guidelines'), which represents current best practice (CIEEM, 2018). The CIEEM Guidelines require an assessment of likely significant effects on important ecological features, but do not require consideration of effects on every species or habitat that may be present.
- 14.1.4 Considering the above, the following important ecological features have been included within the assessments:
- The Coal, Kennetmouth and Kings Meadow East Local Wildlife Site (LWS);
 - Henley Road Gravel Pit LWS;
 - Ancient Woodland;
 - Habitat of Principal Importance (HPI), including Running Water;
 - Bats; and
 - Reptiles.
- 14.1.5 In accordance with Regulation 18(5) of the Town and Country Planning (Environmental Impact Assessment) Regulations 2017, as amended, a statement outlining the relevant expertise and qualifications of competent experts appointed to prepare this ES is provided in **Appendix A.5**.

14.2 Policy Context

- 14.2.1 The assessments contained within this chapter have been informed by current legislation and national and local planning policies, which are relevant to biodiversity in the context of the Application Site and the Combined Site.
- 14.2.2 Full details are provided within **Appendix I.1**, with a summary outlined below.

Legislation Context

- 14.2.3 The following legislation is relevant in the context of the Application Site and the Combined Site:
- The Conservation of Habitats and Species Regulations 2017;
 - The Wildlife and Countryside Act 1981 (as amended);
 - The Natural Environment and Rural Communities Act 2006;
 - The Protection of Badgers Act 1992; and
 - Wild Mammals Protection Act 1996 (as amended).

Planning Policy Context

14.2.4 The protection of ecological features is promoted by planning statements and policies made at national and local levels, as contained within the following documents:

- National Planning Policy Framework, 2018;
- Government Circular: Biodiversity and Geological Conservation, 2005;
- Reading Borough Council: Core Strategy, 2008 (with alternation adopted 2015);
- Reading Borough Council: Local Plan (draft), 2017; and
- Wokingham Borough Council: Core Strategy, 2010.

Biodiversity Action Plans

14.2.5 The following local Biodiversity Action Plans are also applicable to development of the Application Site and the Combined Site:

- Reading Biodiversity Action Plan (2005 – 2015); and
- Wokingham Biodiversity Action Plan (2012 – 2024).

14.2.6 Reference to local Biodiversity Action Plan designations have only been made within the chapter where an ecological feature is not otherwise identified within a legal or policy context (as set out within 'Legislation Context' section or 'Planning Policy Context' section above).

14.3 Consultation

14.3.1 Formal scoping responses were received from Reading Borough Council (RBC) and Wokingham Borough Council (WBC) in relation to previous full planning application (Ref: RBC 171108 and WBC 172048) in November 2016; and in relation to the current full planning application in October 2018 (see **Paragraph 14.3.4 – 14.3.6** below).

14.3.2 Further ecological consultation was also undertaken at the time of the 2017 application. A summary is provided within **Appendix A.9**. This included:

- Liaison with RBC and WBC relating to the scope of the proposed baseline ecology surveys; and
- Liaison with RBC with regard the use of nearby off-site areas of RBC land for ecological compensation / enhancement.

14.3.3 Further to this, during the public consultation period for the 2017 application, comments were received from both RBC and WBC ecological representatives, Berkshire, Buckinghamshire and Oxfordshire Wildlife Trust (BBOWT), the Environment Agency, other interest groups and individuals. In light of these comments, the scheme design was revised in consultation with RBC, WBC and the Environment Agency.

14.3.4 The formal scoping response received from RBC in October 2018 included comments from the RBC ecologist. These identified that no breeding bird surveys had been undertaken for the Application Site; and that impacts on Habitats of Principal Importance (HPI) (namely the woodland habitat on-site) had not been correctly considered within the previous full planning application (Ref: RBC 171108 and WBC 172048).

14.3.5 No sites designated for breeding birds have been identified within the vicinity of the Application Site, nor have habitats likely to be of value to a notable assemblage of breeding birds (see **Section 14.5** for further information on the baseline conditions). The existing baseline information on birds at the Application Site (desk study data, extended Phase 1 habitat survey data, a single breeding bird survey report completed for the TVP P&R Site and

anecdotal records) is considered sufficient to inform the ecological baseline and further surveys are not considered necessary.

- 14.3.6 Given that the majority of the area designated as HPI 'Lowland Mixed Deciduous Woodland' is located within The Coal, Kennetmouth and Kings Meadow East LWS, the assessment for The Coal, Kennetmouth and Kings Meadow East LWS takes in to account this habitat type where covering the same extent (see **Section 14.7: The Coal, Kennetmouth and Kings Meadow East LWS**). Where this HPI is identified to be located on-site but out with The Coal, Kennetmouth and Kings Meadow East LWS, further consideration is made within **Section 14.7: Habitats of Principal Importance**.

14.4 Methodology

- 14.4.1 This section sets out the following:

- Study Area;
- Baseline Data Collection;
- Approach to Ecological Assessment;
- Terminology;
- Valuation of Ecological Features and Determining Importance;
- Assessing Ecological Impacts and Determining Significance;
- Mitigation and Assessment of Residual Effects; and
- Assumptions and Limitations.

Study Area

- 14.4.2 The ecological study area used to inform this chapter varies for different ecological features.
- 14.4.3 The baseline survey data relates to the Application Site and the TVP P&R Site; as such also capturing the Combined Site. This includes both pre-existing survey data pertaining to the previous associated planning applications (RBC 171108 and WBC 172048; RBC 171108 and WBC 172048; and WBC 161596); as well as update survey data (see 'Baseline Data Collection' below).
- 14.4.4 For the purpose of the ecological desk study, the following search radii were used, as applicable:
- Up to 500 m in relation to waterbodies;
 - 2 km in relation to records for protected species, Species and Habitats of Principal Importance (SPI and HPI) and designated areas (excluding European designated areas); and
 - 10 km in relation to European designated areas.

Baseline Data Collection

- 14.4.5 **Table 14.1** below provides a summary of the baseline data collection methodologies. Full details are provided within the technical reports contained within **Appendices I.2 – I.11**:
- **Appendix I.2:** East MRT: Preliminary Ecological Appraisal (PBA, June, 2017);
 - **Appendix I.3:** East MRT: Reptile Survey Report;
 - **Appendix I.4:** East MRT: Bat Survey Report;

- **Appendix I.5:** East MRT: Botanical Survey Report (PBA, June 2017);
- **Appendix I.6:** Broken Brow: Preliminary Ecological Appraisal (CA Ecology, October 2015);
- **Appendix I.7:** Broken Brow: Ecology Surveys (CA Ecology, November 2015);
- **Appendix I.8:** Thames Valley Park: Park and Ride Scheme: Breeding Bird Survey Report (WSP|PB, August 2015);
- **Appendix I.9:** Thames Valley Park: Park and Ride Scheme: Bat Static Data (WSP|PB, August 2015);
- **Appendix I.10:** Broken Brow: Ecology Surveys – Addendum (CA Ecology, October 2016);
- **Appendix I.11:** Update Site Walkover (PBA, April, 2018); and
- **Appendix I.12:** Update Site Walkover (PBA, October 2018).

14.4.6 To note, minor amendments to the boundary of the Application Site have been made since the time the previous reporting was undertaken. As such, figures within these reports, where not otherwise updated with 2018 data, show an earlier iteration of the Application Site applicable at the time of writing. This includes land within the Application Site and immediate surroundings, as appropriate.

Table 14.1: Baseline Data Collection Methodologies - Summaries

Data Collection	Application Site	TVP P&R Site
Desk study	A desk study was completed for the Application Site in 2016. Data was obtained from the following sources for within 2 km of the Application Site, extended to 10 km for European designated areas: Thames Valley Environmental Records Centre (TCERC) and the Multi-Agency Geographic Information for the Countryside (MAGIC) website (Appendix I.2).	A desk study was completed for the TVP P&R Site in 2015. Data was obtained from the following sources for within 2 km of the TVP P&R Site, with a search for waterbodies within 500 m: TVERC, Berkshire and South Buckinghamshire Bat Group, Berkshire Ornithological Society, freely available OS-mapping and / or aerial photography and the MAGIC website (Appendix I.6).
	An update review of environmental data obtained from freely available online sources was undertaken in September 2018.	
Extended Phase 1 habitat survey	An extended Phase 1 habitat survey of the Application Site was carried out in 2016. Habitats were identified and mapped following standard Joint Nature Conservation Committee (JNCC) Phase 1 habitat survey methodology as detailed in the Phase 1 Habitat Survey Handbook (JNCC, 2010). The survey was extended to give particular consideration to the potential of the habitats present to support protected species or species of conservation importance (Appendix I.2).	An extended Phase 1 habitat survey of the TVP P&R Site was carried out in 2015. Habitats were identified and mapped following JNCC Phase 1 habitat survey methodology as detailed in the Phase 1 Habitat Survey Handbook (JNCC, 2010). The survey was extended to give particular consideration to the potential of the habitats present to support protected species or species of conservation importance (Appendix I.6).
	An updated walkover survey of the Combined Site was undertaken in March 2018 to inform the previous ES addendum (2018) (Appendix I.11). This was repeated in August 2018 to provide an update baseline for this assessment. The purpose of this survey was to re-assess the condition of the habitats present within the Application Site and their potential to support protected species, to determine if there had been any material changes since the 2015 and 2016 survey work (Appendix I.12).	

Detailed botanical	A detailed Phase 2 botanical survey was undertaken in June 2016 (Appendix I.5).	No detailed botanical work was undertaken as it was not considered necessary to determine the ecological baseline.
Bats	A series of bat surveys were completed for the Application Site in 2016 (Appendix I.4). These were completed in accordance with the Bat Conservation Trusts Good Practice Guidance (Collins, 2016) and included: ▪ A ground-level assessment of trees followed by further detailed inspection and dusk emergence/dawn return to roost surveys of trees classified as having a high/medium level of roosting potential; ▪ A dusk emergence survey of the railway bridge spanning the River Kennet; and ▪ Monthly activity transect surveys between May and September inclusive, supplemented through the use of automated static bat detectors between May and October inclusive.	An initial single bat activity survey (static detector monitoring only) was completed for the TVP P&R Site in 2015 (Appendix I.9). Supplementary bat activity surveys (transects and static detector monitoring) were completed for the TVP P&R Site in 2015, with reference to good practice guidance applicable at the time of the survey (Hundt, 2012 and Mitchell-Jones, 2004) (Appendix I.7).
	In addition to the above, a series of bat activity surveys were completed between August and October 2018. These comprised activity transects, supplemented through the use of automated static bat detectors (Appendix I.4).	
Badgers	Potential for badgers <i>Meles meles</i> to be present was assessed as part of the extended Phase 1 habitat survey (Appendix I.2). No further surveys required.	A badger survey was carried out for the TVP P&R Site in 2015 (Appendix I.7).
	Potential for badgers was reconsidered following the update site walkover survey.	
Breeding birds	Potential for breeding birds to be present was assessed as part of the extended Phase 1 habitat survey (Appendix I.2). No further surveys required.	A single breeding bird survey was carried out for the TVP P&R Site in 2015 (Appendix I.8). The survey work followed a standard method based on the British Trust for Ornithology's (BTO's) Common Bird Census (CBC), as summarised by Bibby et al. (2000).
	Potential for breeding birds was reconsidered following the update site walkover survey.	
Great crested newts	Potential for great crested newts <i>Triturus cristatus</i> to be present was assessed as part of the extended Phase 1 habitat survey (Appendix I.2). No further surveys required.	A Habitat Suitability Index (HSI) Assessment was completed for one waterbody located within 500 m of the TVP P&R Site in 2015. The methodology was based on that prescribed by Oldham <i>et al.</i> (2000) and simplified by National Amphibian and Reptile Recording Scheme (NARRS) (Appendix I.7).

	Potential for great crested newts was reconsidered following the update site walkover survey.	
Reptiles	A series of reptile presence / likely absence surveys were completed for the Application Site in 2016 (Appendix I.3). These surveys were based on best practice guidance and professional judgement.	A series of reptile presence / likely absence surveys were completed for the TVP P&R Site in 2015 (Appendix I.7). These surveys were based on best practice guidance and professional judgement.
	In addition to the above, an update reptile surveys were completed for areas of suitable habitat on within the Combined Site between August and September 2018 (Appendix I.3).	

Approach to Ecological Assessment

- 14.4.7 The assessments set out in this Chapter have been undertaken with regard to the CIEEM Guidelines (CIEEM, 2018). The CIEEM Guidelines state that '*EclA is a process of identifying, quantifying and evaluating the potential effects of development-related or other proposed actions on habitats, species and ecosystems*'. It requires an assessment of likely significant effects on important ecological features, and as such, does not require consideration of effects on every species or habitat that may be present.
- 14.4.8 To determine whether there are likely to be significant effects, it is first necessary to identify whether an ecological feature is 'important', and therefore whether an effect upon it could be significant, and thus, material in decision-making. To achieve this, where possible, animal species and their populations have been valued on the basis of a combination of their rarity, status and distribution, using contextual information where it exists. Habitats and plant communities have been evaluated against existing selection criteria, wherever possible (such as those developed to aid the designation of Site of Special Scientific Interest (SSSI) or non-statutory designated areas).
- 14.4.9 Ecological input has been provided in to the design for the Proposed Development; and as such, the Proposed Development has been able to avoid and / or provide 'embedded mitigation' for negative ecological impacts and effects that may otherwise occur. The assessments therefore consider the Proposed Development / Combined Development's impacts and assess the ecological effects taking account these embedded mitigation measures. This approach is in accordance with the CIEEM Guidelines, and the EIA Regulations 2017, which promote the assessment of effects of the mitigated scheme only, where there is high confidence that embedded mitigation will be implemented; as in this situation.
- 14.4.10 These assessments examine effects on important ecological features with regard to the positive (beneficial) or negative (adverse) nature, extent, magnitude, duration, timing, frequency, and reversibility of the impacts. For each ecological feature identified as being important, relevant impacts are then characterised; effects defined (in light of any embedded ecological mitigation) and their significance assessed; further mitigation identified and residual impacts reported. This exercise is performed for the Proposed Development in isolation and also the Combined Development.

Terminology

14.4.11 The terms 'impact' and 'effect' are often used synonymously and this can lead to confusion. For the purposes of these assessments, they are defined as follows, in accordance with the CIEEM Guidelines:

- Impacts: Actions resulting in changes to an ecological feature. For example, the construction activities of a development removing a hedgerow.
- Effects: Outcome to an ecological feature from an impact. For example, the effects on a dormouse population from a loss of a hedgerow.

Valuation of Ecological Features and Determining Importance

14.4.12 The importance of each ecological feature within the study area has been determined having regard to a number of contributory factors relating to conservation value.

14.4.13 The CIEEM Guidelines recognise that determining importance is a complex process, which is a matter of professional judgement guided by the importance and relevance of a number of factors. These include designation and legislative protection as well as biodiversity value, potential value and secondary/supporting value. Consideration of each ecological feature having regard to these factors allows their importance to be determined, with reference to the geographic context set out below:

- International / European;
- National (England);
- Regional (the Thames Valley Region west of London (i.e. Wiltshire, Oxfordshire, Berkshire, Buckinghamshire);
- County (Oxfordshire and / or Berkshire counties); and
- Local (Reading and / or Wokingham Borough unitary authorities).

14.4.14 Ecological features that are important within a 'Local' context or above are then considered further within the impact assessment, with ecological features that are of less than 'Local' importance (i.e. those that may be considered to be important only within the context of the parish/ neighbourhood or Site), excluded.

14.4.15 Where protected species of less than 'Local' importance were nonetheless present, measures to ensure compliance with relevant wildlife legislation have been provided.

Assessing Ecological Impacts and Determining Significance

14.4.16 The nature and extent of the impacts of the Proposed Development / Combined Development have been informed by other studies reported within and undertaken to support this ES. In particular, the outputs in relation to landscape (**Chapter 13**), hydrology and flood risk (**Chapter 11**) and lighting (included within **Chapter 13**) are important as these determine the nature and significance of potential impacts on important ecological features.

14.4.17 The predicted impacts may be direct or indirect in nature and may occur in the construction and/or operational phase of the Proposed Development. The determination and description of the significance of the predicted ecological effects is then based on professional judgement and made with regard to the positive (beneficial) or negative (adverse) nature; extent; magnitude; duration; timing; frequency; and reversibility of the impacts assessed.

14.4.18 These factors provide a means of characterising the impacts of the Proposed Development and thereby support an assessment of the significance of the effects on the important ecological features determined as relevant in this assessment.

- 14.4.19 Whilst the wider impact assessment uses generic criteria, based on an expression of severity, to describe the significance of environmental effects, the CIEEM Guidelines encourages the expression of significance of ecological effects with reference to a geographic frame of reference.
- 14.4.20 The CIEEM Guidelines state that an effect should be determined as being significant when it *'either supports or undermines biodiversity conservation objectives for important ecological features or for biodiversity in general'*. Significance is a concept related to the weight that should be afforded to effects when decisions are made, and to the consequences, in terms of legislation, policy and/or development control. So, a significant negative (adverse) effect on a feature of importance at one level would be likely to trigger related planning policies and, if permissible at all, generate the need for development control mechanisms, such as planning conditions or legal obligations, as described in those policies.
- 14.4.21 An effect on an important ecological feature may be significant at the same geographic scale at which the feature is determined to be important (see **Paragraph 14.4.12**), or at a lesser geographical scale, depending on the characterisation of the impact. By way of example, limited impacts on a woodland of county importance might be assessed as being significant at a local level of importance. This methodology supports an evidence based approach which supersedes previous matrix-based assessment methodologies.
- 14.4.22 This ES uses generic criteria, based on an expression of severity, to describe the significance of environmental impacts. For ease of reference, **Table 14.2** below provides a means of relating the two approaches and is provided in order to allow the EcIA(s) to be integrated into the wider EIA without compromising the CIEEM best practice approach.

Table 14.2: Ecological Significance Criteria

Significance level	Criteria	CIEEM Geographical Criteria
Substantial	Only adverse effects are assigned this level of significance as they represent key factors in the decision-making process. These effects are generally, but not exclusively associated with sites and features of international, national or regional importance. A change at a regional or district scale site or feature may also enter this category.	Ecological impacts assessed as being significant at national or higher geographical scales and that have triggered a response in development control terms are considered to represent impacts that overall within this assessment are of severe significance.
Major	These effects are likely to be important considerations at a local or district scale but, if adverse, are potential concerns to the project and may become key factors in the decision-making process.	Ecological impacts assessed as being significant at the regional scales and that has triggered a response in development control terms are considered to represent impacts that overall within this assessment are of major significance.
Moderate	These effects, if adverse, while important at a local scale, are not likely to be key decision-making issues. Nevertheless, the cumulative effect of such issues may lead to an increase in the overall effects on a particular area or on a particular resource.	Ecological impacts assessed as being significant at the county scale and that has triggered a response in development control terms will be considered to represent impacts that overall within this assessment are of moderate significance.

Minor	These effects may be raised as local issues but are unlikely to be of importance in the decision-making process. Nevertheless, they are of relevance in enhancing the subsequent design of the project and consideration of mitigation or compensation measures.	Ecological impacts assessed as being significant at the local scale and that has triggered a response in development control terms will be considered to represent impacts that overall within this assessment are of minor significance.
Negligible	No effect or effect which is beneath the level of perception, within normal bounds of variation or within the margin of forecasting error.	Ecological impacts that have been assessed as not being significant at any geographic level

Mitigation and Assessment of Residual Effects

- 14.4.23 The CIEEM Guidelines state that: ‘a sequential process should be adopted to avoid, mitigate and compensate negative ecological impacts and effects. This is often referred to as the ‘Mitigation Hierarchy’. In this instance, the assessments take in to account avoidance measures and embedded ecological mitigation. Where potential effects arise, in spite of this, further mitigation is then provided.
- 14.4.24 Residual effects are those that remain after implementation of avoidance and mitigation measures (both embedded and further). They are assigned a significance in accordance with the criteria set out within **Table 14.2** above.

Assumptions and Limitations

- 14.4.25 Limitations associated within the individual ecological baseline surveys are provided within the respective reports (contained within **Appendices I.2 – I.12**).
- 14.4.26 The baseline ecology survey and associated reporting for the TVP P&R Site have been completed by third parties (not under PBA instruction). These have not been audited or influenced by PBA and as such, have been used for reference only. Where conclusions have been drawn by PBA for the purposes of the assessment, they have been indicated within the main body of the Chapter.

14.5 Baseline Conditions

- 14.5.1 The baseline conditions presented within this section provide the results of the desk and baseline ecological surveys described within the ‘**Methodology**’ section of this chapter.

Designated Areas

- 14.5.2 Designated areas identified from TVERC and the MAGIC website (www.magic.gov.uk) within the search radii outlined within **Paragraph 14.4.4** are summarised in **Table 14.3**. Distances above 1 km are rounded to the nearest 0.1 km. The geographic context at which designated areas are considered important has also been identified.

Table 14.3: Designated Areas

Site Name	Designation	Distance from Application Site	Distance from Combined Site	Geographic Context
<i>Statutory Designated Areas</i>				
Highwood	Local Nature Reserve (LNR)	1.8km south east	1.8km south east	County

Non-Statutory Designated Areas				
The Coal, Kennetmouth and Kings Meadow East	LWS	Partially on-site	Partially on-site	County
Henley Road Gravel Pit	LWS	100 m north	100 m north	County
Reading Cemetery	LWS	530 m south	530 m south	County
Thames Valley Park	LWS	1.1 km north east	1.1 km north east	County
Whiteknights Park	LWS	1.5 km south	1.5 km south	County
Holy Brook	LWS	1.6 km south west	1.6 km south west	County
River Kennet / Kennet and Avon Canal	LWS	1.6 km south west	1.6 km south west	County

14.5.3 Full details pertaining to each of the designated areas contained within **Table 14.3** are provided within **Appendix I.2**.

14.5.4 Although there are no other statutory designated areas within 2 km of the Application Site, a number of Site of Special Scientific Interest (SSSI) Impact Risk Zones (IRZ) were identified (www.magic.gov.uk). Of these, the Application Site itself was located only within the IRZ for Lodge Wood and Sandford Mill SSSI, located approximately 4.5 km south east of the Proposed Development. The IRZ is a tool used to determine whether planning applications are likely to impact on European designated areas or, as in this case, SSSI's. The citation for Lodge Wood and Sandford Mill SSSI identifies the area to comprise two small wet woodlands, bordering the River Loddon; with notable populations of Loddon Lily identified to be present. The IRZ for Lodge Wood and Sandford Mill SSSI identifies that impacts on this area are only anticipated as a result of the following development types: airports, helipads and other aviation proposals; pig & poultry units, slurry lagoons > 750m³ & manure stores > 3500t as opposed to transport as per the Proposed Development.

14.5.5 No European designated areas were identified within 10 km of the Combined Site.

Notable Habitats and Flora

Ancient Woodland

14.5.6 Eight parcels of Ancient and Semi-Natural Woodland or Ancient Replanted Woodland were identified (www.magic.gov.uk) within the search radii outlined within **Paragraph 14.4.4**. Details of these are summarised in **Table 14.4**. Distances above 1 km rounded to the nearest 0.1 km. The geographic context at which Ancient Woodland is considered important has also been identified.

Table 14.4: Ancient Woodland

Site Name	Distance from Application Site	Distance from Combined Site	Geographic Context
Unnamed Woodland ID: 1504533	960 m north	900 m north	National
Great Bramley's Park ID: 1505319	1.5 km south east	1.5 km south east	National

Site Name	Distance from Application Site	Distance from Combined Site	Geographic Context
Great Bramley's Park ID: 1505075	1.4 km south east	1.4 km south east	National
Colcrafts Coppice ID: 1505076	1.7 km south east	1.7 km south east	National
High Wood (South Land Coppice) ID: 1505077	1.6 km south east	1.6 km south east	National
High Wood (South Land Coppice) – Ancient Replanted Woodland ID: 1505078	1.9 km south east	1.9 km south east	National
South Land Coppice ID: 1505079	2.0 km south east	2.0 km south east	National
High Wood (Wood Adjoining Coppice) ID: 1505081	1.8 km south east	1.8 km south east	National

Habitats of Principal Importance

- 14.5.7 Parcels of HPI identified from MAGIC (www.magic.gov.uk) within the search radii outlined within **Paragraph 14.4.4** are summarised in **Table 14.5**. Distances above 1 km rounded to the nearest 0.1 km. The geographic context at which the Ancient Woodland is considered important has also been identified.

Table 14.5: Habitats of Principal Importance

Habitat Type	Distance of closest from Application Site	Distance of closest from Combined Site	Geographic Context
Lowland mixed deciduous woodland	On-site	On-site	County
Eutrophic standing waters	65 m north	65 m north	County
Rivers ²⁵	990 m north	990 m north	County
Traditional orchard	1.3 km north	1.3 km north	County
Reedbeds	1.1 km north east	1.1 km north east	County
Lowland fens	1.1 km north east	1.1 km north east	County
Lowland wood pastures and parkland	1.9 km south	1.9 km south	County

²⁵ Although the River Thames is located immediately north of the Combined Site, with the River Kennet crossing beneath it, neither is identified as HPI: Rivers within the desk study data received.

Notable Flora

14.5.8 A review of data provided by TVERC in March 2016 identified that two nationally scarce plant species (Status-NS) were identified from within 2 km of the Application Site during the 10 years previous:

- In 2012, two records of summer snowflake *Leucojum aestivum subsp. Aestivum* (also known as 'Loddon lily') were returned from within The Coal, Kennetmouth and Kings Meadow East LWS located partially within the Application Site. An additional record was returned from within Thames Valley Park, located over 1 km from the Application Site; and
- A single record of sea-buckthorn *Hippophae rhamnoides* was identified from within Whiteknights Park, approximately 1.7 km south of the Application Site, in 2006.

14.5.9 Further consideration of notable flora is made within the habitats below, as required.

On-Site Habitats

Previous Survey Data

14.5.10 An extended Phase 1 habitat survey was completed for the TVP P&R Site in 2015 (**Appendix I.6**). An extended Phase 1 habitat survey (**Appendix I.2**) and subsequent detailed botanical survey (**Appendix I.5**) was completed for the Application Site in 2016. Following this, and in advance of the ES Addendum being submitted (2018), an update site walkover survey of the Combined Site was carried out in 2018 (**Appendix I.11**). Full details of the habitats identified are provided within the identified appendices.

Update Survey Data

14.5.11 To inform the current assessment, an additional update site walkover survey of the Combined Site was carried out. Full details are provided within **Appendix I.12**.

14.5.1 The distribution and types of habitats within the Application Site (and typical plant species they support) was found to be broadly similar to that recorded in 2016, with the exception of the TVP P&R Site in the eastern extent of the Application Site / Combined Site which had been largely cleared and fenced with HERAS security fencing (as recorded in the March 2018 walkover survey; PBA, 2018).

14.5.2 The habitats recorded in 2018 are summarised in **Table 14.6** below together with a brief note on any changes to these habitats since the 2016 survey. Note many areas have been classified as habitat mosaics where a mixture of habitat types occur in a small area (often due to succession or natural colonisation). Habitat areas and valuation is set out in **Table 14.7** below.

Table 14.6: Habitats Recorded within the Combined Site in 2018

Habitat Type	Description/Notes on Distribution	Dominant/Characteristic Plant Species	Comparison with 2016 Survey Data (PBA, 2016) and 2015 Data (CA Ecology, 2015)
Broadleaved semi-natural woodland	Concentrated in the central part of the Application / Combined Site to the west of the River Thames crossing. These are blocks of woodland	Silver birch <i>Betula pendula</i> Sycamore <i>Acer pseudoplatanus</i> Norway maple <i>Acer platanoides</i> Ash <i>Fraxinus excelsior</i> Butterfly-bush <i>Buddleja davidii</i> Elder <i>Sambucus nigra</i> Hawthorn <i>Crataegus monogyna</i> Bramble <i>Rubus fruticosus</i>	No material change. However, a small clearing within the easternmost block of woodland was recorded in 2018 as tall ruderal/ephemeral/short-

Habitat Type	Description/Notes on Distribution	Dominant/Characteristic Plant Species	Comparison with 2016 Survey Data (PBA, 2016) and 2015 Data (CA Ecology, 2015)
	linked to wider areas of woodland off-site to the north and west.	Garlic mustard <i>Alliaria petiolata</i>	perennial mosaic (see below).
Broadleaved plantation woodland	Areas of planted woodland are most prevalent in the eastern extent of the Combined Site around the Wokingham Waterside area (outside of the Application Site). Planted trees also occur in a mosaic with introduced shrub around the supermarket car-park to the west (see below).	Sycamore <i>Acer pseudoplatanus</i> Hazel <i>Corylus avellana</i> Field maple <i>Acer campestre</i> Wild privet <i>Ligustrum vulgare</i>	No material change.
Dense scrub	Dense scrub is present in numerous locations within the Application / Combined Site, particularly in the central area south of the woodland, at the western extent of the Application / Combined Site and toward the eastern extent around the margins of the now cleared TVP P&R Site (outside of the Application Site).	Bramble <i>Rubus fruticosus</i> Butterfly-bush <i>Buddleja davidii</i> Dogwood <i>Cornus sanguinea</i> Hawthorn <i>Crataegus monogyna</i> Blackthorn <i>Prunus spinosa</i> Dog-rose <i>Rosa canina</i>	Areas of former scrub occurred within the TVP P&R Site (and as such, the eastern extent of the Application / Combined Site) which have now been cleared. Otherwise remaining dense scrub on-site is in a similar condition to that recorded in 2016 allowing for a small amount of continued colonisation of some of the marginal areas (i.e. slight increase in scrub area).
Scattered scrub	Scattered scrub occurs as individual bushes (e.g. on the edge of grassland to the east of the River Thames crossing) or in a mosaic with other habitats (see below).	Hawthorn <i>Crataegus monogyna</i> Butterfly-bush <i>Buddleja davidii</i> Elder <i>Sambucus nigra</i> Bramble <i>Rubus fruticosus</i>	No material change.
Scattered broadleaved trees	Scattered trees are present in the eastern extent of the Application / Combined Site, largely in association with grassland areas, or in mosaic with other habitat types (see below).	Weeping willow <i>Salix</i> sp. Sycamore <i>Acer pseudoplatanus</i> Crack willow <i>Salix fragilis</i>	No material change.

Habitat Type	Description/Notes on Distribution	Dominant/Characteristic Plant Species	Comparison with 2016 Survey Data (PBA, 2016) and 2015 Data (CA Ecology, 2015)
Unimproved calcareous grassland	Not recorded in 2018; however a strip is anticipated to have been retained within the southern extent of the TVP P&R Site as part of the reptile receptor area.	N/A	This habitat type was recorded within the TVP P&R Site during the 2015 surveys. Whilst it had largely removed as part of the clearance of the TVP P&R Site in 2018, it is anticipated that a strip has been retained within the southern extent of the TVP P&R Site (within the Application / Combined Site) as part of the reptile receptor area.
Poor semi-improved grassland	Poor semi-improved grassland occurs to the east of the River Thames crossing as a section of more open ground between the River Thames and the railway embankment.	Cock's-foot <i>Dactylis glomerata</i> <i>Angelica Angelica sylvestris</i> Common nettle <i>Urtica dioica</i> False oat-grass <i>Arrhenatherum elatius</i>	Largely similar although increasing invasion by ruderal species has occurred in places.
Running water (part of the River Kennett and the River Thames)	This comprises the section of the open River Thames along the northern extent of the Application / Combined Site and the River Kennett over which the Application / Combined Site crosses.	N/A (see marginal vegetation)	No material change.
Amenity grassland	Amenity grassland occurs as a mown area (with scattered trees above) in the eastern extent of the Combined Site.	Perennial rye-grass <i>Lolium perenne</i> Red fescue <i>Festuca rubra</i> Creeping cinquefoil <i>Potentilla reptans</i> Mosses	No material change.
Introduced shrub	This occurs as planted 'amenity' shrubberies in association with the supermarket car-park in the western extent of the Application / Combined Site as well as areas dominated by butterfly-bush.	Butterfly-bush <i>Buddleja davidii</i> Cotoneaster sp <i>Cotoneaster</i> spp. Bay laurel <i>Laurus nobilis</i> Shrubby honeysuckle <i>Lonicera</i> sp. <i>Viburnum Viburnum</i> sp.	No material change.
Fences	Low post and rail fencing and iron railings occur in parts of the Application /	N/A	No material change.

Habitat Type	Description/Notes on Distribution	Dominant/Characteristic Plant Species	Comparison with 2016 Survey Data (PBA, 2016) and 2015 Data (CA Ecology, 2015)
	Combined Site, in particular the areas west of the Thames in association with the supermarket car-park boundary and along the River Thames path.		
Hardstanding	Areas of hardstanding include the car-parking in the west of the Application / Combined Site and associated access roads plus surfaced paths along the River Thames and through the woodland.	N/A	No material change.
Buildings	A single building is located within the TVP P&R Site. This is located outside the Application Site, but inside the Combined Site.	N/A	No material change.
Other habitat – recently cleared ground	This comprises the area cleared for the TVP P&R Site in the eastern extent of the Application / Combined Site. This area is now largely devoid of vegetation, although brash indicates a mosaic of scrub, small trees and ruderal vegetation formerly occurred here.	N/A	New habitat since 2016 – area was formerly a mosaic of scrub, ruderal vegetation and small trees.
Bare Ground	Small areas are located within the eastern extent of the Application / Combined Site.	N/A	No material change.
Broadleaved plantation woodland/introduced shrub mosaic	This habitat type occurs widely through the supermarket car-parking area in the western extent of the Application / Combined Site as 'amenity' landscape planting.	Common lime <i>Tilia × europaea</i> Field maple <i>Acer campestre</i> Cotoneaster sp <i>Cotoneaster</i> spp. Bay laurel <i>Laurus nobilis</i> Shrubby honeysuckle <i>Lonicera</i> sp. Viburnum <i>Viburnum</i> sp. Butterfly-bush <i>Buddleja davidii</i>	No material change.

Habitat Type	Description/Notes on Distribution	Dominant/Characteristic Plant Species	Comparison with 2016 Survey Data (PBA, 2016) and 2015 Data (CA Ecology, 2015)
Scattered scrub/ poor semi-improved neutral grassland/ ephemeral/ short-perennial mosaic	This mosaic occurs in the western extent of the Application / Combined Site as an overgrown area (likely former grassland) with increasing colonisation by scrub and self-seeded species.	Wild mignonette <i>Reseda lutea</i> Great mullein <i>Verbascum thapsus</i> Creeping bent <i>Agrostis stolonifera</i> Perforate St John's-wort <i>Hypericum perforatum</i> Dark mullein <i>Verbascum nigrum</i> Creeping cinquefoil <i>Potentilla reptans</i> Butterfly-bush <i>Buddleja davidii</i> Common centaury <i>Centaureum erythraea</i> Teasel <i>Dipsacus fullonum</i> Stonecrop (dead) <i>Sedum</i> sp. Cypress spurge <i>Euphorbia cyparissias</i> False brome <i>Brachypodium sylvaticum</i>	Broadly similar although slight increase in the area of scrub through natural succession.
Scattered scrub/ ephemeral/ short-perennial/ introduced shrub mosaic	This mosaic is present toward the western extent of the Application / Combined Site adjacent to the railway boundary and bordered by the supermarket access road to the north.	Dark mullein <i>Verbascum nigrum</i> Butterfly-bush <i>Buddleja davidii</i> Bramble <i>Rubus fruticosus</i> Perforate St John's-wort <i>Hypericum perforatum</i> Wild parsnip <i>Pastinaca sativa</i> Hemlock <i>Conium maculatum</i>	No material change (although classified as a mosaic in 2018).
Tall ruderal/ ephemeral/ short-perennial mosaic	A small clearing in the woodland toward the centre of the Application / Combined Site was classified as a habitat mosaic due to the presence of short vegetation and colonising ruderal species.	Common nettle <i>Urtica dioica</i> Perforate St John's-wort <i>Hypericum perforatum</i> Great mullein <i>Verbascum thapsus</i> Comfrey <i>Symphytum officinale</i>	Formerly included within the woodland categorisation in 2016.
Tall ruderal/ marginal vegetation mosaic	Marginal vegetation along the banks of the River Thames occurs in places, particularly adjacent to the River Thames crossing in the central part of the Application / Combined Site.	Himalayan balsam <i>Impatiens glandulifera</i> Hemlock water-dropwort <i>Oenanthe crocata</i> Great willowherb <i>Epilobium hirsutum</i> Common nettle <i>Urtica dioica</i> Purple loosestrife <i>Lythrum salicaria</i>	No material change, although classified as a mosaic due to tall ruderal component (formerly classified as marginal vegetation only).
Scattered broadleaved trees/ tall ruderal mosaic	This mosaic was recorded just east of the River Thames crossing as a dense stand of ruderal vegetation beneath scattered trees.	Weeping willow <i>Salix</i> sp. Sycamore <i>Acer pseudoplatanus</i> Crack willow <i>Salix fragilis</i> Common nettle <i>Urtica dioica</i> Bramble <i>Rubus fruticosus</i>	Formerly this area contained a greater proportion of poor semi-improved grassland which has now been invaded by dense tall ruderal vegetation.

Valuation

14.5.3 Of the habitats identified above, the following are considered common, widely re-creatable and of limited intrinsic ecological importance. They are not identified as habitats within either Reading or Wokingham for which conservation action plans have been produced and as such, they are not considered to be of importance within the Local context or greater:

- Scattered scrub: this habitat type is present across the Application Site / Combined Site, often encroaching from the adjacent railway corridor comprising limited species diversity;
- Introduced shrub (including broadleaved plantation woodland / introduced shrub mosaic): this habitat type comprised man-made beds of predominantly non-naïve species planting;
- Other habitat: recently cleared ground: this area is now devoid of vegetation and therefore intrinsic ecological value; and
- Other mosaic habitats: where not otherwise specified below, these habitat matrices namely comprised habitats of low intrinsic ecological value, and were themselves limited in area and botanical diversity.

14.5.4 Further detail is provided below for the remaining habitats:

Broadleaved Semi-Natural Woodland

14.5.5 Broad-leaved semi-natural woodland is present within the Application / Combined Site, to the west of the River Kennet; primarily located within The Coal, Kennetmouth and Kings Meadow East LWS.

14.5.6 Information obtained during a detailed botanical survey (June, 2016) identified four different habitat/habitat mosaic parcels within the portion of broad-leaved semi-natural woodland located between the Tesco Car Park and the River Kennet. These habitats / habitat mosaic parcels were based on vegetation character/structure and species present. Full details are provided within the detailed botanical report (**Appendix I.5**). A high-level summary is provided below:

- The woodland making up the bulk of the portion of the LWS located between the Tesco Car Park and the River Kennet was divided into two areas, north (BW1) and south (BW2) of a surfaced footpath (see **Appendix I.5, Figure 2**). The northern area (BW1) is located almost wholly outside of the Application Site/ Combined Site. It comprised a mixed secondary woodland with frequent mature and young self-seeded sycamore and occasional mature ash, plus a dense shrub layer of elder, hawthorn and butterfly-bush. This section of woodland also had a characteristic row of mature horse chestnut *Aesculus hippocastanum* trees growing along the northern edge adjacent to the Thames path (footpath). Virginia creeper *Parthenocissus quinquefolia* was noted growing on trunks of trees and across the ground in this location. The area of woodland to the south (BW2) is located almost wholly within the Application Site / Combined Site. It was noticeably different in character (compared to BW1), having abundant silver birch, frequent Norway maple and a group of mature hybrid black poplar *Populus deltoides x nigra*, resulting in a more open woodland with a less dense shrub layer (although elder and young sycamore are still frequent). Ground cover in both BW1 and BW2 contained a mixture of species such as common nettle, garlic mustard, ground ivy *Glechoma hederacea*, green alkanet *Pentaglottis sempervirens* and cleavers *Galium aparine*. Due to the predominance of shrub species in the bulk of the woodland parcels, both BW1 and BW2 showed more affinity to scrub community (e.g. W21 (*Crataegus monogyna* - *Hedera helix*) scrub), as opposed to 'true' woodland.
- The eastern end of the portion of the LWS located between the Tesco Car Park and the River Kennet consisted of a more open 'glade' with scattered scrub and ruderal vegetation. Again, this area is located largely within the Application Site / Combined Site. The scrub component comprised a mixture of young, self-seeded sycamore and ash with frequent butterfly-bush and occasional dogwood. Characteristic ground cover species

here included creeping cinquefoil and common nettle, with other species including thyme-leaved speedwell *Veronica serpyllifolia*, wild mignonette and wood forget-me-not *Myosotis sylvatica*. In the most open areas some grassland had established including creeping bent and red fescue.

- The southern part of the portion of the LWS located between the Tesco Car Park and the River Kennet consisted of a strip of scrub/introduced shrub between the woodland (BW2) and the adjacent railway corridor. This area was located almost wholly within the Application Site / Combined Site. Dense stands of butterfly-bush were characteristic of this area, with frequent young self-seeded sycamore and patches of bramble and common nettle. Where scrub was more open, a variety of ground cover species was recorded including ground ivy, green alkanet, creeping cinquefoil, common ragwort *Senecio jacobaea*, teasel, wood forget-me-not, garlic mustard, cleavers, great mullein and dark mullein.

14.5.7 No material changes were identified within this area in August 2018.

14.5.8 Given its setting, largely within The Coal, Kennetmouth and Kings Meadow East LWS; and having been identified as 'lowland mixed deciduous woodland' HPI following the botanical surveys (albeit whilst acknowledging that the on-site areas of woodland in the LWS are not good examples of this habitat type due to their small size and general lack of mature tree cover), this habitat type is considered to be of importance within the **County** context, in line with the importance level at which the LWS is valued.

Broad Leaved Plantation Woodland

14.5.9 An area of planted broad-leaved woodland is present within the Combined Site (**Appendix I.6**²⁶); a small strip of which extends in to the eastern extent of the Application Site.

14.5.10 Although identified within the Preliminary Ecological Appraisal as an HPI (**Appendix I.6**), this habitat type is limited in extent and of low quality, comprising moderate and low grade trees (as identified within the Arboricultural Impact Assessment & Tree Protection Plan (Bosky Trees, 2016)). As such, it is of low intrinsic ecological value, and is not considered to be of importance within the Local context or greater.

Dense Scrub

14.5.11 Dense scrub was present in several discrete areas throughout the Application / Combined Site, as well as forming part of habitat matrices. Given the common and easily re-creatable nature of this habitat type and the species within it, dense scrub is of low intrinsic ecological value and is not considered to be of importance within the Local context or greater.

14.5.12 Where this habitat type is located within the footprint of The Coal, Kennetmouth and Kings Meadow East LWS however, it is identified to provide a component part of the habitats for which it is designated; and as such, is considered to be of importance within the **County** context, in line with the importance level at which the LWS is valued.

Scattered Trees

14.5.13 Scattered trees are present throughout the Application Site / Combined Site. These vary in age, including mature and semi-mature specimen, and comprise common and widespread species. As the main tree resource for the Application Site / Combined Site is contained within the broad-leaved semi-natural woodland and or plantation woodland however (and as such, has been considered within these habitat types above), the remaining scattered trees are

²⁶ This habitat type was surveyed as part of the baseline for the permitted TVP P&R Site, and as such, was completed by third parties (not under PBA instruction). Further details are provided within Appendix I.6.

limited in number and as such are not considered to be of importance within the Local context or greater.

Unimproved Calcareous Grassland

- 14.5.14 A small strip of calcareous grassland (c. 0.05 ha) is anticipated to have been retained within the southern extent of the Application / Combined Site, as part of the reptile mitigation implemented as part of the TVP P&R planning permission.
- 14.5.15 Although unimproved calcareous grassland was identified within the Preliminary Ecological Appraisal as an HPI (**Appendix I.6**) and as such, of intrinsic ecological value, this habitat type is a low quality and isolated example of limited extent. As such, unimproved calcareous grassland is not considered to be of importance within the Local context or greater.

Poor Semi-Improved and Amenity Grassland

- 14.5.16 The majority of the eastern portion of the Application Site / Combined Site comprised poor semi-improved or amenity grassland. Although semi-improved grassland and amenity grassland are referenced within the Urban II Habitat Action Plan within Reading BAP ('*open grassland*') and the Grassland and Hedgerow Habitat Action Plan within Wokingham BAP ('*all types of lowland grassland*'), the example of these habitat types with the Application Site / Combined Site are species poor, and of low intrinsic ecological value, being dominated by common plant species and easily re-creatable in nature. As such, neither poor semi-improved grassland nor amenity grassland are considered to be of importance within the Local context or greater.

Running Water

- 14.5.17 Running water is located within the Application / Combined Site both where the Proposed Development crosses the River Kennet; and as a narrow strip of the River Thames along the northern extent of the Application Site / Combined Site. Whilst not identified as a HPI within the desk study, all natural and near-natural running waters in the UK are considered to be HPI in accordance with the broad nature of the Priority Habitat Description (taken from: UK Biodiversity Action Plan; Priority Habitat Descriptions. BRIG (ed. Ant Maddock) 2008). Riparian habitat associated with the edge of this habitat type is considered within the section below.
- 14.5.18 Whilst identified to be an HPI, the both the River Kennet and the extent of the River Thames associated with the Application / Combined Site are highly modified, with both reinforced banks and high levels of anthropogenic disturbance. Running water in the form of the River Kennet and River Thames is considered to be of importance within the **County** context.

Tall Ruderal / Marginal Vegetation Mosaic

- 14.5.19 Information obtained during the detailed botanical survey (June, 2016) identified a strip of vegetation north of the Thames path (footpath) growing on the south bank of the River Thames. The majority of this strip (now located wholly outside the Application / Combined Site) was recorded as scattered broadleaved trees and tall ruderal vegetation (SBW/TR1²⁷). The eastern end of this strip of vegetation (again, located outside the Application / Combined Site) was recorded as a mosaic of tall ruderal and marginal vegetation (TR/MV1) growing where there is a break in tree cover. Characteristic species here included clumps of yellow iris *Iris pseudacorus* on the water's edge with dense stands of Himalayan balsam on the bank along with common nettle, cleavers, creeping thistle *Cirsium arvense* and clustered dock *Rumex conglomeratus* (among others). The Coal, Kennetmouth and Kings Meadow East LWS also appeared to include a narrow strip of land leading up to the existing railway bridge (i.e.

²⁷ Habitat Codes are described further in the List of Abbreviations and in Appendix I.5.

along the west of the River Kennet, and within the Application Site). This area included stands of common nettle as well as characteristic mature crack willow pollards.

14.5.20 No material changes were identified within this area in August 2018.

14.5.21 This habitat type is of low intrinsic ecological value on account of the extensive grazing by swans and presence of Himalayan balsam. Given its location within the footprint of The Coal, Kennetmouth and Kings Meadow East LWS however, it is identified to provide a component part of the habitats for which it is designated; and as such, is considered to be of importance within the **County** context, in line with the importance level at which the LWS is valued.

Summary

14.5.22 A summary of habitat types, the geographic context at which they are important and associated areas (in hectares) is provided within **Table 14.7** below.

Table 14.7: Habitat Summary

Habitat Type	Geographic Context	Application Site	Combined Site
Broadleaved semi-natural woodland	County ²⁸	0.25	0.25
Broadleaved plantation woodland	Less than Local	Less than 0.01	0.16
Dense scrub	County ³	0.79	0.87
Scattered scrub	Less than Local	N/A ²⁹	N/A
Scattered broadleaved trees	Less than Local	N/A	N/A
Unimproved calcareous grassland	Less than Local	0.05	0.05
Poor semi-improved grassland	Less than Local	0.34	0.34
Running water (part of the River Kennett and the River Thames)	County	0.22	0.22
Amenity grassland	Less than Local	0.02	0.23
Introduced shrub	Less than Local	0.30	0.30
Hardstanding	None	0.62	0.62
Buildings	None	N/A	Less than 0.01
Other habitat – recently cleared ground	None	0.48	1.01
Bare Ground	None	0.06	0.08

²⁸ These habitats have been identified as important within the context of the County on account of their association with The Coal, Kennetmouth and Kings Meadow East LWS.

²⁹ For scattered habitats or those habitat matrices for which there is a dominant habitat type, additional areas have not been provided.

Habitat Type	Geographic Context	Application Site	Combined Site
Broadleaved plantation woodland/introduced shrub mosaic	Less than Local	N/A	N/A
Scattered scrub/poor semi-improved neutral grassland/ephemeral/short-perennial mosaic	Less than Local	N/A	N/A
Scattered scrub/ ephemeral/short-perennial/introduced shrub mosaic	Less than Local	N/A	N/A
Tall ruderal/ ephemeral/short-perennial mosaic	Less than Local	N/A	N/A
Tall ruderal/marginal vegetation mosaic	County³	0.02	0.02
Scattered broadleaved trees/tall ruderal mosaic	Less than Local	0.31 ³⁰	0.31

Protected and Notable Species

14.5.23 A suite of protected species surveys was completed for the TVP P&R Site in 2015 and the Application Site in 2016. To inform the current assessment, update reptile and bat activity surveys were also completed in 2018. The results of these surveys have been included within the existing reports for each species group. For further details see **Appendices I.2 – I.12**.

14.5.24 For each species / species group a summary of baseline results is presented below, along with the geographic context at which any such species using the Application / Combined Site are considered to be importance.

Bats

Previous Desk Study

14.5.25 A review of data provided by TVERC in March 2016 identified numerous bat records from within 2 km of the Application Site from within the 10 years previous. These included records for Daubenton's bat *Myotis daubentonii*, noctule bat *Nyctalus noctula*, common pipistrelle *Pipistrellus pipistrellus*, soprano pipistrelle *Pipistrellus pygmaeus* and brown long eared bat *Plecotus auritus* with additional records for bat sp. *Chiroptera* and pipistrelle bat species *Pipistrellus* sp. Confirmed roost records were returned for bat sp., located 1,450 m south of the Application Site in 2009, and soprano pipistrelle, located 770 m south west of the Application Site in 2010.

Previous Survey Data

14.5.26 Habitat within the Application Site was previously identified to provide habitat suitable for use by foraging, commuting and potentially roosting bats; as such, further surveys were undertaken in 2016. In summary, these surveys identified the following:

- A total of three trees/tree groups assessed as having high roosting suitability (T88, T91 and G115), and one tree (T163) assessed as having moderate roosting suitability;

³⁰ This area includes all 'tall ruderal habitat' as show within Appendix I.12: Figure 1; the most substantial of which is located to the east of the River Kennet.

however, no bats were observed roosting in any of these trees during further emergence / re-entry surveys undertaken in 2016.

- No bats were observed emerging from the railway bridge spanning the River Kennet during a dusk emergence survey undertaken in 2016; and as such, were considered likely absent from this structure.
- Bat activity surveys were completed in May – October 2016. Activity levels were recorded to be highest along the River Thames and adjacent to woodland/tree-lines which is to be expected as this constitutes high quality foraging and commuting habitat for bats.
- During the activity surveys, soprano pipistrelle and common pipistrelle bat calls made up the majority of the calls recorded. Other species identified during the activity transects or static detector surveys included: *Myotis* sp. (likely Daubenton's bat given recorded call parameters and observed flight behaviour), noctule, nathusius' pipistrelle *Pipistrellus nathusii*, Leisler's *Nyctalus leisleri*, *Nyctalus* sp. (either Noctule or Leisler's bat), serotine *Eptesicus serotinus* with a single Barbastelle *Barbastella barbastellus* call.

14.5.27 Full details of these surveys are provided within **Appendix I.4**.

14.5.28 In addition, a single preliminary bat activity survey (static detector monitoring only) had already been completed for the TVP P&R Site in 2015, with supplementary bat activity surveys (transects and static detector monitoring) completed for the TVP P&R Site also in 2015. In summary, these surveys identified the following:

- Bat activity levels to be highest within the area of amenity grassland behind the Waterside Centre, with relatively high levels of activity also recorded along the river;
- Soprano and common pipistrelle made up the majority of calls, with *myotis* sp., noctule bats, bats from the *Eptesicus*/*Nyctalus* guild and nathusius' pipistrelle also identified; and
- Given the emergence time and location of a bat recorded during the activity surveys it was identified that the Waterside Centre (off-site) or an adjacent storage shed (within the TVP P&R Site) could be utilised as a roost by soprano pipistrelle bats.

14.5.29 Further details of these surveys are provided within **Appendix I.7**.

Update Desk Study - 2018

14.5.30 A check of records (www.magic.gov.uk) from within 2 km of the Application Site identified a number of granted European Protected Species licences for bats. Of these, the majority were for common and soprano pipistrelle. Whilst it is not possible to determine the exact distance of these records from the Application Site on account of the resolution at which the records are provided, it is anticipated the closest was for common pipistrelle, over 500m from the Application Site.

Update Habitat Suitability Assessment - 2018

14.5.31 The update site walkover survey (August 2018) confirmed both the habitat along the River Thames and adjacent woodland/tree-lines; and habitat within the area of amenity grassland behind the Waterside Centre (i.e. those areas where the most bat activity had been previously recorded) remained unchanged, in spite of the removal of c. 1 ha of semi-natural habitat had been removed from within the TVP P&R Site (and therefore the eastern extent of the Application Site / Combined Site). As such, the habitats within the Application / Combined Site were found to continue to have potential to support foraging and commuting habitat, with the trees and railway bridge, as previously identified, remaining present.

Update Survey Data - 2018

14.5.32 At least four species of bats were recorded over the activity transect surveys. The confirmed species or species groups include:

- Noctule;
- Soprano pipistrelle;
- Common pipistrelle; and
- Barbastelle.

14.5.33 The calls recorded during the transect surveys between August and October 2018 are summarised in **Appendix I.4**, along with figures to display the results.

14.5.34 In contrast to the data gained in 2016, a smaller assemblage of bats was recorded during the activity transects undertaken in late summer/autumn 2018 (note: the data collated in 2018 is not directly comparable to 2016 given the shorter survey period and the use of a different type of bat detector to collect data). Activity levels were highest in August which was likely to be the result of this year's young adding to the number of bats using the Application Site, as young bats become independent by July-August (Mitchell-Jones, 2004).

14.5.35 In 2016, soprano and common pipistrelle bat calls made up the majority of the calls recorded during the activity transects (73.83% of total activity). The second most frequently recorded species was the noctule bat. In contrast, noctule bats made up the bulk of activity in 2018 accounting for 49.05% of calls with activity focussed along the southern-western boundary of the Application Site, close to the Network Rail compounds. Here, the noctule bats were observed foraging on invertebrates attracted to the lighting along the edge of the compound (similar to that recorded in 2016). As in 2016, activity was highest along the River Thames and adjacent to woodland/tree-lines (high quality foraging and commuting habitats for bats).

14.5.36 As in 2016, higher levels of soprano pipistrelle activity were recorded in comparison to common pipistrelle activity (see **Appendix I.4**, Section 4.9 for further analysis). Activity was low in the vicinity of the Tesco car-park (likely due to higher lighting levels and a lack of good quality foraging habitat) and lowest in the eastern extent of the Application Site where the transect route followed Thames Valley Park Drive. A possible reason for this is the extremely bright lighting levels resulting from the use of LED street-lighting in this location.

14.5.37 A single barbastelle bat pass was recorded in the October 2018 surveys. Whilst none were recorded during the 2016 activity transects, a single barbastelle was also recorded during the static detector surveys in 2016.

14.5.38 At least seven bat species were recorded within the Application Site during the periods of static detector monitoring in 2018. These species were as follows:

- Common pipistrelle;
- Soprano pipistrelle;
- Nathusius pipistrelle;
- Noctule;
- *Nyctalus* sp. (either Noctule or Leisler's bat);
- *Myotis* sp.;
- Serotine; and
- Barbastelle.

14.5.39 The data recorded during the static monitoring periods for all months are summarised in **Appendix I.4.**

Valuation – Application Site

14.5.40 In 2016, no bats were observed roosting within the railway bridge adjacent to the Application Site. Furthermore, no bats were observed roosting within on-site trees although the potential for their future use by roosting bats remains.

14.5.41 The assemblage of bats recorded during the activity surveys (transect surveys and automated static detector surveys) in 2016 was dominated by common and widespread species of bats, with activity focussed along the River Thames and adjacent to woodland/tree-lines. This assemblage is likely to be typical of the wider urban and riparian landscape in which the Application Site is located.

14.5.42 Similar trends were observed in 2018, though slightly higher numbers of noctule bats were recorded in comparison to common and soprano pipistrelle bats. The noctule is considered to have a widespread distribution within the county (Berkshire Bat Group) and therefore given its local distribution and ecology it is unsurprising that this species readily utilises the habitats on and around the Application Site as a foraging and commuting resource. As in 2016, very small numbers of rare bat species (Nathusius' pipistrelle and barbastelle bat) were recorded, though the survey data indicates that the Application Site is unlikely to constitute a core portion of their foraging, roosting or commuting habitat.

14.5.43 In summary, the bat surveys as summarised above, identified a range of species utilising the Application Site and surrounding area for foraging and commuting purposes. Although no roosting bats were identified, trees with suitability support roosts are present. When considered within the wider landscape context, however, the importance of the habitats within the Application Site for bats is likely to be reduced on account of the existing presence of the mainline railway immediately to the south (already limiting the north south connectivity) and the presence of more suitable habitat (both the River Thames and more extensive semi-natural habitat associated with Henley Road Gravel Pits and the surrounding) to the north. Considering the above, the Application Site is of **Local** importance for bats.

Valuation – Combined Site

14.5.44 Although the Combined Site provides a greater area of habitat suitable for use by bats (albeit that the majority of the TVP P&R Site has now been cleared), given that the habitat types present are similar throughout, with the same external factors of note (such as lighting, proximity to the mainline railway etc.) it is considered unlikely that the Combined Site is of any greater importance to the assemblages of bat species identified within the individual sites. As such, the Combined Site is of **Local** importance for bats.

Great Crested Newts

Previous Desk Study

14.5.45 A review of data provided by TVERC in March 2016 identified no records of great crested newts *Triturus cristatus* from within 2 km of the Application Site within the 10 years previous.

Previous Survey Data

14.5.46 No standing waterbodies, connected to the Application Site by contiguous suitable habitat, were identified within the Application Site itself or within 250 m of its boundaries (following a review of OS mapping (1:25,000)) at the time of the extended Phase 1 habitat survey (in

2016). As such, great crested newts were considered unlikely to utilise the terrestrial habitats present on site (see **Appendix I.2**); and were therefore considered likely absent.

14.5.47 One pond was identified to be present within 500 m of the TVP P&R Site, with the TVP P&R Site itself identified to provide suitable terrestrial habitat for this species (see **Appendix I.6**). A habitat Suitability Index (HSI) assessment of the pond (in 2015) identified it to provide 'good' habitat for great crested newts. Given the distance between this pond and the TVP P&R Site however, the absence of other waterbodies within 500 m, and the presence of the A3290 / Thames Valley Park Drive as a partial barrier, it was considered unlikely that terrestrial phase great crested newts would be present on the TVP P&R Site, in the unlikely event they did breed within the nearby pond.

14.5.48 Given the results of the above, great crested newts were considered likely absent from the Combined Site at the time of the previous surveys.

Update Desk Study - 2018

14.5.49 A check of OS 1:25,000 mapping confirmed that the single pond identified above remained. A check of records (www.magic.gov.uk) from within 2 km of the Site identified the absence of granted European Protected Species Applications for great crested newt.

Update Habitat Suitability Assessment - 2018

14.5.50 The update site walkover survey (August 2018) identified the removal of c. 1 ha of semi-natural habitat from within the TVP P&R Site (and therefore the eastern extent of the Application Site / Combined Site) in accordance with the TVP P&R planning permission; whereby the Application Site / Combined Site is considered less suitable for use by this species than at the time of the previous surveys, due to the removal of suitable terrestrial habitat within the TVP P&R Site.

Valuation – Application Site / Combined Site

14.5.51 For the reasons set out above, and in light of the results of the update site walkover survey, great crested newts are considered likely absent from the Application Site / Combined Site and as such, they are not considered further within this assessment.

Hazel Dormice

Previous Desk Study

14.5.52 A review of data provided by TVERC in March 2016 identified no records of hazel dormouse *Muscardinus avellanarius* from within 2 km of the Application Site within the 10 years previous.

Previous Survey Data

14.5.53 Although the Application Site was previously identified to provide habitats which could be suitable for use by hazel dormouse (during the extended Phase 1 habitat survey in 2016), these were limited in extent and isolated from more substantive areas of suitable habitat within the wider landscape. Furthermore, no records of hazel dormouse were identified from within 2 km of the Application Site. As such hazel dormice were considered likely absent from the Application Site.

14.5.54 Similarly, although the TVP P&R Site was also previously identified to provide habitats which could be suitable for use by hazel dormouse (during the extended Phase 1 habitat survey in 2015), these were also limited in extent and isolated with no connectivity to the wider

landscape. Furthermore, no records of hazel dormouse were identified from within 2 km of the TVP P&R Site. As such hazel dormice were considered likely absent from the TVP P&R Site.

- 14.5.55 Give the results of the above, hazel dormouse was considered likely absent from the Combined Site.

Update Desk Study - 2018

- 14.5.56 A check of records from within 2 km of the Site identified an absence of granted European Protected Species Applications for hazel dormice.

Update Habitat Suitability Assessment - 2018

- 14.5.57 The update site walkover survey (August 2018) identified the removal of c. 1 ha of semi-natural habitat from within the TVP P&R Site (and therefore the eastern extent of the Application Site / Combined Site) in accordance with the P&R planning permission; whereby the Application Site / Combined Site is considered less suitable for use by this species than at the time of the previous surveys, due to the removal of suitable habitat within the TVP P&R Site.

Valuation – Application Site / Combined Site

- 14.5.58 For the reasons set out above, and in light of the results of the update site walkover survey, dormouse are considered likely absent from the Application Site / Combined Site and as such, they are not considered further within this assessment.

Otter

Previous Desk Study

- 14.5.59 A review of data provided by TVERC in March 2016 identified five records of European otter *Lutra lutra* from within 2 km of the Application Site within the 10 years previous. The closest of these was from c. 625 m west of the Application Site, although c. 1.3 km downstream when following the alignment of the river.

Previous Survey Data

- 14.5.60 The Application Site was previously identified to provide some habitat which may be suitable for terrestrial use by otter *Lutra lutra* (for example, woodland edges and mature trees). Due to the limited extent of habitat present however, and high levels of anthropogenic disturbance, the value of this habitat for use by otter was limited (see **Appendix I.2**).
- 14.5.61 The habitats present at the TVP P&R Site at the time of the extended Phase 1 habitat survey in 2015 (i.e. predominantly dense scrub) were identified to be unsuitable for use by otters (see **Appendix I.6**).

Update Habitat Suitability Assessment - 2018

- 14.5.62 The update site walkover survey (August 2018) identified the removal of c. 1 ha of semi-natural habitat from within the TVP P&R Site (and therefore the eastern extent of the Application Site / Combined Site) in accordance with the P&R planning permission. Given that habitats within the TVP P&R Site were previously identified to be unsuitable for use by otter; however, there was no change to the suitability of this area to support otters.
- 14.5.63 The update site walkover survey identified no material change to the remaining habitats within the Application / Combined Site suitable for use by occasional and transitional use by otter.

Valuation – Application Site / Combined Site

14.5.64 Considering the above, it is unlikely that the Application Site or Combined Site is of importance for otters within the Local context or greater.

Badger

Previous Desk Study

14.5.65 A review of data provided by TVERC in March 2016 identified three confidential records of Eurasian badger *Meles meles* from within 2 km of the Application Site within the 10 years previous. None of these were identified to be within 500 m of the Application Site however. Of these records, two were for road kill (2010 and 2012), with a single sett record from 2013.

Previous Survey Data

14.5.66 For reasons outlined within the Preliminary Ecological Appraisal (**Appendix I.2**), it was considered unlikely that badgers would use the Application Site as a primary resource for either sett building or foraging; particularly given the presence of the more suitable habitats present within the Network Rail corridor located immediately to the south, and the more extensive King's Meadow to the west. No evidence of badger setts or other field signs were recorded during surveys undertaken for the Application Site in 2016.

14.5.67 Although the habitat within the TVP P&R Site was considered suitable for use by badgers, both for sett building and foraging, only one fresh scat was identified across a series of site visits (in 2015). As such, the TVP P&R Site was not considered to be regularly or heavily used by this species (see **Appendix I.7**).

Update Habitat Suitability Assessment - 2018

14.5.68 The update site walkover survey identified the removal of c. 1 ha of semi-natural habitat from within the TVP P&R Site (and therefore the eastern extent of the Application Site / Combined Site) in accordance with the P&R planning permission; whereby the Application Site / Combined Site is considered less suitable for use by this species than at the time of the original survey.

Valuation – Application Site / Combined Site

14.5.69 Considering the above, it is unlikely that the Application Site or Combined Site is of importance for badgers within the Local context or greater.

Breeding Birds

Previous Desk Study

14.5.70 A review of data provided by TVERC in March 2016 identified numerous bird records from within 2 km of the Application Site within the 10 years previous. These included the following species listed on Schedule 1 of the Wildlife and Countryside Act, 1981 (as amended):

- Greylag goose *Anser anser*³¹;
- Peregrine falcon *Falco peregrinus*; and
- Kingfisher *Alcedo atthis*.

³¹ Schedule 1; Part 2 only.

14.5.71 Additional records were provided for six species identified as SPI and therefore included on the list drawn up in response to the NERC Act, 2006, with a further eight 'amber' listed species, in accordance with the Birds of Conservation Concern (BoCC (Eaton *et al*, 2015). The locations of the above records largely comprised: Henley Road Gravel Pit (approximately 100 m north of the Application Site), Whiteknights Park (approximately 1.5 km south of the Application Site) and Thames Valley Park (approximately 1.5 km north east of the Application Site).

Previous Survey Data

14.5.72 Although many of the habitat types within the Application Site were considered suitable for use by common and widespread breeding birds, typical of the semi-urban environment (including those species identified during the extended Phase 1 habitat survey completed for the Application Site in 2016³²); use by a particularly notable or diverse assemblage was considered unlikely (as set out within the Preliminary Ecological Appraisal (see **Appendix I.2**)).

14.5.73 A single breeding bird survey visit was completed for the TVP P&R Site in 2015. This recorded a total of twenty-four species within the survey area. Of these, robin *Erithacus rubecula* was identified as a confirmed breeder and long-tailed tit *Aegithalos caudatus* a probable breeder. Fourteen species were identified as possible breeders and eight species were categorised as non-breeders. Of the species identified, eight are listed as SPI on Section 41 of the NERC Act, 2006, local Biodiversity Action Plans and / or are identified as 'Species of Conservation Concern'.

14.5.74 Taking into account the survey findings, the TVP P&R Site was not considered likely to constitute an important area of habitat for breeding birds, providing only very limited habitat suitable for breeding birds in the context of the wider landscape; in particular, the extensive areas of semi-natural habitat that occur to the north of the River Thames. Furthermore, the assemblage of breeding birds identified utilising the TVP P&R Site was relatively small in terms of the number of species, as well as the number of breeding pairs and associated territories.

Update Habitat Suitability Assessment - 2018

14.5.75 The update site walkover survey (August 2018) identified the removal of c. 1 ha of semi-natural habitat from within the TVP P&R Site (and therefore the eastern extent of the Application Site / Combined Site) in accordance with the P&R planning permission; whereby the Application Site / Combined Site is considered less suitable for use by breeding birds than at the time of the original surveys (in 2015 / 2016). Habitat across the remainder of the Application Site / Combined Site was largely as recorded previously in 2016.

14.5.76 During the update surveys undertaken for the Application Site in 2018, an incidental bird species list was recorded. This is provided within **Appendix I.13**. Of these, the following species were identified to be using terrestrial habitat present within the Application / Combined Site: blackcap *Sylvia atricapilla*, blue tit *Cyanistes caeruleus*, bullfinch *Pyrrhula pyrrhula*, Canada goose *Branta canadensis* (on margins of the River Thames), chiffchaff *Phylloscopus collybita*, goldfinch *Carduelis carduelis*, great tit *Parus major*, green finch *Carduelis chloris*, long tailed tit *Aegithalos caudatus*, magpie *Pica pica*, mallard *Anas platyrhynchos*, moorhen *Gallinula chloropus*, mute swan *Cygnus olor* (previous three on margins of River Thames), robin *Erithacus rubecula*, and wood pigeon *Columba palumbus*. Other species were identified flying overhead / along the River Thames, but not on-site.

³² House sparrow *Passer domesticus*; blue tit *Cyanistes caeruleus*; wood pigeon *Columba palumbus*; great tit *Parus major*; mute swan *Cygnus olor*; black bird *Turdus merula*; and robin.

Valuation – Application Site / Combined Site

- 14.5.77 Considering the absence of high quality habitat on-site, the recent clearance of the eastern extend of the Application / Combined Site, the high levels of anthropogenic disturbance and the presence of large areas of higher quality and less disturbed surrounding habitat, use of the Application Site / Combined Site by a particularly notable or diverse assemblage is considered unlikely. This conclusion has been confirmed through the incidental species recorded for the Application Site / Combined Site during the update surveys completed in 2018.
- 14.5.78 Considering the above, it is unlikely that the Application Site or Combined Site is of importance for breeding birds within the Local context or greater.

Reptiles

Previous Desk Study

- 14.5.79 A review of data provided by TVERC in March 2016 identified a single record of common lizard *Zootoca vivipara* from 1.2 km north east of the Application Site in 2013, with a single record of adder *Vipera berus* returned from 1.4 km north of the Application Site in 2008. Three records of grass snake *Natrix helvetica* were also returned from within 2 km of the Application Site from within the 10 years previous, with the closest record from within The Coal, Kennetmouth and Kings Meadow East LWS; which is connected to the Application Site through contiguous suitable habitat.

Previous Survey Data

- 14.5.80 Full results of the reptile surveys undertaken in 2016 at the Application Site are provided within **Appendix I.3**, with a summary provided below.
- 14.5.81 Reptile presence / absence surveys revealed two species of reptile to use the Application Site; grass snake and slow worm *Anguis fragilis*. Only very low numbers of grass snakes were recorded (single individuals), with numbers of slow worms indicating a likely medium breeding population (with an adult peak count of seven) of this species on the Application Site and in the surrounding area. Reptiles were concentrated along the margins of grassland and scrub habitats, particularly close to an adjacent railway corridor in the central part of the Application Site, as well as in open areas to the east and west.
- 14.5.82 Full results of the reptile surveys undertaken at the TVP P&R Site in 2015 are provided within **Appendix I.7**, with a summary provided below.
- 14.5.83 A peak count of one female adult slow worm was identified on the TVP P&R Site. Juvenile slow worms were also identified (with a peak count of four), indicating the presence of a breeding population.

Update Habitat Suitability Assessment - 2018

- 14.5.84 The update site walkover survey (August 2018) identified the removal of c. 1 ha of semi-natural habitat from within the TVP P&R Site (and therefore the eastern extent of the Application Site / Combined Site) in accordance with the P&R planning permission. This had been cleared in accordance with a prescribed reptile mitigation strategy however; with artificial refugia deployed across the area to enable a translocation exercise to take place. Although the habitat within the TVP P&R Site had reduced in suitability for this species group since the time of the previous survey, measures had been implemented to ensure that the conservation status of this species group was maintained.

Update Survey Data - 2018

14.5.85 An additional reptile survey was conducted in August/September 2018. This indicated that a medium population of slow worms was still present with a similar distribution to that recorded in 2016. Slow worms were concentrated along the margins of grassland and scrub habitats, particularly close to an adjacent railway corridor in the central part of the Application Site / Combined Site as well as in open areas to the east. No reptiles were recorded in the western extent of the Application Site / Combined Site during these visits. A single grass snake was also identified in the centre of the Application Site / Combined Site in 2018, indicating the continued presence of a low population of this species.

Valuation – Application Site

14.5.86 Considering the reptile species and populations present, the Application Site does not meet the selection criteria for a key reptile site (Froglife, 1999). Neither does it provide high quality habitat for reptiles, particularly when considered in relation to other surrounding habitat (for example, habitat along the railway corridor to the south, or surrounding the Henley Road Gravel Pit to the north). That said, on account of the presence of two species of reptile and a known medium population breeding population of slow worm within the Application Site, the Application Site is of **Local** importance for reptiles.

Valuation – Combined Site

14.5.87 In spite of the removal of c. 1 ha of semi-natural habitat from within the TVP P&R Site, the Combined Site, in combination with the habitat surrounding the Dreadnaught and the adjacent railway line, provides connecting habitat, suitable for use by reptiles, along the entire extent. Although it is not possible to identify a peak count of slow worm and grass snake across the Combined Site (on account of surveys within each element being completed at different times of year, with different refuge densities etc.), for the reasons set out above, the Application Site is of **Local** importance for reptiles.

Water Voles

Previous Desk Study

14.5.88 A review of data provided by TVERC in March 2016 identified a single water vole record returned from within the 2 km search area during the 10 years previous.

Previous Survey Data

14.5.89 The nature of the banks of the River Thames and River Kennet throughout the extent of the Application Site (either artificially reinforced or shallow and isolated from nearby suitable burrowing habitat) was largely unsuitable for water vole. This combined with the limited presence and diversity of a suitable food source, and the high levels of anthropogenic disturbance, means that the Application Site was considered unsuitable for water vole throughout at the time of the previous extended Phase 1 habitat survey (see **Appendix I.2**). As such, water voles were considered likely absent from the Application Site.

14.5.90 Similarly, as the TVP P&R Site lacks direct connectivity to waterways, it was also identified to be unsuitable for use by water voles; and as such, water voles were considered likely absent from the TVP P&R Site.

Update Habitat Suitability Assessment - 2018

14.5.91 No material changes to the banks of the River Thames or River Kennet were observed during the update site walkover survey; whereby new habitat or habitat of increased suitability was identified.

Valuation

- 14.5.92 For the reasons set out above, and in light of the results of the update site walkover survey, water voles are considered likely absent from the Application Site / Combined Site and as such, they are not considered further within this assessment.

Fish and Aquatic Invertebrates

Previous Desk Study

- 14.5.93 A review of data provided by TVERC in March 2016 identified six records of European eel *Anguilla Anguilla* from within 2 km of the Application Site from the 10 years previous. European eel are a SPI as listed under Section 41 of the NERC (2006) Act. Of these records, five were returned from c. 495 m north east of the Application Site from within the River Thames, with a single record from 380 m south of the Application Site, within the River Kennet. In addition, a single record of depressed (or compressed) river mussel *Pseudanodonta complanata* were also identified approximately 790 m east of the Application Site in 2012.

Habitat Suitability Assessment

- 14.5.94 Running water is located within the Application / Combined Site both where the Proposed Development crosses the River Kennet; and as a narrow strip of the River Thames along the northern extent of the Application Site / Combined Site. Whilst detailed aquatic surveys of this habitat have not been undertaken, given the very high levels of anthropogenic disturbance, including the semi-permanent presence of house boats, use of leisure boats and dog-walkers, in addition to the presence of large areas of higher quality and less disturbed surrounding habitat, their value is limited.

Valuation – Application and Combined Site

- 14.5.95 Considering the above, it is unlikely that the Application Site or Combined Site is of importance for fish or aquatic invertebrates/ molluscs within the Local context or greater.

Invertebrates

Previous Desk Study

- 14.5.96 A review of the data provided by TVERC in March 2016 identified presence of stag beetle *Lucanus cervus* and common club-tail *Gomphus vulgatissimus* from within 2 km of the Application Site within the last 10 years.

Previous Survey Data

- 14.5.97 The Application Site was previously (in 2016) identified to provide a variety of terrestrial habitats considered suitable to support a broad diversity of invertebrates including protected and notable terrestrial species, including stag beetle, as identified during the desk study. However, due to the nature of habitats present, and the fact they were limited in extent, it was considered unlikely that the Application Site would support a notable site-wide invertebrate assemblage (as set out within the Preliminary Ecological Appraisal (see [Appendix I.2](#))).
- 14.5.98 The TVP P&R Site was similarly identified to provide a variety of terrestrial habitats which were considered suitable to support a diversity of invertebrates including protected and notable terrestrial species such as stag beetle and cinnabar moth *Tyria jacobaeae* (with the latter species also identified from the desk study). Due to the small size of the TVP P&R Site however, it was considered unlikely to support a notable site-wide invertebrate assemblage.

Update Habitat Suitability Assessment - 2018

- 14.5.99 The update site walkover survey identified the removal of c. 1 ha of semi-natural habitat from within the TVP P&R Site (and therefore the eastern extent of the Application Site / Combined Site) in accordance with the P&R planning permission; whereby the Application Site / Combined Site is considered to provide less habitat diversity, and is therefore less likely to support a notable site-wide invertebrate assemblage. Habitat across the remainder of the Application Site / Combined Site was largely as recorded previously in 2016.

Valuation – Application Site / Combined Site

- 14.5.100 Considering the above, it is unlikely that the Application Site or Combined Site is of importance for invertebrates within the Local context or greater.

European Hedgehog

Previous Desk Study

- 14.5.101 A review of the data provided by TVERC in March 2016 identified five records of European hedgehog *Erinaceas europaeus* from within 2km of the Application Site from within the 10 years previous; all from 2006. Of these, the closest record was 615m south west of the Application Site.

Previous Survey Data

- 14.5.102 No evidence of use by European hedgehog was identified throughout the surveys completed at the Application Site in 2016. Further to this, it was identified that although the Application Site was identified to provide a range of habitats which may be utilised by this species should they be present within the vicinity (including woodland, scrub and open grassland), the suitability of these habitat types was reduced on account of the high level of management and other anthropogenic disturbance.
- 14.5.103 Again, no evidence of use by European hedgehog was identified throughout the surveys completed across the TVP P&R Site (in 2015). Furthermore, although habitat within the TVP P&R Site was identified to be suitable for use by European hedgehog, given the small size of the TVP P&R Site, it was considered likely to limit any population of European hedgehogs using the TVP P&R Site.

Update Habitat Suitability Assessment 2018

- 14.5.104 The update site walkover survey (August 2018) identified the removal of c. 1 ha of semi-natural habitat from within the TVP P&R Site (and therefore the eastern extent of the Application Site / Combined Site) in accordance with the P&R planning permission; whereby the Application Site / Combined Site is considered less suitable for use by European hedgehogs than at the time of the previous survey. Habitat across the remainder of the Application Site / Combined Site was largely as previously recorded in 2016.

Valuation – Application Site / Combined Site

- 14.5.105 Considering the above, it is unlikely that the Application Site or Combined Site is of importance for European hedgehog within the Local context or greater.

Summary

- 14.5.106 A summary of protected and notable species considerations and the geographic context at which they are important is provided within **Table 14.8** below.

Table 14.8: Protected and Notable Species - Valuation

Protected / Notable Species	Application Site	Combined Site
Bats	Local	Local
Great Crested Newt	N/A – Likely Absent	N/A – Likely Absent
Hazel Dormouse	N/A – Likely Absent	N/A – Likely Absent
Otter	Less than Local	Less than Local
Badger	Less than Local	Less than Local
Breeding Birds	Less than Local	Less than Local
Reptiles	Local	Local
Water Voles	N/A – Likely Absent	N/A – Likely Absent
Fish and Aquatic Invertebrates/ Molluscs	Less than Local	Less than Local
Invertebrates	Less than Local	Less than Local
European hedgehog	Less than Local	Less than Local

Summary of Baseline

14.5.107 Given that a number of the ecological features of importance within the **Local** context or greater are wholly or predominantly contained within The Coal, Kennetmouth and Kings Meadow East LWS, a combined assessment will be made for this feature, which includes consideration of the following:

- Broad-leaved semi-natural woodland / 'Lowland Mixed Deciduous Woodland' HPI;
- Dense scrub;
- Tall ruderal/marginal vegetation mosaic; and
- Loddon lily.

14.5.108 As such, the following ecological features of importance in the **Local** context or greater are considered further within the assessment(s):

- The Coal, Kennetmouth and Kings Meadow East LWS;
- Henley Road Gravel Pits LWS;
- Ancient Woodland;
- HPI, including Running Water;
- Bats; and
- Reptiles.

14.5.109 Impacts on habitats and species valued at lower than **Local** level are not considered further within this assessment as they are not expected to experience significant effects that would form a material consideration during planning. Nevertheless, the information gained on habitat and species valued at lower than **Local** level has been used to determine the approach necessary to ensure that future development will be acceptable with reference to the

planning and legal framework relating to ecological resources. Further consideration of these features is provided within the **Legal Compliance and Enhancement** Section of this Chapter.

Baseline Evolution

14.5.110 Given that pre-commencement works within the TVP P&R Site (and therefore the eastern extent of the Application Site / Combined Site) began in March 2018, it is considered that the suitability of this plot for protected and notable species will continue to decline for the duration during which construction occurs. Once the TVP P&R Scheme is operational, the majority of the TVP P&R Site (including the eastern extent of the Application Site / Combined Site) will comprise hardstanding, of no intrinsic ecological value, and will be largely unsuitable for use protected and / or notable species. Although there will be areas of habitat within the TVP P&R Site / Combined Site that will be protected / retained and enhanced for use by the species identified above, these fall outside of the footprint of the Application Site.

14.5.111 For the remainder of the Application Site (i.e. to the west of the TVP P&R Site), in the absence of development and assuming the current management regimes remain in place, there is no reason to believe that baseline conditions would alter greatly in the foreseeable future. It is possible that should management significantly alter, (i.e. through increased or lapsed management), the value of habitats for use by protected and notable species could change, potentially benefitting some species, but limiting others e.g. removal of scrub habitat may result in more open grassland habitat, suitable for use by reptiles; however largely removing habitat suitable for use by breeding birds.

14.5.112 The below assessments are made with regard to the baseline conditions as recorded during the update site walkover survey.

14.6 Predicted Impacts

14.6.1 The following sections set out an assessment of predicted impacts and subsequent effects arising from the construction and/ operation of the:

- Proposed Development; and
- Combined Development.

Inherent Design and Embedded Ecological Mitigation

14.6.2 Ecological input has been provided as the design of the Proposed Development has evolved; and as such, it includes avoidance measures and provides embedded mitigation for ecology, as described in the section below.

14.6.3 In addition, the design of the permitted TVP P&R Scheme was similarly ecologically informed. Further details pertaining to this are contained within the Design and Access Statement submitted for the planning application for the TVP P&R Site (Planning Application 161596) and the TVP P&R S73 Application (Planning Application: 182496). Such measures included: retention of mature trees around the boundary of the TVP P&R Site, new tree planting and landscape planting and ecologically informed lighting

14.6.4 The following assessments therefore consider the impacts and assess the effects of the schemes on important ecological features taking account these measures. This approach is in accordance with the CIEEM Guidelines which promotes the assessment of effects of the mitigated scheme only, where there is high confidence that integrated mitigation will be implemented; as in this situation.

Avoidance Measures/ Inherent Scheme Design

14.6.5 The Proposed Development has been designed to take in to account the following avoidance measures:

- By removing the requirement for the Proposed Development to provide additional car parking spaces within the Tesco car park to aid compensation for those lost (as was originally proposed), an additional 824 sqm of semi-natural habitat within the footprint of the on-site portion of The Coal, Kennet Mouth and Kings Meadow East LWS will be retained and protected when compared to the 2017 Planning Application (Ref: 171108); and
- Avoidance and retention of weeping willow *Salix x sepulcralis* (Tree 88). Tree 88 is a mature weeping willow tree located to the south of the River Thames. During baseline survey work, it was identified as having high suitability to support roosting bats with multiple rot holes present; although no bats were identified to emerge during survey work completed for the tree. This tree was originally identified for removal, but has now been retained in the design.

Embedded Mitigation Measures

14.6.6 The following embedded ecological mitigation will be provided, secured by suitably worded planning conditions, during the construction phase of the Proposed Development:

- Implementation of a CEMP which will remain in place throughout the duration of the construction of the Proposed Development. This will include best practice mitigation measures relating to:
 - The control of construction phase noise;
 - The control of construction phase lighting;
 - The control of dust or other air pollutants that may arise as a result of the construction; and
 - The control of oil / chemical / chemical spillage or other water pollutants that may arise as a result of construction, including where working near to water.

14.6.7 The following embedded ecological mitigation will be provided, secured by suitably worded planning conditions, during the operational phase of the Proposed Development:

- Implementation of an ecologically informed lighting strategy once the Proposed Development is operational. This will include use of low-level lighting of the viaduct. This will comprise: LED handrail lighting to be installed along the northern extent of the structure, facing southwards (i.e. away from the River Thames) to light the pedestrian / cycle way only. This will minimise the levels of light spill from the structure on to surrounding habitat. (see Appendix H5 for further details).
- Implementation of appropriate flood and environmental control measures, as defined within the **Chapter 11: Hydrology and Flood Risk**. These include the consenting / permitting process (via the Environment Agency and Lead Local Flood Authority) and associated method statements for works within watercourse corridors.
- Implementation of a Landscape and Ecology Strategy (see **Chapter 13: Landscape and Visual and Landscape and Ecology Strategy**, for further details). This will include installation of new species-rich biodiverse habitats across the Application Site, including within the on-site portion of The Coal, Kennetmouth and Kings Meadow East LWS. These include: acid grassland, tussocky grassland, wildflower grassland, native tree, hedgerow and shrub planting, wetland marsh planting and riverside marginal planting.
- Inclusion of species specific mitigation measures, to include:

- Reptile tunnels to facilitate access north – south through the structure between areas of suitable habitat;
- Bat boxes on suitable mature / semi-mature trees to be retained throughout the Proposed Development;
- Bird boxes on suitable mature / semi-mature trees to be retained throughout the Proposed Development; and
- Deadwood habitat and rubble piles.

Identification of Impacts

- 14.6.8 Taking account of the inherent scheme design and embedded mitigation measures, but in the absence of additional mitigation and compensation measures, a number of direct and indirect impacts with the potential to result in a significant effect on important ecological features have potential to occur as a result of construction and operation related activities.
- 14.6.9 Potential direct and indirect impacts that may occur as a result of construction phase activities, and in the absence of additional mitigation/ compensation, include:
- Reduction in habitat extent, quality and connectivity within the extent of the works footprint. This could result in a permanent, adverse impact during construction, with resulting long-term effects;
 - Severance / loss of foraging / commuting routes within the extent of the works footprint. This could result in a temporary adverse impact during construction;
 - Mortality/injury of individual animals. This could result in a permanent, adverse impact caused during construction. This impact could occur in habitat suitable for individual animals.
- 14.6.10 Potential direct and indirect impacts that may occur as a result of operation phase activities and in the absence of additional mitigation/ compensation, include:
- Severance / loss of foraging / commuting routes. This could result in a permanent, adverse impact. This impact could occur along the extent of development footprint, and into suitable habitat beyond;
 - Mortality/injury of individual animals. This could result in a permanent, adverse impact caused during operation. This impact could occur in habitat suitable for individual animals;
 - Hydrological changes including changes in water movement as a result of altered run-off patterns and/ or changes in water quality. This impact could result in a permanent beneficial or adverse impact, the magnitude, extent and reversibility of such change is not possible to identify;
 - Changes in lighting levels. This could result in a permanent, adverse impact. This impact could occur along the extent of development footprint, and beyond where there is light spill;
 - Increase in overshadowing. This could result in a permanent adverse impact. This impact could occur along the extent of the development footprint, where adjacent to particularly light sensitive habitats; and
 - Improvements in habitat quality and connectivity. This could result in a permanent beneficial impact in the long-term. This impact could occur within the entire extent of the works footprint and beyond into the immediate vicinity; and as such, would be of magnitude within the vicinity of the works.
- 14.6.11 Possible changes in air quality and noise levels as a result of operation are considered unlikely to arise in significant effects on the important ecological features of **Local** value or

above. Such impacts have therefore been discounted from further consideration within this assessment. Further details relating to air quality are provided within **Chapters 10: Air Quality**.

14.7 Ecological Impact Assessment: Proposed Development

The Coal, Kennetmouth and Kings Meadow East LWS

- 14.7.1 With the exception of The Coal, Kennetmouth and Kings Meadow East LWS and Henley Road Pit LWS (see below), the designated areas located within the Study Area, are located sufficiently far from the Application Site, and isolated from it by already highly urbanised land, that effects arising as a result of the Proposed Development are not anticipated. No further consideration is made to these designated areas within this assessment.

Construction Phase Impacts

- 14.7.2 With reference to The Coal, Kennetmouth and Kings Meadow East LWS citation and based on the results of the 2016 field survey (see **Appendix I. 5**), key features (i.e. those of the greatest biodiversity or cultural/landscape value) within the on-site portion the LWS, and the area immediately surrounding (i.e. between the Tesco Car Park and the River Kennet as a whole), include:

- The presence of Loddon lily³³;
- The row of mature horse chestnut trees along the northern edge of BW1;
- The mature hybrid black poplar located in BW2; and
- The mature crack willow trees on the western bank of the River Kennet.

- 14.7.3 Although of these, only mature black poplar trees located within BW2 are located within the Application Site, given the potential for indirect impacts on the key features of the LWS as a whole, consideration of the entire LWS has been made within the assessment.
- 14.7.4 The construction phase of the Proposed Development will result in the removal of up to 0.43 ha of habitat within The Coal, Kennetmouth and Kings Meadow East LWS. This equates to c. 10% of the overall LWS area. Habitat removal will predominantly affect the south-eastern end of the LWS, including areas of broad-leaved semi-natural woodland, within which the mature poplar trees are located (BW1 and BW2 – see **Appendix I.5**), as well as the area of shrubs and ruderal vegetation (SS/TR1 – see **Appendix I.5**) and scrub adjacent to the railway corridor (DS/IS1 – see **Appendix I.5**). These areas are characterised by dense shrubs and secondary woodland. The row of mature horse chestnut trees along the northern edge of BW1 are located outside the Proposed Development boundary and will remain unaffected by the works.
- 14.7.5 The majority of the riparian trees and vegetation (including the crack willow pollards further south) associated with the Kennetmouth part of the LWS are also located outside the Proposed Development and will not be affected, aside from the area immediately beneath the new bridge itself. Importantly, the riparian habitat at the confluence of the River Thames and River Kennet where Loddon lily was recorded is located during the extended Phase 1 habitat survey in 2016 (see **Appendix I.2**) outside the Proposed Development boundary and will remain unaffected by the works.
- 14.7.6 The construction phase of the Proposed Development will result in permanent reduction in the overall size of The Coal, Kennetmouth and Kings Meadow East LWS. However, the majority

³³ Loddon lily *Leucojum aestivum subsp. Aestivum* (or summer snowflake as it is also known) was identified to be present within The Coal, Kennetmouth and Kings Meadow East LWS, immediately north of the Application Site. Loddon lily is included in the Vascular Plant Red Data List for Great Britain (Cheffings et al., 2005) as 'nationally scarce' (i.e. found in between 16 and 100 hectads in the Ordnance Survey National Grid). It is also identified as a Priority Species within Reading BAP.

of key features associated with the LWS are located outside the Proposed Development boundary and will remain unaffected by the works.

- 14.7.7 To suitably control construction phase changes in air quality, water quality and lighting (which might otherwise impact on the LWS, or the protected and / or notable species it is likely to support³⁴); appropriate measures will be specified within the CEMP, and implemented as part of the Proposed Development.
- 14.7.8 Considering the above, the construction phase of the Proposed Development will result in permanent reduction in the overall size of The Coal, Kennetmouth and Kings Meadow East LWS (and by virtue of this, the area designated as HPI 'Lowland Mixed Deciduous Woodland'); as such resulting in a **permanent adverse effect** on this important ecological feature. Given that the majority of key features associated with the LWS are located outside the Proposed Development boundary however, and will remain unaffected by the works, this is not anticipated to be significant beyond the **Local** context.

Operation Phase Impacts

- 14.7.9 Once operational, the Proposed Development will result in the overall improvement of up to 0.31 ha of on-site habitat within The Coal, Kennetmouth and Kings Meadow East LWS. Further details are provided within the **Landscape and Ecology Strategy**.
- 14.7.10 To suitably control changes in water quality / quantity (which could otherwise adversely affect the habitats for which the LWS have been designated), appropriate control measures have been specified within **Chapter 11: Hydrology and Flood Risk**. These will be implemented as part of the Proposed Development.
- 14.7.11 As identified above, although the designation for The Coal, Kennetmouth and Kings Meadow East LWS relates namely to habitat interest features (which, in themselves, would be unaffected by changes in lighting), protected and notable species (including light sensitive species) will be reliant on these habitats and as such, have been considered within the context of The Coal, Kennetmouth and Kings Meadow East LWS. Given that the operational lighting design has been ecologically informed, with measures included to mitigate for impacts on local wildlife, the lighting of the Proposed Development, once operational, will be suitably controlled such that adverse effects on species as a result of increased light spill are not anticipated. Further consideration relating to bats and lighting specifically is provided within the assessment for 'Bats' below.
- 14.7.12 Once operational, there will be a permanent improvement in the quality of habitat present within the remaining on-site portion of The Coal, Kennetmouth and Kings Meadow East LWS (and by virtue of this, the area designated as HPI 'Lowland Mixed Deciduous Woodland' (up to 0.31 ha). Given that this is for a lesser area than that being lost during construction however, there remains a **permanent adverse effect** on this important ecological feature. Given that the majority of key features associated with the LWS are located outside the Proposed Development boundary, as identified above, and will remain unaffected by the works however, this is not anticipated to be significant beyond the **Local** context.

Henley Road Gravel Pits LWS

- 14.7.13 Given the location of Henley Road Gravel Pits LWS (approximately 100 m north of the Application Site), an assessment of potential impact on this LWS is provided below. In addition, given that much of the Henley Road Gravel Pits LWS comprises the same area as

³⁴ Whilst the designation for The Coal, Kennetmouth and Kings Meadow East LWS relates namely to habitat interest features (which, in themselves, would be unaffected by changes in lighting), protected and notable species (including light sensitive species) will be reliant on these habitats and as such, have been considered within the context of The Coal, Kennetmouth and Kings Meadow East LWS. Further consideration relating to bats and lighting specifically is provided within the assessment for 'Bats' below

the closest parcel of the HPI 'eutrophic standing water' to the Application Site, this habitat type will also be considered within this assessment.

Construction Phase Impacts

- 14.7.14 No direct impacts on Henley Road Gravel Pits LWS / eutrophic standing water HPI are anticipated as a result of the construction phase of the Proposed Development.
- 14.7.15 To suitably control construction phase changes in air quality or water quality (which might otherwise impact the habitats within the LWS, including the eutrophic standing water HPI), appropriate measures will be specified within the CEMP, and implemented as part of the Proposed Development.
- 14.7.16 Although Henley Road Gravel Pits LWS is identified to support a range of water fowl species, which may be sensitive to changes in lighting levels, it is a sufficient distance from the Proposed Development that adverse effects on these species as a result of construction phase light spill are not anticipated.
- 14.7.17 Considering the above, and subject to the implementation of the CEMP, **no significant effects** on Henley Road Gravel Pits LWS / eutrophic standing water HPI are anticipated as a result of the construction phase of the Proposed Development.

Operation Phase Impacts

- 14.7.18 No direct impacts on Henley Road Gravel Pits LWS / eutrophic standing water HPI are anticipated as a result of the Proposed Development, once operational.
- 14.7.19 To suitably control that changes in water quality / quantity (which could adversely affect the habitats (including eutrophic standing water) on which the waterfowl (identified within the designation for the LWS) rely), appropriate control measures have been specified within the **Chapter 11: Hydrology and Flood Risk**. These will be implemented as part of the Proposed Development.
- 14.7.20 Although Henley Road Gravel Pits LWS is identified to support a range of water fowl species, which may be sensitive to changes in lighting levels, the design of the lighting has been ecologically informed, ensuring that consideration for local wildlife has been appropriately made such that adverse effects on these species as a result of increased light spill once the Proposed Development is operational are not anticipated.
- 14.7.21 Considering the above, and subject to the implementation of appropriate hydrological control measures, **no significant effects** on Henley Road Gravel Pits LWS / eutrophic standing water HPI are anticipated as a result of the Proposed Development, once operational.

Ancient Woodland

- 14.7.22 The parcels of Ancient Woodland identified to be present within the Study Area are located sufficiently far from the Application Site (with the closest located approximately 960 m north on an island within the Henley Gravel Pits LWS), that effects arising as a result of the Proposed Development are not anticipated. No further consideration is made to Ancient Woodland within this assessment.

Habitats of Principal Importance

14.7.23 Of the HPI types identified to be present within 2 km of the Application Site, parcels of the following are either present on site or directly connected to it, via the River Thames:

- Rivers: The River Kennet passes south - north under the footprint of the Proposed Development. Furthermore, the River Thames is located along the northern extent of the Application Site);
- Lowland mixed deciduous woodland: located within the on-site portion of The Coal, Kennetmouth and Kings Meadow East LWS and extending along the Tesco Car Park boundary / Network Rail access corridor to the south of the Application Site;
- Lowland fens and reedbeds: located downstream of the Application Site; and
- Eutrophic standing waters: the closest parcel opposite the Application Site, located within the Henley Road Gravel Pits LWS.

14.7.24 As the lowland mixed deciduous woodland has largely been considered within the earlier assessment relating to The Coal, Kennetmouth and Kings Meadow East LWS, and the eutrophic standing water has been considered within the earlier assessment relating to Henley Road Gravel Pits LWS; an assessment of potential impacts on 'lowland mixed deciduous woodland' (out with the LWS), 'rivers', 'lowland fens' and 'reedbeds' only is provided within the sections below.

14.7.25 Effects on the remaining HPI parcels located within 2 km of the Application Site as a result of the Proposed Development are not anticipated as these are sufficiently isolated from the Application Site such that indirect impacts are highly unlikely to occur. No further consideration is made to these HPI within this assessment.

Construction Phase Impacts

Lowland Mixed Deciduous Woodland (Out With the LWS)

14.7.26 Whilst a strip of habitat identified as 'lowland mixed deciduous woodland' is identified to be present along the southern extent of the Tesco Car Park / Network Rail access corridor to the south of the Application Site (www.magic.gov.uk), habitat surveys undertaken for the Application Site have consistently identified broad habitat types within this area to include introduced shrub and dense scrub as opposed to woodland habitat.

14.7.27 Furthermore, a detailed botanical survey undertaken for the Application Site in 2016 included two samples within this area. In a more 'open' sample location, the habitat type comprised short grazed grassland showing some affinity with an acid grassland community; with the second identified as scrub and introduced shrub (characterised by dense stands of butterfly-bush with bramble and common nettle) (see [Appendix I.5](#)). As such, the HPI identification as depicted on MAGIC is not considered representative of the habitat types identified within the Application Site and no further consideration as to this HPI (where located out with The Coal, Kennetmouth and Kings Meadow East LWS) is made within this chapter.

Rivers

14.7.28 The Proposed Development will include the removal of the existing failing river wall and adjacent amenity grassland strip, along approximately 100 m of the southern bank of the River Thames. These will be replaced by mooring enhancement and associated native marginal planting to 'soften' the riverbank. The implementation of measures set out in the CEMP and as required by any Conditions imposed upon Permits/Consents for works within watercourse corridors will control the potential impacts of construction works upon the River Thames. As

such, **no significant effects** on 'river' habitat is anticipated as a result of the construction phase of the Proposed Development.

Lowland Fens and Reedbeds

- 14.7.29 No direct impacts on 'lowland fens' and 'reedbeds' are anticipated as a result of the construction phase of the Proposed Development, due to the distance separation.
- 14.7.30 To suitably control construction phase changes in air quality or water quality (which might otherwise impact these HPI), appropriate measures will be specified within the CEMP, and implemented as part of the Proposed Development. As such, **no significant effects** on 'lowland fens' and 'reedbeds' are anticipated as a result of the construction phase of the Proposed Development.

Operation Phase Impacts

Rivers

- 14.7.31 No direct impacts on the 'running water' habitat are anticipated as a result of the Proposed Development, once operational.
- 14.7.32 To suitably control that changes in water quality / quantity (which could adversely affect the 'running water' habitat), appropriate control measures have been specified within **Chapter 11: Hydrology and Flood Risk**. These will be implemented as part of the Proposed Development.
- 14.7.33 Once operational the Proposed Development will comprise a segregated fast-track public transport, pedestrian and cycle bridge and viaduct, comprising concrete bridge structure with a river span of 59.5m and a land span of 316m. Where this crosses the River Kennet (i.e. the river span of 59.5m), or is located immediately alongside the River Thames (i.e. the viaduct to the east of the River Kennet), overshadowing of the running water habitat (and river bank habitat) beneath or immediately adjacent will occur.
- 14.7.34 The interest features of the running water habitat along this section of the River Kennet are already very limited on account of the high levels of overshadowing associated with the adjacent railway bridge and horseshoe bridge, the artificial reinforcement of the river banks and an absence of in-channel vegetation.
- 14.7.35 Considering the installation of approximately 100 m native marginal planting along the southern extent of the River Thames, the ecological value of the river corridor at this point will have increased as a result of the construction. That said, given the linear east – west nature of the Proposed Development, it is anticipated that the extent of the overshadowing will be limited to areas below or within the immediate vicinity of the viaduct only, with any overshadowing of the native marginal planting for a limited period on any one day. As such, where overshadowing does occur, the effect on the running water habitat is unlikely to be significant on account of both the limited time this overshadowing will occur and the limited extent of this overshadowing.
- 14.7.36 Considering the above, and subject to the implementation of appropriate hydrological control measures, **no significant effects** on 'running water' habitat are anticipated as a result of the Proposed Development, once operational.

Lowland Fens and Reedbeds

- 14.7.37 No direct impacts on 'lowland fens' and 'reedbeds' are anticipated as a result of the Proposed Development, once operational. Furthermore, subject to the implementation of appropriate control measures as specified within **Chapter 11: Hydrology and Flood Risk**, **no significant**

effects on 'lowland fens' and 'reedbeds' are anticipated as a result of the Proposed Development, once operational.

Bats

14.7.38 Habitats on-site and immediately adjacent to it are utilised by a range of foraging and commuting bat species. Although no roosting bats were identified, trees with suitability to support roosts are also present.

Construction Phase Impacts

14.7.39 The survey results have shown that the Application Site provides a foraging and commuting resource for an assemblage of at least eight species of bats.

14.7.40 Of the habitats present, and within the immediate surrounding, the tree-lines, woodland parcels and nearby water courses were identified to be of most value to foraging and commuting bats. The construction phase of the Proposed Development will result in the removal of 2.31 ha of semi-natural habitat within the footprint of the Application Site, of which up to 0.88 ha comprises woodland and dense scrub, with tree lines also present. This will result in a permanent reduction in the overall extent of habitat available to foraging and commuting bats; and as such, a permanent adverse effect on foraging and commuting populations of bats. The Proposed Development will further affect (indirectly) a span of 59.5 m of the River Kennet, where this waterway passes underneath the route alignment. The affected habitat (in terms of direct and indirect) represents only a small proportion of the overall area of these habitat types present on-site and within the immediate vicinity and overall habitat connectivity is to be maintained throughout construction, albeit reduced in overall extent. No specific mitigation will therefore be provided for construction phase habitat loss.

14.7.41 Although no roosting bats were identified during the survey work, current best practice guidance (Collins, 2016) states that *'From what is known about the ecology of tree-roosting bats, it is arguable that all trees with bat roosting potential should be considered part of a resource that will be used at one time or another by tree roosting bats in order to determine the extent of impacts. Survey work on individual trees may confirm presence but is unlikely to conclusively confirm absence. Precautionary measures are likely to still be essential during works even where surveys have not identified occupancy'*. The same is considered to apply for the Railway Bridge. As such, there remains a risk of killing and / or injury and / or disturbance of roosting bats if undertaken in the absence of species specific precautionary methods or working/ mitigation.

14.7.42 Common and soprano pipistrelle bats, noctule, Leisler's and serotine bats all tolerate relatively high light levels, often foraging on invertebrates attracted to street-lighting. As such no adverse significant effects on these species are anticipated as a result of the use of construction phase lighting along the Proposed Development.

14.7.43 A number of species however, (including *Myotis* bats, barbastelle bats and long-eared bats (identified from within 2 km of the Application Site during the desk study) prefer to roost, commute and forage within areas with very low levels of lighting or preferably no artificial lighting. The CEMP (as described within the Embedded Ecological Mitigation section) will include prescriptions with regards to construction phase lighting; particularly in relation to bats, and will be implemented as part of the Proposed Development.

14.7.44 Considering the above, and given an absence of specific mitigation associated with the construction phase habitat loss, there remains a **temporary adverse effect** on the local bat assemblage utilising the Application Site for the duration of the construction period. This is potentially significant within the **Local** context.

Operation Phase Impacts

- 14.7.45 Once operational, the Proposed Development will include a variety of habitat suitable for use by foraging and commuting bats. These habitats will include a variety of species rich grasslands and wildflower planting and new tree and shrub planting as shown on the **Landscape and Ecology Strategy**.
- 14.7.46 Furthermore, habitat improvements will be included within the River Thames immediately to the north of the eastern portion of the Application Site. These will comprise approximately 100m of naturalised river edge, which will include a variety of native species, adding floristic diversity (and therefore likely invertebrate diversity and an increased food source) to the River Thames.
- 14.7.47 Subject to the implementation of the landscape planting and habitat creation above, and once new growth has become established, there will be improvements in quality and diversity of habitat and retention in overall habitat connectivity, in spite of the construction phase losses. As such, no significant effects on the foraging and commuting bats are anticipated as a result of habitat changes once the Proposed Development is operational.
- 14.7.48 A study undertaken by Kerth and Melber in 2009 investigated the barrier effects that a motorway would have on foraging barbastelle and Bechstein's bats. The authors of this report stated that due to similarities in morphology/ecology the findings of their study would also be applicable to noctule and Leisler's bats (in the case of the barbastelle bat results) and other species of *Myotis* bats (in the case of Bechstein's bat results). This study focussed on a motorway which, although a significantly larger barrier than the Proposed Development, provides a useful indication of how bats can be affected by linear transport features. This study found that the ecology and physiology of the two different bat species affected their ability to cross roads. Barbastelle bats (a hawking aerial species) were found to cross over the road with far greater regularity, with Bechstein's bats found to use underpasses rather than fly over the road (Kerth & Melber, 2009). Therefore, the physiology and ecology of different bat species leads bats to be affected by severance of commuting habitats to a greater or lesser extent.
- 14.7.49 Aerial hawking species (pipistrelle bats, noctule, Leisler's, serotine and barbastelle bats) will often fly over open habitats, with the *Nyctalus* (noctule and Leisler's) bats known to commute at greater heights of around 10-70 m above ground level (Russ, 1999). As such, the Proposed Development is not considered to be a barrier to these species, as they are adapted to flying at high levels and over more open landscapes. Pipistrelle bats do tend to prefer to fly close to vegetation to avoid predation but will regularly cross roads.
- 14.7.50 The UK bat species adapted to gleaning invertebrates from vegetation (*Myotis* bats and long-eared bats) fly at low levels often within dense vegetation (including along hedgerows), with Daubenton's bats favouring riverine habitats. Given that such vegetation is largely absent extending in a north-south direction from the Application Site into the wider landscape; and that the north-south connectivity via vegetation is already severely compromised by the presence of the adjacent mainline railway; the likelihood of these species preferentially foraging and commuting in a north south direction across the Proposed Development, is low. Furthermore, and namely in relation to Daubenton's bats, given that the stretch of the River Kennet from the confluence with the River Thames south already contains four structures within c. 150 m, addition of the Proposed Development, spanning the River Kennet at the same elevation as the existing adjacent rail bridge is equally unlikely to significantly alter the foraging or commuting conditions for Daubenton's bats.
- 14.7.51 Notwithstanding the ecology of the bat species known to be associated with the Application Site, and their foraging preferences, there remains a risk that mortality of individuals may occur as a result of collision with vehicles. This risk is however considered low due to the fact that no buses will run between 00.00 and 04.00, those that will be running, will be travelling at

speeds of less than 30 mph, with no more than 30 passes per hour; movements that are both comparable to the adjacent train movements.

14.7.52 Common and soprano pipistrelle bats, noctule, Leisler's and serotine bats all tolerate relatively high light levels. As such the use of lighting along the Proposed Development is predicted to have a negligible or limited adverse impact on these species. A number of species (including *Myotis* bats, barbastelle bats and long-eared bats) prefer to roost, commute and forage within areas with very low levels of lighting or preferably no artificial lighting. Therefore, the lighting design for the Proposed Development once operational has been ecologically informed (as summarised within the Embedded Ecological Mitigation section), ensuring consideration for local bat species has been appropriately made. Specifically, lux levels of no more than 1 lux will occur along the extent of the watercourses.

14.7.53 As such, **no significant effects** on the bat assemblage known to commute, forage and potentially roost within the Application Site are anticipated as a result of the operational phase of the Proposed Development.

Reptiles

14.7.54 Only very low numbers of grass snakes were recorded (single individuals) with numbers of slow worms (including juveniles) indicating that a medium-sized breeding population of this species is likely to be present on site and in the surrounding area.

Construction Phase Impacts

14.7.55 Reptiles were concentrated along the margins of grassland and scrub habitats, particularly close to an adjacent railway corridor in the central part of the Application Site as well as in open areas to the east and west. The construction phase of the Proposed Development will result in the removal of a total of 2.31 ha of semi-natural habitat, which will include habitat suitable for use by grass snake and slow worms. Although the affected habitat represents only a proportion of the overall area of these habitat types present on-site and within the immediate vicinity, the overall on-site habitat resource will nonetheless be reduced as a result of construction.

14.7.56 In addition to the above, the establishment of the construction footprint (i.e. as a result of habitat removal and the establishment of a works area through fencing etc.), will result in a physical barrier to the movement of reptiles in a north-south direction. Although specific mitigation will not be provided for construction phase habitat loss, construction of the Proposed Development will be phased ensuring that temporary severance of north – south connectivity will not occur across the entire footprint of the Proposed Development at once.

14.7.57 Throughout the above works, there also remains a risk of killing and / or injury of reptiles if undertaken in the absence of species specific mitigation.

14.7.58 Considering the above, and in the absence of specific construction phase mitigation for reptiles, there is a risk of accidental killing or injury and or temporary phased north south habitat severance resulting in a **temporary adverse effect** on populations of grass snake and slow worm utilising the Application Site for the duration of the construction period. This is potentially significant within the **Local** context.

Operation Phase Impacts

14.7.59 Once operational, the Proposed Development will include a variety of habitat suitable for use by reptiles, as shown on the **Landscape and Ecology Strategy**. These habitats will include a variety of grassland types, to be managed for the purpose of biodiversity, as well as native shrub planting, wetland marsh planting and riverside marginal planting. Further to this, deadwood features and rubble piles will be installed within the Application Site to provide hibernacula for these species.

- 14.7.60 Subject to the implementation of the measures as described above, and once new growth has become established, there will be improvements in quality and diversity of habitat for reptiles, in spite of the construction phase losses.
- 14.7.61 Once operational the Proposed Development will comprise a structure 316 m in length. This will begin at ground level in the west and will increase in height along a solid embankment to the west of the River Kennet. From the River Kennet east, the structure will comprise a concrete and stainless steel structure, on vertical columns. North – south connectivity will be retained once the Proposed Development is operational via reptile tunnels and semi-natural habitat (to the east of the River Kennet). Whilst this is not anticipated to affect reptiles to the east of the River Kennet, there is anticipated to be some limitation to the north – south movement of reptiles to the west of the River Kennet when compared to the existing baseline.
- 14.7.62 To supplement the reptile tunnels, guide walls will be installed as appropriate within the Proposed Development. These act to direct reptiles towards the tunnels, ensuring their ability to move north – south across the Proposed Development is maintained, whilst preventing them from climbing on to the carriageway (only applicable to the west of the River Kennet) and reducing the risk that injury or mortality of individuals may occur as a result of vehicle accidents once the Proposed Development is operational.
- 14.7.63 Subject to the implementation of habitat interventions, reptile tunnels and guide walls across the Application Site as part of the embedded scheme mitigation, and once new growth has become established, **no significant effects** on the reptile population associated with the Application Site is anticipated to arise once the Proposed Development is operational.

14.8 Ecological Impact Assessment: Combined Development

The Coal, Kennetmouth and Kings Meadow East LWS

- 14.8.1 With the exception of The Coal, Kennetmouth and Kings Meadow East LWS and Henley Road Pit LWS, the designated areas located within the Study Area, are located sufficiently far from the Combined Site, and isolated from it by already highly urbanised land, that effects arising as a result of the Combined Development are not anticipated. No further consideration is made to these designated areas within this assessment.

Construction Phase Impacts

- 14.8.2 The construction phase of the Combined Development will result in permanent reduction in the overall size of The Coal, Kennetmouth and Kings Meadow East LWS (see **Paragraphs 14.7.3 – 14.7.9** for details). However, the majority of key features for which the LWS is noted will be retained. No specific mitigation will be provided for construction phase habitat loss.
- 14.8.3 To suitably control construction phase changes in air quality, water quality and lighting (which might otherwise impact on the LWS, or the protected and / or notable species it is likely to support³⁵), appropriate measures will be specified within CEMP documents³⁶, and implemented as part of the Combined Development.
- 14.8.4 Considering the above, the construction phase of the Combined Development will result in permanent reduction in the overall size of the Coal, Kennetmouth and Kings Meadow East LWS (and by virtue of this, the area designated as HPI 'Lowland Mixed Deciduous Woodland');

³⁵ Whilst the designation for The Coal, Kennetmouth and Kings Meadow East LWS relates namely to habitat interest features (which, in themselves, would be unaffected by changes in lighting), protected and notable species (including light sensitive species) will be reliant on these habitats and as such, have been considered within the context of The Coal, Kennetmouth and Kings Meadow East LWS. Further consideration relating to bats and lighting specifically is provided within the assessment for 'Bats' below

³⁶ In addition to the CEMP relating to the 'Proposed Development, a CEMP will be produced in relation to the TVP P&R Scheme (Planning Application 161596 – Planning Condition 19).

as such resulting in a **permanent adverse effect** on this important ecological feature. Given that the majority of key features associated with the LWS are located outside the Combined Development boundary however, and will remain unaffected by the works, this is not anticipated to be significant beyond the **Local** context.

Operation Phase Impacts

- 14.8.5 Once operational, the Combined Development will result in the overall improvement of up to 0.31 ha of on-site habitat within The Coal, Kennetmouth and Kings Meadow East LWS. Further details are provided within the **Landscape and Ecology Strategy**.
- 14.8.6 To suitably control changes in water quality / quantity (which could otherwise adversely affect the habitats for which the LWS have been designated), appropriate control measures have been specified within the **Chapter 11: Hydrology and Flood Risk**. These will be implemented as part of the Proposed Development. Given the isolation of the TVP P&R Site from The Coal, Kennetmouth and Kings Meadow East LWS, no further considerations specific to the TVP P&R Site are considered necessary in relation to this important ecological feature.
- 14.8.7 As identified above, although the designation for The Coal, Kennetmouth and Kings Meadow East LWS relates namely to habitat interest features (which, in themselves, would be unaffected by changes in lighting), protected and notable species (including light sensitive species) will be reliant on these habitats and as such, have been considered within the context of The Coal, Kennetmouth and Kings Meadow East LWS. Given that the operational lighting design has been ecologically informed however, with measures included to mitigate for impacts on local wildlife, the lighting of the Combined Development, once operational, will be suitably controlled such that adverse effects on species as a result of increased light spill are not anticipated. Given the isolation of the TVP P&R Site from The Coal, Kennetmouth and Kings Meadow East LWS, no further considerations specific to the TVP P&R Site are considered necessary in relation to this important ecological feature. Further consideration relating to bats and lighting specifically is provided within the assessment for 'Bats' below.
- 14.8.8 Once operational, there will be a permanent improvement in the quality of habitat present within the remaining on-site portion of The Coal, Kennetmouth and Kings Meadow East LWS (and by virtue of this, the area designated as HPI 'Lowland Mixed Deciduous Woodland' (up to 0.31 ha). Given that this is for a lesser area than that being lost during construction however, there remains a **permanent adverse effect** on this important ecological feature. Given that the majority of key features associated with the LWS are located outside the Combined Development boundary, as identified above, and will remain unaffected by the works, this is not anticipated to be significant beyond the **Local** context.

Henley Road Gravel Pits LWS

- 14.8.9 Given the location of Henley Road Gravel Pits LWS (approximately 100 m north of the Combined Site), an assessment of potential impact on this site is provided below. Given that much of the Henley Road Gravel Pits LWS comprises the same area as the closest parcel of the HPI 'eutrophic standing water' to the Combined Site, this habitat type too will be considered within this assessment.

Construction Phase Impacts

- 14.8.10 No direct impacts on Henley Road Gravel Pits LWS / eutrophic standing water HPI are anticipated as a result of the construction phase of the Combined Development.
- 14.8.11 To suitably control construction phase changes in air quality or water quality (which might otherwise impact the habitats within the LWS, including the eutrophic standing water HPI),

appropriate measures will be specified within the CEMP documents³⁷, and implemented as part of the Combined Development.

14.8.12 Although Henley Road Gravel Pits LWS is identified to support a range of water fowl species, which may be sensitive to changes in lighting levels, it is a sufficient distance from the Combined Development that adverse effects on these species as a result of construction phase light spill are not anticipated.

14.8.13 Considering the above, and subject to the implementation of the CEMP documents, **no significant effects** on Henley Road Gravel Pits LWS / eutrophic standing water HPI are anticipated as a result of the construction phase of the Combined Development.

Operation Phase Impacts

14.8.14 No direct impacts on Henley Road Gravel Pits LWS are anticipated as a result of the Combined Development, once operational.

14.8.15 To suitably control changes in water quality / quantity (which could adversely affect the habitats (including eutrophic standing water) on which the waterfowl (identified within the designation for the LWS) rely), appropriate control measures have been specified within the **Chapter 11: Hydrology and Flood Risk**. These will be implemented as part of the Combined Development. Given that the TVP P&R element of the Combined Site is set back from the River Thames, and as such, is isolated from it by existing vegetation and the Thames Path, appropriate control measures have been specified for the Application Site element of the Combined Site only.

14.8.16 Although Henley Road Gravel Pits LWS is identified to support a range of water fowl species, which may be sensitive to changes in lighting levels, the design of the lighting has been ecologically informed, ensuring that consideration for local wildlife has been appropriately made such that adverse effects on these species as a result of increased light spill once the Combined Development is operational are not anticipated.

14.8.17 Considering the above, and subject to the implementation of appropriate hydrological control measures, **no significant effects** on Henley Road Gravel Pits LWS / eutrophic standing water HPI are anticipated as a result of the Combined Development, once operational.

Ancient Woodland

14.8.18 The parcels of Ancient Woodland identified to be present within the Study Area are located sufficiently far from the Combined Site (with the closest located approximately 900 m north at its closest point, and located on an island within the Henley Gravel Pits LWS), that effects arising as a result of the Combined Development are not anticipated. No further consideration is made to Ancient Woodland within this assessment.

Habitats of Principal Importance

14.8.19 Of the HPI types identified to be present within 2 km of the Combined Site, parcels of the following are either present on site or directly connected to it, via the River Thames:

- Rivers: The River Kennet passes south - north under the footprint of the Proposed Development. Furthermore, the River Thames is located along the northern extent of the Application / Combined Site;

³⁷ In addition to the CEMP relating to the 'Proposed Development', a CEMP will be produced in relation to the TVP P&R Scheme (Planning Application 161596 – Planning Condition 19).

- Lowland mixed deciduous woodland: located within the on-site portion of The Coal, Kennetmouth and Kings Meadow East LWS and extending along the Tesco Car Park boundary / Network Rail access corridor to the south of the Application Site;
- Lowland fens and reedbeds: located downstream of the Combined Site; and
- Eutrophic standing waters: the closest parcel opposite the Combined Site, located within The Henley Road Gravel Pits LWS.

14.8.20 As the lowland mixed deciduous woodland has been considered within the earlier assessment relating to The Coal, Kennetmouth and Kings Meadow East LWS, and the eutrophic standing water has been considered within the earlier assessment relating to Henley Road Gravel Pits LWS; an assessment of potential impacts on 'rivers', 'lowland fens' and 'reedbeds' only is provided within the sections below.

14.8.21 Effects on the remaining HPI parcels as a result of the Combined Development are not anticipated as these are sufficiently isolated from the Combined Site such that indirect impacts are highly unlikely to occur. No further consideration is made to these HPI within this assessment.

Construction Phase Impacts

Rivers

14.8.22 The Proposed Development element of the Combined Development will include the removal of the existing failing river wall and adjacent amenity grassland strip, along approximately 100 m of the southern bank of the River Thames. These will be replaced by mooring enhancement and associated native marginal planting to 'soften' the riverbank. The implementation of measures set out in the CEMP³⁸ and as required by any Conditions imposed upon Permits/Consents for works within watercourse corridors will control the potential impacts of construction works upon the River Thames. As such, **no significant effects** on 'river' habitat are anticipated as a result of the construction phase of the Proposed Development.

Lowland Fens and Reedbeds

14.8.23 No direct impacts on 'lowland fens' and 'reedbeds' are anticipated as a result of the construction phase of the Combined Development, due to the distance separation.

14.8.24 To suitably control construction phase changes in air quality or water quality (which might otherwise impact these HPI), appropriate measures will be specified within the CEMP documents³⁹, and implemented as part of the Combined Development. As such, **no significant effects** on 'lowland fens' and 'reedbeds' are anticipated as a result of the construction phase of the Combined Development.

Operation Phase Impacts

Rivers

14.8.25 No direct impacts on the 'running water' habitat are anticipated as a result of the Combined Development, once operational.

14.8.26 To suitably control changes in water quality / quantity (which could adversely affect the 'running water' habitat), appropriate control measures have been specified within **Chapter 11: Hydrology and Flood Risk**. Given that the TVP P&R element of the Combined Site is set back from the River Thames, and as such, is isolated from it (and therefore the running water

³⁸ In addition to the CEMP relating to the 'Proposed Development', a CEMP will be produced in relation to the TVP P&R Scheme (Planning Application 161596 – Planning Condition 19).

³⁹ In addition to the CEMP relating to the 'Proposed Development', a CEMP will be produced in relation to the TVP P&R Scheme (Planning Application 161596 – Planning Condition 19).

habitat) by existing vegetation and the Thames Path, appropriate control measures have been specified for the Application Site element of the Combined Site only.

- 14.8.27 Once operational the Proposed Development section of the Combined Development will comprise a segregated fast-track public transport, pedestrian and cycle bridge and viaduct, comprising concrete bridge structure with a river span of 59.5m and a land span of 316m. Where this crosses the River Kennet (i.e. the river span of 59.5m), or is located immediately alongside the River Thames (i.e. the viaduct to the east of the River Kennet), overshadowing of the running water habitat (and river bank habitat) beneath or immediately adjacent will occur.
- 14.8.28 The interest features of the running water habitat along this section of the River Kennet are already very limited on account of the high levels of overshadowing associated with the adjacent railway bridge and horseshoe bridge, the reinforcement of the river banks and an absence of in-channel vegetation.
- 14.8.29 Considering the installation of approximately 100 m of native marginal planting along the southern extent of the River Thames, the ecological value of the river corridor at this point will have increased as a result of construction. That said, given the linear east – west nature of the Proposed Development, it is anticipated that the extent of the overshadowing will be limited to areas below or within the immediate vicinity of the viaduct only; with any overshadowing of the native marginal planting for a limited period on any one day. As such, where overshadowing does occur, the effect on the running water habitat is unlikely to be significant on account of both the limited time this overshadowing will occur and the limited extent of this overshadowing.
- 14.8.30 Considering the above, and subject to the implementation of appropriate hydrological control measures, **no significant effects** on 'running water' habitat are anticipated as a result of the Combined Development, once operational.

Lowland Fens and Reedbeds

- 14.8.31 No direct impacts on 'lowland fens' and 'reedbeds' are anticipated as a result of the Combined Development, once operational. Furthermore, subject to the implementation of appropriate measures as specified within the Flood Risk Assessment (see details within the Embedded Mitigation Measures section), **no significant effects** on 'lowland fens' and 'reedbeds' are anticipated as a result of the Combined Development, once operational. Given that the TVP P&R element of the Combined Site is set back from the River Thames, and as such, is isolated from it (and therefore from influencing the 'lowland fens' and 'reedbeds') by existing vegetation and the Thames Path, appropriate control measures have been specified for the Application Site element of the Combined Site only.

Bats

- 14.8.32 Habitats on-site and immediately adjacent to it are utilised by a range of foraging and commuting bat species. Although no roosting bats were identified, trees and the Railway Bridge were identified to have suitability to support roosts. Further to this, the Waterside Centre (off-site) and / or the adjacent storage shed (within the Combined Site, but outside the Application Site) were previously anticipated to support a roost of soprano pipistrelle.

Construction Phase Impacts

- 14.8.33 The survey results have shown that the Combined Site provides, in part, a high quality foraging and commuting resource for an assemblage of at least eight species of bats.
- 14.8.34 Of the habitats present and within the immediate surroundings, the outgrown hedgerow / dense scrub, tree-lines, woodland parcels and nearby water courses were identified to be of most value to foraging and commuting bats. The construction phase of the Combined

Development will result in the removal of a of 2.31 ha of semi-natural habitat within the footprint of the Combined Site, in addition to the area recently cleared within the TVP P&R Site. It will further affect (indirectly) a span of 59.5 m of the River Kennet where this watercourse passes underneath the route alignment. The affected habitat represents only a proportion of the overall area of these habitat types present on-site and within the immediate vicinity however; meaning that overall habitat connectivity is to be maintained throughout construction, albeit reduced in overall extent. No specific mitigation will therefore be provided for construction phase habitat loss.

- 14.8.35 As detailed within **Paragraph 14.7.39**, trees and structures within the Combined Site are suitable for use by roosting bats. As such, there remains a risk of killing and / or injury and / or disturbance of roosting bats if undertaken in the absence of species specific precautionary methods of working/ mitigation
- 14.8.36 The CEMP documents⁴⁰ will include prescriptions with regards to construction phase lighting; particularly in relation to bats. These will be implemented as part of the Combined Development.
- 14.8.37 Considering the above, and given an absence of specific mitigation associated with the construction phase habitat loss, there remains a **temporary adverse effect** on the local bat assemblage utilising the Combined Site for the duration of the construction period. This is potentially significant within the **Local** context.

Operation Phase Impacts

- 14.8.38 Once operational, the Combined Development will include a variety of habitat suitable for use by foraging and commuting bats. These habitats will include a variety of species rich grasslands and wildflower planting and new tree and shrub planting as shown on the **Landscape and Ecology Strategy**; with additional shrub, tree and hedgerow planting within the TVP P&R Site.
- 14.8.39 Furthermore, habitat improvements will be included within the River Thames immediately to the north of the eastern portion of the Combined Site. These will comprise approximately 100m of naturalised river edge, which will include a variety of native species adding floristic diversity (and therefore likely invertebrate diversity and an increased food source) to the River Thames.
- 14.8.40 Subject to the implementation of the landscape planting and habitat creation above, and once new growth has become established, there will be improvements in quality and diversity of habitat and retention in overall habitat connectivity, in spite of the construction phase losses. As such, no significant effects on the foraging and commuting bats are anticipated as a result of habitat changes once the Combined Development is operational.
- 14.8.41 For the reasons outlined within **Paragraphs 14.7.46 - 14.7.49** above, no adverse effects on the north – south foraging and commuting of bat species is anticipated as a result of route severance caused by the Combined Development, once operational. The risk of mortality of individuals as a result of vehicle collision is also considered to be negligible.
- 14.8.42 For the reasons set out within **Paragraph 14.7.50** above, effects on the local bat assemblage as a result of changes in lighting are not anticipated as a result of the proposed Application Site section of the Combined Development. Further to this, ecological input has been provided into the lighting design for the TVP P&R element of the Combined Development, the detail of which is due to be captured within a planning condition associated with the TVP P&R Scheme (Planning Application 161596 – Planning Condition 16).

⁴⁰ In addition to the CEMP relating to the 'Proposed Development', a CEMP will be produced in relation to the TVP P&R Scheme (Planning Application 161596 – Planning Condition 19).

- 14.8.43 As such, **no significant effects** on the bat assemblage known to commute, forage and potentially roost within the Combined Site are anticipated as a result of the operational phase of the Combined Development.

Reptiles

- 14.8.44 The Combined Site supports only very low numbers of grass snakes. Numbers of slow worms recorded (including juveniles) indicate that a medium breeding population of this species is likely to be present on the Combined Site and in the surrounding area.

Construction Phase Impacts

- 14.8.45 Reptiles were concentrated along the margins of grassland and scrub habitats, particularly close to an adjacent railway corridor in the central and eastern portions of the Combined Site, as well as in open areas to the east and to the north. The construction phase of the Combined Development will result in the removal of a total of 2.31 ha of semi-natural habitat within the footprint of the Combined Site, in addition to the area recently cleared within the TVP P&R Site, which will include habitat suitable for use by grass snake and slow worms. Although the affected habitat represents only a proportion of the overall area of these habitat types present on-site and within the immediate vicinity the overall on-site habitat connectivity will be lost albeit temporarily as a result of construction.
- 14.8.46 In addition to the above, the establishment of the construction footprint (i.e. as a result of habitat removal and the establishment of a works area through fencing etc.), will result in a physical barrier to the movement of reptiles in a north-south direction. Although specific mitigation will not be provided for construction phase habitat loss, construction of the Combined Development will be phased, ensuring that temporary severance of north – south connectivity will not occur across the entire footprint of the works at once.
- 14.8.47 Throughout the above works, there also remains a risk of killing and / or injury of reptiles if undertaken in the absence of species specific mitigation.
- 14.8.48 Considering the above, and in the absence of specific construction phase mitigation, there is a risk of accidental killing or injury and or temporary phased north-south habitat severance resulting in a **temporary adverse effect** on populations of grass snake and slow worm utilising the Combined Site for the duration of the construction period. This is potentially significant within the **Local** context.

Operation Phase Impacts

- 14.8.49 Once operational, the Combined Development will include a variety of habitat suitable for use by reptiles, as shown on the **Landscape and Ecology Strategy**, with additional areas of retained habitat surrounding the Waterside Centre at the north-eastern extent of the Combined Development.
- 14.8.50 Once operational the Combined Development will include a structure approximately 316 m in length, along with the TVP P&R car park. North – south connectivity will be retained once the Combined Development is operational via reptile tunnels and semi-natural habitat (to the east of the River Kennet). Whilst this is not anticipated to affect reptiles to the east of the River Kennet, there is anticipated to be some limitation to the north – south movement of reptiles to the west of the River Kennet when compared to the existing baseline.
- 14.8.51 To supplement the reptile tunnels, guide walls will be installed as appropriate within the Proposed Development. These act to direct reptiles towards the tunnels, ensuring their ability to move north – south across the Proposed Development is maintained, whilst preventing them from climbing on to the carriageway (only applicable to the west of the River Kennet) and

reducing the risk that injury or mortality of individuals may occur as a result of vehicle accidents once the Combined Development is operational.

- 14.8.52 Subject to the implementation of habitat interventions, reptile tunnels and guide walls across the Combined Site, and once new growth has become established, **no significant effects** on the reptile population associated with the Combined Site is anticipated to arise once the Combined Development is operational.

Impact Assessment Summary

- 14.8.53 **Table 14.9** below summarises the effects of the Proposed Development / Combined Development on important ecological features during the construction and operation phase, in the absence of additional mitigation, compensation and enhancement measures. Where remaining residual effects are identified for the important ecological features, additional mitigation measures are set out below.

Table 14.9: Summary of Residual Effects

Important Ecological Feature	Geographic Context	Proposed Development		Combined Development	
		Construction	Operation	Construction	Operation
The Coal, Kennetmouth & Kings Meadow East LWS (including HPI 'Lowland Mixed Deciduous Woodland')	County	Permanent adverse (Local)	Permanent adverse (Local)	Permanent adverse (Local)	Permanent adverse (Local)
Henley Road Gravel Pits LWS	County	No significant effect	No significant effect	No significant effect	No significant effect
Ancient Woodland	National	No significant effect	No significant effect	No significant effect	No significant effect
HPI	County	No significant effect	No significant effect	No significant effect	No significant effect
Bats	Local	Temporary adverse (Local)	No significant effect	Temporary adverse (Local)	No significant effect
Reptiles	Local	Temporary adverse (Local)	No significant effect	Temporary adverse (Local)	No significant effect

14.9 Additional Ecological Mitigation and Compensation

- 14.9.1 For those important ecological features with effects remaining, following the consideration of avoidance and embedded mitigation measures, further mitigation and compensations measures are set out below to build on those included within the scheme design.

The Coal, Kennetmouth & Kings Meadow East LWS

- 14.9.2 Given that there will be a loss in the overall area of The Coal, Kennetmouth & Kings Meadow East LWS, and that the footprint of the Application Site is highly constrained, it has been agreed that a package of off-site measures will be delivered outside the Application Site, but in association with the Proposed Development. These measures are in addition to those incorporated within the Application Site itself, as identified within the Embedded Ecological

Mitigation above. These measures have been discussed and agreed with RBC and will be secured in the long term via the S106 Agreement.

14.9.3 The following measures will be implemented within the off-site portion of The Coal, Kennet Mouth and Kings Meadow East LWS:

- Removal of invasive, non-native plant species (e.g. Himalayan balsam *Impatiens glandulifera* and butterfly bush):
- Selective tree management; and
- Native understorey planting.

14.9.4 Whilst there will remain a reduction in the size of The Coal, Kennetmouth and Kings Meadow East LWS as a result of the Proposed / Combined Development, there will be a permanent improvement in the quality of the habitat present within the remainder of The Coal, Kennetmouth and Kings Meadow East LWS. As such **no significant effect** on this important ecological feature is anticipated as a result of the Proposed / Combined Development.

Bats

14.9.5 Given the nature of the Proposed / Combined Development (which will result in unavoidable habitat loss during construction), it is not anticipated that further mitigation will negate the **temporary adverse effect** on bats during the construction period; however, to ensure compliance with the legislation by which bats are protected, a detailed mitigation strategy will be conditioned and implemented during the construction works. This will include prescriptions in relation to bats to avoid killing, injury and disturbance to roosting bats. This will include recommendations in relation to felling trees with potential to support roosting bats, for example, re-survey prior to felling.

Reptiles

14.9.6 Given the nature of the Proposed / Combined Development (which will result in unavoidable habitat loss during construction), it is not anticipated that further mitigation will negate the **temporary adverse effect** on reptiles during the construction period; however, to ensure compliance with the legislation by which reptiles are protected, a detailed mitigation strategy will be conditioned and implemented to avoid the construction phase effects on reptiles. This will include appropriate working methods to avoid incidental mortality and injury of reptiles during clearance of areas of suitable reptile habitat during construction and a strategy for the retention and protection of suitable habitat post-construction. Further details are provided below.

Reptile Mitigation Strategy

14.9.7 The following section provides supplementary information with regard the proposed Reptile Mitigation Strategy.

Receptor Site Selection

14.9.8 The Coal, Kennet Mouth and Kings Meadow East LWS provides suitable habitat for use by local reptile populations. It is connected to the Application Site in the east and to the wider Kings Meadow in the west. It currently comprises a variety of habitat types which, although suitable for reptile dispersal, will be enhanced as part of the site preparation works. As such, management of the vegetation within The Coal, Kennet Mouth and Kings Meadow East LWS will be undertaken as part of the site preparation works. This will include: selective clearance and cutting back of scrub to open up some parts of the ground to promote the growth of

grasses and shorter vegetation. Further enhancements could include the creation of log and/or brash piles located on higher ground to provide suitable refuges for reptiles.

- 14.9.9 Although The Coal, Kennet Mouth and Kings Meadow East LWS is located immediately to the south of the River Thames, within Flood Zone 2 (i.e. an area of between a 1 in 100 (1%) and 1 in 1,000 (0.1%) annual probability of river flooding), detailed mapping identifies numerous areas of higher ground within The Coal, Kennet Mouth and Kings Meadow East LWS which fall outside of both of these areas and are not susceptible to flooding and as such, are considered suitable for reptile translocation.

Draft Mitigation Strategy

- 14.9.10 The Reptile Mitigation Strategy is proposed to retain a viable population of reptiles within the application site. This will be achieved through the temporary exclusion of reptiles from application site for the duration of the construction process, following which, they will be allowed to recolonise naturally. The following steps are proposed:

- **Installation of reptile-proof fencing:** reptile-proof fencing will be installed around and within the Application Site;
- **Deployment of artificial refugia:** once the reptile-proof fencing has been installed, artificial refugia will be deployed within each of the fenced compartments (at high density; e.g. 100 refugia per hectare of suitable habitat);
- **Translocation of reptiles:** once the artificial refugia have been allowed to 'bed in', they will be checked over a series of days, with any reptiles found being captured and removed to the receptor site (i.e. the off-site portion of The Coal, Kennet Mouth and Kings Meadow East LWS). For a medium population of slow worms, a minimum capture period of 70 days is recommended (HGBI, 1998). However, the duration of trapping could be shorter than this (with agreement from the RBC/WBC) depending on trapping results (i.e. if there is an extended period during which no reptiles are caught, despite favourable weather conditions). A minimum of 5 suitable days during which no reptiles are caught should be reached before trapping can cease;
- In combination with trapping, once approximately half of the trapping days have been completed, habitat manipulation within fenced compartments can be employed to focus trapping effort. This could involve partially reducing vegetation within compartments to a short height (e.g. 10 to 15 cm) via careful strimming / cutting to facilitate capture of reptiles and focus animals in remaining areas of taller vegetation; and
- **Destructive search:** once sufficient trapping has been undertaken the application site will be 'destructively searched'. This involves first reducing vegetation to ground level in the presence of an ecologist who will rescue any remaining reptiles, followed by the removal of the top layer of soil; e.g. using an excavator fitted with a toothed bucket. This will also be completed in the presence of an ecologist.
- **Fencing removal:** the perimeter fencing will remain in place until such time that either the habitat within the application site is no longer suitable or construction works are complete. Following this, any remaining fencing will be removed, and reptiles will be allowed to recolonise the application site from both the retained population within The Coal, Kennet Mouth and Kings Meadow East LWS and the adjacent Network Rail corridor.

14.9.11 It may be possible to clear the land to the west of the River Kennet through habitat manipulation instead of a trap and translocate exercise; however, this will need to be informed by a review of habitat present in advance of clearance works commencing.

14.9.12 Implementation of the above Reptile Mitigation Strategy, with details to be secured by a pre-commencing planning condition, is considered sufficient to maintain the conservation status of the local reptile population and inform the planning submission.

14.10 Residual Effects

14.10.1 Taking in to account the above mitigation, **Table 14.10** sets out the residual effects remaining for the important ecological features considered within these EclA's.

Table 14.10: Summary of Residual Effects

Important Ecological Feature	Geographic Context	Proposed Development		Combined Development	
		Construction	Operation	Construction	Operation
The Coal, Kennetmouth & Kings Meadow East LWS (including HPI 'Lowland Mixed Deciduous Woodland')	County	Permanent adverse (Local)	No significant effect	Permanent adverse (Local)	No significant effect
Henley Road Gravel Pits LWS	County	No significant effect	No significant effect	No significant effect	No significant effect
Ancient Woodland	National	No significant effect	No significant effect	No significant effect	No significant effect
HPI	County	No significant effect	No significant effect	No significant effect	No significant effect
Bats	Local	Temporary adverse (Local)	No significant effect	Temporary adverse (Local)	No significant effect
Reptiles	Local	Temporary adverse (Local)	No significant effect	Temporary adverse (Local)	No significant effect

14.11 Legal Compliance and Enhancement

14.11.1 The following section sets out the details of the following:

- Ecological mitigation measures to promote compliance with relevant wildlife legislation;
- Ecological enhancement measures to promote compliance with planning policy requirements to achieve measurable net gain in biodiversity; and
- Details of a Landscape and Ecology Management and Maintenance Plan.

Legal Compliance

- 14.11.2 Further to the above, the Application Site / Combined Site is known / has the potential to support populations of protected species. With the exception of reptiles and bats, impacts on these species have not been subject to full impact assessment as they are valued as being of less than Local importance. The Proposed Development will nonetheless require the implementation of appropriate avoidance, mitigation and / or compensation measures to assist in ensuring compliance with the legislation by which these species are protected.
- 14.11.3 A comprehensive Ecological Mitigation Strategy will be created either sitting within the CEMP, or as a standalone document to sit alongside the CEMP and secured by planning condition. This will set out avoidance and mitigation measures that will be implemented to avoid or minimise impacts on ecological features (both 'important' or otherwise legally protected) during the construction phase of the Proposed Development. It will include:
- Details on areas of habitat / features to be protected throughout construction, procedures for site clearance and specification for ecological fencing (e.g. trees, woodland / LWS and aquatic protection zones);
 - Ecological input to the control of construction phase lighting;
 - Prescriptions in relation to nesting birds to avoid killing, injury of breeding birds, eggs and young and destruction of active nests. This will include recommendations for seasonal timing and appropriate working methods;
 - Prescriptions in relation to wild mammals (to include precautionary measures in relation to badgers and hedgehogs) to avoid unnecessary suffering to wild mammals, including by crushing and asphyxiating. These will largely include recommendations for appropriate working methods; and
 - The Bat and Reptile Mitigation Strategies as identified above.

Ecological Enhancement

- 14.11.4 To promote compliance with planning policy requirements to achieve measurable net gain in biodiversity, the following measures will be implemented within King's Meadow and Hills Meadow LWS:
- Planting of four black poplar *Populus nigra* within King's Meadow;
 - Rotational management to reduce invasive species within the belt of vegetation at the north of King's Meadow;
 - A one-off project to resolve tree and undergrowth management, followed by rotational annual maintenance of the belt of vegetation at the south of Hills Meadow; and
 - Installation of bird and bat boxes within Hills Meadow and / or the off-site portion of The Coal, Kennet Mouth and Kings Meadow East LWS (6 x bird boxes, 6 x bat boxes (general) and 1 x bat box (hibernation)).
- 14.11.5 These measures have been discussed and agreed with RBC and will be secured via the S106 Agreement. All off-site measures are shown within **Appendix I.13**.
- 14.11.6 Where flood compensation works are required within the off-site portion of The Coal, Kennet Mouth and Kings Meadow East LWS, high quality biodiverse habitat appropriate to the setting, will be reinstated.

- 14.11.7 The Proposed Development will result in a measurable net gain in biodiversity in accordance with national and local planning policy. Further detail is provided within the Biodiversity Metric contained within **Appendix I.13**.

Landscape and Ecology Management and Maintenance Plan

- 14.11.8 In addition to the Ecological Mitigation Strategy, it is anticipated that a comprehensive Landscape and Ecology Management and Maintenance Plan (LEMMP) will be secured by planning condition. The purpose of this document will be to set out details of specific habitat establishment, management and maintenance operations, including timing, associated with habitat and species measures to be implemented as part of the Proposed Development. Ecological input to this document will include:

- Details of the on-site and wider habitat creation and / or enhancement measures, including the nature, extent, and ecological input to the specification of native seed mixes and species for landscape planting;
- Details of mitigation and enhancement measures for species, to include the specification and location of features such as bat and bird boxes/bricks, deadwood habitat and reptile hibernacula; and
- If not already captured within a wider management document, prescriptions in relation to the management of land within The Coal, Kennetmouth and Kings Meadow East LWS and the other off-site locations.

14.12 Monitoring

- 14.12.1 The CIEEM Guidelines prescribe the requirement for monitoring of mitigation, compensation and / or enhancement measures where there are uncertainties in predicting the effectiveness of measures, or mitigation packages are novel i.e. to determine whether the predicted efficiency of the mitigation meets expectations.
- 14.12.2 Given that the measures prescribed within this Chapter are standard mitigation procedures, and considering that no significant adverse effects are anticipated as a result of the Proposed Development / Combined Development once operational, monitoring measures specific to ecology are not required.

14.13 Cumulative Effects

- 14.13.1 Additional planning applications present within 1 km of the Proposed Development / Combined Development are contained within **Appendix A.10** (i.e. from June 2017 to August 2018, following the original submission).
- 14.13.2 The majority of these applications are considered unlikely to arise in significant in-combination (cumulative) adverse effects on 'important ecological features' identified. This is mainly on account of the nature and location of these developments, predominantly within Reading Town Centre; whereby they are isolated from the Combined Site and the habitats or features which support the important ecological features as identified and assessed within this chapter. Further detail is provided for two specific applications below.
- 14.13.3 Application Number: 171445: allows for the *'temporary change of use for up to 45 days in a Calendar year, to change from Class D2 Assembly & Leisure to Christmas Party Events at Kings Meadow, with the site being restored to its former conditions at, or before 16.00 on the 31st December'*. Although this is located within Kings Meadow, it is not located within The Coal, Kennet Mouth and Kings Meadow East LWS. Further to this, the setting of the temporary events marquee is within amenity grassland used for existing leisure activities. As such, when considered in addition to the Proposed / Combined Development it is not

anticipated to arise in significant in-combination (cumulative) adverse effects on 'important ecological features' identified.

14.13.4 Application Number: 162166: is located within Kings Meadow Road, RG1 8BN. This allows for the '*erection of a part 12 storey, part 23 storey building comprising 315 apartments and demolition of existing multi-storey car park*'. Again, although this is located within the vicinity of Kings Meadow, it is located over 650 m from The Coal, Kennet Mouth and Kings Meadow East LWS. Ecology reporting for this development identified it to have low ecological value and no adverse impact on biodiversity or protected species were identified (Protected Species Ecology Ltd, 2016). As such, when considered in addition to the Proposed / Combined Development it is not anticipated to arise in significant in-combination (cumulative) adverse effects on 'important ecological features' identified.

14.14 Summary

14.14.1 This chapter presents an ecological impact assessment of the Proposed Development in isolation, and the Proposed Development and the TVP P&R Development together (Combined Site). It provides an evaluation of the ecological features relevant to the Combined Site and has been informed by a combination of baseline ecological desk study and survey data.

14.14.2 This chapter describes the methods used to determine the impacts of the Proposed Development and the Combined Development on current baseline conditions; the mitigation measures incorporated within the Proposed Development to prevent, reduce or offset any adverse effects; and any likely residual effects after these measures have been employed.

14.14.3 The habitats within the Application Site and Combined Site are generally of low intrinsic ecological value; with broadleaved semi-natural woodland, running water and marginal vegetation (namely associated with the on-site LWS and adjacent water courses) of importance in the Local context or greater. With the exception of slow worm and grass snake populations, and roosting, foraging and commuting bats, protected or otherwise notable species recorded within and adjacent to the Application Site and / or Combined Site are not considered to be of importance within the 'Local' context or greater, and as such, have not been considered within the current assessments.

14.14.4 There are a number of designated areas of nature conservation importance within 2 km of the Application Site, including The Coal, Kennetmouth and Kings Meadow East LWS (which is located partially within the Application / Combined Site) and Henley Road Gravel Pits LWS.

14.14.5 In summary, important ecological features that have been considered within this chapter include:

- The Coal, Kennetmouth and Kings Meadow East LWS;
- Henley Road Gravel Pits LWS;
- Ancient Woodland;
- Habitat of Principal Importance;
- Bats; and
- Reptiles.

14.14.6 Where effects on important ecological features remain, once embedded mitigation measures have been taken into account, further mitigation and compensation has been identified. In addition measures have been outlined to promote compliance with relevant legislation for species not otherwise considered in the assessment, with enhancement measures, including habitat management and enhancement within King's Meadow and Hills Meadow LWS, to promote compliance with planning policy.

- 14.14.7 Although the construction phase of the Proposed Development / Combined Development will result in residual adverse effects on a small number of important ecological features at the local level; no significant effects on the important ecological features identified are anticipated once the scheme is operational. Furthermore, and to promote compliance with planning policy, the Proposed Development will provide overall net gain for biodiversity through on-site and off-site measures, as detailed within a Biodiversity Metric.

15 Other Issues Considered

15.1 Archaeology and Built Heritage

- 15.1.1 A heritage desk-based assessment was completed to inform the 2017 ES for the Application Site and a 1 km radius from its centre (i.e. the study area). No evidence suggesting that remains of national importance are likely to be present on the Application Site was identified.

Baseline

Non-Designated Heritage Assets

- 15.1.2 Based on the available evidence, the heritage desk-based assessment identified that the Application Site has moderate/low potential for remains of prehistoric, Roman and Medieval date. This is primarily associated with the Application Site being located within the River Kennet floodplain, where archaeological evidence could be sealed within alluvial deposits at depth.
- 15.1.3 A low archaeological potential is identified for the Post-Medieval/Modern periods.
- 15.1.4 It is considered that due to the moderate/low archaeological potential of the Application Site, additional work may be requested by the archaeological advisor to the Local Planning Authority. Any such work can be accommodated by an appropriately worded planning condition.

Designated Heritage Assets

- 15.1.5 The heritage desk-based assessment identified that there are no Scheduled Monuments, Conservation Areas, Registered Parks and Gardens, and Historic Battlefields which will be impacted upon by the Proposed Development.
- 15.1.6 Reading Cemetery (a Grade II Listed Park and Garden) and forty-seven Listed Buildings are located within the study area.
- 15.1.7 The heritage desk-based assessment identified that the only Listed Building which has the potential to be impacted by the Proposed Development is the Grade II Listed Railway Bridge and attached Accommodation Bridge that lie immediately to the south of the Application Site. However, views to and from the bridges will be screened by woodland which runs along the River Kennet, although glimpsed views of the bridges from the Site may be possible, these are considered to be limited. The surrounding area of the listed bridge is also of an industrialised nature and the proposed new bridge will have an arch height at the height of the existing bridge to limit visual impacts. Therefore, it is considered that there will be no impact on the setting and significance of the bridge and Accommodation Bridge from the Proposed Development.
- 15.1.8 Reading Cemetery (a Grade II Listed Park and Garden) lies c. 500 m to the south of the Application Site. It is located in an area of modern development, with no intervisibility between it and the Application Site. Therefore, it is considered that the proposed development will not impact on its setting or significance.

Potential Effects

15.1.9 Based on the previous studies, the following potential effects may occur without mitigation:

- **Designated Heritage Assets:** Construction and operation of the East MRT would change views from the Grade II Listed Railway and Accommodation Bridge over the River Kennet, resulting in a minor adverse effect; and
- **Non-designated Heritage Assets:** The construction of the East MRT development would remove any buried archaeological remains which may be present within the Application Site where below ground works are proposed, resulting in a negligible to minor adverse effect.

15.1.10 The programme of archaeological works would provide benefits which would serve to mitigate much of the loss of the remains. The loss of any Prehistoric remains would be offset by the increased knowledge of this period which would be gained for the wider area should such remains be encountered. As such in this instance the residual effect would be negligible, with potential to be slightly beneficial.

15.1.11 Should remnants of the Saxon remains be present in the easternmost part of the Application Site the programme of archaeology works would serve to mitigate their loss and add to knowledge of Saxon and early Medieval history of the area. This would result in a residual negligible to minor adverse significance of effect.

15.1.12 The cumulative effect of the proposed East MRT development was considered together with the permitted TVP P&R development (the Combined Site) and other developments in the wider area, and no significant cumulative effects would result from these.

16 Impact Interactions and Summary

16.1 Introduction

- 16.1.1 Environmental effects can result from incremental changes caused by the interactions between effects resulting from a project.
- 16.1.2 The direct and indirect effects of the proposed development have been assessed within the relevant topic chapters of the ES prepared by suitable competent experts. Environmental effects are assessed relative to the topic under consideration. This approach can lead to the interaction of effects being reported in separate chapters but the collective effect on the same environmental resource(s) not being considered.
- 16.1.3 In response, this chapter summarises the principal findings of each topic chapter of the ES to enable assessment of the potential for impact interactions. This chapter also provides a summary of the environmental effects identified throughout the ES.

16.2 Methodology

- 16.2.1 The assessment methodology involves the identification of impact interactions associated with both the construction and operational phases of the Proposed Development upon one or more environmental resources. This is undertaken using a qualitative appraisal process drawing upon the residual effects identified within the individual topic chapters. Receptors have been grouped into Natural Resources and Human Beings and Society categories.

16.3 Construction Effects

- 16.3.1 As set out in Chapter 4, careful management of the construction works, including the use of a Construction Environmental Management Plan (CEMP), will minimise the adverse effects of construction. As a result, the majority of construction effects identified in **Chapters 7-15** are not significant.

Natural Resources

- 16.3.2 The main residual effects during construction on Natural Resources relate to the change in land use from open land to a construction site to facilitate the Proposed Development and the related construction activities affecting the local landscape character of the area, vegetation and tree cover, landform and watercourses and major landscape features. The effects were identified as temporary, direct, up to major or moderate adverse and considered significant.
- 16.3.3 Construction is expected to adversely affect King's Meadow and Coal Woodland, an important area of open space, Wokingham District Council Landscape Character Area, bats, reptiles and land contamination. These effects have been identified as minor and not significant. This includes impact interactions relevant to ecology, such as potential adverse lighting effects.
- 16.3.4 All other effects on Natural Resources during construction will be mitigated through the implementation of a CEMP and no likely significant impact interactions have been identified.

Human Beings and Society

- 16.3.5 The main effects during construction on Human Beings and Society relate to visual effects on users of the Thames Path and open space. The effects vary from up to major to moderate adverse, where construction activities and cranes are expected to be visible. Users of the Thames Path may also be affected by a minor adverse and not significant effect on promoting

walking and cycling. Well managed construction activities and the application of good practice through the application of a CEMP will minimise these effects.

16.3.6 The construction phase will provide minor beneficial employment effects through the provision of 78 net additional temporary construction local jobs.

16.3.7 No significant adverse impact interactions have been identified during the construction phase.

16.4 Operation

16.4.1 Mitigation set out within the assessment of effects chapter (**Chapter 6**) will reduce adverse effects during operation. As a result, the majority of the operation effects identified in the ES are not significant.

Natural Resources

16.4.2 During operation, significant adverse effects are expected to impact major landscape features, King's Meadow and Coal Woodland, the local landscape character of the Application Site, landuse, vegetation and tree cover. After 15 years of operation, the proposed planting will have matured and the effects are expected to lessen, however some local landscape effects are still expected to be significant.

16.4.3 Minor adverse effects have also been identified on the WBC Landscape Character area, landform and watercourses, bats and reptiles. Effects on ecology include interactions with effects such as lighting or pollution. These are all considered not significant.

16.4.4 A minor beneficial effect on surface water and WFD designated water bodies has been identified due to proposed flood compensation and a drainage strategy which will provide improvement in comparison to existing conditions.

16.4.5 Open space is expected to experience a minor adverse effect due to the changes to the character of the Application Site, however, high quality design, landscaping and lighting will provide minor beneficial effects.

16.4.6 No significant impact interactions have been identified during the operation on Natural Resources.

Human Beings and Society

16.4.7 During operation, significant visual effects are expected at certain points along the Thames Path, where there are direct or partial views of the Proposed Development. After 15 years of operation, the proposed planting will have matured and the effects are expected to lessen, however some are still expected to be significant and adverse. These are local visual effects which would not alter the integrity of the Application Site or features of national or regional importance. Users of the Thames Path are also expected to experience major beneficial effects in terms of pedestrian and cyclist delay, amenity and fear and intimidation due to the provision of a new footway as part of the East MRT Scheme.

16.4.8 The Proposed Development will provide major beneficial effects on public transport delay, severance. Further beneficial effects on Human Beings and Society relate to promoting walking and cycling, safety, connectivity, access to social infrastructure and labour are expected due to the nature of the scheme and the provision of operational jobs.

- 16.4.9 No significant impact interactions have been identified during the operation of the Proposed Development, however the Proposed Development is expected to deliver several benefits to human beings and society.

17 Schedule of Mitigation and Monitoring

17.1 Introduction

- 17.1.1 This chapter of the ES provides a consolidated schedule of all mitigation and enhancement measures proposed to avoid significant adverse effects and enhance beneficial effects from the Proposed Development. This chapter is provided to assist the planning authority with its obligation under the 2017 EIA Regulations to secure any proposed mitigation measures and monitoring arrangements relating to significant adverse effects within any planning permission decision notice granted for the Proposed Development.

17.2 Proposed Mitigation

- 17.2.1 **Table 17.1** summarises all further mitigation and enhancement measures committed to by the applicant for the construction phase of the Proposed Development. **Table 17.2** details mitigation for the operational phases of the Proposed Development. A summary of the nature of each measure and compliance mechanism is provided, together with a cross-reference to the relevant section of this ES where further details of the required measure are set out.
- 17.2.2 A list of embedded mitigation is included with **Section 3.3** of this ES.

17.3 Proposed Monitoring

- 17.3.1 Part 1(2) of the EIA Regulations defines a '*monitoring measure*' as a '*provision requiring the monitoring of any significant adverse effects on the environment of Proposed Development including any measures contained in— (a) a condition imposed on the grant of planning permission; or (b) a planning obligation*'.
- 17.3.2 As required by the EIA Regulations, this chapter sets out any monitoring required during construction (**Table 17.1**) and operation of the proposed development (**Table 17.2**), as identified in the relevant topic chapters.

Table 17:1 Summary of Proposed Mitigation and Monitoring During Demolition and Construction

Proposed Mitigation	Proposed Monitoring	Potential Compliance Mechanism(s)
Chapter 7: Socio-Economics		
The construction impacts are considered to be beneficial and do not require further mitigation measures.	No monitoring will be necessary as no significant residual adverse effects have been identified.	N/A
Chapter 8: Health		
No further mitigation and enhancement is proposed beyond that set out as embedded mitigation in the Proposed Development.	No monitoring will be necessary as no significant residual adverse effects have been identified.	N/A
Chapter 9: Transport and Access		
Implementation of a CEMP.	No monitoring will be necessary as no significant residual adverse effects have been identified.	Planning Condition
Chapter 10: Air Quality		
Implementation of a CEMP.	No monitoring will be necessary as no significant residual adverse effects have been identified.	Planning Condition
Chapter 11: Hydrology and Flood Risk		
Implementation of a CEMP.	No monitoring will be necessary as no significant residual adverse effects have been identified.	Planning Condition
Chapter 12: Land		
Further ground investigation will be required as part of the geotechnical design of the Proposed Development.	No monitoring will be necessary as no significant residual adverse effects have been identified.	Planning Condition

Proposed Mitigation	Proposed Monitoring	Potential Compliance Mechanism(s)
Chapter 13: Landscape and Visual		
Implementation of a CEMP.	Monitoring of tree protection fencing and any temporary footway diversions.	Planning Condition
Chapter 14: Ecology		
Reptile and bat mitigation strategy. Off-site measures to improve The Coal, Kennetmouth & Kings Meadow East LWS.	No monitoring will be necessary as no significant residual adverse effects have been identified.	Planning Condition S106 Agreement
Chapter 15: Other Topics Considered		
Implementation of a programme of archaeological works.	No monitoring will be necessary as no significant residual adverse effects have been identified.	Planning Condition

Table 17:2 Summary of Proposed Mitigation and Monitoring During Operation

Proposed Mitigation	Proposed Monitoring	Potential Compliance Mechanism(s)
Chapter 7: Socio-Economics		
The operational impacts are considered to be beneficial and do not require further mitigation measures	No monitoring will be necessary as no significant residual adverse effects have been identified.	N/A
Chapter 8: Health		
Use of story boards, benches, involvement of community groups and local schools.	No monitoring will be necessary as no significant residual adverse effects have been identified.	
Chapter 9: Transport and Access		
No further mitigation and enhancement is proposed beyond that set out as embedded mitigation in the Proposed Development.	No monitoring will be necessary as no significant residual adverse effects have been identified.	N/A
Chapter 10: Air Quality		
The operational effects of the Proposed Development are judged to be not significant. No additional mitigation measures are therefore required.	No monitoring will be necessary as no significant residual adverse effects have been identified.	N/A
Chapter 11: Hydrology and Flood Risk		
No further mitigation and enhancement is proposed beyond that set out as embedded mitigation in the Proposed Development.	No monitoring will be necessary as no significant residual adverse effects have been identified.	N/A
Chapter 12: Land		
No further mitigation and enhancement is proposed beyond that set out as embedded mitigation in the Proposed Development.	No monitoring will be necessary as no significant residual adverse effects have been identified.	N/A

Proposed Mitigation	Proposed Monitoring	Potential Compliance Mechanism(s)
Chapter 13: Landscape and Visual (Including lighting)		
Implementation of a LEMMP. Installation of shields and hoods on luminaires.	It is proposed that the implementation, maintenance and long-term management of embedded mitigation would be monitored through the normal planning and post-planning consents.	Planning Condition
Chapter 14: Biodiversity		
Implementation of a LEMMP.	No monitoring will be necessary as no significant residual adverse effects have been identified.	Planning Condition
Chapter 15: Other Topics Considered		
No further mitigation and enhancement is proposed beyond that set out as embedded mitigation in the Proposed Development.	No monitoring will be necessary as no significant residual adverse effects have been identified	N/A

Glossary of Terms

Term	Definition
Baseline Conditions	The environment as it appears (or would appear) immediately prior to the implementation of the proposed development together with any known or foreseeable future changes that will take place before completion of the project
Baseline Information	Collection of background information on the environmental, social and economic setting of a proposed development, to be used to predict changes and compare and evaluate them in terms of importance
Characteristics	Elements, or combinations of elements, which make a contribution to distinctive landscape or townscape character
Approved Development	Development projects that are either under construction or which have valid planning permission/consents
Conservation Area	Land awarded protection status to prevent change to the natural features, cultural heritage and biodiversity of the area
Cumulative effects	Additional changes caused by the proposed development in conjunction with other developments (associated with or separate to it), or actions that occurred in the past, present or are likely to occur in the foreseeable future. And: The summation of effects that result from changes caused by a development in conjunction with other past, present, or reasonably foreseeable actions
Designated Landscape or Townscape	Areas of landscape or townscape identified as being of importance at international, national or local levels, either defined by statute or identified in development plans or other documents
Desktop Studies	The gathering and analysis of existing data from the public domain, scientific and commercial databases, and available project sources, in order to identify environmental constraints and opportunities
Direct Effect	An effect that is directly attributable to the proposed development
Development	Any proposal that results in a change to the landscape and/or visual environment
Enhancement	Proposals that seek to improve the landscape resource and the visual amenity of the proposed development site and its wider setting, over and above its baseline condition
Environmental Impact Assessment	Method for identifying and evaluating the likely significant environmental effects of a proposed development
Environmental Statement	Supporting document to Planning Application providing environmental information to the planners (in a form suitable for public consumption) reporting the outcome of the EIA
Heritage	The historic environment and especially valued assets and qualities such as historic buildings and cultural traditions
Historic Environment Records	Details of both designated and non-designated heritage assets, previous archaeological events and secondary source
Key Characteristics	Those combinations of elements which are particularly important to the current character of the landscape or townscape, and which help to give an area its particularly distinctive sense of place

Term	Definition
Landscape	An area, as perceived by people, the character of which is the result of action and interaction of natural and/or human factors
Landscape or Townscape Character	A distinct and recognisable pattern of elements that occurs consistently in a particular type of landscape or townscape and which makes one landscape or townscape different from another. It reflects particular combinations of geology, landform, soils, vegetation, land use and human settlement, built form and layout, scale, mass and legibility. It creates the particular sense of place of different areas of the landscape or townscape
Landscape or Townscape Effects	Effects on the landscape or townscape as a resource in its own right
Landscape or Townscape Quality (condition)	A measure of the physical state of the landscape or townscape. It may include the extent to which typical character is represented in the individual areas, the intactness of the landscape or townscape and the condition of individual elements
Landscape or Townscape Receptors	Defined aspects of the landscape or townscape resource that have the potential to be affected by a proposal.
Landscape or Townscape Value	The relative value that is attached to different landscapes or townscapes by society. A landscape or townscape may be valued by different stakeholders for a variety of reasons.
Listed Buildings	A building with historic, artistic or architectural interest, which has been listed on the statutory list of buildings
Magnitude	A term that combines judgements about the size and scale of the effect, the extent of the area over which it occurs, whether it is reversible or irreversible and the length of its duration. Includes consideration of whether the effect is reversible or irreversible. Magnitude is presented in terms of being major, moderate, slight or negligible. Magnitude is defined for LVIA in the LVIA Methodology Appendix.
Mitigation Measures	Action taken to avoid reduce or offset adverse environmental, social and economic impacts of a project
Indirect Effects	Effects that result indirectly from the proposed project as a consequence of the direct effects, often occurring away from the site, or as a result of a sequence of interrelationships or a complex pathway. They may be separated by distance or in time from the source of the effects.
Phase 1 Habitat Survey	Recognised methodology used for collating information on the habitat structure of a particular site
Photomontage	The superimposing of an image onto a photograph for the purpose of creating a realistic representation of proposed or potential changes to a view
Receptor	Physical resource or user group that would experience an effect, either negative or positive from the proposed development
Residual Effects	Impacts that would remain following the implementation of the mitigation measures
Schedule 2	Plans or projects which are listed under Annex II of the EIA Directive, and Schedule 2 of the EIA Regulations
Sensitivity	A term applied to specific receptors, combining judgements of the susceptibility of the receptor to the specific type of change of development proposed and the value related to that receptor
Scoping	Scoping is the process of determining what issues are to be addressed, and setting out a methodology in which to address them in a structured manner appropriate to the plan or programme. Scoping is carried out in consultation with the appropriate bodies.

Term	Definition
Site of Special Scientific Interest (SSSI)	Sites that support a range of habitats and/or species considered to be of national nature conservation interest designated and protected under the WCA 1981
Special Protection Area (SPA)	An area designated under the Wild Birds Directive to protect important bird habitats. Implemented initially under the Wildlife and Countryside Act 1981
Significance	A measure of the importance or gravity of the environmental effect, defined by significance criteria specific to the environmental topic. This assessment considers the sensitivity or importance of the receptor (high, medium, low and negligible) and the magnitude/scale of change (large, medium, small and negligible) which is likely to occur in the receiving environment after mitigation. The combined effect of these creates a significance level which ranges from 'none', 'slight', 'moderate', 'significant' and 'very significant'
Study Area	Areas surrounding and including the proposed development, where there is reasonable potential for environmental, economic and social impacts arising from the proposed development. Study areas are defined for each topic of the EIA
Susceptibility	The ability of a defined landscape or townscape or visual receptor to accommodate the specific proposed development without undue negative consequences
Townscape	The character and composition of the built environment including the buildings and the relationships between them, the different types of urban open space, including green spaces, and the relationship between buildings and open spaces
Visual Amenity	The overall pleasantness of the views people enjoy of their surroundings, which provides an attractive visual setting or backdrop for the enjoyment of activities of the people living, working, recreating, visiting, or travelling through an area.
Visual Effects	Effects on specific views and on the general visual amenity experienced by people
Visual Receptor	Individuals and/or defined groups of people who have the potential to be affected by a proposal. Typically represented by a selected viewpoint location.
Visualisation	A computer simulation, photomontage or other technique illustrating the predicted appearance of a development. Accurate Visual Representations (AVRs) are produced in accordance with specific methodology.
Zone of Theoretical Visibility (ZTV)	A map, usually digitally produced, showing areas of land within which a development is theoretically visible.
Flood Zone 1	'Low Probability' of flooding (less than 1 in 1,000 annual probability of river or sea flooding in any year)
Flood Zone 2	'Medium Probability' of flooding (between a 1 in 100 and 1 in 1,000 annual probability of river flooding or between a 1 in 200 and 1 in 1,000 annual probability of tidal flooding in any year)
Flood Zone 3a	'High Probability' (1 in 100 or greater annual probability of river flooding or 1 in 200 or greater annual probability of sea flooding in any year)
Flood Zone 3b	'Functional Floodplain' (where water is stored in times of flood, including water conveyance routes, 'annual probability of 1 in 20 or greater in any given year).
Product 4	EA supplied detailed Flood Risk Assessment Map, including flood zones, defences and storage areas, areas benefiting from flood defences, statutory main river designations, historic flood event outlines and more detailed

Term	Definition
	information from computer river models (including model extent, information on one or more specific point, flood levels, flood flows)
River Basin Management Plan	Specific to a River Basin District, these RBMPs are designed to protect and improve the quality of the
Diffusion Tube	A passive sampler used for collecting NO ₂ in the air water environment, and support the government's framework for the 25-year environment plans
HDV	a vehicle with a gross vehicle weight greater than 3.5 tonnes, includes Heavy Goods Vehicles (HGV) and buses

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Abbreviations

Term	Definition
AADT	Annual Average Daily Traffic
ADMS	Air Dispersion Modelling System
AMS	Arboricultural Method Statement
AOD	Above Ordnance Datum
APS	Annual Population Survey
AQAP	Air Quality Action Plan
AQMA	Air Quality Management Area
ATC	Automatic Traffic Count
AURN	Automatic Urban and Rural Network
BAP	Biodiversity Action Plan
BBOWT	Berks, Bucks & Oxon Wildlife Trust
BGL	Below Ground Level
BGS	British Geological Survey
BRES	Business Register and Employment Survey
BSI	British Standards Institution
BTEX	Benzene, Toluene, Ethylbenzene and Xylene
BTO	British Trust for Ornithology
BW	Broad-leaved Woodland
CA	Conservation Area
CEMP	Construction Environmental Management Plan
CIEEM	Chartered Institute of Ecology and Environmental Management
ClfA	Chartered Institute of Archaeologists
CIRIA	Construction Industry Research and Information Association
CLR	Contaminated Land Report
CMO	Chief Medical Officer

Term	Definition
COPD	Chronic Obstructive Pulmonary Disease
CS	Characteristic Situation
CSM	Conceptual Site Model
CWG	Criteria Working Group
DAS	Design and Access Statement
DCLG	Department for Communities and Local Government
DEFRA	Department for Environment, Food and Rural Affairs
DS	Dense Scrub
EA	Environment Agency
EC	European Commission
EclA	Ecological Impact Assessment
ECOW	Ecological Clerk of Works
EFT	Emission Factor Toolkit
EHO	Environmental Health Officer
EIA	Environmental Impact Assessment
EPUK	Environmental Protection UK
ES	Environmental Statement
EU	European Union
FOAN	Fully Objectively Assessed Need
FRA	Flood Risk Assessment
FTE	Full-time Equivalent
FWMA	Flood and Water Management Act
GLVIA3	Guidelines for Landscape and Visual Impact Assessment (Third edition)
GP3	Groundwater Pollution Prevention Principles
GPLC	Guiding Principles for Managing Land Contamination
GQA	General Quality Assessment

Term	Definition
GVA	Gros value Added
GWD	Groundwater Directive 1980
GWDD	Groundwater Daughter Directive 2006
HDV	Heavy Duty Vehicle
HGBI	Herpetofauna Groups of Britain and Ireland
HGV	Heavy Goods Vehicles
HMA	Housing Market Area
HMWB	Heavily Modified Water Body
HPI	Habitats of Principal Importance
HSI	Habitat Suitability Index
HUDU	Health Urban Development Unit
IAQM	Institute of Air Quality Management
IDR	Reading Inner Distribution Road
IEF	Important Ecological Feature
IEMA	Institute of Environmental Management & Assessment
IMD	Index of Multiple Deprivation
JK	Japanese Knotweed
JNCC	Joint Nature Conservation Committee
JSNA	Joint Strategic Needs Assessment
LAQM	Local Air Quality Management
LCA	Landscape Character Area
LCT	Landscape Character Type
LDP	Local Development Plan
LEMMP	Landscape and Ecological Management and Maintenance Plane
LEP	Local Enterprise Partnership
LI	Landscape Institute

Term	Definition
LLFA	Lead Local Flood Authority
LNR	Local Nature Reserve
LPA	Local Planning Authority
LSOA	Lower Super Output Area
LVIA	Landscape and Visual Impact Assessment
LWS	Local Wildlife Site
MRT	Mass Rapid Transit
MV	Marginal Vegetation
NAQO	National Air Quality Objective
NARRS	National Amphibian and Reptile Recording Scheme
NCA	National Character Area
NE	Natural England
NERC	Natural Environment and Rural Communities
NNR	National Nature Reserve
NO ₂	Nitrogen Dioxide
NO _x	Nitrogen Oxides
NPPF	National Planning Policy Framework
NPSE	Noise Policy Statement for England
NTS	Non Technical Summary
ONS	Office for National Statistics
OS	Ordnance Survey
PAH	Poly Aromatic Hydrocarbons
PBA	Peter Brett Associates LLP
PEA	Preliminary Ecological Appraisal
PFRA	Preliminary Flood Risk Assessment
PHE	Public Health England

Term	Definition
PIC	Personal Injury Collision
PID	Photo-ionisation Detector
PM ₁₀	Particulate Matter less than 10µm in diameter
PM _{2.5}	Particulate Matter less than 2.5 µm in diameter
POM	Programme of Measures
PPE	Personal Protective Equipment
PPG	Planning Practice Guidance
ppm	Parts Per Million
PPV	Peak Particle Velocity
PRF	Potential (Bat) Roost Feature
PROW	Public Right of Way
PSC	Potential Sources of Contamination
RBC	Reading Borough Council
RBMP	River Basin Management Plan
RHPG	Register of Parks and Gardens of Special Historic Interest
RNAG	Reasons for Not Achieving Good
RTD	River terrace deposits
RTM	Reading Transport SATURN Model
SAB	SuDS Approval Board
SAC	Special Area of Conservation
SAM	Scheduled Ancient Monument
SBW	Scattered Broad-leaved Woodland
SFRA	Strategic Flood Risk Assessment
SHWL	Standard Head Water Level
SINC	Site of Importance for Nature Conservation
SPA	Special Protection Area

Term	Definition
SPAHG	Spatial Planning and Health Group
SPZ	Source Protection Zone
SRS	Site Remedial Services Ltd
SS	Scattered Scrub
SSSI	Site of Special Scientific Interest
SuDS	Sustainable Drainage Systems
TA	Transport Assessment
TCA	Townscape Character Area
TPH	Total Petroleum Hydrocarbon
TPO	Tree Protection Order
TR	Tall Ruderal
TS	Transport Statement
TVP P&R	Thames Valley Park and Ride
UVF	Ultraviolet Fluorescence Spectroscopy
UXO	Unexploded Ordnance
VDV	Vibration Dose Value
VE	Visual Envelope
VOC	Volatile Organic Compound
WBC	Wokingham Borough Council
WFD	Water Framework Directive
WHO	World Health Organisation
WHS	World Heritage Site
WIA	Water Industry Act
WRA	Water Resources Act
XRF	X-ray Fluorescence Spectroscopy
ZTV	Zone of Theoretical Visibility

