River Thames Scheme

Environmental Impact Assessment
Scoping Report

October 2022

View of the River Thames at Laleham Park looking south towards the M3 crossing

Non-Technical Summary

Introduction

Working in Partnership we, the Environment Agency and Surrey County Council, are together delivering The River Thames Scheme (RTS).

The RTS represents a new landscape-based approach to creating healthier, more resilient, and more sustainable communities. The RTS will be an integrated scheme which responds to the challenges of flooding; creating more access to green open spaces and sustainable travel routes, in addition to encouraging inclusive economic growth, increasing biodiversity and responding to the dual challenges of climate change and nature recovery.

A major new piece of blue and green infrastructure, each element of the RTS will work together to deliver benefits for communities. A new flood channel will reduce the risk of flooding to homes, businesses, and infrastructure, while also providing habitat for wildlife and a new feature in the landscape for recreation. The channel will be flanked by new areas of public green open space, for recreation and spending time with nature.

New footpaths and cycleways will run along the channel and through the new public spaces, linking different elements of the project with communities and providing better connections within and across the area. Areas of new and improved habitat for wildlife and nature recovery will connect with existing nature sites and wildlife corridors to provide a new nature recovery network along the length of the channel which supports more biodiversity.

The RTS is an infrastructure project of national significance and must be consented through a Development Consent Order. We will undertake an Environmental Impact Assessment (EIA) under the Infrastructure Planning (EIA) Regulations 2017 (SI 2017/572), given the size and potential for likely significant effects on the environment.

This EIA Scoping Report identifies the likely significant effects of the RTS as understood at this early stage of project development. It supports our written request for a Scoping Opinion from the Planning Inspectorate on behalf of the Secretary of State, to inform the Environmental Statement that we will submit as part of the Development Consent Order application.

The EIA Scoping Report is part of ongoing consultation to allow stakeholders the opportunity to review and comment on the EIA process, current findings and the project design. The next consultation after the EIA Scoping Report will be the Preliminary Environmental Information Report which, as part of the Development

Consent Order statutory consultation stage, provides an update to stakeholders and the public on the ongoing EIA, consultation, and the design of the RTS.

Background

The River Thames between Egham and Teddington runs through the largest area of populated but undefended floodplain in England. There is little to no flood resilience in place for this area. In addition to the towns and villages in this area, the landscape has been heavily shaped by major infrastructure and extensive mineral workings. This has resulted in an area in which many homes and businesses are at risk of flooding, within a landscape which suffers from visual barriers and physical constraints which prevent the open space being used to its full potential.

A major flood would put thousands of homes, businesses and commercial spaces at risk. It would also cause risk to life and severe disturbance to local communities plus disruption on both nationally and locally significant road and rail routes including sections of the M25 and M4. Several major drinking water abstractions supplying south-east England, and up to 20 local electricity sub-stations would also be affected by a major flood, with a risk of flooding to the public sewage network, all resulting in disruption to homes and businesses.

Plate 1 (below) shows the extent of inundation at Runnymede M25 junction 13 during the 2014 flooding event. The land in the middle of the Egham By-Pass is submerged, with fields, businesses and roads being affected.

Plate 1: Flooding at Runnymede (M25 junction 13) in 2014

With climate change, larger and more frequent floods are likely to be experienced in the future, which will have an even greater impact on communities, infrastructure and the economy.

Surrey County Council is committed to supporting sustainable growth in the area, connecting communities and creating an environment where people, businesses and wildlife can thrive.

Through extensive studies led by the Environment Agency, we have concluded that the preferred approach to flood risk management in the Lower Thames Area is to improve conveyance and reduce flood risk through construction of a flood relief channel, and capacity improvements downstream of the new flood relief channel in the River Thames.

The health and resilience of communities will be further enhanced, and sustainable growth encouraged by the provision of better access to green open spaces and an enhanced active travel network.

This has led to the evolution of the RTS.

RTS Vision

The RTS will be a major new piece of green and blue infrastructure which integrates a new flood channel with new public open space, associated recreational infrastructure and environmental enhancements. The RTS project vision is “to reduce flood risk to people living and working near the Thames, enhance the resilience of nationally important infrastructure, contribute to a vibrant local economy and maximise the social and environmental value of the River Thames”. To achieve the project vision several goals have been identified, which are:

- Reduce flood risk to dwellings, businesses, and infrastructure;
- Provide better access to green open spaces, connection with wildlife and more sustainable travel network;
- Create a network of high-quality habitat and achieve biodiversity net gain;
- Facilitate sustainable and inclusive economic growth; and
- Enable delivery and design that contributes to the achievement of Environment Agency and Surrey County Council goals in relation to carbon use.

Project Description

The RTS design comprises the following elements, which will be undertaken within the project boundary.

- A new flood channel in two sections, through the boroughs of Runnymede and Spelthorne in Surrey. Permanent features associated with the flood channel include flow and water level control structures, flood embankments, erosion prevention, bridges and permanent site compounds for maintenance; the channel will include planting for wildlife and places for recreational access;
- Capacity improvements to the River Thames through lowering the bed of the River Thames downstream of Desborough Cut, upgrades to Sunbury, Molesey and Teddington Weirs;
- New green open spaces adjacent to the channel and accessible to local communities;
- Habitat creation areas which link with existing and new blue and green wildlife corridors and build upon the network of existing wildlife sites;
- New or improved active travel provision along and across the flood channel corridor and new open spaces with connections to the existing network;
- Permanent compounds for maintenance; and
- Temporary construction features such as site compounds and materials reprocessing sites.

For EIA scoping purposes, the area within the project boundary is approximately the pink shaded area shown in Figure 0-1, which includes a large corridor of land south of the River Thames and north of the M3 between Thorpe and Chertsey, and north of the River Thames between Chertsey and Shepperton; as well as separate areas around Sunbury, Molesey and Teddington Weirs, plus land south of Island Barn Reservoir and south of Virginia Water (the latter is not shown on Figure 0-1). The project boundary for EIA scoping will be reviewed as the design is developed and is likely to reduce in size as part of the EIA process. Certain aspects of the RTS design are shown on Figure 0-1, including the Runnymede Channel (shaded in purple), the Spelthorne Channel (shaded in orange), and the locations of Desborough Cut, Sunbury Weir, Molesey Weir and Teddington Weir labelled.

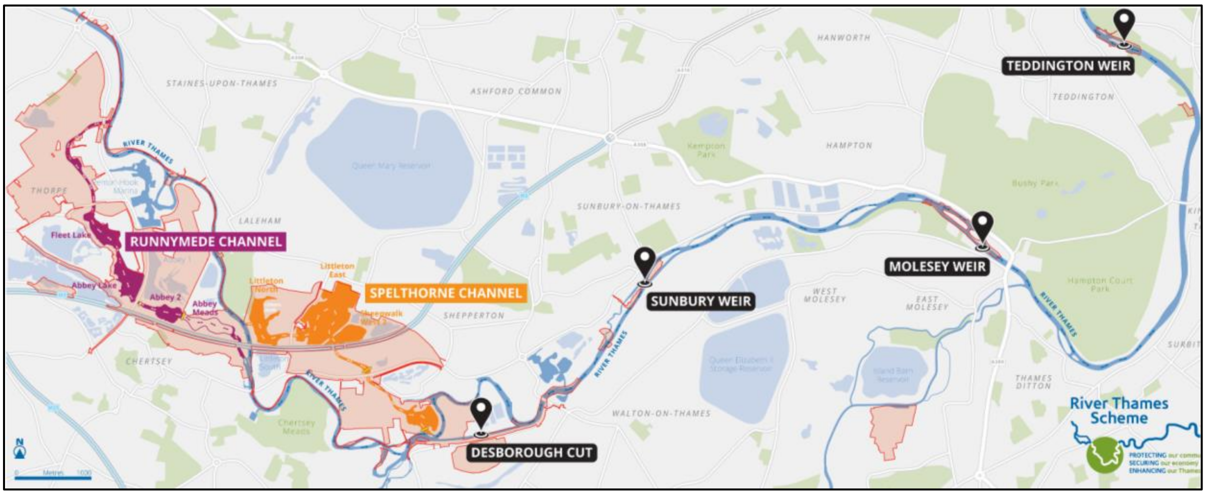

Figure 0-1 - Overview of the RTS (Environment Agency, 2022).

Design development is ongoing, and is being informed by consultation, and technical surveys and assessments. The EIA Scoping Report and subsequent Preliminary Environmental Information Report and Environmental Statement will be based on the project design at time of writing.

We expect construction to commence with enabling works (such as demolition of five buildings (the owners have been notified), services diversions, works to some existing structures, bank protection works, and construction of compound areas) in 2026. The flood channel is expected to be operational by winter 2030/31, with some construction of green open spaces and habitat creation areas continuing into 2032.

Existing Environmental Conditions

The baseline environment has been identified through a combination of desk study and site surveys. Where applicable, we have also consulted with relevant stakeholders such as Local Planning Authorities to obtain additional baseline information.

The RTS is located in the Thames Valley, historically an open floodplain of flat grazing lands with scattered historic parkland on the higher ground. However, the character is now increasingly dominated by:

- Settlements, including: Wraysbury, Staines, Chertsey, Sunbury, East Molesey, and Teddington;
- Transport links such as the M25, M4 and M3 motorways, A-roads, railways; and
- Land uses including Heathrow Airport, Thorpe Park, lakes left from past mineral workings, raised landfills and vast raised reservoirs.

There are many rivers, streams and lakes in the area, several of them legally protected for their water quality and biodiversity status. There are also several important water abstractions from groundwater and from the River Thames.

Whilst much of the land within the project boundary for EIA scoping contains historic or licensed landfills, the River Thames catchment is an area of high archaeological importance, a varied historic landscape and contains a wealth of historic features, such as ancient monuments, important buildings and buried archaeological remains.

The area is very important for biodiversity. Several of the lakes within the project boundary for EIA scoping are internationally important for overwintering birds, a hay meadow at Thorpe is nationally designated for rare plants and insects, and the area contains many other protected and important species (both land and water based).

Several lakes are used for water sports including angling, sailing, and swimming. Areas of floodplain are used for walking or other recreation where open to the public or grazing of livestock where privately owned.

EIA Scoping Process

For each environmental topic, the EIA Scoping Report considers the key legislation, policy and guidance relevant to the topic, the baseline conditions within a defined study area; the predicted changes to the environment and the likely significant effects to be scoped into the assessment (including construction and operational effects); the proposed assessment methodology; any key assumptions and limitations; and proposed mitigation measures.

There is no specified definition of what constitutes a likely significant effect. For the purposes of this Scoping Report, a likely significant effect has been defined as an effect which, either in isolation or combination with others, should (in the professional opinion of the competent experts carrying out the EIA) be considered in the EIA, on the basis of information regarding:

- The proposed development;
- The baseline conditions, and the sensitivity and importance of receptors;
- The expected magnitude of change upon each receptor (including consideration of the nature and duration of effects); and
- The potential to avoid or reduce any potential effects through mitigation, such that they are unlikely to be significant.

Where sufficient information existed to inform expert judgement that there is not a likely significant effect on an environmental receptor, this has been identified as being able to be 'scoped out' of further assessment. These effects will not be taken forward for consideration in the EIA process.

The design of the project is ongoing; therefore it is recognised that at this stage it may not be possible to scope out some effects. This is a precautionary approach due to the level of uncertainty. The EIA Scoping Opinion will further inform the data gathering and assessment methodologies to inform the detailed assessment that will be presented within the Environmental Statement.

Effects proposed to be 'scoped in'

Likely significant effects (positive and/or negative) have been identified from certain project activities during both the construction and operational phases upon several features of almost all environmental topics. Of particular note are the likely significant effects upon water, soil and land through construction and operation of the new flood channel, with subsequent effects on their use by people and wildlife.

The environmental topics (or parts thereof) scoped into the EIA are: air quality, biodiversity, cultural heritage, archaeology and built heritage, climatic factors, flood risk, health, landscape and visual amenity, materials and waste, noise and vibration, socio-economics, soils and land, traffic and transport, water environment and cumulative effects.

Effects proposed to be 'scoped out'

Effects associated with decommissioning of the project are proposed to be scoped out of the EIA. In the unlikely event that the project is no longer required, it is highly unlikely to be decommissioned (i.e. removed). It is more likely that the flood channel would be left in-situ and its operational regime modified as needed. As changes to the operational regime would need to be properly designed, assessed and implemented they would likely form the basis of another project that may be subject to its own EIA.

A transboundary effects screening exercise has been undertaken to determine the potential for likely significant effects upon the environment of other European Economic Area States. The only potential effect identified is in relation to potential changes in greenhouse gas emissions, and this will be covered by the 'Climatic Factors' assessment within the EIA.

It is proposed to scope Major Accidents and Disasters out of the EIA as a separate topic. A screening exercise identified climate change, flood risk and unstable ground conditions as potential risks arising from a) the vulnerability of the project to risks of major accidents and disasters or b) the project as a source of hazard that could result in major accident or disaster. These will be considered within the climatic factors, flood risk and health Chapters respectively.

Certain effects to individual topics are also proposed to be scoped out of the EIA, on the basis that embedded or standard mitigation will avoid likely significant effects. For example, effects from spillages during construction will be managed through good construction practice and a Construction Environmental Management Plan.

Next steps

This EIA Scoping Report has been prepared to enable the Planning Inspectorate, on behalf of the Secretary of State, to provide its opinion as to the scope and level of detail to be provided within the Environmental Statement.

Following the EIA scoping process, we will prepare a Preliminary Environmental Information Report to allow consultees (both specialist and non-specialist) to develop an informed view of the likely significant effects of the project when they are commenting on the proposals at the pre-application stage.

Following this, we will prepare an Environmental Statement which we will submit as part of the Development Consent Order application. This is proposed to be submitted in winter 2024/25.

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1.1.1.2 The RTS will be an integrated project which responds to the challenges of flooding; creating more access to green open spaces and sustainable travel routes, in addition to encouraging inclusive economic growth, increasing biodiversity and responding to the dual challenges of climate change and nature recovery.

1.1.1.3 The project will be a major new piece of green and blue infrastructure. It is classified further to a direction made by the Secretary of State (SoS) dated 24 December 2020 as a project that is nationally significant and that must be consented by Development Consent Order (DCO) in accordance with the Planning Act 2008 (PA08).

1.1.1.4 This Environmental Impact Assessment (EIA) Scoping Report identifies the likely significant effects of the RTS as understood at this early stage of project development. It supports a written request for a Scoping Opinion from the Planning Inspectorate (PINS) on behalf of the SoS, to inform an EIA for construction and operation of the project and the Environmental Statement (ES) that will be submitted as part of the DCO application. It is understood that the PINS case reference number for the RTS will be WA020001.

1.1.1.5 EIA is a staged process that starts by defining the proposal and extends to the monitoring of any identified significant adverse effects (Institute of Environmental Management and Assessment (IEMA), 2004).

1.1.1.6 The Scoping Report has been produced in accordance with the requirements of the Infrastructure Planning (EIA) Regulations 2017 (SI 2017/572) (‘the EIA Regulations’) having regard to relevant PINS Advice Notes and other industry guidance.

1.1.1.7 The Scoping Report is part of ongoing consultation to allow stakeholders the opportunity to review and comment on the EIA process, current findings and the project design. The next consultation after the EIA Scoping Report is the Preliminary Environmental Information Report (‘PEIR’) which, as part of the DCO pre-application documents, provides an update to stakeholders and the public on the ongoing EIA, consultation, and the design of the RTS.

1.2 Background

1.2.1.1 The River Thames between Egham and Teddington runs through the largest area of undefended flood plain in England. There is little to no flood resilience in place for this area. In addition to the towns and villages in this area, the landscape has been heavily shaped by major infrastructure and extensive mineral workings. This has resulted in an area in which many homes and businesses are at risk of flooding, within a landscape which suffers from visual barriers and physical constraints preventing the open space from being used to its full potential. A major flood would put thousands of homes, businesses and commercial spaces at risk. It would also cause risk to life and severe disturbance to local communities plus disruption on both nationally and locally significant road and rail routes including sections of the M25 and M4, and the Staines to Windsor and Waterloo to Reading railway lines. Several major drinking water abstractions supplying south-east England, and up to 20 local electricity sub-stations would also be affected by a major flood, with a risk of flooding to the public sewage network, all resulting in disruption to homes and businesses.

1.2.1.2 With climate change, larger and more frequent floods are likely to be experienced in the future, which will have an even greater impact on communities, infrastructure and the economy. Surrey County Council is committed to supporting sustainable growth in the area, connecting communities and creating an environment where people, businesses and wildlife can thrive.

1.2.1.3 Extensive studies by the Environment Agency have concluded that the preferred approach to flood risk management in the Lower Thames Area is to improve conveyance and reduce flood risk through construction of a flood relief channel, plus other capacity improvements downstream of the new flood relief channel in the River Thames. These studies are documented in the Lower Thames Flood Risk Management Strategy (LTFRMS) (Environment Agency 2009), and this has led to the evolution of the RTS.

1.2.1.4 The health and resilience of communities will be further enhanced and sustainable growth encouraged by the provision of better access to green open spaces and an enhanced active travel network.

1.3 RTS Vision

1.3.1.1 The RTS Vision is “to reduce flood risk to people living and working near the River Thames, enhance the resilience of nationally important infrastructure, contribute to a vibrant local economy and maximise the social and environmental value of the River Thames”. To achieve the project vision several goals have been identified, which are:

- Reduce flood risk to dwellings, businesses, and infrastructure;
- Provide better access to green open spaces, connection with wildlife and more sustainable travel network;
- Create a network of high-quality habitat and achieve biodiversity net gain;
- Facilitate sustainable and inclusive economic growth; and
- Enable delivery and design that contributes to the achievement of Environment Agency and Surrey County Council goals in relation to carbon use.

1.4 Overview of the Project

1.4.1.1 A major new piece of blue and green infrastructure, each element of the RTS will work together to deliver benefits for communities. A new flood channel will reduce the risk of flooding to homes, businesses, and infrastructure, while also providing habitat for wildlife and a new feature in the landscape for recreation. The channel will be flanked by new areas of public green open space, for recreation and spending time with nature. New footpaths and cycleways will run along the channel and through the new public spaces, linking different elements of the project with communities and providing better connections within and across the area. Areas of new and improved habitat for wildlife and nature recovery will connect with existing nature sites and wildlife corridors to provide a new nature recovery network along the length of the channel which supports more biodiversity.

1.4.1.2 The proposed RTS will significantly reduce flood risk from main rivers in the areas between Hythe End and Shepperton and the settlements of Staines, Egham Hythe, Chertsey, Laleham and Shepperton. Flood risk will also be reduced in all areas of the fluvial River Thames between

Shepperton and Teddington. Furthermore, all properties in the River Thames floodplain in the Royal Borough of Windsor and Maidenhead (RBWM) will have a small reduction in flood risk from the channel sections constructed in Surrey as the benefits extend some way upstream. The RTS will reduce the risk of flooding to approximately 11,000 homes, 2,000 businesses and reduce the risk to existing nationally significant infrastructure, including highways, railways and utilities, as well as heritage and ecological sites.

1.4.1.3 As with all flood alleviation schemes, the risk of flooding is not removed but it is reduced to levels which make communities more resilient for the future. For the RTS the amount of change to the standard of flood protection as a result of the project will vary depending where you are located within the floodplain. With climate change the background level of flood risk will increase. The RTS will continue to reduce risk throughout its operation, albeit against a changing background flood risk in the area as a result of climate change.

1.4.1.4 As well as contributing to a vibrant local economy, the project will also enhance biodiversity through habitat improvements (including improved fish passage), create new green open spaces for recreation and improve public access between these and existing communities by improving active transport routes for walking and cycling. The project also provides the opportunity to design the amenity spaces such that they can operate safely during flood events. This means safer and more accessible open spaces for the communities who live in the lower Thames area.

1.4.1.5 The outline design of the flood alleviation aspects is well progressed and will consist of a new flood channel in two sections through the boroughs of Runnymede and Spelthorne in Surrey. In addition, there will be increases in capacity at three weirs at Sunbury, Molesey and Teddington on the River Thames through installation of new weir gates, and downstream of the Desborough Cut through lowering of the riverbed (see Figure 1-1 below).

1.4.1.6 The outline design of landscape and green infrastructure opportunities such as open green spaces, active travel and habitat improvements is ongoing and being refined through an integrated optioneering process. However, sufficient information on all aspects of the RTS has been provided to allow for a robust consultation exercise and scoping opinion.

1.4.1.7 The Environment Agency and Surrey County Council are committed to delivering biodiversity net gain (BNG) as part of the RTS. The project will therefore include the provision of diverse, high-quality habitats. While habitat creation and improvement will be included throughout the project, specific habitat creation areas (HCAs) are also being considered, as a key measure to support the aspirations for BNG and high-quality habitats.

1.4.1.8 For EIA scoping purposes, the area within the project boundary is approximately the pink shaded area shown in Figure 1-1, which includes a large corridor of land south of the River Thames and north of the M3 between Thorpe and Chertsey, and north of the River Thames between Chertsey and Shepperton; as well as separate areas around Sunbury, Molesey and Teddington Weirs, plus land south of Island Barn Reservoir and south of Virginia Water (the latter is not shown on Figure 1-1, but is on Figure 1-2 in Appendix A). The project boundary for EIA scoping will be reviewed as the design is developed and is likely to reduce in size as part of the EIA process.

1.4.1.9 An overview of the main features of the RTS, including the project boundary for EIA scoping, are shown in Figure 1-2 in Appendix A. Further explanation of the project is provided in Chapter 4.

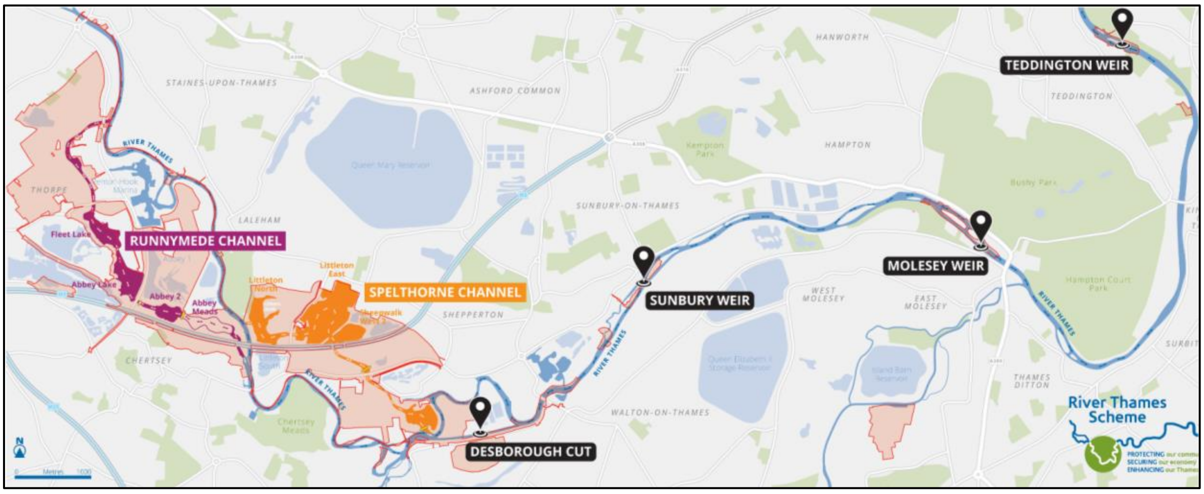

Figure 1-1 Overview of the RTS (Environment Agency, 2022d).

1.5 Structure of this report

1.5.1.1 The remainder of this report is structured as follows:

- Chapter 2 (Legislative and Policy Context) outlines the key legislation and policy documents of relevance to the project;

- Chapter 3 (EIA Notification and Scoping) summarises the requirements for EIA Scoping as stated by relevant regulations and guidance. It also provides a summary of previous EIA scoping undertaken for the project and justification for this updated Scoping Report;
- Chapter 4 (Project Description and Alternative Options Considered) provides a detailed description of the project design components, its evolution and alternative options considered;
- Chapter 5 (Approach to EIA Scoping) presents the key themes that have been used to inform the EIA Scoping Report;
- Chapters 6 to 18 relate to each of the environmental topics proposed to be scoped into the assessment. Appendix M summarises the key legislation, policy and guidance relevant to the topic; details the baseline conditions of the site; outlines the predicted changes to the environment and the proposed scope of the assessment; outlines the proposed assessment methodology; highlights any key assumptions and limitations and outlines proposed mitigation measures. Topics scoped into the assessment are air quality; biodiversity; climatic factors; cultural heritage, archaeology and built heritage; flood risk; health; landscape and visual amenity; materials and waste; noise and vibration; socio-economics; soils and land; traffic and transport; and water;
- Chapter 19 (Cumulative Effects Assessment) considers the inter-relationships between environmental topics and the potential for cumulative effects with other developments;
- Chapter 20 (Stakeholder Engagement) provides an overview of engagement planning, the breadth of past stakeholder engagement, how engagement has informed the project design and EIA scoping and proposed future engagement activities;
- Chapter 21 (Scope of the EIA) provides a summary of the proposed scope of the EIA based on the preceding Chapters; and
- Chapter 22 (Next Steps) outlines the remainder of the EIA process.

2. Legislative and Policy Context

2.1 Introduction

2.1.1.1 This section outlines the legislation and policy of relevance to the RTS, including those against which the DCO application will be assessed. It also identifies the site-specific planning policy designations. Legislation and policy is subject to change and development; therefore the relevant statutes and policies will be reviewed throughout preparation of the PEIR, ES and supporting studies.

2.2 The Planning Act 2008

2.2.1.1 The PA08 established the legal framework used to apply for, examine and determine development consent applications, taking into consideration the National Policy Statements (NPS). The RTS does not fall into the category of Nationally Significant Infrastructure Project (NSIP). However, Section 35 of the PA08 states that the SoS may give a direction for development to be treated as development for which development consent is required, if the SoS considers that the criteria in the PA08 have been met. The Environment Agency therefore requested a Section 35 Direction from the SoS via a request dated 25 November 2020.

2.2.1.2 The Section 35 Direction was given by the SoS on 24 December 2020 and confirms that the project is nationally significant, and it should be treated as development for which development consent is required.

2.2.1.3 The SoS notes that the project encompasses the following:

- Construction of a new flood relief channel in one or more sections on the River Thames;
- Capacity improvements;
- Managed country parks;
- Biodiversity net gain sites; and
- New or improved active travel provision outside of the flood channel corridor.

2.2.1.4 The Section 35 Direction also states that the SoS is of the view that the RTS would:

- Be a complex and substantial scheme, involving extensive infrastructure works and requiring multiple consents (ranging from multiple planning permissions, compulsory acquisition for the whole route and environmental consents), that should be seen as an NSIP in its own right; and
- Will benefit from the application being determined in a timely and consistent manner by the SoS and by removing the need and uncertainty of applying for a large number of separate consents.

2.2.1.5 The Localism Act 2011 abolished the Infrastructure Planning Commission and transferred its decision-making powers to the SoS. It also made amendments to the PA08 which alter the procedure for seeking development consent for NSIPs. The Localism Act appointed PINS as the agency responsible for managing the DCO process. Accordingly, PINS is responsible for examining the application. Planning Inspectors appointed by the SoS hear the DCO examination and make a recommendation to the SoS, who then makes the decision on whether to grant development consent.

2.3 Environmental Impact Assessment legislation

2.3.1.1 The project will be subject to an EIA, and the environmental effects reported within an ES. It meets the criteria of Schedule 2 paragraph 10 (h) of the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (the EIA Regulations), being an “inland-waterway construction not included in Schedule 1 of these Regulations, canalisation and flood-relief works”. A high-level screening by the Environment Agency and Surrey County Council, as joint applicants, against Schedule 3 of the EIA Regulations determined that there is potential for significant environmental effects based on the characteristics of the development, the location of the development and the type and characteristics of potential impact.

2.3.1.2 This EIA Scoping Report has been prepared pursuant to Regulation 10 of the EIA Regulations in support of a request to the SoS to provide their opinion as to the scope and level of detail of information to be provided within the ES (this is discussed further in Section 3.2).

2.4 Flood and Coastal Erosion Risk Management Policy Statement

2.4.1.1 The Flood and Coastal Erosion Risk Management Policy Statement (July 2020) sets out the Government's ambition to create a nation that is more resilient to future flood risk and reduces the risk of harm to people, the environment, and the economy. Upgrading and expanding national flood defences and infrastructure is one of five key policies within the Policy Statement.

2.4.1.2 The Flood and Coastal Erosion Risk Management Policy Statement considered the National Infrastructure Commission's (NIC) report, 'Anticipate, React, Recover Assessment of Resilient Infrastructure Systems' (NIC, 2020) which sets out a detailed framework for UK Infrastructure resilience. The NIC has identified the development of flood defence programmes as a key action which can be taken to deliver resilient infrastructure systems.

2.4.1.3 The policy statement forms part of the government's wider commitment to tackle climate change. Alongside the policy statement, the Environment Agency have published its National Flood and Coastal Erosion Risk Management Strategy for England (Environment Agency, 2020). This provides a framework for guiding the operational activities and decision making of practitioners.

2.5 Planning Policy

2.5.1.1 Under Section 5(1) of the PA08, NPS are designated by the SoS which set out national policy in relation to one or more specified descriptions of development (Section 5(1)) and the application would be decided under Section 104. However, there is no applicable NPS for the RTS, therefore the application will be decided under Section 105 of the PA08. Despite this, parts of the draft NPS for Water Resources Infrastructure published in November 2018 and updated in August 2019 may be important and relevant to the SoS's consideration of the project for the purposes of Section 105(2)(c) as it is considered that water resources projects are the closest projects in form to the RTS that are covered by a NPS. Notably elements of Section 3 on 'Assessment Principles' and Section 4 on 'Generic Impacts' are particularly relevant to the RTS.

2.5.1.2 Appendix M summarises the relevant sections of the draft NPS for Water Resources Infrastructure specific to each environmental topic.

2.5.1.3 Other matters that the SoS will consider include relevant national and local planning policy. The National Planning Policy Framework (NPPF) (MHCLG, 2021a) is relevant national policy.

2.5.1.4 The NPPF sets out the UK government's planning policies for England and how these ought to be applied. The NPPF must be considered in the preparation of local and neighbourhood plans and is a material consideration in granting development consent. At the heart of the NPPF is a presumption in favour of sustainable development. The framework sets out guidance under thirteen subheadings that contribute to delivering sustainable development, as follows:

- Delivering a sufficient supply of homes;
- Building a strong, competitive economy;
- Ensuring the vitality of town centres;
- Promoting healthy and safe communities;
- Promoting sustainable transport;
- Supporting high quality communications;
- Making effective use of land;
- Achieving well-designed places;
- Protecting Green Belt land;
- Meeting the challenge of climate change, flooding and coastal change;
- Conserving and enhancing the natural environment;
- Conserving and enhancing the historic environment; and
- Facilitating the sustainable use of minerals.

2.5.1.5 The National Planning Policy Guidance underpins the NPPF. Where technical guidance is available, this will inform the technical assessments for environmental topics within the EIA for the project. A comprehensive list of guidance likely to be relevant to each environmental topic of the EIA is provided in Appendix M.

2.5.1.6 Most of the area within the project boundary for EIA scoping is located within the administrative boundary of Surrey County Council. Downstream works near Molesey Weir and Teddington Weir are the exception, which fall within Greater London. The administrative boundaries and names of the regional planning authorities and Local Planning Authorities (LPAs) in proximity to the project boundary for EIA scoping are illustrated in Figure 2-1 (Appendix A).

2.5.1.7 Section 105 of the PA08 requires the decision maker to have regard to matters that they think are both relevant and important. The provisions of the Development Plan are clearly an important and relevant consideration. The Development Plan is defined by Section 70(2) of the Town and Country Planning Act 1990 and Section 38(6) of the Planning and Compulsory Purchase Act 2004 (as amended).

2.5.1.8 Appendix M outlines Development Plans relevant to the RTS and details the specific national and local planning policies relevant to the assessment for each environmental topic included within the EIA. The appendix includes the local development plan policy documents relevant to each LPA (and which will inform the Local Impact Reports that are produced by each LPA and considered by the SoS pursuant to section 105 of the PA08).

2.5.1.9 The purpose of considering planning policy at the EIA scoping stage is to identify policy that could influence the sensitivity of receptors (and therefore the significance of environmental effects) and to identify policies which have the potential to influence the proposed assessment methodologies. National, regional and local policy documents have therefore guided the production of this EIA Scoping Report.

3 EIA Notification and Scoping Request

3.1 EIA Notification

3.1.1.1 As noted in Section 2.3 the project meets the criteria of Schedule 2 paragraph 10 (h) of the EIA Regulations. The Environment Agency and Surrey County Council, as joint applicants, are proposing to undertake an EIA of their own volition rather than seek an EIA screening request from the SoS. A letter accompanying this Scoping Report notifies the SoS under Regulation 8(1)(b) of the EIA Regulations that the Environment Agency and Surrey County Council, as joint applicants, propose to provide an ES with the application for development consent in relation to the project.

3.1.1.2 PINS Advice Note Seven requests that notifications made in accordance with an EIA notification are accompanied by information sufficient to facilitate the notification of EIA consultation bodies (as per the information requirements listed in Insert 1 of the Advice note). Table 3-1 identifies where in this EIA Scoping Report the information requested to be provided alongside the EIA notification can be found.

3.1.1.3 It should be noted that there is a clear separation of responsibilities and an information barrier in place between the officers advising and promoting the RTS on behalf of the applicant and the officers who will perform a regulatory function within Surrey County Council and the Environment Agency as part of the PA08 process and in performing duties under the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017.

Table 3-1: Information to be provided alongside EIA notification under Regulation 8 of the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017.

Requirement	Location in this Scoping Report
A plan sufficient to identify the land.	Figure 1-2 (Appendix A).
A description of the physical characteristics of the whole development.	Chapter 4: Project Description and Alternative Options Considered.
A description of the location with particular regard to the environmental sensitivity of geographical areas likely to be affected.	Outlined in individual topic Chapters 6 to 18 and in associated Appendices.
A description of the aspects of the environment likely to be significantly affected by the development.	Outlined in individual topic Chapters 6 to 18 and Chapter 21:Scope of the EIA.
A description of any likely significant effects of the development resulting from expected residues and emissions, and the production of waste, and the use of natural resources (in particular soil, land, water and biodiversity).	Outlined in individual topic Chapters 6 to 18 and Chapter 21:Scope of the EIA, and Chapter 13: Materials and Waste in particular for the use of natural resources.
Details of any features of the proposed development and any measures envisaged to avoid or prevent what might otherwise have been a significant adverse effect on the environment.	Primary mitigation is described within the context of the Project Description (Chapter 4: Project Description and Alternative Options Considered). Secondary measures are outlined in individual topic Chapters 6 to 18 with commentary on how mitigation may be secured and the anticipated residual effects.

3.2 Request for a Scoping Opinion

3.2.1 Introduction

3.2.1.1 As noted in PINS Advice Note Seven paragraph 5.7, ‘an effective scoping process should enable the refinement of the assessment and ultimately the information required to form the ES. If done well, it allows for an early identification of the likely significant effects applicable to the EIA Regulations (in particular Schedule 4) and also provides opportunity to agree where aspects and matters can be scoped out from further assessment’.

3.2.2 Previous Requests for Scoping Opinion

3.2.2.1 An EIA Scoping Report was originally produced for the RTS in 2017. At that time, the project was proposed to be consented under the Town and Country Planning (EIA) Regulations 2017 (SI 2017/571).

3.2.2.2 That EIA Scoping Report was submitted as a request for a Scoping Opinion from the local authorities that were due to be directly affected by the project (i.e. Surrey County Council, RBWM, Runnymede Borough Council (RBC), Spelthorne Borough Council (SBC), Elmbridge Borough Council (EBC), Royal Borough of Kingston upon Thames (RBKUT) and the London Borough of Richmond upon Thames (LBRUT)). The LPAs also sought advice, and received responses, from the following statutory and non-statutory consultees:

- Environment Agency;
- Historic England (HE);
- Natural England (NE);
- Berkshire, Buckinghamshire and Oxfordshire Wildlife Trust;
- Greater London Authority (GLA);
- Heathrow Airport;
- National Highways (formerly Highways England);
- Surrey County Council (Historic Environment, Natural Environment and Assessment, Minerals and Waste and Highways Authority);

- Sport England;
- Surrey Gardens Trust;
- Surrey Wildlife Trust;
- Transport for London; and
- RBC Environmental Health Officer (EHO) and contaminated land officer.

3.2.2.3 Teddington Weir marks the tidal extent of the River Thames. Since there are minor works downstream of Teddington Weir, where the River Thames falls below Mean High Water Springs this is therefore within the jurisdiction of the Marine Management Organisation (MMO). Pursuant to the Marine Works (EIA) Regulations 2007 (SI 2007/1518), it was agreed that an ES was required to support the application for a marine licence under the Marine and Coastal Access Act 2009 and therefore the request for an EIA Scoping Opinion was also sent to the MMO.

3.2.2.4 The Scoping Opinions subsequently received from the LPAs and the MMO in 2017 and 2018 respectively, broadly agreed with the proposed scope of the assessment but did request the inclusion of some additional potential effects for certain aspects. For example, the Scoping Opinion did not agree with the applicant's determination that there would be no likely significant effects on waste. This has subsequently been given full consideration within this Scoping Report (covered within Chapter 13: Materials and Waste).

3.2.2.5 Comments made as part of the previous LPA and MMO Scoping Opinions that are relevant to the current design have been taken into consideration during the production of this Scoping Report. The 'stakeholder engagement' sections of topic Chapters summarise the feedback and how they have been addressed.

3.2.3 Previous request for pre-application advice and feedback on draft assessment methodologies

3.2.3.1 Pre-application advice was sought from prescribed consultees and LPAs in 2019 on an earlier design (under the Town and County Planning Act, 1990). Feedback from that consultation has informed this EIA Scoping Report and has been incorporated within the 'stakeholder engagement' sections of applicable topic Chapters alongside any other relevant stakeholder feedback.

3.2.3.2 Draft assessment methodologies for most environmental topics (excluding water) were submitted to Surrey County Council's Principal Environmental Assessment Officer in 2019 for informal feedback. No feedback was made in respect of the criteria for determining sensitivity, magnitude and significance of effects proposed in each method paper, however comment was made on the need to reference relevant policies and reference site and development specific assessments.

3.2.4 Updated request for Scoping Opinion

3.2.4.1 Since the receipt of the Scoping Opinions in 2017 and 2018, there have been significant design changes, including the removal of the channel section located within Berkshire and removal of Desborough Cut widening (see Chapter 4: Project Description and Alternative Options Considered for further information) as well as evolution of the project into a significant piece of green and blue infrastructure that will deliver a range of new features including new green open spaces, HCAs, and new or improved active travel provision.

3.2.4.2 The consenting route has also changed with the project now classed as nationally significant and which must be consented through a DCO. Both the changes in design and consenting route necessitate the need to re-scope

3.2.4.3 Regulation 10(1) of the EIA Regulations enables a person who proposes to make an application for an order granting development consent to ask the SoS to state in writing its opinion as to the scope and level of detail of the information to be provided in the ES. The Environment Agency and Surrey County Council, as joint applicants, are therefore submitting this report to request a Scoping Opinion from the SoS administered by PINS under Regulation 10 of the EIA Regulations.

3.2.4.4 Table 3-2 below sets out the requirements of the EIA Regulations for scoping requests made under regulation 10(1) and outlines where in this Scoping Report the requirements have been addressed.

3.2.4.5 Table 3-3 sets out the information to be provided with a scoping request as listed in PINS Advice Note Seven.

Table 3-2: Requirements for scoping requests made under regulation 10(1) of the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017.

Requirement	Location in this Scoping Report
A plan sufficient to identify the land.	Figure 1-2 (Appendix A).
A description of the proposed development, including its location and technical capacity.	Chapter 4: Project Description and Alternative Options Considered.
An explanation of the likely significant effects of the development on the environment.	Outlined in individual topic Chapters 6 to 18 and Chapter 21:Scope of the EIA.
Such other information or representations as the person making the request may wish to provide or make.	Where relevant, any further information is provided throughout this EIA Scoping Report.

Table 3-3: Information to be provided with a scoping request as listed in PINS Advice Note Seven (Environmental Impact Assessment: Process, Preliminary Environmental Information and Environmental Statements).

Requirement	Location in this Scoping Report
The proposed development	
An explanation of the approach to addressing uncertainty where it remains in relation to elements of the proposed development e.g. design parameters.	Chapter 4: Project Description and Alternative Options Considered and Chapter 5: Approach to EIA Scoping.
Referenced plans presented at an appropriate scale to convey clearly the information and all known features associated with the proposed development.	Appendix A: Figures.

Requirement	Location in this Scoping Report
EIA Approach and Topic Areas	
An outline of the reasonable alternatives considered and the reasons for selecting the preferred option.	Chapter 4: Project Description and Alternative Options Considered.
A summary table depicting each of the aspects and matters that are requested to be scoped out allowing for quick identification of issues.	Chapter 21: Scope of the EIA.
A detailed description of the aspects and matters proposed to be scoped out of further assessment with justification provided.	Outlined in individual topic Chapters 6 to 18.
Results of desktop and baseline studies where available and where relevant to the decision to scope in or out aspects or matters.	Outlined in individual topic Chapters 6 to 18 and in associated Appendices A, C to L, and N.
Aspects or matters to be scoped in, the report should include details of the methods used to assess impacts and to determine significant of effect e.g. criteria for determining sensitivity and magnitude.	Outlined in individual topic Chapters 6 to 18.
Any avoidance or mitigation measures proposed, how they may be secured and the anticipated residual effects.	Primary mitigation is described within the context of the Project Description (Chapter 4: Project Description and Alternative Options Considered). Secondary and tertiary mitigation measures are outlined in individual topic Chapters 6 to 18 with commentary on how mitigation may be secured and the anticipated residual effects.

Requirement	Location in this Scoping Report
Information Sources	
References to any guidance and best practice to be relied upon.	Outlined in individual topic Chapters 6 to 18.
Evidence of agreements reached with consultation bodies (for example the statutory nature conservation bodies or local authorities).	Outlined in individual topic Chapters 6 to 18.
An outline of the structure of the proposed ES.	Chapter 22: Next Steps.

3.2.4.6 The Scoping Opinion will inform the preparation and completion of the Environment Statement (ES). The Scoping Report is seeking an opinion on:

- The environmental topics that should be included within the EIA;
- The relevant components of the RTS project that have the potential to result in likely significant effects;
- Those effects considered not likely to be significant that do not need to be considered further;
- The approach to setting the study area for each topic;
- The data that has been gathered (and will be gathered);
- The assessment methods that will be used to determine likely significant effects; and
- The approach to determining the environmental measures that could be incorporated into the project to avoid, prevent, reduce or, if necessary, offset significant effects.

3.2.4.7 Before adopting a Scoping Opinion, PINS must, under Regulation 10(6) of the EIA Regulations, consult the relevant consultation bodies (as defined by Regulation 3(1) of the EIA Regulations).

3.2.4.8 Each of the individual topic Chapters (Chapters 6 to 18) within this Scoping Report outline relevant stakeholder feedback received from the 2017 EIA Scoping Opinion, pre application consultation, plus other relevant consultation (further detail on our consultation to date is provided in Chapter 21). The feedback that is relevant to the current project design has been given full consideration and, where appropriate, incorporated into the scoping of effects within this report.

4 Project Description and Alternative Options Considered

4.1 The Proposed Development

4.1.1 Overview

4.1.1.1 The RTS is a significant new piece of green and blue infrastructure that will deliver a range of new features working together to deliver its goals. This will include the following elements (also summarised on Figures 1-2 and 4-1 in Appendix A):

- A new flood channel in two sections, through the boroughs of Runnymede and Spelthorne in Surrey. Permanent flood channel associated features include flow and water level control structures, flood embankments, erosion prevention, bridges and permanent site compounds for maintenance of the flood channel; the channel will include planting for wildlife and places for recreational access;

- Capacity improvements to the River Thames through bed lowering for approximately 1km downstream of Desborough Cut (in the boroughs of Spelthorne and Elmbridge) and upgrades to Sunbury Weir (in the borough of Elmbridge), Molesey Weir (on the boundary between the boroughs of Elmbridge and the LBRUT) and Teddington Weir (within the LBRUT);

- New green open spaces adjacent to the channel and accessible by local communities;

- HCAs which link with existing and new blue and green wildlife corridors and build upon the network of existing wildlife sites;

- New or improved active travel provision outside, along and across the flood channel corridor and new open spaces with connections to the existing network; and

- Temporary construction features such as site compounds and materials reprocessing sites.

4.1.1.2 Design development is ongoing, and is being informed by consultation, and technical surveys and assessments. Any updates to the project description and the consideration of alternatives will be reported in the PEIR and in the ES.

4.1.1.3 As noted in Section 5.3.1, the EIA scoping exercise is being undertaken using the current project design. PINS Advice Note Nine: ‘Rochdale Envelope’ (PINS, 2019a) provides guidance regarding the degree of flexibility that may be considered appropriate in order to address uncertainties within an application for development consent under the PA08 process. The guidance states that the assessment of likely significant effects should establish relevant parameters for the purposes of the assessment “likely to result in the maximum adverse effect (the worst-case scenario) and be undertaken accordingly to determine significance”. Design parameters are described in the following sections of Chapter 4 and summarised on Figures 1-2 and 4-1 in Appendix A.

4.1.2 Flood Channel

4.1.2.1 The Runnymede Channel will be approximately 4.8km in length, and the Spelthorne Channel will be approximately 3.2km in length. The channels will be created by linking together existing lakes formed by historical gravel workings. The new connecting channel sections will generally be 20m to 50m wide (and up to 94m wide at the fixed weir water level control structures). They will be between 3m and 4m deep and the completed channels will transfer up to approximately 150m^3/s of water when operated during major flooding of the River Thames.

4.1.2.2 In non-flood conditions the gates in the flow control structures located at the inlet of each channel section intake will be closed. However, the new channels will not be “dry”, as the water level in the channels will match the existing groundwater levels, with an average depth of water of 2-3m. Furthermore, there will be a small, continuous flow into the flood channels that will be limited to a flow of up to 1.5m^3/s (known as the ‘augmented flow’). In-channel water level control structures will maintain the water levels within the flood channel and will provide a suitable flow for water quality and fish passage through the channel. This is a legal requirement to prevent stranding of fish that end up in the flood channel e.g. after a flood event.

4.1.2.3 The Runnymede Channel will start at Egham Hythe and end at Chertsey. The intake to the flood channel will be on the right bank of the River Thames (i.e. the right-hand side as one faces downstream). It will pass under the A320 Chertsey Lane, then through agricultural fields before heading south across Green Lane and joining the existing course of the Mead Lake Ditch. Passing through five existing lakes (lake south of Green Lane, lakes south of Norlands Lane 1 and 2, Fleet Lake and Abbey Lake (the latter two being part of Thorpe Park)). It will then pass under Staines Road (also part of the A320) through Abbey 2 lake towards Abbey Meads, and through the existing Burway Ditch M3 flood culverts, returning to the River Thames just south of the M3 motorway and downstream of Chertsey Weir.

4.1.2.4 The Spelthorne Channel will leave the left bank (i.e. the left-hand side as one faces downstream) of the River Thames at Laleham, approximately 0.4km upstream of the outlet of the Runnymede Channel, and north of the M3 motorway. The flood channel will follow an easterly route through three existing lakes (Littleton North, Littleton East and Sheepwalk 2) and pass under two local roads before turning south underneath the M3 motorway. The flood channel route continues through areas of grassland and scrub at Sheepwalk and Manor Farm and will pass under a further three local roads and through a Ferry Lane lake before re-joining the River Thames opposite D'Oyly Carte Island, just upstream of Desborough Island, and downstream of Shepperton Weir.

4.1.2.5 The flood channel will comprise of new sections of engineered channel connecting existing lakes, passing through the following types of land use:

- Natural ground;
- Reworked natural ground and made ground with little man-made material (e.g. bricks and rubble); and
- Existing or former landfill sites.

4.1.2.6 The shape of the flood channel will vary according to the type of land use or lake that it passes through. The width of the channel will be largely minimised to avoid additional land take, excavation and the processing of material. The new channel will include in-channel and riparian habitat and a wider and softer landscape channel edge where ground constraints allow.

Channels through natural ground and made ground

4.1.2.7 Where the channel passes through natural ground or made ground it will be excavated to create a 'natural' looking trapezoidal cross-section of approximately 0.5km and 0.2km in length in the Runnymede and Spelthorne Channels respectively. Locations of natural ground and made ground can be seen in Figure 4-1 in Appendix A.

4.1.2.8 The trapezoidal sections will be approximately 45m wide, 3m to 4m deep (depending on the location) with an average water depth (in a non-flood scenario) of 2m to 3m. The trapezoidal channel sections will typically be unlined and have been identified as the areas with the most potential to include in-channel and riparian habitats and/ or softer landscaping of the flood channel.

4.1.2.9 The majority of channel in these areas will be excavated through topsoil and sub-soil into the underlying (Shepperton) gravels. These gravels will form the bed of the flood channel, lying anywhere between 1m and 2m below existing groundwater levels.

4.1.2.10 Figure 4-1 below shows a typical cross-section of the channel through natural ground or made ground. The left bank of the channel is gently sloping with marginal herbaceous vegetation extending from the water, and a tree is shown on the higher ground. The right bank is steeper, but also with herbaceous vegetation extending from the water. There are opportunities for improved active travel alongside the channel edge. Approximately 20m from the channel is a band of taller shrubby vegetation; this is approximately 30m wide. To the right of this is a 3m wide maintenance access track for the Environment Agency, flanked by a line of trees to its right.

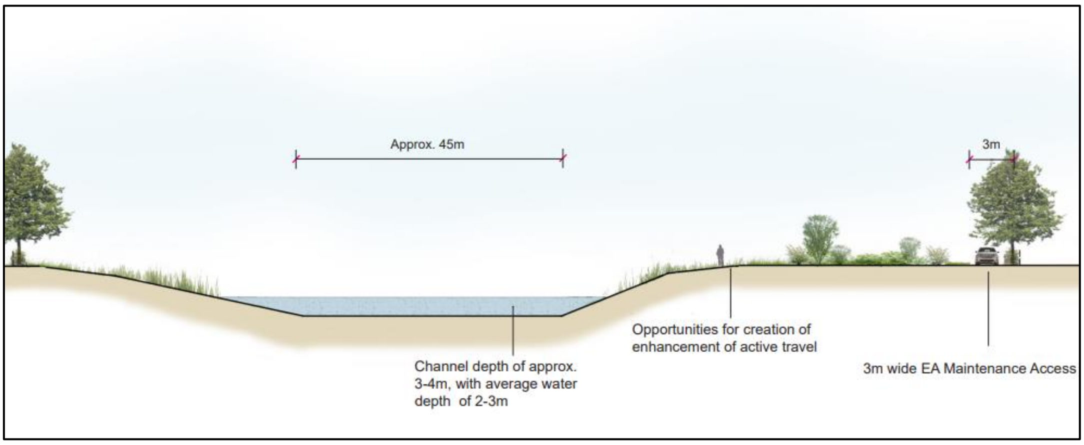

Figure 4-1: Cross-section example of a typical section of the 'natural' looking trapezoidal channel showing softer slopes with river edge habitat.

Channels through landfill sites

4.1.2.11 Sections of the flood channel that pass through existing and historic landfill sites will be extensively engineered with vertical sheet piled sides. The channel will be approximately 0.9km and 1.2km in length Runnymede and Spelthorne Channels respectively. Locations of landfill sites can be seen in Figure 16-1 in Appendix A.

4.1.2.12 The channel depth will be approximately 20m wide and 4m deep in these sections of channel. The water depth in these sections of channel will be approximately two to three metres. The sheet pile sides of the channel will be driven into the ground from the existing ground level. Where possible, berms would be formed to give the channel a more ‘natural’ appearance (such as in Figure 4-1 above).

4.1.2.13 Figure 4-2 shows a typical cross-section of the channel through landfill sites. On the left bank (but not the right bank) the top of the sheet pile is shown with a raised capping beam flood defence wall. The section shows that there is no vegetation within the channel. On the left bank there is a band of trees and shrubby vegetation, approximately 15m wide, and grassy vegetation right up to the channel edge. On the right bank there is longer meadow grass, but no woody vegetation shown. A footpath is indicated adjacent the channel on the right bank, varying in width from 5m to 13m, providing opportunities for enhancement or creation of active travel.

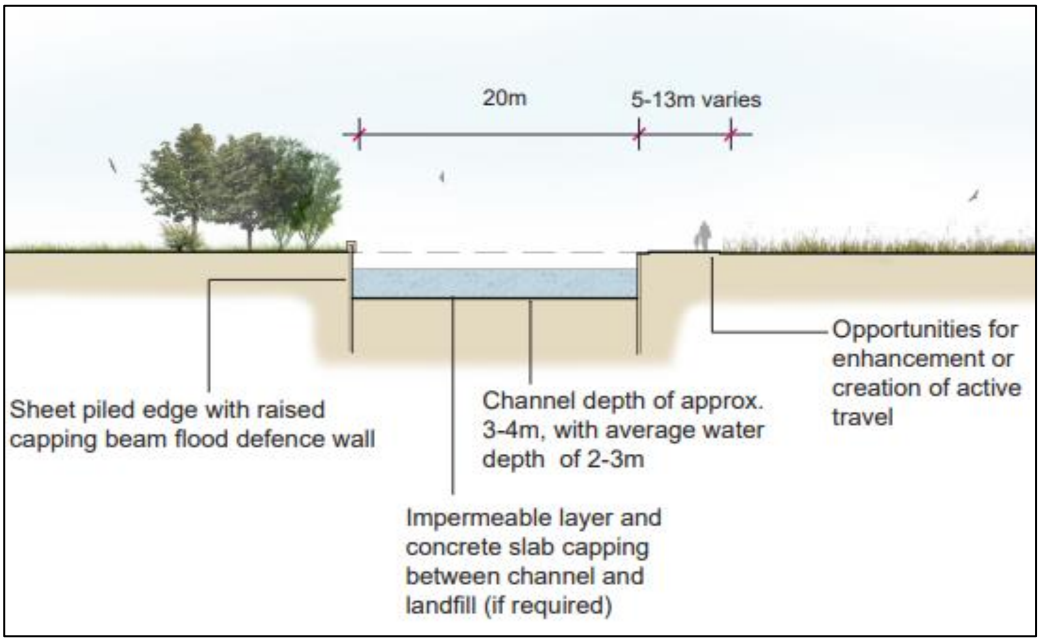

Figure 4-2: Cross-section example of the engineered channel.

Channels through existing lakes

4.1.2.14 Using the network of existing lakes as a flood flow route is an integral part of the project. This means hard engineering can be kept to a minimum. The flood channel will enter each lake; the flood water will flow through the lake and exit the other side. It is not intended to deepen any lakes, however, there may be a requirement for the smaller lakes that the channel passes through (e.g. Lake South of Green Lane) to be reshaped to ensure flow passes efficiently. Existing silt layers will remain in place, though operation of the flood channel may be expected to add to and redistribute the silt.

4.1.2.15 Shallowing of the existing lake banks and using the material generated from reducing their gradients to form shallow margins and wetland edges to the lakes will improve habitats.

Abbey Meads Floodway

4.1.2.16 In non-flood conditions, most of the flood channel will have an augmented flow and always contain groundwater due to the presence of water level control structures. The Abbey Meads area is the exception to this, as the augmented flow will be passed down the Abbey River via a flow control structure at the downstream end. The Abbey Meads area will be a predominantly dry floodway with the existing ground levels lowered and profiled to provide a damp to wet summer grazing area (Figure 4-3 and 4-4 below). This area will typically be partially flooded during wetter winter months and largely dry in the summer with rough grazing pasture. When the flood channel is not operating, the partial flooding will be caused by water backing up from the River Thames (through the M3 culverts) rather than flow control structures on the flood channel.

4.1.2.17 The existing Burway Ditch water body which runs through the northern half of the site will be realigned where required. The existing trees and the existing Affinity Water boreholes will be retained on slightly raised ‘islands’. A permanent backwater of the River Thames will be established north of the M3 culverts, creating a greater range of habitats.

4.1.2.18 Figure 4-3 shows the arrangement of the Abbey Meads floodway, including the levels dropping down to it from the M3 which lies to the south, and from the flood bank to the north, and the raised ‘islands’ of vegetation.

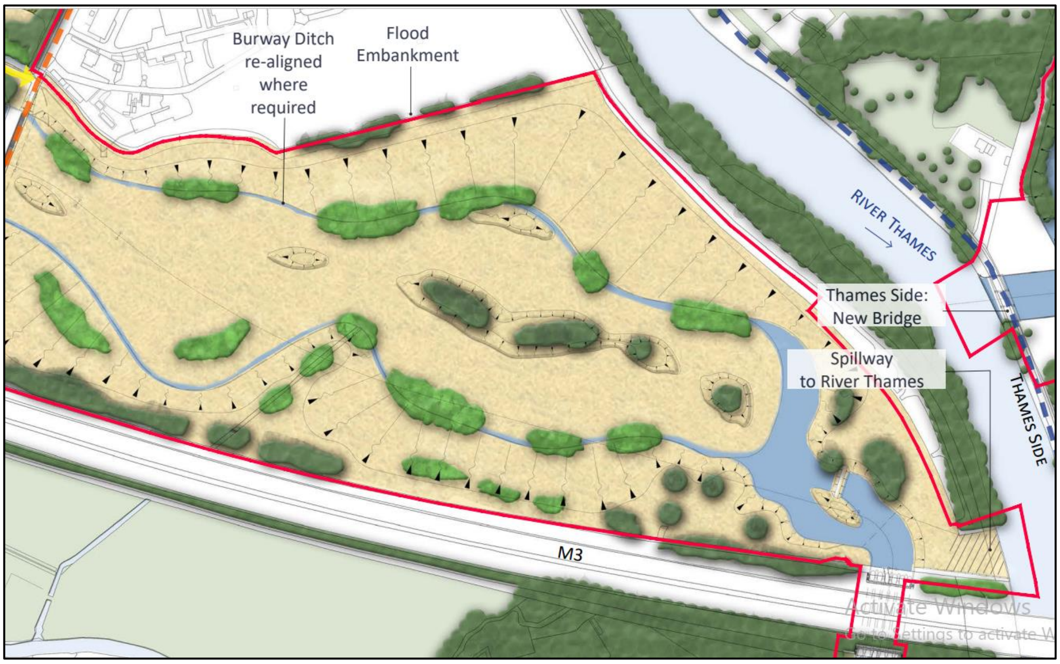

Figure 4-3: Flood channel alignment at Abbey Meads Floodway.

4.1.2.19 The cross section at Figure 4-4 below is cut through the site running from the north to the south. It shows the area is mostly flat and open, except for the higher ground of the M3 motorway to the south, the flood embankment to the north, and a raised island of vegetation in the centre. The realigned Burway Ditch in the northern half of the site and an unnamed ditch in the southern half are both labelled. Both are flanked with small trees either side.

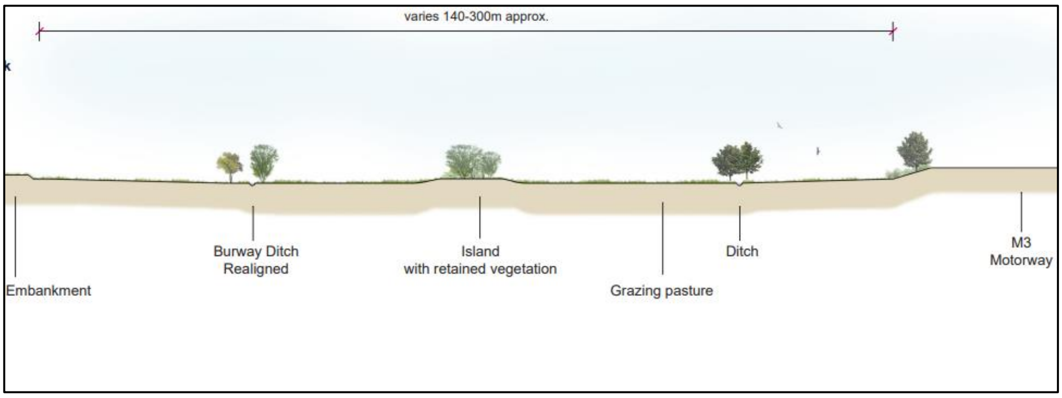

Figure 4-4: Indicative cross-section of Abbey Meads Floodway.

4.1.3 Flood Channel Associated Features

Flow control structures

4.1.3.1 Flow control structures (Plate 4-1) with fish passes are required at the intake of each channel section and at the crossing of Staines Road (A320), downstream of the Thorpe Park Lakes on the Runnymede Channel. These will be required to control the amount of water entering the flood channel.

4.1.3.2 Water level control structures (Plate 4-2) with fish passes, are required along both of the flood channel sections. Their function will be to control water levels during non-flood conditions, to ensure that the flood channel does not act as a drain leading to the surrounding groundwater levels being drawn down by the flood channel during normal conditions.

4.1.3.3 Flow control structures are shown in Figure 4-1 in Appendix A and include:

- A gated control structure with nine gates at the inlet of the Runnymede Channel (structure reference IS2);
- An uncontrolled inlet (scour protected) at the Drain in Thorpe Hay Meadow (structure reference TCS9);
- A piped inlet with flap valve at Mead Lake Ditch (structure reference FCS6);
- A broad crested weir with submerged orifice (with flap gate) and tilting gate at Abbey Lake outlet to St Ann’s Lake (structure reference FCS7);
- Lowering of 20m of river bank on the Chertsey Bourne at St Ann’s Lake inlet (structure reference FCS8);
- A narrow channel with adjustable stoplogs at St Ann’s Lake outlet to Chertsey Bourne River (structure reference FCS9);
- A gated control structure (nine gates) at the Thorpe Park Lakes outlet (structure reference FCS10);
- An uncontrolled inlet (scour protected) on the Abbey River (structure reference TCS10);
- A stop logged channel outlet structure on the Abbey River (structure reference TCS11);

- Burway Ditch water body will be blocked off (structure reference TCS12);
- A fixed level control structure (concrete, 82m long) at Ferry Lane (structure reference FCS12);
- A gated control structure (nine gates) on the Spelthorne Channel between Littleton North Lake and Littleton East Lake (structure reference IS3);
- A fixed level control structure (concrete, 94m long) at Manor Farm (structure reference FCS18);
- Flow restriction at the outlet weir from Sheepwalk West 1 lake to the Pool End Ditch;
- An overflow at Drain to Ferry Lane (structure reference TCS13); and
- A fixed level control structure (concrete, 75m long) at Ferry Lane Lake (structure reference FCS19).

4.1.3.4 The flow control structure example shown in in Plate 4-1 below comprises a series of metal gates spanning the channel, separated by concrete walls, with an elevated steel walkway and railings running along the top of the whole structure.

Plate 4-1 - An example of a typical flow control structure.

Plate 4-2 - An example of a typical water level control structure.

Flood embankments and erosion prevention

4.1.3.5 Flood embankments between approximately 0.3m and 2m high are to be constructed in proximity to housing estates, commercial developments, and important utilities as shown in Figure 4-1 in Appendix A. Embankments will have a clay core and cut-off and have minimum top widths of 3m.

4.1.3.6 Some riverbank protection works will be required, to prevent erosion of the River Thames around the outlet of each flood channel section. Some areas will also require some embankment raising (see Figure 4-1 in Appendix A). The protection works are likely to be sheet piling, rock armour or concrete revetments.

Intersected Structures

4.1.3.7 The following existing features will be intersected by the flood channel, requiring a wide range of structures, including:

- Major and minor roads; this will require road bridges for the channel to pass underneath (possibly through culverts) (Plate 4-3 below);
- Natural drainage lines; this will require drainage structures;
- Footpaths and bridleways; this will require bridges over the channel; and
- Services including gas, water, electricity etc.; these will require re-location.

Plate 4-3 - An example of a typical culvert.

Bridges

4.1.3.8 Road bridges will be required on minor and major roads that the channel sections intersect. Some of these bridges will be designed to hydraulically “drown out” during channel operation (i.e. operate safely and efficiently with the soffit of the bridge submerged). Footbridges will also be required. The following bridges have been identified as required;

- Road bridge at Chertsey Lane (structure reference HA1);
- Service bridge upstream of Thorpe Hay Meadow (structure reference FBR5);
- Accommodation bridge at Green Lane (structure reference C2);
- Road bridge at Norlands Lane (structure reference LA6);
- Accommodation bridges at Thorpe Park to provide access (structure references C3 and T5);
- Road bridge at Staines Road (structure reference HA2);
- Accommodation bridge at Monks Walk Access (structure reference T4);
- Accommodation bridge at Ferry Lane Access (structure reference T3);
- M3 motorway crossing using the existing Burway Ditch Culverts (structure reference HA3M);
- Road bridge at Thames Side (structure reference LA7);

- Road bridge at Littleton Lane (structure reference LA9);
- Accommodation bridge at Littleton Sailing Club Access (structure reference T6);
- Footbridge at Littleton East lake (structure reference FBR6);
- M3 motorway crossing at Underbridge (structure reference HA7M);
- Road bridge at Sheep Walk (structure reference LA13);
- Road bridge at Renfree Way (structure reference LA11);
- Road bridge at Ferry Lane (structure reference LA12); and
- Footbridge at the outfall of the Spelthorne Channel (structure reference FBR7).

Permanent maintenance structures and access

4.1.3.9 Permanent maintenance compounds will be required at the three gated flow control structures on the flood channel; these will include kiosks to house the operational equipment. Potential locations of permanent maintenance compounds are:

- A320 Chertsey Lane, at the intake to the Runnymede Channel;
- A320 Staines Road, downstream of the Thorpe Park Lakes (Runnymede Channel); and
- Littleton Lane, Shepperton on the Spelthorne Channel.

4.1.3.10 Access tracks along the flood channel will facilitate access for maintenance purposes together with slipways at appropriate locations. Where appropriate (locations to be confirmed), these may also be used by the public for walking and cycling.

4.1.4 Capacity Improvements

4.1.4.1 There are four locations in which capacity improvement works are required as part of the project to ensure no detriment in flood conditions downstream of the flood channel, all are located downstream of the proposed flood channels.

Bed lowering downstream of Desborough Cut

4.1.4.2 Bed lowering of a stretch of the River Thames, approximately 1km in length, downstream of Desborough Cut will be undertaken through excavation of the river bed to improve channel capacity in this area. Bed lowering is proposed from the confluence of the Desborough Cut with the River Thames to just downstream of Walton Marina.

4.1.4.3 It is anticipated that only the central third of the River Thames channel (approximately 20m width) will be excavated. No impacts upon the banks of the River Thames are therefore anticipated as a result of this work. The average total depth of bed lowering will be 0.7m, including built-in resilience against siltation. This is all shown in the cross section below (Figure 4-5).

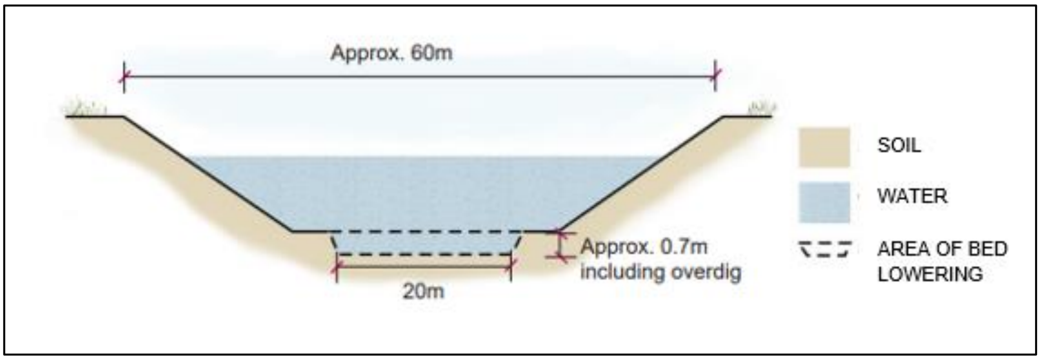

Figure 4-5: Cross-section of proposed bed lowering in the River Thames downstream of Desborough Cut (not to scale).

Upgrades to Sunbury Weir

4.1.4.4 The capacity improvements at Sunbury Weir will be achieved by constructing a new weir complex with three dipping radial weir gates through Sunbury Lock Ait (Figure 4-7 in Appendix A). A channel, approximately 12m wide, 75m long and 5m deep, will be cut through the island, at a diagonal angle, leaving the existing lock cut just upstream of the footbridge and entering the River Thames (on the other side of Sunbury Lock Ait) downstream of weirs A and B. A typical example of a weir complex with dipping radial weir gates is shown in Plate 4-4 below. Three bays are formed across the channel divided by concrete walls, with steel radial gates within each bay. An elevated walkway with railings either side and a pitched roof above bridges across the top of the structure.

Plate 4-4 - An example of an existing River Thames radial gate weir at Molesey.

Upgrades to Molesey Weir

4.1.4.5 Molesey Weir is on the boundary between the Borough of Elmbridge, in Surrey and the LBRUT. The proposed works are in the LBRUT section of Molesey Weir. The capacity improvements at this weir will be achieved by replacing the existing overfall weir and salmonid fish pass on weir C (Plate 4-5 below) with two dipping radial weir gates and a multi species fish pass (with a combined width of approximately 13m) (Figure 4-8 in Appendix A).

Plate 4-5 - Photograph of the existing overfall weir (far left) on weir C at Molesey.

Upgrades to Teddington Weir

4.1.4.6 The Teddington Weir complex is on the official tidal limit of the River Thames. The capacity improvements at this weir will be achieved by constructing a new weir complex with five dipping radial gates through Teddington Lock Island, which also lies on the boundary of the tidal limit (Figure 4-9 in Appendix A). A channel, approximately 20m wide, 20m long and 5m deep, will be cut through the island, approximately 10m upstream of the existing boat rollers and 70m downstream of the footbridge.

4.1.5 Landscape and Green Infrastructure

4.1.5.1 The project will deliver a wide range of benefits through the development of new landscape and green infrastructure provision in and around the corridor of the proposed flood channel. This is likely to result in several new green open spaces, areas of habitat creation and enhancement, and new footpaths and cycleways.

4.1.5.2 A landscape design feasibility study has explored a series of opportunities including promoting visual connections, active recreation, active travel and enhancing ecological value. The outline design of landscape and green infrastructure opportunities is ongoing and being refined through an integrated optioneering process that will be reported on in the ES.

4.1.5.3 It is currently considered that the project design will likely include the provision of new green open spaces, at any or all of the following locations (see Figure 4-1, Appendix A):

- Royal Hythe;
- Abbey;
- Manor Farm;
- Chertsey Road Tip; and
- Land South of Chertsey Road.

4.1.5.4 As part of the consideration of the landscape and green infrastructure opportunities, any of the following are being considered for delivery within the new green spaces at the above locations:

- Sporting fields;

- Adventure golf;
- Viewing platforms;
- Elevated viewpoints;
- Boardwalks;
- Maze;
- Sculptures and artwork;
- Education centre;
- Visitor facilities;
- Amphitheatre;
- Field centres;
- Trim trail;
- Entertainment space;
- BMX pump track;
- Outdoor gym;
- Land art;
- Sculptural landforms;
- Wetlands;
- New woodland planting;
- Accessible pathway networks;
- Enhancing habitats and creating opportunities for interaction;
- Active travel (cycle and pedestrian);
- Educational signage;
- Lighting;
- Playgrounds and nature play spaces;

- Car parking;
- Maintenance facilities (no public access); and
- Re-creation of historic landscapes.

4.1.5.5 These elements will be considered as part of the wider appraisal of the landscape and green infrastructure opportunities.

4.1.5.6 For the purpose of EIA Scoping, some height parameters have been applied to the potential features listed above which will be further developed for the ES stage. Raised landforms designed to provide views across the area could be up to a maximum of 22m in height, whereas items such as lighting, shade structures, signage, artwork and boardwalks could be up to a maximum of 7m in height. Stadium style lighting associated with sporting fields could be up to a maximum of 12m in height. Buildings (education centre, visitor facilities, field centres or maintenance facilities) could be up to 10m in height.

4.1.5.7 Use of excavated arisings onsite for construction such as for landscaping (such as raised landforms) will be undertaken where material is geotechnically and/or geochemically suitable for use. All excavated arisings that are chemically and/or physically suitable for transfer between the project sites for use will be done so via the project MMPs. Further information on materials management is included in Section 4.2.4.

4.1.6 Active Travel

4.1.6.1 Opportunities to upgrade existing road corridors or Public Rights of Way (PRoW) could include:

- Creating or improving access paths or roads (including the Thames Path National Trail) and incorporating opportunities for active travel into the design of the flood channels and associated features;
- Wayfinding devices;
- Improved drainage through sustainable drainage;
- Urban tree planting;
- Lighting;
- Accessible pathway networks;

- Links to existing transportation networks; and
- Bridges.

4.1.6.2 We are still to confirm the extent of recreational non-motorised (e.g. canoes) navigation that will be possible in the flood channel. It is currently assumed that this will be possible on the Runnymede Channel between Chertsey Lane and Norlands Lane, as well as downstream of the M3. Slipways will be included in the design to enable this.

4.1.6.3 Further optioneering and feasibility assessment, consultation and design work is required before a preferred landscape and green infrastructure design can be identified. An assessment of the project impacts and opportunities relating to the natural capital of the area is also being undertaken to inform the development of the landscape design. The ES will provide information on the optioneering process and its outcomes.

4.1.6.4 Therefore, for the purposes of EIA Scoping (and to assume the widest range of uses and locations as a reasonable worst-case at this early stage) it is assumed that any parts of the above landscape design themes and opportunities could be identified as preferred and could be delivered anywhere within the 'Landscape Feasibility Parameter' (see Figure 1-2 in Appendix A). As the project design develops following optioneering and feasibility assessments, the scale of the proposed project footprint, and the associated scope of the EIA, will be reviewed and refined where applicable, in discussion with stakeholders.

4.1.7 Habitat Creation Areas

4.1.7.1 The RTS aims to achieve a range of biodiversity improvements within the project boundary for EIA scoping. The locations and designs of these biodiversity improvements are currently being considered. They will be informed by the project goal to create a network of high-quality habitat and achieve BNG as well as the need for mitigation for effects on certain habitats and species that may be required from the ecological impact assessment (EcIA) or the associated Water Framework Directive (WFD) compliance assessment and Habitats Regulations Assessment (HRA) being undertaken for the project.

4.1.7.2 Types of biodiversity improvements are likely to include:

- Naturalised shallow margins in certain sections of the flood channel and around the edges of some existing lakes and watercourses to improve bankside vegetation growth;
- Sinking of trees removed during construction, along the flood channel and in some other waterbodies to provide alternative habitats;
- Targeted tree planting adjacent to the flood channel and some existing waterbodies plus macrophyte planting and the creation of islands in waterbodies;
- Enhancing the condition of existing terrestrial and river habitats;
- Improving connectivity of the River Thames floodplain, between the River Thames and other waterbodies;
- Creating new habitats such as woodland and wetland;
- Creating hedgerows and enhancing existing through infilling of a diverse mix of species; and
- Species specific measures to enhance habitat conditions.

4.1.7.3 Specifically, to deliver BNG and to supplement the improvement measures above, a series of potential HCAs (Figure 1-2 in Appendix A) are being considered.

4.1.7.4 We are looking to achieve BNG firstly through the delivery of habitat creation and enhancement within the flood channel and landscape design footprint. Where possible this will integrate with other desired landscape and green infrastructure outcomes through the provision of recreation and amenity benefits, active travel routes and reconnection to historic landscapes. HCAs where such opportunities are currently being explored include Norlands Lane, Laleham Golf Course, Littleton Lane, Land South of Chertsey Road, Chertsey Road Tip and Desborough Island.

4.1.7.5 In addition to these multi-functional sites, it may be necessary to include sites which would be more focussed on habitat creation or enhancement. These opportunities will be explored at Land South of Wraysbury Reservoir, Drinkwater Pit, Laleham Reach, Grove Farm and land between Desborough Cut and Engine River.

4.1.7.6 All of the HCAs will be the subject of further site selection and design but will typically favour enhancement of the existing habitats where appropriate. This may include, for example, enhancement of neutral grassland, mixed scrub, broadleaved and other woodlands, ponds, wet woodland, and open mosaic habitat. The design of the HCAs will also seek to create high quality habitats including reedbeds, ditches, hedgerows and lowland meadows.

4.1.7.7 The Environment Agency and Surrey County Council are committed to an approach for the delivery of BNG that balances the rules and principles associated with the Department for Environment, Food and Rural Affairs (Defra) Metric by ensuring that sound ecological judgement is used to ensure high quality habitats are delivered (i.e. the delivery of BNG will not solely be driven by Defra Metric outputs).

4.1.8 Improved fish passage

4.1.8.1 The project proposes to improve fish passage along the River Thames and its tributaries, through the installation of multi-species fish passes at five locations on the river within the project boundary for EIA scoping; these being (from upstream to downstream) at Chertsey Weir, Beasley’s Ait, Sunbury Weir, Molesey Weir and Teddington Weir. As noted above, at Molesey Weir this will involve replacing the existing salmonid fish pass. The project also proposes the installation of a fish pass on the Abbey River alongside other enhancements to improve the watercourse for fish and other water dependent species. The locations of the proposed fish passes are shown on Figure 1-2, Appendix A.

4.1.9 Environmental Mitigation

4.1.9.1 Certain primary (embedded) environmental mitigation has been included in the project design to date and will be refined as part of the EIA process. This includes for example:

- The sequential approach to flood risk is being followed as part of the ongoing design of the RTS. The sequential approach means that the proposed project components will be appropriately located relevant to the different flood zones within the project boundary for EIA scoping based on their NPPF vulnerability classification. The NPPF Sequential and Exception Tests will also be applied where appropriate to demonstrate that the project is NPPF compliant (see Chapter 10:

Flood Risk) provides further information in relation to subsequent flood risk tests);

- The provision of six fish passes on flow control structures along the new flood channel (shown on Figure 1-2, Appendix A);
- Enhancement of habitats immediately downstream of three weirs on the River Thames in the reach bypassed by the flood channel (at Penton Hook, Chertsey and Shepperton). Implementation of enhancements will be subject to the EIA confirming effects on these habitats from diverting water along the flood channel; but could include macrophyte planting;
- In relation to invasive non-native species (INNS) and aquatic pathogens, management plans will be developed as part of the EcIA. These management plans will set out potential mitigation measures, however, for the purposes of EIA scoping certain design assumptions have been made about required measures, including for example chemical treatment of terrestrial and aquatic habitats or removal of species through targeted capture and kill, or temporarily lowering water levels in existing waterbodies to remove aquatic species;
- Subject to the results of ground investigations (GI), the prior removal, isolation, or treatment of contaminated sediments that may be disturbed during construction works, capacity improvements (particularly bed lowering downstream of Desborough Island) and through scour of bed material during operation of the flood channel;
- The augmented flow of up to 1.5m^3/s along the flood channel (when not being operated with a larger flow during major flooding), which aims to avoid nutrient enrichment of existing lakes and allow for fish passage over water level control structures on the channel;
- The potential for management of the augmented flow during periods of low flow is currently being considered to limit potential impacts on water resources, water quality and biodiversity within the River Thames and new flood channel. This could include temporarily reducing flow to an appropriate level, ceasing or alternating flow between the flood channels;
- Within the Thorpe Park Lakes WFD water body, the existing connection between Manor Lake and Fleet Lake will be infilled to limit

the nutrient inputs from the River Thames reaching Manor Lake. Similarly, the water level control structure between St Ann's Lake and Abbey Lake will isolate St Ann's Lake (part of the Southwest London Waterbodies Special Protection Area (SPA)) from the flood channel again limiting nutrient inputs from the River Thames;

- Application of the waste hierarchy to minimise waste and maximise material re-use, which will also reduce traffic movements on public roads and associated effects on air and noise etc; and
- Avoidance of work within Thorpe Hay Meadow Site of Special Scientific Interest (SSSI) (further details of which are provided in Section 4.5.3.6).

4.1.9.2 Other environmental mitigation may be required as a result of the EIA, WFD compliance assessment and HRA, and is yet to be developed. It may be that some of the biodiversity improvements identified in Section 4.1.7 above will be required as mitigation in some locations.

4.2 Construction

4.2.1 Programme

4.2.1.1 The project is scheduled to be delivered over a seven-year period (see Table 4-1 below). The key activities, and their timings, are:

- Enabling works – will commence in mid-2026 and finish mid-2027;
- Weirs and bed lowing downstream of Desborough Cut - construction commences summer 2027 and finishes mid-2030;
- Flood relief channel - construction commences winter 2026/27 and is operational winter 2030/31;
- HCAs and new green open spaces - construction commences winter 2026/27 and finishes early 2032; and
- Landscaping and Mitigation Works - construction commences mid-2026 and finishes early 2032. A maintenance period follows until end of 2035.

Table 4-1: Project construction programme.

	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Enabling Works												
Weirs and bed lowering downstream of Desborough Cut												
Flood Relief Channel												
Habitat Creation Areas and New Open Green Spaces												
Landscaping and Mitigation Works												

Construction

Maintenance

4.2.1.2 Enabling works, which are proposed to take place during the latter half of 2026 and the first half of 2027, include activities such as demolition of buildings, services diversions, works to some existing structures, bank protection works, and construction of compound areas. These have been considered as construction phase works for the purposes of EIA scoping.

4.2.1.3 The capacity improvements at the three River Thames weirs will be completed ahead of the flood channel becoming operational. It is anticipated that the majority of construction work will take place during normal working hours, although there may be a requirement for weekend or night-time working with associated lighting (for example for works in roads).

4.2.2 Capacity Improvements

4.2.2.1 Construction of the capacity improvement works at the River Thames weirs will typically take place within a coffer dam (Plate 4-6 below). The coffer dam will act to exclude either groundwater or river water or both whilst construction of the new weir gates takes place inside the dam. Plate 4-6 below provides an example of a coffer dam, showing large sheet piles enclosing a working construction area, standing at least 4m high above the channel.

Plate 4-6 - An example of a coffer dam, used to construct new weir gates.

4.2.2.2 It is assumed that access to some sections of the River Thames will be restricted for construction, but navigation will be maintained throughout the duration of construction.

4.2.3 Flood Channel

4.2.3.1 Some sections of the flood channel will pass through existing built properties; this will likely require the demolition four dwellings and one outbuilding at the northern end of the Runnymede Channel (relevant landowners have been notified).

4.2.3.2 Through natural ground, the flood channel will typically be dug ‘wet’ (i.e. groundwater will not be excluded from the excavation). Through landfill, the sheet piles that form the edges of the flood channel will first be driven into the ground. Groundwater in the landfill areas could potentially be contaminated and require treatment before being discharged into public sewers, river or removed via tanker from site. The ground between the piles will either be excavated and drained before processing, resulting in a body of water remaining, or the ground will be dewatered then excavated and transported for processing, resulting in a largely dry excavation. In both approaches, the ground will be excavated to bed level and any contaminated water will be treated.

4.2.4 Materials Management

4.2.4.1 The project will develop a Materials Management Strategy (MMS) which will be incorporated into the ES (see Chapter 13: Materials and Waste) for further information).

4.2.4.2 A considerable volume of material will need to be excavated to create the new flood channel. The project seeks to minimise the excavation of material and retain excavated material on site where needed through application of the waste hierarchy. Where possible, excavated material will be stored at materials processing sites within the DCO application project boundary and then re-used for features identified as part of the landscape and green infrastructure works.

4.2.4.3 Large, temporary stockpiles of excavated (and other construction) materials will be required to facilitate construction phasing within the project boundary for EIA scoping. The precise location of these is currently unknown however they will be sited and designed to consider amongst other elements, flood risk, soil compaction, control of water run-off, dust, odour and travel movements.

4.2.4.4 Hazardous excavated material will need to be removed to suitably permitted facilities via the public road network (or other means of transportation). In addition, the project is in the process of determining the possible use of sites outside of the project boundary for EIA scoping for placement of non-hazardous material (i.e. material that is not chemically and/or physically suitable for project purposes or surplus to requirements). Once the locations for placement are determined, the Environment Agency and Surrey County Council as joint applicants will consider the appropriate assessment methodologies for placement at those sites in consultation with appropriate statutory bodies (which will depend on the current licencing status of those sites).

4.2.5 Vehicle Movements

4.2.5.1 Plant associated with the earthworks and piling will be heavy and large and thus will require a dedicated haul road along the route of the flood channel as well as compounds sufficiently large to store the plant when it is not in use. By using haul roads along the flood channel route, some movement of construction and excavated materials can be managed without using the public roads in the local area. Some of the haul roads can also be reused following construction as access tracks for maintenance activities. However, there will be unavoidable use of the public road network (or other means of transportation) for delivery of materials and plant and movements of material which cannot be used on site (for example by Heavy Goods Vehicles (HGVs) and concrete wagons).

4.2.5.2 There will also be movements of Light Goods Vehicles (LGVs) and worker/commuter traffic associated with operatives and construction staff attending site. Road access to site will be routed via main thoroughfares from the arterial roads i.e. routes through villages and towns will be avoided in favour of direct links to the motorways and 'A' roads. There are limited options to use the River Thames for transportation given accessibility issues due to existing low bridges on the alignment of new flood channel and the large volumes of materials that may need to be transported. Nevertheless, river transport is likely to be possible for the capacity improvement works i.e. the River Thames bed lowering downstream of Desborough Cut and improvements at three River Thames weirs. The possibility of using rail for transport of construction materials will be investigated.

4.2.5.3 Traffic volumes have not been finalised and will be evaluated as part of design development, including in relation to movements to and from identified sites. The EIA will assess the impacts associated with transport movements (such as traffic, noise, air quality and drainage).

4.2.6 Bridges

4.2.6.1 The flood channel crosses several public roads. Bridges are required to carry these public roads over the flood channel. These road bridges will be designed to typically adopt a 'top down' construction method. This method involves forming the bridge supports with bored concrete piles and then casting the bridge deck in formwork supported by the ground. The earth beneath the deck will be excavated out after the bridge deck has achieved full strength. This technique allows the bridges to be built in sections whilst managing traffic flows around the site with narrow lanes and traffic light controls. This construction method will reduce the need for full road closures during construction. The construction approach for road bridges will be finalised during the detailed design phase of the project.

4.2.6.2 The flood channel crosses several existing access tracks and roads. The accommodation bridges required to carry the access tracks/roads over the flood channel are generally located on private land and will be used for operational access around the land by the landowner and the Environment Agency Operations teams. The structures are likely to consist of either reinforced concrete slab type bridges or bridges with a composite reinforced concrete and steel deck. Some of the bridges will also be used to carry services across the flood channel. The services are likely to generally be laid in ducts within the structure.

4.2.6.3 The flood channel crosses several PRoWs. The footbridges/bridleway bridges required to carry these PRoWs over the flood channel are likely to consist of lightweight composite deck bridge structures, but this will be considered further as design work continues.

4.2.7 Flow and Water Level Control Structures

4.2.7.1 Flow control structures and water level control structures in the flood channel will be constructed in coffer dams in a similar manner to the capacity improvements to the River Thames weirs.

4.2.8 New Green Open Spaces, Habitat Creation Areas and Active Travel Provision

4.2.8.1 Certain landscaping and land management works will be done in advance of the main construction activities, particularly habitat enhancement works at some of the HCAs and parts of the new green open spaces to enable vegetation to become established. Other parts of the new green open spaces will be used for management of excavated materials initially during the construction period, before likely being formed into permanent public areas with associated recreation and amenity features. Timeframes and the nature of active travel improvements (both in new green open spaces and outside of them) are yet to be confirmed, but it is anticipated that these will be completed within the overall construction period.

4.2.9 Site Compounds

4.2.9.1 There will be a series of site compounds but the locations of these are still under consideration. For the purposes of EIA scoping, it is assumed that they could be anywhere within the project boundary for EIA scoping.

4.2.9.2 Temporary construction compounds will likely be located along the flood channel alignment and in proximity to the River Thames capacity improvements to store plant, materials, office, and welfare facilities. Temporary construction compounds will also likely be required at new green open spaces and HCAs.

4.3 Operation and Maintenance

4.3.1 Operation

4.3.1.1 The capacity improvements in the River Thames at each weir and downstream of Desborough Cut will be ready for use once construction has been completed at each site. It is anticipated that the flood channel and associated flood management features will be in operation by the end of 2032 (Table 4-1).

4.3.1.2 The flood channel will only operate once flow in the River Thames exceeds a certain threshold flow value. This flow value is yet to be confirmed, but it is thought that it will be approximately 230m^3/s. Once operational, the flow down the flood channel will be regulated by flow control structures at the intakes (one flow control structure for each section of the flood channel and one just east of the crossing of Staines Road (A320), downstream of the Thorpe Park Lakes). These gates will be opened incrementally so that more and more flow is conveyed by the flood channel (up to a maximum of 150m^3/s) whilst flow in the River Thames remains at approximately the threshold value (~230m^3/s). If flow down the River Thames is such that the capacity of the flood channel would be exceeded (for example, during a flood event greater than a 1 in 100 flood (one per cent chance of happening in any given year)), the flow control structures will throttle flow to ensure the channel does not overtop its banks. From this point, increased flows in the River Thames will cause flooding in a mechanism similar to the existing scenario. Reduced flows at the end of a flood will see the flow control structures gradually close in a reverse manner to how they were opened.

4.3.1.3 In non-flood conditions, the flood channel will always contain groundwater due to the presence of water level control structures.

4.3.1.4 The Abbey Meads area is the exception, which will be a predominantly dry floodway with the existing levels lowered and profiled to provide a damp to wet summer grazing area.

4.3.1.5 For the most part, the water level control structures on the flood channel route will be fixed weirs (see Plate 4-5 above). The weirs are necessary to ensure that the existing lakes (which the flood channel flows through) and the adjacent land (where the groundwater is typically only 1 to 2m below ground level) are not drained below their existing levels. The augmented flow of up to 1.5 m^3/s will be allowed to pass down the flood channel in non-flood conditions (normal and low flows).

4.3.1.6 The flood channel will also be used to manage flood flows in the Chertsey Bourne. A formalised overspill from the Chertsey Bourne will allow high flows to spill into St Ann's Lake (structure FCS8 as detailed in Section 4.1.3) (this formalises a situation that already occurs). The pressure of the rising water level in St Ann's Lake will open a new flap gate between St Ann's and Abbey Lakes (structure FCS7 as detailed in Section 4.1.3). Some flows will be diverted back from St Ann's Lake to the Chertsey Bourne (structure FCS9 as detailed in Section 4.1.3). In this way, some of the Chertsey Bourne flood flows will be directed towards, and conveyed through, the downstream end of the Runnymede Channel to the River Thames to alleviate flooding in Chertsey.

4.3.1.7 The bed lowering of the River Thames downstream of Desborough Cut will allow more flow to pass through this section of the river. The additional gates on the three River Thames weirs downstream of the flood channel will add flow capacity by opening incrementally once all the existing weir gates have been opened fully.

4.3.1.8 The capacity improvements will balance out any detriment in downstream flood levels that would otherwise have been caused by the flood channel alone. Therefore, the net effect will mean that there is no increase in flood levels in the River Thames downstream of Shepperton Weir during use of the flood channel in times of flood.

4.3.1.9 The Environment Agency are also exploring opportunities with Thames Water to adjust the timing of their abstractions to existing storage reservoirs during large flood events so that the highest rate of abstraction coincides with the flood peak. This would be undertaken in accordance with an agreed protocol between the Environment Agency and Thames Water. There is potential for the abstraction regime to be altered at Datchet (which primarily supplies the Queen Mother and Wraysbury Reservoirs), Laleham (which primarily supplies the Queen Mary Reservoir) and Walton (which primarily supplies the Queen Elizabeth II Reservoir).

Changes to the abstraction regime would help to achieve additional benefit by reducing the peak flows and river water levels downstream of the abstraction points and downstream of the flood channel during large floods.

4.3.2 Maintenance

4.3.2.1 Maintenance requirements for the flood channel will consist of vegetation maintenance (trimming, replacement, coppicing trees etc.), removing debris, inspecting the channel banks and structures and maintenance of mechanical gate parts.

4.3.2.2 Maintenance of Sunbury, Molesey and Teddington Weirs and any other landscape design or green infrastructure aspects of the project (including new green open spaces, HCAs and active travel provision) will be maintained in accordance with operational requirements and other regimes agreed with project partners and developed as part of the DCO application (or subject to a DCO requirement to do so).

4.3.2.3 Two forms of maintenance will be required for new green open spaces, HCAs and active travel provision.

4.3.2.4 An approximate two-year establishment maintenance period will generally include:

- Watering;
- De-weeding;
- Removing rubbish;
- Pruning of trees to ensure clear trunk;
- Pruning of trees and shrubs as required to maintain visibility into new green open spaces and active travel routes;
- Deadwooding;
- Mowing;
- Removing graffiti;
- Topping up protective coatings of furniture and fixings;

- Upkeep/ replacing any furniture or fixtures to ensure they are up to standard and functional;
- Maintaining pavement surfaces to be hazard free;
- Re-mulching planting areas;
- Monitoring habitats to ensure the preferred habitat develops; and
- Replacing dead plants and removing undesirable plants.

4.3.2.5 Beyond the two-year establishment period, longer term maintenance will be required that will include the above establishment activities plus potentially the following:

- Grazing of grasslands/ wildflower meadows; and
- Mowing of select amenity grassland (such as around potential visitor centres and along active travel routes).

4.3.2.6 Bathymetric surveys will be undertaken periodically to detect any changes in siltation and erosion over time. Work to reinstate the design profile may be needed to maintain the design capacity of the flood channel and bed lowering downstream of Desborough Cut.

4.3.2.7 Permanent site compounds will be sited at the three gated flow control structures on the flood channel as shown in Figure 4-1 in Appendix A and detailed in Section 4.1.3.The permanent site compounds will primarily serve as an area to operate and maintain the gates of the flow control structures at the intakes. A similar compound with the same function as those next to the intake structures will also be located adjacent to the flow control structure (FCS 10 on Figure 4-1 in Appendix A) on the Runnymede Channel just downstream of Thorpe Park lakes. Other small permanent compounds may be required along the flood channel.

4.3.2.8 Access tracks along the flood channel will facilitate access to the various flow and water level control structures as well as the flood channel itself for maintenance purposes.

4.3.2.9 A preliminary Public Safety Risk Assessment (PSRA) has been prepared for an earlier iteration of the project design. This will be further developed during the detailed design stage and before construction. The PSRA will be reviewed by the responsible party on completion of construction and after every five years, with safety inspections every year in between. The

PSRA will give consideration, for example, to emergency egress points for anyone who might fall into the channel (e.g. a formalised exit point and/or grab chains) and access for emergency vehicles to deal with such situations. The PSRA will also consider the installation of handrails at maintenance sites and strategic provision of life buoys, throw lines and warning signage.

4.4 Decommissioning

4.4.1.1 The need for the project is likely to increase over time and therefore it is unlikely that a point in time will be reached when the project is no longer required. Due to climate change it is highly likely that to maintain operation of the project beyond 100 years at the required level of flood risk reduction, changes to its capacity or operation may be required. In the unlikely event that the project is no longer required it is not anticipated that the RTS would be decommissioned (i.e. removed). It is more likely that the flood channel and its associated features would be left in-situ and its operational regime modified as needed. Similarly, there are no plans to decommission the landscape and green infrastructure opportunities, HCAs, improved fish passage or environmental mitigation being incorporated to the project.

4.4.1.2 Future changes to the design or operation of the RTS would need to be developed, assessed and implemented and would therefore likely form the basis of another project. Any such development may be subject to an EIA as this project has been.

4.4.1.3 Effects associated with decommissioning of the project are therefore scoped out of the EIA.

4.5 Alternative Options Considered

4.5.1 History of the Project

4.5.1.1 From a flood risk management perspective, the RTS will deliver the recommendations set out in the LTFRMS, which was finalised after consultation with other public bodies, businesses and residents in 2009. The strategy was approved by the Environment Agency board in 2010 and accepted by Defra in 2011.

4.5.1.2 The LTFRMS considered options to reduce flood risk. Investigations into technical feasibility, economic viability and environmental acceptability of different flood risk management approaches were undertaken, and the LTFRMS was the subject of a Strategic Environmental Assessment (SEA) (Environment Agency, 2009a). The LTFRMS concluded that the preferred approach to flood risk management is to improve conveyance and reduce flood risk through construction of a flood channel and capacity improvements in the River Thames downstream of the new flood channel.

4.5.1.3 This channel was to be made up of three sections; the Runnymede Channel, the Spelthorne Channel and a third channel in Berkshire. The channel in Berkshire is not being brought forward as part of the scope of the project, as funding is not available at this time.

4.5.1.4 Planning and design work on the project have been ongoing since 2015, including consultation with the public. During that time an initial design for the RTS has been developed from the recommendations set out in the LTFRMS, that considers economic, environmental, community, technical and landowner factors.

4.5.1.5 There have also been important changes to the design in that time, where alternatives have been considered and choices have been made to lead to the design that is presented in this Scoping Report. These are discussed below.

4.5.2 Strategic Alternatives for Managing Flood Risk considered in the LTFRMS

4.5.2.1 The ‘LTFRMS – Strategy Appraisal Report’ (Environment Agency, 2010a) outlines the strategic alternatives considered and the corresponding long list of options which informed the decision-making process for the preferred strategy.

4.5.2.2 The strategic alternative approaches to flood risk management considered during the preliminary stages of the LTFRMS study included:

- A ‘Do nothing’ scenario;
- A ‘Do minimum’ scenario (maintain assets but do not replace as they fail);
- Asset replacement (maintain and replace assets as they fail);
- Reach based structural options (including riverbed re-profiling, flood diversion channels, improvements to existing structures and riverbank works);

- Catchment wide options (storage, land use planning and use of the Thames Barrier);
- Non-structural options (development of flood plain management tools to improve land use planning, development control, emergency response, flood warning and public awareness); and
- Community-based options (local defence schemes and individual property protection).

4.5.2.3 During the preliminary stages of the LTFRMS study, the broad approaches to flood risk management were developed into a long list of over 50 options. This long list of options underwent varying degrees of evaluation. The process included screening against SEA objectives; technical, hydraulic and economic analysis; and internal and external consultation.

4.5.2.4 The LTFRMS concluded that the preferred approach to flood risk management is to improve conveyance and reduce flood risk through construction of a flood channel and capacity improvements in the River Thames downstream of the new flood channel. The Strategy preferred option comprised the following:

- Non-structural flood plain management elements including development of Floodplain Management tools; to enable intensified public awareness programmes, intensified flood warning/emergency response planning, intensified land use planning/development control, and conjunctive planning for fluvial flooding and surface water drainage;
- Community based measures such as defences to groups of properties; comprising fixed, temporary and demountable defences targeted at over 500 of the most vulnerable properties and individual property protection targeted at over 1000 of the most vulnerable properties;
- Three flood diversion channels (Datchet to Shepperton), and landscaping, environmental mitigation and compensation works;
- Compensation/betterment works including widening of Desborough Cut by 3-4m and increased capacity at Sunbury, Molesey and Teddington Weirs (new gates); and
- Additional surveys and studies to support the preferred option.

4.5.2.5 Further details on the alternative options considered at this stage, and the reasons for selecting the preferred project design taken forward for the Strategy can be found in the 'LTFRMS– Strategy Appraisal Report' (Environment Agency, 2010a).

4.5.2.6 Schedule 4 of the EIA Regulations require developers to outline how chosen options have been selected and the reasonable alternatives considered. Further detail regarding the strategic alternatives considered will therefore be presented within the PEIR and ES.

4.5.3 Alternative Options Considered as Part of Design Development Post LTFRMS

4.5.3.1 As part of the project development, the design has followed an iterative design process to identify ways to improve it. The process of iterative design has included considering the technical and economic feasibility, the potential environmental effects and the opinions of landowners and stakeholders. The process also included ensuring statutory responsibilities were included, such as compliance with the WFD and Habitats Regulations.

4.5.3.2 A deliberative stakeholder engagement process has been undertaken as part of the design development. Stakeholder opinions have been sought on areas of uncertainty and where multiple options have been identified.

4.5.3.3 Five specific areas of uncertainty were identified by the LTFRMS for further investigation including:

- The channel alignment at Thorpe Hay Meadow SSSI;
- Assessing the need for a formalised flood control structure between Chertsey Bourne and St Ann's Lake;
- The downstream section of Channel Section 2 (now referred to as the Runnymede Channel);
- Whether the flood channel should have an augmented flow; and
- The outlet of Channel Section 3 (now referred to as the Spelthorne Channel).

4.5.3.4 Additional design developments were investigated as either option appraisals or further investigation:

- Capacity improvements at Desborough Cut;
- Hybrid option to improve capacity at downstream weirs;
- Realignment avoiding Abbey 1 Lake on the Runnymede Channel;
- Spelthorne Channel alternative route (M3 Bridge);
- Abbey Meads Floodway on the Runnymede Channel;
- Littleton East Lake separation bund;
- Sunbury Weir capacity improvements;
- Molesey Weir capacity improvements; and
- Teddington Weir capacity improvements.

4.5.3.5 A summary of the reasonable alternative options that were considered to address these areas of uncertainty are detailed below, together with details as to why the preferred option was carried forwards, and alternative options were discounted. Further detail of the alternatives considered will be provided within the PEIR/ES including commentary on the environmental effects, technical feasibility and overall objectives of the project.

Channel alignment at Thorpe Hay Meadow SSSI

4.5.3.6 The Strategy proposed that the flood channel would pass through the south eastern corner of Thorpe Hay Meadow SSSI and result in the loss of one dwelling. Seven options for the alignment and construction of the channel were considered, including the original strategy option. The preferred alignment option selected will physically avoid the SSSI and the assessment has shown that the groundwater conditions in the meadow will also not be affected (see Appendix B; Section 1.1). The inclusion of an access and maintenance track along the northern side of the flood channel in this location will also provide access to the SSSI which will help to improve the management of the meadow (which is currently limited due to access issues). Both options would still affect dwellings. The preferred option was selected to avoid the SSSI following engagement with NE, and to minimise the direct loss of residential buildings, which was raised as a concern during the Surrey Discussion Group workshop in 2016 (an engagement exercise with key stakeholders including local community representatives, local authorities, water companies, landowners and other interest groups – see Chapter 20: Stakeholder Engagement for further information).

Chertsey Bourne Spill Arrangement

4.5.3.7 The Strategy proposed that on the Runnymede Channel a gate between Abbey and St Ann's lakes would be fitted, to allow control of water movement between them (see Appendix B; Section 1.2). As a result of a review of flood risk, water quality and recreation, the Strategy design was varied. The preferred option includes the construction of three hydraulic control structures (structures FCS7, FCS8 and FCS9, detailed in Section 4.1.3) which will allow the flood channel capacity to be used for conveying Chertsey Bourne flood flows, whilst also not allowing any flows from the flood channel to reach St Ann's Lake to prevent nutrient-rich River Thames water reaching St Ann's Lake, which is a water body within the South West London Waterbodies (SWLW) SPA and Ramsar site (see Figure 4-1, Appendix A). This modification in the project design ensures that flood risk is reduced in Chertsey, whilst also minimising the project's effect on the SPA.

Runnymede Channel Downstream (Navigation)

4.5.3.8 The Strategy proposed that the Runnymede Channel would not have the capabilities to allow navigation from Abbey Lake (adjacent to Thorpe Park) downstream to the River Thames. Two alternative navigation options with variants were considered as alternatives to the Strategy non-navigation option. These identified that the navigation options were technically feasible, but at a significantly increased cost to the landowner who wanted to retain ownership of the land. Following discussions with the landowner, navigation options were not progressed further as the landowner felt the maintenance responsibilities and associated costs that they would need to bear were prohibitive (see Appendix B, Section 1.3).

Wet or Dry Channel (Augmented Flow)

4.5.3.9 The Strategy assumed that there would be no augmented flow in the channels. It was subsequently established that in-channel water level control structures are required to maintain water levels within the flood channel, to maintain existing groundwater and lake levels. There is also a legal requirement to provide a suitable flow over the control structures to enable fish passage. It was identified that an augmented flow was necessary to prevent increased nutrient content of the water in the lakes that could lead to frequent and significant growth of phytoplankton.

4.5.3.10 As a result of assessment and discussion with key stakeholders such as the Environment Agency and water companies, an augmented flow of up to 1.5m^3/s is proposed. An integrated groundwater / water quality model, developed specifically for the RTS, is currently being completed to determine if the augmented flow volume is appropriate or whether it needs to be adjusted to mitigate environmental effects, either on lake ecology through nutrient enrichment and ecosystem changes or on water abstractions and habitats in the bypassed reach of the River Thames due to reduced flows in the river, especially during periods of low flow.

Capacity Improvements at Desborough Cut

4.5.3.11 The presence of the flood channel means that floods pass through the study area more quickly because water flows faster in the flood channel than if it enters the floodplain. Consequently, there would be a slight increase in peak flows downstream of the flood channel in some circumstances without additional capacity improvements. As part of measures proposed to mitigate these higher flows downstream, the Strategy proposed that the widening of Desborough Cut would improve the conveyance of water downstream of the flood channel. It proposed widening the Cut from the right bank. There was uncertainty as to whether this approach was the most appropriate considering the effect this option would have on the Thames National Path which runs adjacent to Desborough Cut on the right bank, and on existing habitats and species. Five options including the Strategy proposal were considered including widening, bed lowering, and the creation of a new channel through Desborough Island (see Appendix B; Section 1.4).

4.5.3.12 Due to the effect that the option to widen the right bank would have on the Thames National Path, and as a result of consultation with local residents this option was not considered further. The widening on the left bank was chosen as the preferred option at as part of a previous iteration of the design.

4.5.3.13 During 2019, an assessment of the alternatives for increasing capacity at Desborough Cut was undertaken. The following options were considered:

- Baseline – Widening of Desborough Cut with bed lowering under the bridges over the Cut;
- Option 1 – Widening of Desborough Cut with bed lowering under the bridges over the Cut;

- Option 2 – Bed lowering throughout the length of Desborough Cut; and
- Option 3 – Bed lowering downstream of Desborough Cut.

4.5.3.14 Option 3 was taken forward as the preferred option, due to the fact it has the lowest cost (in terms of both capital cost and whole life cost) and on balance has the least overall impact. The selection of this option avoids the loss of trees and natural bank associated with the left bank widening (Option 1) (see Appendix B; Section 1.4).

Hybrid Option to Improve Capacity at Downstream Weirs

4.5.3.15 In some conditions the new flood channels would lead to higher flows in the River Thames downstream of Shepperton, and therefore measures need to be included in the project to mitigate this effect and avoid any increase in flood levels. The Strategy proposed increasing capacity at Desborough Cut, and improving capacity at Sunbury, Molesey and Teddington Weirs.

4.5.3.16 An alternative option was considered, comprising bed lowering of the River Thames, which would lead to a reduction in the number of new gates required at the three weirs (‘hybrid option’). Two options for each of the three weirs were considered:

- Sufficient upstream bed lowering along the reach to provide the equivalent water level reduction of one of the proposed gates at the downstream weir, so that one gate could be removed from the proposal; and
- Sufficient upstream bed lowering along the reach to provide the equivalent water level reduction of two of the proposed gates at the downstream weir, so that two gates could be removed from the proposal.

4.5.3.17 To achieve a comparable water level reduction to the strategy approach, the hybrid approach was shown to be more expensive in terms of capital and maintenance costs, have a greater environmental impact, and it would create a risk that maintenance could be neglected in the long term if funding were no longer available. The strategy approach to increase capacity at Sunbury, Molesey and Teddington Weirs was therefore taken forward as the preferred option (see Appendix B; Section 1.5).

Runnymede Channel Realignment to avoid Abbey 1 Lake

4.5.3.18 The Strategy alignment passes east from the Thorpe Park Lakes through Abbey 1 lake. It was identified that an alternative alignment to the south, avoiding Abbey 1 lake, offered cost, constructability and environmental benefits (see Appendix B; Section 1.6). Potential benefits include the avoidance of critical infrastructure (a 700mm diameter water main), simplified channel construction, reduced impact on Chertsey Water Treatment Works, and avoidance of Abbey 1 lake (whilst not within the SWLW SPA and Ramsar site, it supports interest features of the site).

Spelthorne Southern Channel Outlet

4.5.3.19 The Strategy alignment for the Spelthorne Channel southern section (through Littleton South Lake) ran adjacent to Dumsey Meadow SSSI, returning to the River Thames at Dumsey Eyot (western option) (see Appendix B; Section 1.7). The alternative route alignment considered in this location was to cross Littleton Lane and enter the River Thames further downstream, further from the Dumsey Meadow SSSI (eastern option). Two channel design options were also considered for this alignment, a ‘sheet piled’ or ‘natural’ flood channel. The preferred option chosen was the western route option, the original Strategy alignment, due to the significant differences in costs as the alternative options considered would require additional road crossings and a longer section of channel would need to be constructed.

4.5.3.20 The Spelthorne Channel southern outlet was later deleted from the project as part of the adopted alternative design for the ‘Spelthorne Channel alternative alignment (M3 Bridge)’ (see paragraph 4.5.3.21 below).

Spelthorne Channel Alternative Route (M3 Bridge)

4.5.3.21 The Strategy alignment for the Spelthorne Channel (previously called Channel Section 3) comprised two sub-sections of channel: Channel Section 3 (South) that bypasses Chertsey Weir and would carry approximately one third of the design flow; and Channel Section 3 (North) that bypasses Chertsey and Shepperton Weirs and would carry approximately two thirds of the design flow. Two alternative options were considered:

- Option 1 – the deletion of Channel Section 3 (South) and utilisation of a second set of existing culverts under the M3; and

- Option 2 – the deletion of Channel Section 3 (South) and provision of a new M3 underbridge.

4.5.3.22 Option 2 was shown to have greater capacity than the existing M3 culverts, reduce traffic disruption by removing the crossing of Chertsey Road Bridge, remove the impact to two lakes that support interest features of the SWLW SPA and Ramsar site (Littleton South and Sheepwalk East) and have a lesser impact on PRoW compared to the Strategy option and Option 1. Option 2 has therefore been selected as the preferred option (see Appendix B; Section 1.8).

Littleton East Lake Separation Bund

4.5.3.23 A separation bund in Littleton East Lake (Spelthorne Channel) was introduced in the later stages of the Strategy studies because of the perceived risk of adversely affecting water quality in the lake (that supports interest features of the SWLW SPA and Ramsar site) through the more frequent admission of (higher nutrient) River Thames water. Groundwater and surface water quality modelling to assess the project’s effect on water quality was undertaken. The results showed an acceptably low risk of adversely impacting on water quality in the Littleton East without a separation embankment. This would also minimise the environmental impact of land take in the lake. Hydraulic modelling of the alternative alignment for the Spelthorne Channel showed that the alignment no longer requires the separation embankment to operate as a form of flood defence. Consultation with key users of the lake also concluded that the removal of the separation embankment was beneficial to the sailing club as the useable sailing area will no longer be constrained by the bund (see Appendix B; Section 1.9).

Abbey Meads Floodway on the Runnymede Channel

4.5.3.24 The strategy proposed a straight section of channel through Abbey Meads, adjacent to the M3 (see Appendix B; Section 1.10). During the stakeholder engagement process, this section was identified as a popular location for habitat creation or enhancement (see Appendix B; Section 1.10).

4.5.3.25 During design development, it became apparent that a wide shallow, normally dry channel offered several advantages over a narrow deep, normally wet channel, including significantly reduced potential construction and operational impact on water quality at the adjacent Chertsey WTW wellfield; maintaining access to all operational observation boreholes (Affinity Water); no impact on the aquifer and nearby groundwater abstraction (Affinity Water); and greater opportunities for environmental improvement and increased biodiversity.

4.5.3.26 The fixed weir structure (FCS12; see Appendix A, Figure 4-1) at the east end of Abbey 2 Lake only allows flows to pass into the floodway when the flood channel is activated during a flood event. For the remainder of the time the flood channel carries a small, augmented flow. At the west end of Abbey 2 Lake the flood channel intersects the course of the Abbey River (a tributary of the River Thames). The Abbey River will be allowed to flow into, across and then out of the flood channel in order to maintain the local regime in the Abbey River as close as possible to existing conditions. When the augmented flow reaches the intersection point it then flows down the Abbey River, eventually returning to the River Thames.

4.5.3.27 The alternative design has no impact on hydraulic performance of the flood channel and hence this alternative design was preferred. This Abbey Meads Floodway landscape and ecological concept design was presented to the discussion group workshop and feedback was generally positive, especially with regards to the biodiversity and habitat gain.

Sunbury Weir Capacity Improvements

4.5.3.28 The Strategy proposed that the capacity improvements at Sunbury Weir would be achieved by constructing three new gates at the end of the lock cut. These gates would be constructed on Sunbury Lock Ait; there would be no changes made to any of the existing weirs. Six options were considered for locating the additional three gates (see Appendix B; Section 1.11). Three of them did not provide sufficient capacity to eliminate the increased downstream flood risk from the flood channel and two would affect existing land uses. Therefore, Option 4: three gates, diagonally through the downstream end of Sunbury Lock Ait, adjacent to the footbridge, has been selected as the preferred option.

4.5.3.29 The different options for the capacity improvements at Sunbury Weir were presented at public drop-ins and discussed with The Middle Thames Yacht club that lease a part of the island owned by the Environment Agency. Stakeholder feedback showed a clear preference towards the ‘preferred option’ and there was a consensus view that there should not be a canopy at Sunbury.

Molesey Weir Capacity Improvements

4.5.3.30 The Strategy proposed that the capacity improvements at Molesey Weir would be achieved by replacing a section of the overfall weir (weir A) with four large gates. Six options were considered for providing the additional capacity (see Appendix B; Section 1.12), they included the provision of five, three or two new standard width gates, depending on location. The appraisal identified that the options at weir C were more hydraulically efficient than elsewhere and so fewer gates were required.

4.5.3.31 The different options for the capacity improvements at Molesey Weir were presented at public drop-ins. Stakeholder feedback showed a clear preference towards the ‘preferred options’ and there was a consensus view that there should be a canopy at Molesey so that it replicates the appearance of similar local structures, minimising any visual effects.

Teddington Weir Capacity Improvements

4.5.3.32 The Strategy proposed that capacity improvements at Teddington Weir would be achieved by replacing a section of the overfall weir (weir R), adjacent to the upstream end of the Lock Ait, with three large gates. Six options were considered for providing the additional capacity (see Appendix B; Section 1.13), some of which depended on the construction of a proposed Hydro-Electricity Plant on the left bank. The appraisal identified that the options on the existing weirs did not provide sufficient capacity to eliminate the increased downstream flood risk from the flood channel. Therefore, Option 1 to create a new cut with 5 new standard width gates, through the Teddington Lock Ait, has been selected as the preferred option.

4.5.3.33 The different options for the capacity improvements at Teddington Weir were presented at public drop-ins. Stakeholder feedback showed a clear preference towards the ‘preferred options’ and there was a consensus view that there should not be a canopy at Teddington.

5 Approach to EIA Scoping

5.1 Introduction

5.1.1.1 This Chapter presents the key themes of EIA scoping that have been used to inform the production of this EIA Scoping Report. An overview is provided as to how the following have been defined and assessed:

- The current and future baseline;
- The spatial and temporal scope of potential effects;
- Likely significant effects;
- Different types of mitigation;
- Cumulative, intra-project and in-combination effects;
- Transboundary effects; and
- Vulnerability of the project to major accidents and disasters.

5.2 Establishing Baseline Conditions

5.2.1.1 An understanding of the baseline environment without the project is necessary in order to assess the potential effects of the project on environmental receptors and identify the potential for likely significant effects.

5.2.1.2 Each environmental topic Chapter has used appropriate data to obtain a comprehensive understanding of the existing baseline conditions, following any topic specific guidance through a combination of desk study, site surveys and consultation with relevant stakeholders. Where surveys have been undertaken, these are outlined within the relevant topic Chapters of this EIA Scoping Report.

5.2.1.3 The EIA Scoping Opinion will further inform the data gathering and survey requirements to inform the detailed assessment that will be presented within the ES.

5.2.1.4 It is also necessary to consider the likely evolution of the baseline environment without the implementation of the project. A ‘future baseline’ has therefore been defined for each environmental topic (Chapters 6-18).

The future baseline may differ from the existing baseline as a result of any changes to and arising from relevant local plans or policies, new legal obligations that may drive change or wider changes to the environment, such as changes in population or climate change, including completed developments and developments under construction.

5.3 Spatial and Temporal Scope

5.3.1 Spatial Scope

5.3.1.1 The spatial extent of this scoping assessment has considered the following aspects of the project:

- The potential physical extent of the proposed works, as defined by the project boundary for EIA scoping;
- The nature of the baseline environment; and
- The manner and extent to which the effects may occur.

5.3.1.2 The project boundary for EIA scoping was developed to reflect the current project design, whilst following PINS Advice Note Nine: 'Rochdale Envelope' (PINS, 2019a), which states that the assessment of likely significant effects should establish relevant parameters for the purposes of that assessment.

5.3.1.3 Design development is ongoing, and therefore parameters "likely to result in the maximum adverse effect (the worst-case scenario)" were developed to address uncertainties. These design parameters are described in Sections 4.1 to 4.3 and summarised on Figure 1-2 in Appendix A. The spatial extent of the project boundary for EIA scoping was defined to encompass the design parameters.

5.3.1.4 Based on the above, each environment topic within this EIA Scoping Report (Chapters 6 to 18) has defined a specific 'study area' or series of 'study areas'; these necessarily differ within and between topics.

5.3.1.5 The design of the project, EIA and consultation is ongoing, hence the study areas for topics may evolve to accommodate new data. Any required changes to the study areas will be addressed and reported within the PEIR and / or ES.

5.3.2 Temporal Scope

5.3.2.1 The temporal scope of the assessment generally refers to the time periods over which impacts may be experienced. This has been established for each topic using professional judgement, topic guidance or, where appropriate, agreed in discussion with the relevant statutory consultees.

5.3.2.2 Two main categories of effects that will be assessed in the EIA are construction effects and operational effects; these are distinguished in the 'Likely Significant Effects Requiring Assessment' sections of Chapters 6 to 18.

5.3.2.3 Potential decommissioning effects of the project are scoped out of the EIA. This is because it is considered unlikely that there will be a time that the project is no longer required (see Section 4.4 for further information).

5.3.2.4 The duration of effects can be classified as either temporary (short, medium or long-term) or permanent. These can be broadly defined as follows:

- Temporary:
  - Short-term: Effect continues during construction and up to one year following construction;
  - Medium-term: Effect continues for one to five years following construction; and
  - Long-term: Effect continues five to ten years following construction.
- Permanent:
  - Due to the subjectivity of human receptors to timeframes, those effects that continue for greater than 10 years following construction can be defined as permanent.

5.3.2.5 For some environmental receptors these general definitions and criteria may not be considered appropriate to the assessment, for example, where guidelines issued by a professional institute are followed e.g. as in the case of GLVIA3 specific guidance on the temporal scope of Landscape and Visual Impact Assessment (LVIA). Where necessary, receptor-specific definitions and criteria will be defined in the appropriate environmental topic Chapters of the PEIR / ES.

5.4 Approach to Identifying Likely Significant Effects

5.4.1 Legislation and guidance

5.4.1.1 Paragraph 5 of Schedule 4 of the EIA Regulations states that an ES must include a “description of the likely significant effects” of the development, which should cover “the direct effects and any indirect, secondary, cumulative, transboundary, short-term, medium-term and long-term, permanent and temporary, positive and negative effects”[1].

5.4.1.2 Project construction activities and phasing will also be considered for additive / combined effects on each environmental topic as an integral part of the assessment of effects on the receptors within that topic.

5.4.1.3 PINS Advice Note Seven (PINS, 2020a) notes that ESs should be “appropriately focussed on aspects and matters where a likely significant effect may occur […] the Planning Inspectorate is keen to ensure that the scoping process is used effectively, ensuring that the EIA process is proportionate”.

5.4.2 Significance Criteria

5.4.2.1 There is no statutory definition of what constitutes a significant effect. For the purposes of this Scoping Report, a significant effect has been defined as an effect which, either in isolation or combination with others, should (in the professional opinion of the competent experts carrying out the EIA) be considered in the EIA. This definition is consistent with other EIA projects.

5.4.2.2 Professional judgement has been applied to which effects are likely to be significant on the basis of information regarding:

- The baseline conditions, and the sensitivity and importance of receptors;
- The magnitude of change, the nature of the change (positive and negative) and characteristics (i.e. whether direct or indirect, secondary,

[1] ‘Positive and negative’ effects are also referred to as ‘beneficial’ and ‘adverse’ effects in this Scoping Report

cumulative, short or long-term, permanent or temporary, reversible or irreversible) will be assessed and classified as high, moderate, low, or negligible. The magnitude of change is its severity or scale. The magnitude of a change on a resource or receptor reflects consideration of information and analysis relating to the spatial extent (localised/isolated versus widespread with potential secondary effects); the extent (type and quantity of receptor affected); and the duration (short, medium or long-term); and

- The potential to avoid or reduce any potential effects such that they are unlikely to be significant through initial proposals for mitigation measures.

5.4.2.3 Where sufficient information exists to inform expert judgement that there will not likely be a significant effect upon an environmental receptor from a particular project activity, the effect has been proposed to be ‘scoped out’ of further assessment. These effects are not taken forward for more detailed consideration in the EIA process.

5.4.2.4 Where sufficient uncertainty remains such that an environmental receptor could not be ‘scoped out’ in relation to the potential for significant effects, then a worst-case scenario has been assumed, and that receptor has been ‘scoped in’ for consideration in the EIA.

5.4.2.5 The methodology for assessing the significance of an effect will vary between environmental factors but will be assessed on the sensitivity (or value / importance) of a receptor, and the magnitude of change from the baseline conditions. The methodology for assessing significance is detailed in each topic Chapter (see Chapters 6 to 18) and will reflect the overarching methodology outlined above.

5.4.3 Approach to Mitigation

5.4.3.1 IEMA (IEMA, 2016) provides guidance on three broad categories of mitigation measures:

- Primary (embedded): Modifications to the location or design of the development made during the pre-application phase that are an inherent part of the project, and do not require additional action to be taken;

- Secondary (additional): Actions that will require further activity in order to achieve the anticipated outcome. These may be imposed as part of the planning consent, or be identified as necessary through the EIA and included in the ES; and

- Tertiary (best practice): Actions that would occur with or without input from the EIA feeding into the design process. These include actions that will be undertaken to meet other existing legislative requirements, or actions that are considered to be standard or best practices used to manage commonly occurring environmental effects.

5.4.3.2 Primary mitigation is described as ‘embedded measures’ in the context of the Scoping Report and the PEIR and ES that will follow. Embedded mitigation relates to opportunities to avoid or reduce significant effects through design that are taken where possible. Subsequent environmental assessment will also be completed taking these measures into account as part of the pre-application to submitting the DCO application. A good example of primary mitigation is the refinement of the design to avoid impact on Thorpe Hay Meadow SSSI. Certain primary mitigation has been included in the project design to date and will be refined as part of the EIA process (see 4.1.9).

5.4.3.3 Secondary mitigation is described as ‘additional mitigation’ in the context of this Scoping Report and the PEIR and ES that will follow. It is mitigation not related to the design but imposed only to reduce a defined environmental effect. A good example of typical secondary mitigation would be provision of a noise insulation scheme to reduce the effects of noise in people’s homes.

5.4.3.4 Tertiary mitigation is described as ‘best practice’ in the context of this Scoping Report and the PEIR and ES that will follow and relates to measures such as recognised means of dust control on construction sites, controlled within an overall Construction Environmental Management Plan (CEMP).

5.4.3.5 Primary and tertiary mitigation are considered to form part of the RTS, and therefore have been considered when determining if a project effect is likely to be significant. Where project effects are not deemed to be significant due to primary and tertiary mitigation being in place, this is detailed within subsection ’effects not requiring assessment’ of each topic (Chapters 6-18). In some instances, despite the provision of tertiary mitigation, the associated effects are still potentially significant (i.e. scoped into the EIA process).

5.4.3.6 Tertiary mitigation is typically expected to be secured through the receipt of relevant consents and permits (or equivalent provision within the DCO application) and may be required to adhere to the contractor’s own Environmental Management System (EMS). Where relevant, the mitigation actions will be documented within the CEMP or other relevant management plans. This will include, for example:

- Implementation of best construction practices for air quality, odour, dust, noise and vibration control measures with consideration of both human and ecological receptors (for example best practicable means as defined by the Control of Pollution Act 1974;
- Avoidance and reduction of disturbance to habitats supporting sensitive species in accordance with the mitigation hierarchy;
- Eradication and control of INNS prior to works through the production of an INNS management Plan. This will include actions such as strict biosecurity measures in accordance with good construction practice;
- Sediment, silt and spill control in accordance with good construction practice and relevant guidance;
- Handling of soils in accordance with good construction practice and relevant guidance (such as BS3882). Practices may include restricting vehicles to delineated routes and keeping them away from river banks; topsoil stripping, storage and replacement; laying of hardcore at construction compounds and material processing sites and; laying of geotextile matting on certain routes to minimise ground compaction;
- The transportation of hazardous material/waste from the major road network to existing appropriately licensed sites, and placement therein. Management of waste arisings will follow the waste hierarchy and Site Waste Management Plan (SWMP);
- Management of surface water run-off through a Construction Surface Water Management Plan. A flood protocol will be put in place to minimise flood risk from stockpiling material in the floodplain. Relevant consents and permits, for example Flood Risk Activity Permits (or

equivalent provision within the DCO application) will be obtained to ensure fluvial flood risk is managed appropriately;

- A PSRA will be completed as part of the design, with mitigation measures included that will identify where existing and future security issues may occur. Measures for construction worker safety and safe working methods will be documented in the contractors own EMS.
- Traffic movements will be controlled or reduced through the use of best practice techniques including the use of excavated material on site, the use of on-site haul roads (where possible) and the preparation of Traffic Management Plans; and
- Stakeholder engagement will ensure that residents, businesses and other members of the public have the opportunity to remain fully informed about the proposed works to ensure disturbance is minimised.

5.4.3.7 Each of the topic Chapters 6 to 18 includes a section entitled ‘Approach to Mitigation’. These sections outline any topic-specific secondary mitigation measures that may be required to address any potential significant adverse effects, and detail how they are expected to be secured (for example, through a CEMP).

5.4.3.8 Mitigation opportunities will continue to be identified during project development and consultation prior to the submission of the DCO application. The EIA process is deliberately iterative, to enable further refinement of the project, with the objective of, in order of preference, avoiding, reducing, abating, repairing or compensating for significant negative environmental effects. This approach is in accordance with the mitigation hierarchy and is enabled in part as a consequence of the assessment methodology whereby embedded mitigation measures aim to avoid or minimise potential effects in the first instance. Mitigation measures will be identified by regularly reviewing the likely significant negative environmental effects identified during the ongoing assessment process.

5.4.3.9 Further detail in relation to mitigation measures and how they might best be secured will develop as the project evolves and will be documented in the ES and other documents submitted with the application.

5.4.3.10 The approach to embedded measures also means that significant effects in the ES will not be presented as an unmitigated and then mitigated scheme as primary mitigation and tertiary mitigation form part of the RTS and will be considered in the assessment. Likely significant effects arising from the RTS (with primary and tertiary mitigation assumed to be in place) will be presented initially. Any further (secondary) mitigation that may be required to address any remaining significant adverse effects will be identified and residual effects assessed with such additional secondary mitigation in place as a second stage of the assessment.

5.4.4 Cumulative Effects

5.4.4.1 The cumulative effects assessment (CEA) will identify and characterise the potential for in-combination (intra) and cumulative (inter) project effects and then assess the significance of these effects.

5.4.4.2 The approach to scoping of potential cumulative effects in line with the approach set out in PINS Advice Note Seventeen is provided in Chapter 19: Cumulative Effects Assessment.

5.4.4.3 Each topic Chapter of the PEIR / ES, where relevant, will also include an 'In-Combination Climate Impact' (ICCI) section in accordance with IEMA guidance (IEMA, 2020d) which covers the requirement to consider a future climate scenario and assess if that has the potential to influence the operational effects. The ICCI is different in scope to the cumulative climate change. This is fully explained in Chapter 8: Climatic Factors.

5.4.5 Transboundary Screening

5.4.5.1 Regulation 32 of the EIA Regulations requires the consideration of any likely significant effects on the environment of another European Economic Area Member State ('EEA States').

5.4.5.2 To assist the SoS a transboundary screening exercise has been carried out following the guidance in PINS Advice Note Twelve, and is provided in Chapter 19: Cumulative Effects Assessment and Appendix C.

5.4.6 Vulnerability of the Project to Major Accidents and Disasters

5.4.6.1 The EIA Regulations 2017 (Schedule 4, Paragraph 8) requires:

"A description of the expected significant adverse effects of the development on the environment deriving from the vulnerability of the

> *development to risks of major accidents and/or disasters which are relevant to the project concerned…"* (Schedule 4, Paragraph 8).

5.4.6.2 The underlying objective is to ensure that appropriate precautionary actions are taken for those developments which:

> "...*because of their vulnerability to major accidents and/or natural disasters (such as flooding, sea level rise, or earthquakes), are likely to have significant adverse effects on the environment*." (Paragraph 15, European Union Directive 2014/52/EU).

5.4.6.3 The EIA Regulations cite two specific directives as examples of risk assessments to be brought within EIA, these are Directive 2012/18/EU of the European Parliament and of the European Council (which deals with major accident hazard registered sites) and Council Directive 2009/71/Euratom (which deals with nuclear sites). Neither of these directives are relevant to the proposed scheme.

5.4.6.4 There is currently limited guidance for the assessment of major accidents and disasters; the following documents have been used to inform the approach taken:

- Major Accidents and Disasters in EIA: A Primer (IEMA, 2020c); and
- Design Manual for Roads and Bridges (DMRB) LA 104 – Environmental Assessment and Monitoring (Highways England, 2020d).

5.4.6.5 The assessment of major accidents and disasters needs to consider both the vulnerability of the project to risk from major accidents and disasters, and the effect of the project as a source of hazard that could result in a major accident and/or disaster. There is no definition within the legislation for what constitutes a major accident or disaster, but both man-made and natural hazards are to be considered.

5.4.6.6 Figure 5-1 below is a flowchart explaining the approach to assessment, is based on the guidance noted above, and consists of the following steps:

- Apply professional judgement to develop project specific definitions of major events;
- Identify major events that are relevant to and could affect the project or could be caused by the project;

- Where major accidents or disasters are identified, describe the potential for any change in the assessed significance of the project on relevant environmental topics in qualitative terms;
- Report the conclusions of this assessment within the individual environmental topics; and
- Clearly describe any assumed mitigation measures, to provide an evidence base to support the conclusions and demonstrate that likely effects have been managed.

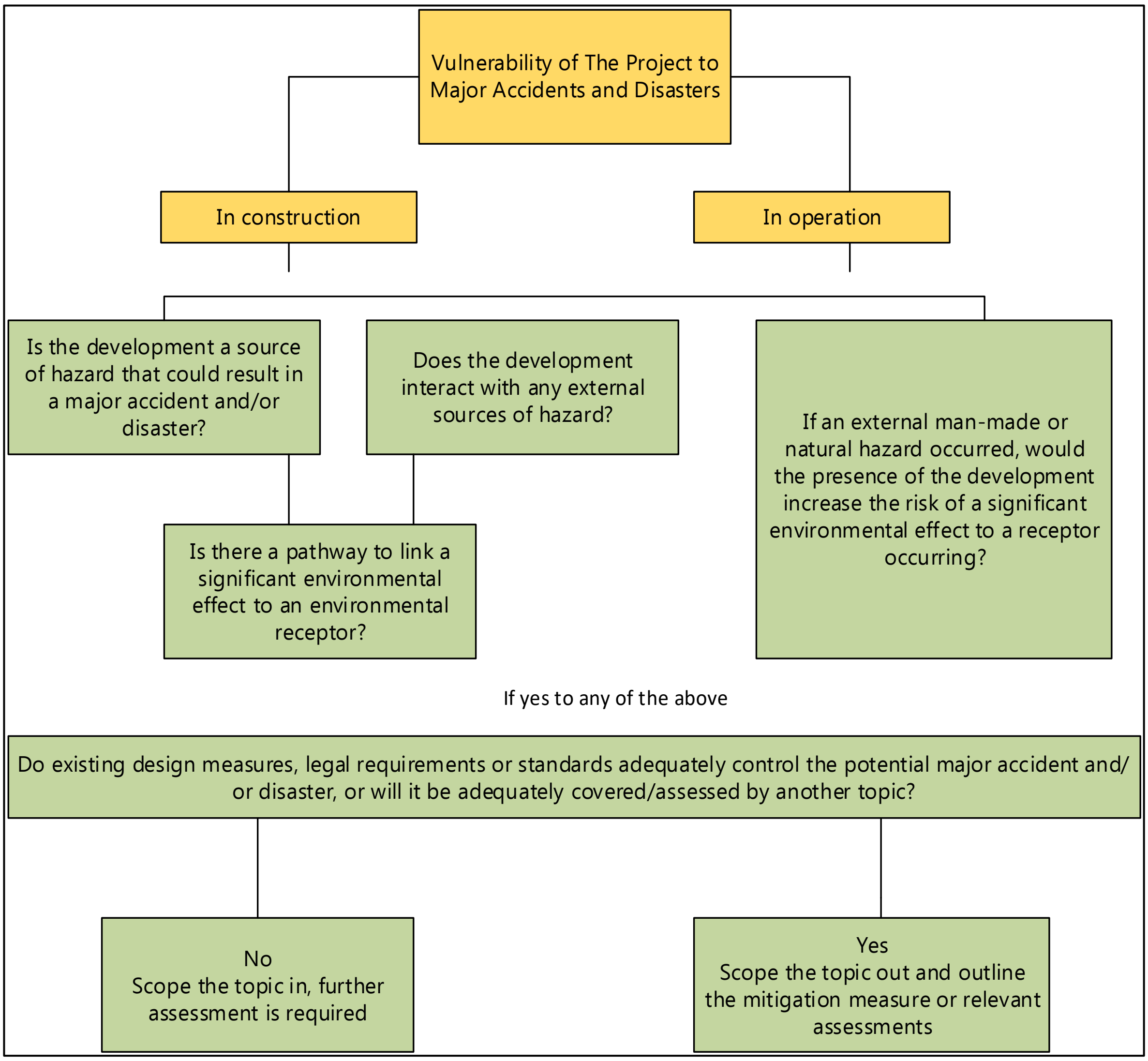

Figure 5-1 - Flowchart summarising the scoping process for Major Accidents and Disasters (modified from IEMA, 2020c).

5.4.6.7 There is a wide range of safety and non-safety-related legislation which in most circumstances sufficiently mitigates and manages vulnerabilities to major accidents and/or disasters, without the need for additional project specific mitigation.

5.4.6.8 To determine the major accidents and disasters appropriate to the RTS a long list has been developed drawing on a variety of sources including the Surrey Community Risk Register (Surrey County Council, 2021). Project specific major accidents and disasters have also been considered. The long list has been reviewed and those major accidents and disasters requiring further consideration have been identified (see Appendix D) for the result of this exercise.

5.4.6.9 Three major accidents and disasters have been identified as requiring further assessment. These are all being considered within topic assessments of the EIA which will be documented within specific Chapters of the ES:

- Climate change (see Chapter 8:Climatic Factors);
- Flooding (see Chapter 10: Flood Risk); and
- Events resulting in human illness or injury (see Chapter 11: Health)

5.4.6.10 No further potential significant adverse effects on the environment resulting from vulnerability of the RTS to major accidents and disasters have been identified. Given that the above listed effects are already being considered as part of the EIA, it is proposed that Major Accidents and Disasters be scoped out of the ES.

5.4.6.11 Furthermore, the aim of the project is to provide flood resilience to people, property and existing infrastructure. In doing so it reduces the vulnerability of human beings (loss of life, illness or injury), infrastructure (transport, sewerage, electricity supply, communications, fresh water) and property (damage, temporary homelessness) to flooding. The beneficial effects associated with these aspects are discussed in Chapter 11: Health, Chapter 15:Socio-Economics and Chapter 17: Traffic and Transport.

6 Air Quality

6.1 Introduction

6.1.1.1 This chapter describes the scope and assessment of air quality aspects. It outlines the baseline status of air quality, the likely effects of the project and the avoidance or mitigation measures proposed to alleviate these. It also outlines the methodology that will be used for the assessment of potential air quality effects arising from the construction and operation of the RTS within the PEIR/ES.

6.1.1.2 The chapter considers potential effects associated with the release of dust, emissions from traffic and construction plant and the release of odour during both the construction and operational phases of the project. Potential effects are considered in respect to receptors including local residents, schools, hospitals and care homes; local businesses; Air Quality Management Areas (AQMAs) and sensitive ecological receptors.

6.1.1.3 The effects of traffic on local air quality will be assessed at sensitive human and ecological receptor locations, with the latter potentially informing the HRA and the EcIA.

6.1.1.4 This chapter should therefore be read in conjunction with Chapter 7: Biodiversity (for potential effects to sensitive ecological receptors), Chapter 11: Health (for potential effects upon the health of human receptors within the study area), Chapter 13: Materials and Waste (for potential effects associated with excavation works and placement of waste), Chapter 15: Socio-Economics, Chapter 16: Soils and Land (for potential effects associated with ground conditions), Chapter 17: Traffic and Transport (for potential construction and operational traffic effects) and Chapter 18: Water Environment (for effects associated with the water environment, including odour).

6.1.1.5 A summary of the key legislation, policy and guidance relevant to air quality is provided in Appendix M.

6.2 Baseline Methodology

6.2.1 Information Sources

6.2.1.1 'Baseline' air quality refers to the concentrations of relevant substances that are already present in ambient air, including from road traffic and industrial sources.

6.2.1.2 As required in the Draft NPS for Water Resources Infrastructure, ambient air quality has been and will be determined as acceptable or unacceptable for the RTS by comparing ambient concentrations of key air pollutants, such as oxides of nitrogen (NOx), nitrogen dioxide (NO_2) and fine particulate matter (PM_{10} and $PM_{2.5}$) to the air quality standards (AQSs) and air quality objectives (AQOs). The AQSs are defined in the Air Quality Standards Regulations 2010 as amended and these are the agreed acceptable concentration levels. The AQOs are derived from the Air Quality (England) Regulations 2000 as amended and set the target date by when exceedances of a standard need to attain an agreed level. The Air Quality Standards Regulations 2010 (as amended) transpose requirements from the European Union (EU) Ambient Air Quality Directive. The Air Quality Standards (AQS) and AQOs which are relevant to this assessment are shown in Table 6-1. Relevance has been determined based both on the likelihood that the RTS would contribute to an AQO or AQS being breached; and the concentrations of a pollutant which may be expected in ambient air without the RTS.

Table 6-1: Air quality standards to be applied for this assessment.

Pollutant	Limit value	Measured as	Receptors to which AQO or AQS applies[2]
Oxides of nitrogen (NOx)	30 µg/m^3	Annual mean	Ecological receptors
Nitrogen dioxide (NO_2)	200 µg/m^3, not to be exceeded more than 18 times per year	One-hour mean	Anywhere where a member of the public may spend one hour or longer

[2] These definitions are indicative only, taken from the Local Air Quality Management Technical Guidance 2022 (Defra, 2022) ('TG22').

Pollutant	Limit value	Measured as	Receptors to which AQO or AQS applies[2]
	40 µg/m³	Annual mean	Human residences, schools and hospitals
Particles (PM_{10})	50 µg/m³, not to be exceeded more than 35 times per year	24-hour mean	Human residences, schools and hospitals and private gardens
	40 µg/m³	Annual mean	Human residences, schools and hospitals
Particles ($PM_{2.5}$)	20 µg/m³	Annual mean	Human residences, schools and hospitals

6.2.1.3 Three desk-based sources of information have been reviewed:

- To obtain information to support the assessment of vehicle emissions from the RTS on air quality within the study area (as defined below); and
- To determine the baseline contribution of particulate matter (as PM_{10} and $PM_{2.5}$) to which dust generated from construction related activities will contribute.

6.2.1.4 Firstly, the United Kingdom Air Information Resource (UK-AIR) interactive map of AQMAs (2022a) has been used to determine whether part or all of the project is located within an AQMA. AQMAs are areas where local authorities know or anticipate that an air quality objective has been or will be breached; and therefore delineate areas where air quality may be unacceptable. Secondly, the estimated (mapped) pollutant concentrations from the Defra background maps have been sourced from the UK Air Information Resource website (UK-AIR, 2022b) to determine background concentrations across the study area. Thirdly, baseline air quality monitoring undertaken by Local Authorities has been sourced from their latest Air Quality Annual Status Reports (ASR), as follows:

- EBC, 2021. *2021 Air Quality Annual Status Report;*
- LBRUT, 2021. *London Borough of Richmond upon Thames Air Quality ASR for 2020;*

- RBKUT, 2021. *RBKUT Air Quality ASR for 2020;*
- RBWM, 2021b. *2021 Air Quality ASR;*
- RBC, 2022a. *2021 Air Quality ASR 2020;*
- Slough Borough Council, 2020. *2020 Air Quality ASR*; and
- SBC, 2021. *2021 Air Quality ASR.*

6.2.1.5 In addition to the above, the Air Pollution Information System (APIS) (APIS, 2022) website will be used to obtain background rates of nitrogen deposition which identifies the rate at which nitrogen is deposited with potential to lead to eutrophication. It will also be used to obtain nitrogen critical loads, following final selection of the habitats to be considered within the study area (critical loads are defined in Section 6.7.1.34).

6.2.1.6 As alluded to above, a desk-based assessment (DBA) has been undertaken to determine existing air quality conditions across the five LPA areas covered by the RTS, as well as the neighbouring jurisdictions of the RBWM and Slough Borough Council where it is initially envisaged some traffic attributable to the RTS may depart from or travel to. The assessment uses existing LPA baseline monitoring data; a map of AQMAs and estimated pollutant concentrations from Defra, to characterise the baseline across these seven LPA areas where air quality effects (regarding vehicle emissions on both human health and ecosystems) are most likely to arise.

6.2.1.7 Additional monitoring for NO_2 using diffusion tubes may be undertaken to inform the EIA where there are no reasonably representative monitoring sites maintained by LPAs within the vehicle emissions study area. This monitoring may be required to inform the dispersion modelling assessment proposed (see below). Any data collected would be adjusted for seasonality (annualisation) and bias in accordance with TG22 and a monitoring methodology agreed with the relevant LPA EHOs.

6.2.1.8 Due to the effect of Covid-19 lockdowns on traffic and consequently air pollutant concentrations during 2020 and 2021, air quality for these years is expected to be unusually good. Hence 2019 concentrations have been used to represent reasonable worst-case ambient air quality for 2022.

6.2.1.9 In relation to data, dust and odour by their nature are to be addressed in accordance with best practice. Dust is typically assessed to determine the potential effects on amenity i.e. the potential to lead to complaints. Dust monitoring (other than for finer fractions - PM_{10} and $PM_{2.5}$) is not routinely undertaken by local authorities, neither is it required for potentially dusty construction sites (it is through management that it is addressed). Background dust monitoring is not proposed to be undertaken for this assessment and this is standard. This is because it is the loss of amenity that determines the need for assessment and the loss of amenity from dust attributable to background sources such as vegetation, disturbance of dusty ground and industry is widespread (in the absence of mitigation) and varies substantially with time and space and is only identified when a receptor makes a complaint.

6.2.1.10 Similar to dust deposition rates, odour levels are not routinely monitored in the UK. According to the Institute of Air Quality Management (IAQM) Odour guidance, the potential for odour to affect amenity is principally governed by the following five factors, which should each be considered when determining the potential for an overall effect on odour:

- Frequency;
- Intensity;
- Duration;
- Offensiveness; and
- Location, such as in relation to surrounding residences and other sensitive receptors.

6.2.1.11 However, LPAs and the Environment Agency hold a log of complaints made under the Environmental Protection Act 1990 relating to sources of odour and other emissions to air and whether or not they were substantiated as a statutory nuisance. This information provides a snapshot regarding historical temporary and permanent baseline sources of odour and dust. A complete series of complaints logs from all LPAs and the Environment Agency were not made available at the time of writing although will be considered within the PEIR and the ES if available.

6.2.2 Stakeholder Engagement

6.2.2.1 Feedback received from consultation on EIA Scoping and draft assessment methodologies

6.2.2.2 Surrey County Council previously provided informal feedback in their capacity as a regulator on the detailed assessment method which was submitted to accompany the project as designed during 2018. The feedback included the following comment:

6.2.2.3 “For the assessment of the risk of dust impacts during construction, the County Planning Authority would expect the proponent to follow the methodology set out in the IAQM publication ‘Guidance on the assessment of dust from demolition & construction’ (2014). For the assessment of the risk of dust impacts arising from the processing of as raised materials, the County Planning Authority would expect the proponent to follow the methodology set out in the 2016 IAQM publication ‘Guidance on the Assessment of Minerals Dust Impacts for Planning’ (2016, v.1.1)’ (‘the IAQM 2016 guidance’).”

6.2.2.4 The IAQM 2016 guidance (to which Surrey County Council refer) “applies to the operational phases of minerals developments.” It advises that “whilst these (and some waste) sites share some common features with construction activities, minerals sites can be on a significantly larger scale.”

6.2.2.5 While the MMS has not been finalised, no minerals are proposed to be extracted once the site becomes operational. The current assumption is that some materials excavated during construction (such as gravels) will be extracted and destined for the local minerals market, with the remainder being restored following completion.

6.2.2.6 Considering the IAQM 2016 guidance “has drawn on certain elements of the [IAQM 2014] guidance” and “the underlying source-pathway-receptor concept is applicable to a wide range of applications”, it is instead proposed to use the IAQM 2014 guidance to assess all excavation activities, regardless of whether materials are destined for sale or storage and reuse.

6.2.2.7 In relation to odour generated from construction related activities, Surrey County Council also commented that “the IAQM guidance provides a multi-tool approach, each tool having a differing level of detail and sophistication. The proponent would need to decide on the most appropriate tool(s) depending on the likelihood of impact”.

6.2.2.8 The tools available to complete an odour assessment include detailed dispersion modelling, odour sniff tests, and qualitative assessment.

Considering odours attributable to the RTS are diffuse (associated with excavation activities or fish decay following specific rainfall or flood events), difficult to quantify accurately (considering the intensity of some odours generated during excavation activities may be masked or changed by water in any existing lakes) and potentially transient, dispersion modelling is not considered an appropriate tool. Sniff testing is also inappropriate as this relies upon the source of odour existing in baseline conditions, whereas much of the odour attributable to the RTS will only be identified as excavation work progresses or (in relation to fish decay) following specific rainfall or flood events. Consequently, this assessment has qualitatively assessed odour, in accordance with the IAQM Odour guidance.

6.2.2.9 To address other comments raised:

- The waste processing facilities will be considered within the assessment of dust and odour. Vehicle movements to and from the facilities will be accounted for within the dispersion modelling assessment to assess air quality effects from the RTS;
- The construction dust assessment will consider PM_{10} concentrations which are applicable within different parts of the dust study area;
- Different air quality study areas have been or will be defined for each element of assessment (dust, odour and road traffic). The features which have been included within each air quality study area are defined as far as possible; and
- The guidance documents and policies listed will be complied with and are listed above.

6.2.2.10 Feedback received from pre-application consultation under the Town and Country Planning Act.

6.2.2.11 No relevant feedback was provided from pre-application consultations which took place to consult on the previous RTS design iteration.

Other topic specific engagement

6.2.2.12 In pre-scoping consultation feedback prior to the 2017 application, SBC indicated that they would like to discuss the extent of any air quality monitoring network proposed, acknowledging that this would be determined once the dispersion modelling assessment study area is defined.

6.2.2.13 SBC also stated that the study area should include triggering the screening criteria in the Environmental Protection United Kingdom (EPUK)-IAQM guidance regarding when an air quality assessment is required, considering construction phase effects. This has been accounted for in defining the criteria which will be used to select the Affected Road Network (ARN). Once the ARN is defined, it will be possible to identify the air quality monitoring locations which will be used to verify the dispersion model and therefore whether the requirement exists to undertake additional air quality monitoring.

6.2.2.14 SBC indicated a requirement to consider ecological receptors. The ecological receptors will be selected following identification of the ARN and a consideration of receptor sensitivity.

6.2.2.15 The detailed dispersion modelling methodology accords with the comments which have been raised by SBC and uses traffic data provided by the traffic and transport team, which considers cumulative development.

6.2.2.16 The landfill gas assessment has been covered in Chapter 16: Soils and Land.

6.2.2.17 Following consultation for this Scoping Report, LBRUT and EBC have each provided their latest air quality Annual Status Reports containing air quality monitoring data, which have been used in the DBA. No response had been received from RBKUT or RBC at the time of writing.

6.2.2.18 The Environment Agency (in their capacity as a statutory consultee), SBC, EBC, LBRUT, RBKUT and RBC have each also been contacted to request their odour complaints history and list of Part A(2) and B sites regulated under the Environmental Permitting Regulations 2010 (as amended). This information should inform the odour baseline. A full response was provided by RBC, SBC and EBC. Correspondence is ongoing with the remaining local authorities and the Environment Agency.

6.2.3 Study Area

6.2.3.1 Different study areas will be adopted for each potential air quality effect outlined in Section 6.1.1.1. These have been defined in the following subsections.

Assessment of dust from construction related activities

6.2.3.2 The air quality – dust study area for EIA scoping has been informed by the screening criteria for determining when a dust assessment is required cited in the IAQM 2014 guidance. Beyond these distances, impacts can be screened out. The activities for which an assessment is required are defined in Section 6.4.

6.2.3.3 The IAQM 2014 guidance states that an assessment should be carried out for all sites where there is a human receptor[3] within:

- 350m of any particular boundary of the relevant project site; or
- 50m of the route(s) used by construction vehicles on the public highway or haul routes, up to 500m from entrance(s) from each relevant specific project worksite.

6.2.3.4 An assessment should also be carried out for all individual work sites where there is an ecological receptor[4] within:

- 50m of the boundary of the relevant RTS worksite; or
- 50m of the route(s) used by construction vehicles on the public highway, up to 500m from entrance(s) from each relevant project worksite.

6.2.3.5 These distances are based on the exponential decline in both airborne concentrations and the rate of deposition with distance from the source.

6.2.3.6 The air quality – dust study area for EIA scoping will be 600m around the project boundary for EIA Scoping. This will encompass all areas within 350m of each worksite, accounting for impacts from demolition, earthworks, materials processing and construction. It will also consider

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[3] The IAQM 2014 guidance states that human receptors include locations where people spend time and where property may be impacted by dust.
[4] Ecological receptors are assumed to include European Sites, SSSIs, Ancient Woodlands, National Nature Reserves (NNRs) and Local Nature Reserves (LNRs). They may also include Local Wildlife Sites (LWSs).

dust generated from trackout in connection with construction related activities as the 600m study area will include receptors up to 50m from the edge of roads along which construction traffic is expected to travel within a maximum of 500m from the exit of each worksite. If all receptors within 50m of roads up to 500m from the exit of each worksite are considered (the precise locations of worksite exits will be provided following ongoing development of the MMS) it is necessary to consider the potential for dust impacts at least 550m around the project boundary for EIA scoping. An additional 50m was therefore added to the air quality – dust study area for EIA scoping as a contingency. These distances were based on the screening distances regarding when a construction dust assessment should be undertaken from the IAQM 2014 guidance, as cited above.

6.2.3.7 The indicative air quality – dust study area for EIA Scoping is presented in Figure 6-1 in Appendix A. The exact extents (and consequently receptors to be considered) will be refined as part of the EIA and design process and consultation responses. The extents will be justified in the ES.

Assessment of odour

6.2.3.8 The indicative air quality – odour study areas for EIA Scoping is presented in Figure 6-1 in Appendix A. The exact extents (and consequently receptors to be considered) will be refined as part of the EIA and design process and consultation responses. The extents will be justified in the ES.

6.2.3.9 The qualitative construction phase odour assessment is likely to consider receptors within approximately one km of the boundary of any areas in which excavation will take place; the Spelthorne and Runnymede Channels and the materials processing areas. Receptors considered will predominantly be of medium or high sensitivity, ignoring low sensitivity receptors. Receptor sensitivity has been defined in Section 6.7.

6.2.3.10 It is initially assumed that the operational odour study area will be one kilometre from the project boundary for EIA Scoping. Receptors considered will predominantly be of medium or high sensitivity, ignoring low sensitivity receptors. Receptor sensitivity has been defined in Section 6.7.

Assessment of air quality due to construction and operational phase traffic

6.2.3.11 The air quality – vehicle emissions study area for EIA scoping is initially assumed to include the RBMW, LBRUT, RBKUT, SBC, EBC, Slough Borough Council and RBC. This study area is presented in Figure 6-1 in Appendix A.

6.2.3.12 Construction and operational phase air quality dispersion modelling will be undertaken to determine the effects from vehicle emissions generated in connection with construction and operational related activity across the RTS. The emissions will be assessed for their potential effects on human health (affecting 'human receptors') and on sensitive features within designated ecosystems (affecting 'ecological receptors'). The vehicle emissions study area will therefore be finalised following the identification of roads and receptors included in the assessment of air quality effects (within the dispersion model).

6.2.3.13 It is intended that any roads which would experience an increase in vehicle movements that would lead to a trigger of the screening criteria, from the EPUK-IAQM guidance, will be used to determine the extent of the modelled road network (in relation to identifying air quality effects on human receptors):

- An increase in light duty vehicle movements (expressed as Average Annual Daily Traffic (AADT) flow) by 500 or more per day, or 100 or more per day within or adjacent to an Air Quality Management Area (AQMA); and
- An increase in heavy duty vehicle movements (expressed as an AADT) by 100 or more per day, or 25 or more per day within or adjacent to an AQMA.

6.2.3.14 Heavy duty vehicles are defined as lorries or other HGVs, buses and coaches. Light duty vehicles are all other vehicles.

6.2.3.15 The EPUK-IAQM (2017) guidance indicates "The presence of an AQMA is taken to indicate the possibility of being close to the objective, but where whole authority AQMAs are present and it is known that the affected roads have concentrations below 90 per cent of the objective, the less stringent criteria are likely to be more appropriate."

6.2.3.16 The DMRB guidance suggests that ARN should be defined by determining which roads trigger screening criteria. It also states that relevant human receptors located within 200m of roads of the ARN; and roads within 200m of the modelled receptors should be included (as far as traffic data permits). The study areas will be different for the construction and operational phase assessment and may exclude some minor roads or roads not available in the traffic model. Roads where the RTS will result in a reduction in traffic will also be excluded (as this would result in an air quality benefit) although will be discussed qualitatively.

6.2.3.17 Some additional or different areas will also be modelled for the baseline (model verification) scenario, including roads within 200m of the monitoring locations. The monitoring locations will be determined once the study areas for the construction and operational effects have been finalised (which is ongoing) and their suitability for use in model verification has been checked. It should be noted that this also explains why the baseline assessment in Section 6.3 below does not follow the vehicle emissions study area but characterises air quality across the seven LPA areas.

6.2.3.18 It should be noted that the screening criteria referenced in the DMRB guidance are less stringent than those in the EPUK-IAQM guidance (which are specified in Section 6.7.1.29 to Section 6.7.1.31). Therefore, the DMRB screening criteria have not been used so that the assessment uses a worst-case scenario.

6.2.3.19 Ecological receptors will be included in the dispersion model where they cannot be scoped out, using the criteria below. The assessment will therefore focus on Special Areas of Conservation (SACs), SPAs and Ramsar sites. Where they are included in the assessment, the vehicle emissions study area (for construction or operational effects) will be extended as follows:

- Distance screen: Ecological sites more than 200m from any roads for which traffic data are available will be excluded;
- Habitat sensitivity screen: Habitats known not to be sensitive to NOx or nitrogen deposition will be excluded;
- Spatial distribution of features screen: Unless sensitive habitats or species which are sensitive to pollution are located within 200m of any roads, the habitats will be excluded; and

- Effects of the RTS: The habitat will only be considered where the RTS introduces over 1,000 additional vehicles (expressed as an AADT) to roads within 200m of the relevant components of the habitat.

6.2.3.20 It is envisaged that this assessment will primarily be required to assess the significance of effects within the EIA. However, where it is also required to contribute to an HRA, in-combination effects will also be accounted for at stage 4 above. Where effects are screened in, a method can be agreed separately.

6.3 Baseline

6.3.1 Existing Baseline

Presence of AQMAs

6.3.1.1 RBKUT, LBRUT and SBC have each declared borough-wide AQMAs due to known or anticipated breaches of the annual mean NO_2 Air Quality Objective (AQO) [5].

6.3.1.2 There are also AQMAs[6] at certain locations in the air quality – vehicle emissions study area for EIA scoping, due to known or anticipated exceedances of annual mean NO_2 concentrations at the time of their declaration.

6.3.1.3 As mentioned above, the existing baseline has considered the five LPA areas covered by the RTS, as well as SBC and RBMW. This is because construction traffic is likely to be most concentrated closer to the RTS and may result in more perceptible air quality impacts than outside of these areas. It is therefore possible that at least some vehicle movements attributable to the RTS may exacerbate the poor ambient air quality in these areas. Relevant designated AQMAs are as follows:

- Addlestone AQMA (RBC);
- Esher AQMA (EBC);
- Hampton Court AQMA (EBC);

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[5] The AQOs and AQSs are presently equivalent to each other for NO_2 and PM_{10}.

[6] As of 2021, the latest year for which Defra have consolidated their list of AQMAs declared throughout the UK.

- Hinchley Wood AQMA (EBC);
- Slough AQMA No.1 (Slough Borough Council);
- Slough AQMA No.2 (Slough Borough Council);
- Walton AQMA (EBC);
- Walton Road, Moseley AQMA (EBC);
- Weybridge AQMA (EBC); and
- Wraysbury/M25 AQMA (RBMW).

6.3.1.4 In addition to those listed above, the M25 AQMA was declared by RBC due to known or anticipated exceedances of the annual mean NO_2 and PM_{10} AQOs and the 24-hour mean PM_{10} AQO.

6.3.1.5 As shown in Figure 6-2 in Appendix A, part of the air quality – vehicle emissions study area for EIA Scoping is located within AQMAs.

Estimated Background Concentrations

6.3.1.6 Modelled background concentrations of NOx, NO_2, PM_{10} and $PM_{2.5}$ were obtained from maps downloaded from the UK-AIR (2022b) website maintained by Defra. The maps present modelled annual mean pollutant concentrations on a $1km^2$ basis for the years 2018 (the base mapping year) to 2030.

6.3.1.7 For consistency with the baseline monitoring undertaken and with the remainder of this Scoping Report, the modelled 2019 and 2022 background concentrations have respectively been presented.

6.3.1.8 As projections were calibrated to a 2018 base year, the maps do not account for the effects of the Covid-19 pandemic on traffic volumes and consequently pollutant concentrations.

6.3.1.9 As shown in Table 6.1, the annual mean NOx AQO only applies to sensitive ecological receptors. As the ecological sites to be considered have not been finalised, NOx concentrations will be assessed in accordance with the assessment methodology relating to vehicle emissions outlined below and this is appropriate for the scoping stage. .

6.3.1.10 The modelled annual mean NO_2 concentrations do not exceed the annual at background locations across the study area and near the proximate strategic highway network. Indeed, during 2019, annual mean NO_2 concentrations only exceeded 30µg/m^3 within some 1km^2 grids along part of the M25 near Wraysbury Reservoir.

6.3.1.11 Annual mean PM_{10} concentrations within the grid squares within the study area do not breach the annual mean AQO in the 1km^2 grids across the RTS and near the proximate strategic highway network during 2019.

6.3.1.12 Moreover, annual mean $PM_{2.5}$ concentrations within the grid squares within the study area do not breach the annual mean AQO in the 1km^2 grids across the study area and near the proximate strategic highway network during 2019. None exceeded the annual mean AQO.

6.3.1.13 Figure 6-3 to Figure 6-6 in Appendix A present the 2019 annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations at locations at and around the RTS.

LPA Monitoring Data

6.3.1.14 AQMAs which cover entire jurisdictions do not necessarily delineate areas in which ambient air quality will exceed AQOs; they may indicate local authorities have multiple hotspots in which air quality is poor such that it is easier to administrate a borough wide AQMA. It is accepted that the boundaries of AQMAs delineated by local authorities may not be up to date, considering air quality can improve or worsen with time for many reasons.

6.3.1.15 The pollutant concentrations embedded in the estimated background maps are also modelled at coarse resolution, meaning that specific hotspots within them may be missed.

6.3.1.16 For these reasons, it is necessary to review air quality monitoring which has already been undertaken by local authorities to locate areas (including localised ‘hotspots’) in which existing air quality may breach AQOs which are not otherwise accounted for.

6.3.1.17 Out of the pollutants of concern listed in Table 6-1, the annual mean NO_2 AQO is the most likely to be breached, as is reflected in existing AQMA declarations. Fossil fuel combustion (associated with road traffic, energy production and industry) are primary contributors to ambient concentrations of air pollutants7. NO_2 is generated in larger quantities from fossil fuel combustion than other air pollutants including PM_{10} and $PM_{2.5}$.

6.3.1.18 Figure 6-4 in Appendix A indicates the range of annual mean NO_2 concentrations measured during 2019 at monitoring locations across the five LPA areas, separated into three categories: more than 10 per cent below the AQO (as desired) (green); within 10 per cent of the AQO (yellow); and at or above the AQO (red).

6.3.1.19 It is anticipated that traffic generated in connection with construction works could therefore contribute to annual mean NO_2 concentrations which either breached or were nearing the AQO during 2019 at multiple hotspots. These include near London Road, Datchet; part of the A308 in Old Windsor; part of London Road in Slough near the M4; within the Wraysbury Road AQMA; in Chertsey near where the A317 meets the A318; the A30/ A308 junction near Staines; near the A308 in Ashford and Sunbury; near the Sunbury Cross roundabout and along the A316 and Staines Road east approaching the roundabout; near where the B376 meets Garston Bridge Road in Shepperton; within the Walton AQMA along the A3050; within the Hampton Court AQMA along the A309; within the Hinchley Wood AQMA along the A309; along the A310 near Kingston Bridge (within LBRUT); at various locations within Kingston; and at various locations near the A3/ A240 junction in Tolworth.

6.3.1.20 As mentioned above, the baseline is still being refined as part of the EIA, design and consultation process. It is possible that traffic generated in connection with the RTS, either during construction or once operational, could travel along other routes; these will be included in the ES baseline if required. During 2019, annual mean NO_2 concentrations breached or neared the AQO at additional hotspots near several arterial roads at various locations across the jurisdiction of LBRUT, RBKUT and SBC, and at Chertsey (near the signalised junctions of Bridge and Weir Road), Addlestone, Weybridge and Colnbrook. However, at most other locations, including all ‘background’ locations, NO_2 concentrations were (as desired) below the annual mean NO_2 AQO.

6.3.1.21 The monitoring results therefore indicate that ambient air quality at and around the RTS is therefore typically good, but some hotspots of poorer air

[7] In this instance, air pollutants refers to substances with the potential to directly affect human health or sensitive ecosystems and excludes greenhouse gases.

quality exist where traffic attributable to the RTS has the potential to worsen it or lead to exceedances of these AQOs. These areas may extend beyond those listed, depending on the origin and destination of traffic attributable to the RTS.

6.3.1.22 It should be noted that monitors are not always installed at locations where air quality would represent ‘relevant’ exposure, which in the case of the annual mean AQOs is defined as the facades of residences, schools and hospitals. Air quality may therefore be better than represented in the monitoring data, even within the hotspots identified by the AQMAs and LPA monitoring data.

6.3.1.23 In addition to monitoring compliance with the annual mean NO_2 AQO, the LBRUT, RBKUT, SBC and EBC [8] have monitored NO_2, PM_{10} and $PM_{2.5}$ concentrations to determine compliance with the hourly mean NO_2 AQO, annual or 24-hour mean PM_{10} AQOs or the annual mean $PM_{2.5}$ AQO. There have been no exceedances recorded at any of the automatic monitoring locations within the jurisdiction of these local authorities for at least the five years up to and including 2019.

Summary of Existing Baseline Air Quality

6.3.1.24 Based on the estimated pollutant concentrations presented in the UK-AIR background maps and data from the majority of LPA monitoring sites, annual mean NO_2 concentrations are generally expected to comply with the annual mean NO_2 AQO at locations representative of relevant exposure. However, a few isolated hotspots in the vicinity of (mostly arterial) roads may experience NO_2 concentrations breaching the AQO. The hotspots may be affected should traffic attributable to the RTS lead to increased NO_2 concentrations in these areas.

6.3.1.25 No exceedances of the hourly mean NO_2 AQO, annual mean or 24-hour mean PM_{10} AQO or annual mean $PM_{2.5}$ AQS were identified in any of the seven local authorities from which data were reviewed.

6.3.2 Future Baseline

6.3.2.1 As newer, cleaner vehicles are progressively sold and introduced into vehicle fleets, the component of NO_2, PM_{10} and $PM_{2.5}$ concentrations influenced by roadside and background concentrations is progressively

[8] RBC did not monitor for air pollutants other than NO_2 in recent years (RBC, 2022a).

decreasing. This is evidenced in future year concentrations presented in the UK-AIR background maps. This should mean that concentrations of these pollutants at and around the RTS will decrease over time.

6.3.3 Key Environmental Considerations and Opportunities

6.3.3.1 The main consideration in relation to air quality relates to the impacts of pollutants generated from changes in traffic movements on air quality at sensitive receptor locations resulting from the construction (e.g. vehicles moving materials to and from site) and operation (e.g. areas of amenity will increase visitors and associated traffic movements) of the RTS. The receptors which may be affected by acute exposure include residences, schools and hospitals. Chronic exposure may also affect locations where members of the public may spend one hour or longer.

6.3.3.2 NOx generated in connection with the RTS also has the potential to affect ecosystems sensitive to eutrophication where NOx is converted via chemical reactions in the air to nitrogen, which is then deposited on land. Due to their conservation status, the most vulnerable habitats which will be considered for assessment include SACs, SPAs and Ramsar Sites. Other national or locally designated sites, such as National Nature Reserves (NNR), will be assessed if deemed necessary (considering factors such as habitat sensitivity) by the project Ecologist. The requirement to assess nationally or locally designated Sites will be determined at PEIR Stage.

6.3.3.3 The AQOs and AQSs in force were designed to determine the impacts which air pollutants may have on chronic exposure.

6.3.3.4 Sensitive receptors may be affected where dust generated from construction related activities or odours generated from excavation affect amenity. Dust can also contribute to particulate matter, affecting human health (at the locations mentioned above, in addition to certain workplaces); and can cause temporary impacts on vascular plant species.

6.3.3.5 The greatest impacts on amenity (from dust deposition) can be expected at locations where users can expect to enjoy a moderate or high level of amenity; i.e. where the appearance, aesthetics or value of their property would be diminished by dust soiling; or the people or property affected would normally be in place for long periods of time. Examples include dwellings, parks, places of work, long-term car parks and car showrooms.

6.3.3.6 Impacts from dust on vascular plant species are reversible, so although dust assessments rarely need to map the locations of said species, it is typically assumed impacts may occur in designated ecosystems such as SACs, SPAs, Ramsar sites and others with national and local designations.

6.3.3.7 The greatest impacts on amenity (from odour) can be expected at locations where users can expect to enjoy a moderate or high level of amenity. As per the IAQM 2018 guidance, a high level of amenity is defined as surrounding land where users can expect enjoyment of a high level of amenity and would reasonably be expected to be present here continuously or regularly. Examples may include residential dwellings, hospitals, schools/education and tourist/cultural. A moderate level of amenity is defined as surrounding land where users would expect a reasonable level of amenity, or where they may be regularly but not continuously exposed, such as places of work, playing fields and commercial/ retail premises.

6.3.3.8 Measures to encourage modal shift in accordance with the 'transport hierarchy', which progressively encourage the use of walking and cycling over public transport, car sharing and individual car usage, can be implemented which would mitigate some transport emissions to air. Procuring newer non road mobile machinery (NRMM), i.e. plant, such as generators and excavators, compliant with increasingly stringent emissions standards will also reduce emissions from construction sites.

6.4 Likely Significant Effects Requiring Assessment

6.4.1 Construction Effects

6.4.1.1 Project activities and associated likely significant effects are identified below:

- Demolition of buildings at the northern end of the Runnymede Channel, material excavation, general construction activities and the movement of vehicles, equipment and site operatives and general construction activities could potentially generate dust and particulate matter causing nuisance, loss of amenity and/or impacts on human health at sensitive receptors near construction areas or routes used by goods vehicles travelling to and from various RTS worksites;

- Potential temporary (short-term) adverse effect on air quality from movement of vehicles used for goods, commuting to and from various RTS worksites and transportation of waste/ material, including processing / placement of non-hazardous material; and
- Material excavation through landfill and other sources of contamination (in addition to some natural ground such as areas containing peat) could have a potential adverse effect due to the emission of odours resulting from excavation, causing a loss of amenity at sensitive receptors near construction areas (e.g. local residents, medical facilities, schools and businesses).

6.4.2 Operational Effects

6.4.2.1 Project activities and associated likely significant effects are identified below:

- The provision of the green open spaces and other landscape and green infrastructure works, including new walking / cycle routes and the provision of HCAs could have a potential effect on air quality and AQMAs due to permanent changes in road traffic accessing these areas;
- The introduction of an augmented flow and flood water to lakes, and any active pumping/operation of weir gates, may have a potential effect due to odour associated with blue green-algae or similar and fish death arising as a result of eutrophication. This could occur due to nutrient influx into any low-flowing water within the Spelthorne or Runnymede Channels (or any lakes of which the Channels are composed) following high precipitation and flood events.

6.5 Effects Not Requiring Assessment

6.5.1 Construction Effects

6.5.1.1 Project activities and associated effects that are deemed not likely to be significant and are therefore proposed to be scoped out of the EIA are identified below:

- Construction NRMM (plant) on and off site could have a potential adverse effect on air quality and AQMAs. Emissions from plant are expected to contribute to pollutants such as NOx and PM, however, their emissions have not been assessed on the basis outlined in TG22 (as outlined below).

- The potential temporary adverse effect on air quality from movement of hazardous materials / waste from the major road network to, and placement at, licensed sites offsite. This is because it is assumed transportation and processing of hazardous material/ waste will be mitigated by licensed carriers and sites in accordance with existing permits.

6.5.2 Operational Effects

6.5.2.1 Project activities and associated effects that are deemed not likely to be significant and are therefore proposed to be scoped out of the EIA are identified below:

- General maintenance activities could result in increased traffic and plant on local roads and within the project boundary, causing a potential adverse effect on air emissions. However, it is anticipated that the effect will not be significant because maintenance activities will follow standard good practice procedures, are likely to be infrequent and of short duration, resulting in minimal effects on air quality.

6.6 Approach to Mitigation

6.6.1.1 This section should be read in conjunction with Chapter 5: Approach to EIA Scoping which sets out further definition for the project regarding primary (embedded) mitigation, secondary (additional) mitigation and tertiary (best practice) mitigation.

6.6.2 Construction

6.6.2.1 Secondary mitigation measures that are under consideration for the construction phase are identified below.

6.6.2.2 Road traffic generated from the RTS will use arterial roads where possible. The AQMAs affected by traffic attributable to the RTS will be more precisely assessed as part of the ongoing EIA process. The implementation of a Traffic Management Plan, Travel Plan and MMP will be recommended as appropriate to manage the anticipated changes in air quality.

6.6.2.3 The Traffic and MMPs will include a suite of mitigation measures. These plans will seek to reduce the total number of delivery vehicles travelling to and from site or require vehicles to follow specific routes away from AQMAs and during specific times.

6.6.2.4 The Travel Plan will encourage ‘modal shift’ by incentivising walking, cycling, public transport use and ‘clean’ (including electric) private vehicles use over single-occupancy combustion vehicles.

6.6.2.5 Electric or low-emission fleet vehicles will be prioritised, which would reduce emissions of NOx, PM_{10} and $PM_{2.5}$ from vehicles. Vehicle charge points will also be recommended in areas with parking provision.

6.6.2.6 The various management and monitoring plans will be secured as appropriate through the DCO process.

6.6.2.7 To reduce emissions of fugitive dust from construction activities, a dust and air quality management plan, or similar, will be produced. Residual effects following dust control measures (including construction phase monitoring) are not expected to be significant.

6.6.2.8 To reduce emissions of odour from construction activities, an odour management plan (OMP), or similar, will be produced.

6.6.2.9 By using ‘best practicable means’ to control the effects of any anticipated odours on amenity, residual effects are not expected to be significant.

6.6.3 Operation

6.6.3.1 Secondary mitigation measures that are under consideration for the operation phase are identified below:

6.6.3.2 Where emissions from vehicles are expected to increase as a result of the RTS, the Travel Plan may also be secured by requirements of the DCO consent.

6.6.3.3 Additional measures will be considered in areas where vehicle movements connected to the RTS has a significant effect on local air quality. This may include a reflection on measures embedded in LPA Air Quality Action Plans.

6.7 Assessment Methodology

6.7.1 Construction Effects

Assessment of dust from construction related activities

6.7.1.1 The IAQM 2014 guidance will be used as the basis for assessing potential effects from the RTS for all activities listed in bullet one of Section 6.5.1.1, including materials processing facilities. Mitigation measures will be recommended in accordance with the IAQM 2014 guidance and supplemented by measures recommended in the Mayor of London Supplementary Planning Guidance (SPG).

6.7.1.2 This assessment will identify potential works that may generate dust and will incorporate a list of appropriate mitigation measures to control them.

6.7.1.3 The qualitative assessment is described below.

6.7.1.4 The demolition, earthworks, construction and trackout activities are firstly assessed for their dust emissions magnitude as either ‘low’, ‘medium’ or ‘high’, in the absence of any mitigation. These are defined as follows:

6.7.1.5 A site is allocated a risk category on the basis of the scale and nature of the works (Step 2A, based on the criteria found in the IAQM 2014 guidance) and the sensitivity of the area to dust effects (Step 2B, based on the criteria found in the IAQM 2014 guidance). These two factors are combined in Step 2C to determine the risk of dust effects before the allocation of mitigation measures. Risks are described as low, medium or high for each of the four separate activities (demolition, construction, earthworks and trackout) and are derived from the risk matrix tables found in the IAQM 2014 guidance. These will be considered as exerting ‘minor’, ‘moderate’ and ‘major’ effects respectively.

6.7.1.6 The overall significance of dust effects will be selected based on the highest effect category (i.e. if demolition has a ‘major’ effect on amenity, all effects will be considered ‘major’).

6.7.1.7 Where site-specific mitigation is required for a proposed scheme, it will be based on a proportionate approach related to the level of risk.

6.7.1.8 Step three of the IAQM 2014 guidance identifies appropriate site-specific mitigation. These measures are related to whether the site is a low-, medium- or high-risk site. The highest risk category of a site (of all activities being undertaken) is recommended when considering appropriate mitigation measures for the site. Where risk is assigned as ‘negligible’, no mitigation measures beyond those required by legislation are required. However, additional mitigation measures may be applied as good practice.

6.7.1.9 An appropriate selection of these measures will be specified as suitable to mitigate dust emissions from activities, based on professional judgement.

6.7.1.10 Following Step 2 (definition of a proposed scheme and the surroundings and identification of the risk of dust effects occurring for each activity), and Step 3 (identification of appropriate site-specific mitigation), the residual significance of the potential dust effects can be determined.

6.7.1.11 The IAQM 2014 guidance suggests that the recommended mitigation measures are assumed to be sufficient to reduce construction dust effects so as the effects from the site would be changed to being ‘not significant’. This is because it is assumed that a Dust and Air Quality Management Plan (or similar) will be produced to control dust, PM_{10} and $PM_{2.5}$ emissions. For these reasons, significant effects should not reasonably be expected following the implementation of mitigation.

6.7.1.12 Step 5: Dust Assessment Report. The dust risk assessment and proposed mitigation measures will be fully described in the ES.

Odour arising from channel excavation

6.7.1.13 Based on RTS design information, it is anticipated that excavation through parts of the Runnymede and Spelthorne Channel, including historic landfills and alluvium and peaty superficial deposits may generate odour. The materials processing facilities will also be assessed, where potentially odorous materials are stockpiled or processed frequently and/or for non-transient durations.

6.7.1.14 A qualitative odour risk assessment will be undertaken in accordance with the method outlined in the IAQM Odour Guidance. This approach will take place in five stages, informed by the existing odour complaints history being sourced to inform baseline conditions; as well as landfill records, and information on soil content from the GI (see Chapter 17).

6.7.1.15 First, the source strength is initially classified as ‘low’, ‘medium’ or ‘high’ using a series of indicative criteria relating to the size of the source and amount of mitigation in place.

6.7.1.16 Second, the 'pathway effectiveness' is then assessed as 'ineffective', 'moderately effective' or 'highly effective' using a series of indicative criteria relating to distance between the source and receptors, whether they are upwind or downwind of prevailing winds and the presence of barriers which would reduce pathway 'connectivity'.

6.7.1.17 Third, the 'risk of odour exposure' is assessed as 'negligible', 'low', 'medium' or 'high' by comparing the pathway effectiveness with the source odour potential in accordance with IAQM odour guidance criteria.

6.7.1.18 Fourth, the sensitivity of receptors in the vicinity of the source of odour is then assessed as 'low', 'medium' or 'high', using definitions from the IAQM Odour guidance. 'Low' sensitivity receptors (areas where the enjoyment of amenity would not be expected or any exposure to odour would be transient, such as on public footpaths, farms or industrial land uses) are not proposed to be assessed.

6.7.1.19 Fifth, the likely odour effect at an individual receptor or group of receptors is ascertained by comparing the risk of odour exposure with receptor sensitivity at those receptors in accordance with IAQM odour guidance criteria.

6.7.1.20 Finally, professional judgement will be used to determine the potential for odour effects. Mitigation, where required, will be recommended in accordance with the IAQM Odour Guidance.

Air pollutant emissions from construction traffic and plant

6.7.1.21 The ADMS-Roads detailed dispersion model will be used to assess effects from the additional vehicles on local air quality at discrete receptor locations where air quality effects are possible. Roads and other information influencing pollutant dispersion such as meteorological data are input to the model to predict pollutant concentrations at specific receptors. Each road drawn will be assigned an 'emissions factor' reflecting the characteristics of traffic expected to use the road. The impact of the RTS will be determined by assessing the differences in pollutant concentrations between different scenarios.

6.7.1.22 Concentrations of NO_2, PM_{10} and $PM_{2.5}$ will be predicted at sensitive receptors "representative of relevant exposure" (as defined in Table 6-1) within the construction vehicle emissions study area.

6.7.1.23 For the construction phase, predictions of NO_2, PM_{10} and $PM_{2.5}$ will be made for the following scenarios:

- Baseline year 2019 (for model verification and adjustment purposes);
- Do-Minimum: a future baseline without the RTS during the peak construction traffic year; and
- Do-Something: a future baseline construction year during the peak construction traffic year with the RTS.

6.7.1.24 The year(s) to be assessed have not been determined at the time of writing and will require liaison with the project team (for example, regarding potential overlaps with the Traffic and Transport assessment, see Chapter 17). However, it is not proposed to use 2020 or 2021 for the baseline year due to the changes as a result of Covid-19 lockdown measures.

6.7.1.25 Traffic data for the local roads of interest will be obtained and will be presented in the Air Quality ES Chapter. 'Emissions factors' – which provide empirically derived emissions calculated over a set variable for individual pollutants for use in the dispersion model (e.g. quantity of NOx per km travelled) will be obtained from Defra's Emissions Factor Toolkit using an appropriate road type for each road included in the model. The emissions year selected will match the year being modelled.

6.7.1.26 This study will use detailed 2019 meteorological data available for Heathrow Airport as the most relevant meteorological data monitoring location.

6.7.1.27 Model verification refers to checks that are carried out on model performance in relation to roads modelling at a local level. Modelled concentrations are compared with the results of local monitoring and, where there is a disparity between modelled and monitored concentrations, an adjustment may be applied to the final model output. Model verification will be undertaken using appropriate diffusion tube monitors and/ or automatic monitoring sites located within the study area.

6.7.1.28 Background concentrations of NO_x, NO_2, PM_{10} and $PM_{2.5}$ will be obtained from the UK-AIR background maps applicable at each receptor for the relevant assessment year, or from local air quality monitoring data. Where UK-AIR maps are used, a background pollutant concentration relevant to the year being assessed is proposed to be used.

6.7.1.29 Following processing of results, predicted annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations for the Do-Minimum and Do-Something scenarios (inclusive of background concentrations) at sensitive human receptors will be compared. These comparisons will be assessed against the change magnitude criteria in the EPUK-IAQM guidance to ascertain air quality impacts at each receptor.

6.7.1.30 According to the EPUK-IAQM guidance, the 24-hour mean PM_{10} AQO will not be exceeded unless the annual mean PM_{10} AQO exceeds ~32µg/m^3. TG22 indicates that exceedances of the hourly mean NO_2 AQO should not be expected if annual mean NO_2 concentrations are below 60 µg/m^3. These criteria will be used to determine whether the RTS would impact upon existing receptors.

6.7.1.31 As recommended in the EPUK-IAQM guidance, the significance of effects on human receptors will be determined using professional judgement, which is required to consider the number and extent of any air quality impacts and baseline air quality without the Development. Where the RTS results in substantial adverse impacts at multiple individual receptors, it is likely the significance would be considered major adverse (regarding effects on human health). Similarly, where the RTS results in negligible impacts at each receptor, the significance would be deemed negligible. A review of the extent of any impacts and breaches of AQOs will be required to determine significance where the impacts are less straightforward. Mitigation will be recommended where the significance of effects is assessed as moderate or substantial adverse.

6.7.1.32 To assess effects at ecological receptor locations, the verified modelled road NOx will be compared to the annual mean NOx AQO. The impact from NOx from road traffic attributable to the project on nitrogen deposition will be calculated using the method outlined in the 'Technical guidance on detailed modelling approach for an appropriate assessment for emissions to air' (Environment Agency, 2013).

6.7.1.33 The significance of effects at ecological receptors will then be determined using screening criteria in the IAQM 2020 and NE 2018 guidance (Natural England, 2018). This means that where the rate of nitrogen deposition attributable to RTS road traffic exceeds the nitrogen critical load by greater than one percent, the impact will not be screened as insignificant. At this stage, the results would be passed to the ecologists for determination of whether impacts would have significant effects, based on factors such as habitat sensitivity.

6.7.1.34 Critical loads are defined as "concentrations of pollutants in the atmosphere above which direct adverse effects on receptors, such as human beings, plants, ecosystems or materials, may occur according to present knowledge”. They will be obtained for the relevant type of habitat from the APIS website and agreed with the project ecologists.

6.7.2 Operational Effects

Odour arising from channel operation

6.7.2.1 The methodology for the assessment of odour from eutrophication and fish decay during operation of the RTS is expected to follow the same five-stage method as outlined above (using information derived only from the complaints history).

Air pollutant emissions from operational traffic

6.7.2.2 The methodology for the assessment of operational effects on air quality due to emissions from traffic will be identical to the construction phase traffic emissions quantitative assessment, except for the proposed study area (the operational vehicle emissions study area will be used) and scenarios modelled.

6.7.2.3 For the operational phase, predictions of NO_2, PM_{10} and $PM_{2.5}$ will be made for the following scenarios (the baseline year will have already been assessed for the construction scenario):

- Do-Minimum year: a future baseline year (the same year as the first operational year) without the project; and
- Do-Something year: the first operational year with the project.

6.7.3 Cumulative Effects

6.7.3.1 There may be other sources of air emissions or odour near to the project during construction or operation, resulting from other cumulative (or, for the purposes of the HRA, in-combination) development schemes ongoing at the same time as the RTS.

6.7.3.2 The potential for cumulative odour effects will be determined following the review of the odour complaints history and accounted for in the qualitative odour assessment (construction and operational phase).

6.7.3.3 Traffic data for any ‘future year’ (Do Minimum and Do Something) dispersion modelling will include these schemes where traffic data are provided by the project team.

6.7.3.4 Receptors from nearby cumulative (or in-combination) schemes which may be affected by the RTS will also be considered and included where they are considered sensitive to the effects from vehicle emissions, odour or dust.

6.8 Assumptions and Limitations

6.8.1.1 The London Plan 2021 requires the development to be considered as air quality neutral and air quality positive. These approaches collectively require consideration of the extent to which air quality exceeds benchmarks regarding their building and transport emissions; and guidance on how ‘large scale developments’ consider air quality within their design. The guidance documents released to accompany these policies exclude infrastructure schemes from the scope of the planning policy.

6.8.1.2 The air quality and transport specialists will liaise with each other to ensure traffic data are provided for as many affected road links as practicable.

6.8.1.3 There will be uncertainties introduced as the model uses a series of algorithms to simplify real world dispersion processes. These uncertainties are an accepted inherent limitation associated with dispersion modelling and will be accounted for in the model verification process.

6.8.1.4 Much of the data imported into the model is based on reasonable estimates. For example, it is assumed that the AADT flow would represent conditions over a year, emissions generated from the EFT represent the average of vehicles from the fleet and modelled background pollutant concentrations are representative of conditions at site. It is also assumed that the meteorological data and related parameters would represent dispersion conditions across the modelled domain.

7 Biodiversity

7.1 Introduction

7.1.1.1 This chapter of the Scoping Report considers the potential significant effects on biodiversity arising from the construction and operation of the RTS. It outlines the baseline state of both terrestrial and aquatic biodiversity, the likely effects of the project and the avoidance or mitigation measures proposed to alleviate these. It also outlines the methodology that will be used for the assessment of potential biodiversity arising from the construction and operation of the RTS within the PEIR/ES.

7.1.1.2 Biodiversity is intrinsically linked with many other topics and therefore this chapter should be read in conjunction with the other relevant topic Chapters, particularly Chapter 6: Air Quality (in relation to habitats and species sensitive to changes in air quality, including dust), Chapter 14: Noise and Vibration (in relation to species sensitive to noise Chapter 12: Landscape and Visual Amenity and Chapter 18: Water Environment (for effects upon the aquatic environment). It is also recommended to be read in conjunction with the WFD re-screening (Appendix K) and HRA screening assessment (Appendix N).

7.1.1.3 A summary of the key legislation, policy and guidance relevant to biodiversity is provided in Appendix M.

7.2 Baseline Methodology

7.2.1 Information Sources

7.2.1.1 An extensive range of data has been collected for biodiversity using a combination of desk-study data and surveys across the area within the project boundary for EIA scoping and focussed, where necessary, on specific species (see Section 7.2.3 for details of the ‘biodiversity study area’ for EIA Scoping).

7.2.1.2 The area within the project boundary for EIA scoping includes some areas, which have been recently added as part of landscape and green infrastructure design work that have no habitat baseline information or information from protected species surveys to inform this report. Desk study and surveys undertaken to date are described below and future work is described.

7.2.1.3 The baseline information presented uses extensive desk-based research of information collated from Environment Agency datasets, Surrey Biodiversity Information Centre (SBIC), Thames Valley Environmental Records Centre, Surrey Bat Group (SBG), West Surrey Badger Group, Greenspace Information for Greater London, Environment Agency internal INNS datasets (ID1803) and data from national repositories including BIOSYS and the National Biodiversity Network. Site surveys/assessments have also been (and continue to be) conducted to provide up to date baseline information, and baseline information is available on request.

7.2.1.4 To date site specific ecological information has been gathered across areas within the project boundary for EIA scoping through a series of desk top studies and on-site Phase 1 Habitat Surveys (P1HS) (GBJV, 2021d; 2021e), P1HS Validation surveys and UK Habitat classification (UKHab) surveys with associated habitat condition assessments. The latest reports have been completed in 2021 (eCountability, 2021 and GBJV 2021f; 2021g; 2021h; 2021i; 2021j; 2021k; 2021l).

7.2.1.5 A list of all the biodiversity surveys undertaken to inform the baseline across varying extents of the area within the project boundary for EIA scoping, are noted below, further information on these surveys can be found in Appendix F:

- P1HS (including hedgerows);
- UK Habitat Classification Survey;
- River Condition Assessment (RCA);
- Bats;
- Badger;
- Botany/National Vegetation Classification;
- Dormouse;
- Otter;
- Water Vole;
- Great Crested Newt;
- Reptiles;

- Breeding Birds;
- Wintering/non-breeding Birds;
- Terrestrial Invertebrates;
- Hairstreak Butterflies;
- Stag Beetle;
- Fish;
- Phytoplankton;
- Zooplankton;
- White Clawed Crayfish;
- Macrophytes (including INNS);
- Phytobenthos (diatoms);
- Aquatic Invertebrates (including INNS); and
- Terrestrial (T-INNS).

7.2.1.6 The baseline information gained from desk study and on-site observations have been analysed and presented in report formats, which are summarised in Section 7.3.

7.2.1.7 Given the mobility and nature of certain species, several of the above surveys are potentially out of date and/or need to be expanded to consider the full area within the project boundary for EIA scoping.

7.2.1.8 With regards to validity of terrestrial biodiversity surveys, the approach being undertaken is that surveys less than two years old will not typically be repeated across the whole area within the project boundary for EIA scoping, as the habitats and species distribution is not likely to substantially change within the anticipated two years from survey to DCO application submission. Guidance from the Charted Institute of Ecology and Environmental Management (CIEEM) (Advice Note on the Lifespan of Ecological Reports and Surveys, April 2019) supports this approach to survey validity, however, guidance for specific species varies depending on the mobility and nature of the species.

7.2.1.9 CIEEM's Advice Note on the Lifespan of Ecological Surveys (online) recommends that terrestrial and aquatics biodiversity survey data, that will be over two years old at the time of submitting the DCO application, should be repeated in the closest available season and then the data combined with earlier survey data to enable a complete, accurate and robust evaluation which will inform the EIA, HRA and WFD compliance assessment.

7.2.1.10 Therefore, surveys are being updated where appropriate prior to submission of the DCO application and will be reported upon in the ES.

7.2.1.11 It is also anticipated that pre-construction surveys may be required, but the detail of these will not be fully known until the EIA and associated assessments are complete. The ES and any other mitigation and monitoring documentation that may need to be produced for the DCO application will provide more detail on the nature of required pre-construction surveys.

7.2.2 Stakeholder Engagement

7.2.2.1 This section details the stakeholder consultation that has been undertaken to date. Relevant feedback has been given full consideration and incorporated into the design, data gathering, and assessment of biodiversity features where applicable.

Feedback received from consultation on EIA Scoping and draft assessment methodologies

7.2.2.2 Surrey County Council in their capacity as a regulator provided a Scoping Opinion on the EIA Scoping Report submitted for the project under the Town and Country Planning Act in 2017, which contained biodiversity related comments from relevant combined LPAs, wildlife trusts and NE. The previous Scoping Opinion includes the following key comments in relation to biodiversity:

- With reference to the construction phase, NE highlighted the need for the project to demonstrate compliance with relevant legislation protecting sensitive sites and species. NE also asked that greater detail be provided about the biodiversity benefits that it is anticipated will be delivered by the project. This has been taken onboard and further detail will be provided through the Defra BNG metric calculation and other reporting on biodiversity outcomes;

- Surrey County Council's ecologist recommended that further survey and assessment work is required with reference to terrestrial invertebrates. They also advised that with reference to the proposals for habitat enhancement, account should be taken of the relevant Biodiversity Opportunity Area (BOA), and their associated Policy Statements, which could help to inform the design of the HCAs. This has been taken onboard and further terrestrial invertebrate surveys are being undertaken. Additionally, opportunities to enhance habitat and connect into the wider landscape are being considered as part of landscape and green infrastructure optioneering (discussed further in Section 4.1.5);

- Surrey County Council's ecologist recommended that an index of the habitat and species surveys be provided, identifying in each case the date of the survey, its spatial extent, and the time period for which it could be considered valid (e.g. two years, three years, etc.), to ensure that planning decisions are being informed by the most up-to-date information;

- The Berkshire, Buckinghamshire & Oxfordshire Wildlife Trust recommended that further surveys and assessment work is required with reference to the potential for effects on fragmentation of terrestrial habitats used by Great Crested Newt. It also advised that the assessment of cumulative ecological effects should include consideration of the proposed expansion of Heathrow Airport in relation to bird strike and, other habitats and species of conservation interest. This will be provided as part of the ES;

- The Surrey Wildlife Trust recommended that with reference to the proposed habitat creation, reference should be made to the Surrey Nature Partnership's adopted objectives and targets in the relevant BOA policy statement. As above, opportunities to enhance habitat and connect into the wider landscape are being considered as part of landscape and green infrastructure optioneering (discussed further in Section 4.1.5); and

- The Surrey Wildlife Trust also recommended that the assessment take account of the likely presence of Nathusius' pipistrelle, and that the habitat creation proposals take account of the historic land management practices encountered in the Thames floodplain and seek to create wet/seasonally flooded grasslands in low lying areas, and lowland dry acid grasslands in more elevated locations. This will be considered further as part of the landscape and green infrastructure design optioneering process.

7.2.2.3 A further iteration of the EIA Scoping Report was issued to the MMO in 2018. Feedback received in relation to biodiversity included:

- The MMO provided responses noting that consideration should be given to the potential impacts of the project on Richmond Park SAC, Bushy Park SSSI and Home Park SSSI and regarding the potential for introduction of INNS and an appropriate assessment should be undertaken including details of mitigation and consideration of materials and equipment used on site. Comments also noted that effects of accidental spillage/runoff from stored chemicals and fuel can be scoped out as mitigation is sufficient to protect benthic ecology from spill or release;
- With regards to fish ecology and fisheries, the MMO noted:
    - Potential impact of works on fish spawning areas due to silt smothering/sediment disturbance. Advised to contact the Centre for Environment, Fisheries and Aquaculture Science or Environment Agency (in their capacity as a statutory consultee) to identify appropriate information relating to these receptors to ensure that assessment is appropriate;
    - The ES must demonstrate no adverse effect on fisheries during and after construction;
    - The ES needs to demonstrate coffer dam construction has been considered in detail in order to reduce risk of impact on aquatic fauna;
    - Consideration to be taken of noise and vibration on fish. Unexploded Ordnance (UXO) clearance certification is required before piling/clearance can start – must be discussed in ES;
    - Appendix to ES should include fish surveys; and
    - MMO deems mitigation measures in the pre-app document (Section 8, Table 8.2) to be sufficient.

7.2.2.4 Surrey County Council in their capacity as a regulator was provided the opportunity to provide informal feedback on the draft EIA methodology for the biodiversity topic in 2019. Comments from Surrey County Council's Principal Environment Assessment Officer in relation to biodiversity asked for the following:

- More detail on which biodiversity receptors would be affected in each LPA borough, and on the justification of scoping out effects on Great Crested Newt;
- More detail on the point in time at which further survey work on each relevant biodiversity receptor would need to be undertaken for information to remain valid for the DCO submission; and
- Reference to policies relevant to biodiversity in the adopted Surrey Minerals Plan (Core Strategy DPD) (2011), Surrey Waste Plan (2008/09) and the Emerging Surrey Waste Local Plan (Submission version, January 2019).

Feedback received from pre-application consultation under the Town and Country Planning Act

7.2.2.5 Pre-application consultation was undertaken in 2019 with Surrey County Council (in their capacity as a statutory consultee), LPAs, GLA, and Environment Agency Sustainable Places.

7.2.2.6 The GLA noted that biodiversity impacts should be fully assessed, then safeguarded, mitigated and improved.

7.2.2.7 The RBWM and the LBRUT commented that where effects on biodiversity occur within their boroughs, they would want mitigation and enhancement to also occur within their borough. The LBRUT also stated that it was not clear how much demolition would be undertaken at Teddington Weir and what the effects on adjacent habitats and species would be. It requested a Preliminary Ecological Appraisal (PEA), ecological enhancement plan, and full lighting details for construction and operation works at the Teddington and Molesey Weirs and associated site compounds.

7.2.2.8 EBC noted that at Desborough Island tree planting is to be avoided at all costs with priority given to retention of existing meadow landscape and appropriate species.

7.2.2.9 The Environment Agency National Sustainable Places team provided pre-application feedback in 2019. Feedback noted the following:

- The project should, in accordance with Paragraphs 170 and 175 of the NPPF, contribute and enhance the natural and local environment by minimising impacts and provide net gains for biodiversity. Sustainable Places also noted that assessment of sites designated for nature conservation will be required and that some sites may require an HRA;
- Under the Salmon and Freshwater Fisheries Act 1975 and The Eels Regulations 2009, fish and eel passage must be maintain and facilitated. Multi-species passes are the preferred method;
- Habitat mitigation should be provided where habitat is being lost in the first instance, only where this is not feasible should offsite mitigation be considered;
- Article 4.7 (now Regulation 19) derogation agreements for impacts on WFD waterbodies will require substantial working through. It was also queried whether the main Thames reach (Egham to Teddington) had been considered to require an Article 4.7. The Thames Upper waterbody (GB530603911403) should be reassessed for impacts given it is particularly sensitive to water quality issues and the impact on fish species;
- In order to protect the Thames and associated wetland features, a 10 m minimum ecological buffer must be required to be retained or restored between the top of the riverbank and any development of open green spaces, including lighting and storage of materials;
- Online lakes, in particular the gravel pits will change from being oligotrophic (low nutrient) to eutrophic (high nutrient) ecosystems. There could be an impact on the carp fisheries through nutrient enrichment and escapement of fish, plus a possible increase in algae, a decrease in zooplankton and an increase in silver fish;
- INNS interacting with the system will require assessment. There is a risk of invasive species becoming widespread through the new wetland systems and online lakes;
- It needs to be demonstrated that the augmented flow will not have an impact of the main River Thames WFD status during periods of lower

flows. Low flow impacts need to be fully assessed, particularly on the ecology and water quality of the River Thames in the depleted reaches between the intake and outfall of each channel section and in the reach between the Runnymede Channel outfall and the Spelthorne Channel intake upstream;

- It would be prudent to understand the potential impacts of the augmented flow, and design mitigation that can be adapted if necessary, based on monitoring;
- Consideration should also be given to reed beds as a sink for nutrients in the channels and online lakes;
- The spillway into the Thames, upstream from Chertsey Weir must be designed as a backwater habitat during normal conditions to offer connectivity for fish; and
- Abbey River should be lined with gravel (ideally sourced from excavations in the project) to provide fish spawning habitat, plus Abbey Chase Weir will need to be removed or a multispecies fish pass installing.

Other topic specific engagement

7.2.2.10 Engagement on biodiversity has been ongoing with stakeholders over several years. Engagement with Environment Agency Fisheries, Biodiversity and Geomorphology teams, the Surrey County Council ecologist and NE has informed the data-collection required to inform both the EcIA and HRA. This has included discussions regarding the validity of survey data and the target to achieve BNG for the project. In addition, other ecological organisations have attended meetings and stakeholder workshops; these include the Wildfowl and Wetlands Trust, Royal Society for Protection of Birds (RSPB), local wildlife trusts and LPA ecologists/biodiversity advisors. Further specific/ongoing stakeholder engagement will be undertaken where necessary throughout the project programme.

Environment Agency National Permitting Service pre-application feedback on water related consenting

7.2.2.11 Feedback was received from the National Permitting Service in 2020 in response to a pre-application request for advice on water related consents submitted in 2019. The feedback relating to biodiversity largely mirrored the feedback from Sustainable Places. In addition, early involvement of the Environment Agency and national fish specialists was recommended at the design stage, as certain details will need to be included on the water resources licence. Application for a formal fish pass approval to the National Fish Pass Panel will also be required. Consideration must also be given to the competing legislative responsibilities to maintain water through the fish passes, while not causing derogation of protected rights on the River Thames and impacting lawful users.

Engagement on survey validity

7.2.2.12 The Environment Agency Fisheries, Biodiversity and Geomorphology team, NE, Surrey County Council, EBC and the LBRUT have indicated their agreement with the approach to validity of surveys noted above, however, given changes to the project design, further consultation will be undertaken to confirm this. Other LPAs were also consulted on this proposed approach to survey validity but did not provide a formal response. Other engagement with NE

7.2.2.13 Engagement with NE has been ongoing as part of the HRA since 2015. An initial HRA screening was produced in 2017 in dialogue with NE, determining no likely significant effects on the interest features of the SWLW SPA. NE provided a letter of support for this determination. Due to project design changes and amendments through case law the HRA is being revisited, and dialogue is ongoing with NE on this matter. To date, an updated HRA screening assessment has been completed, a summary of which has been presented to NE, and is included in Appendix N.

7.2.2.14 In undertaking the BNG calculations for the RTS, the project team has met with NE on several occasions since 2017 to discuss applicability and use of the Defra Biodiversity Metric.

Engagement informing design

7.2.2.15 Extensive engagement has been undertaken with stakeholders since 2015, to consider biodiversity factors in the development of the design, in particular:

- *Flood channel alignment in proximity to Thorpe Hay Meadow SSSI* - As noted in Chapter 4 (Project Description and Alternative Options Considered), the preferred alignment was selected to avoid the SSSI whilst minimising land take from residential dwellings, following engagement with NE and the Surrey Discussion Group in 2016;

- *Augmented flow* - As noted in Chapter 4 (Project Description and Alternative Options Considered), as a result of assessment and discussion with key stakeholders such as the Environment Agency and water companies, an augmented flow of up to $1.5m^3/s$ is proposed. Further assessment of how this flow will affect different biodiversity features will be undertaken in consultation with key stakeholders with the final decided flow rate reported on and assessed in the ES, however for Scoping purposes up to $1.5m^3/s$ has been assumed; and

- *Biodiversity mitigation and enhancements* – a large number of responses have been made by stakeholders to date through Discussion Group workshops, public exhibitions, and other engagement in relation to enhancement of the natural environment and landscape focussing on topics such as habitat enhancement, protected habitats, wetland habitat creation and bird conservation. Some of these suggestions were taken forward into the design of the project (discussed further in Sections 4.1.7 and 4.1.9) and will be developed further as part of landscape design optioneering (in liaison with stakeholders).

7.2.3 Study Area

7.2.3.1 For the purposes of identifying biodiversity features that need to be considered, a series of study areas were projected around the project boundary for EIA scoping. Each study area represents a Zone of Influence of the project for different ecological features, as outlined in CIEEM, 2018.

7.2.3.2 All of the study areas used are described below:

Habitats and Flora:

- The area within the project boundary for EIA scoping.

All fauna species and statutory and non-statutory designated nature conservation sites:

- 2km around the project boundary for EIA scoping or the extent of the 1 in 100 year floodplain (i.e. the area with a one per cent chance of flooding in any given year) affected by the RTS whichever is greater.

Additional HRA study areas:

- 10km around the project boundary for EIA scoping for SPA, SAC, potential/candidate (p/c) SPA, possible /candidate (p/c) SAC, Ramsar or proposed (p) Ramsar sites with mobile species as the qualifying features, such as bats (maternity and hibernation roosts), wintering birds, and those sites that have a potential hydrological connection to the project boundary for EIA scoping, that would require consideration under the HRA;

- 20 km buffer to capture otter foraging grounds (DMRB, 2009); and
- 30 km buffer to capture sites where bats are the qualifying interest.

7.2.3.3 The project boundary for EIA Scoping, 2km and 10km study areas are shown on Figures 7-1 and 7-2 in Appendix A, whilst all of the above, including the 20km and 30km study areas are shown on maps provided within the HRA Screening Assessment (Appendix N).

7.3 Baseline

7.3.1 Existing Baseline

Designated Sites

7.3.1.1 The biodiversity study area is crossed by a matrix of lakes (largely former gravel pits restored to open water habitats following the end of extraction works). St Ann's Lake, within the project boundary for EIA scoping, and Wraysbury Reservoir and Wraysbury 2(N) within 100m of the project boundary for EIA scoping are waterbodies forming part of the SWLW SPA and Ramsar site that have been screened in for further consideration within the HRA Screening Assessment (Appendix N). All these sites support internationally important numbers of overwintering gadwall *Mareca strepera* and shoveler *Anas clypeata*. These species also overwinter on other lakes within the biodiversity study area that are not formally part of the SPA but are recognised as being supporting sites given their use over winter. A total of 17 'supporting' lakes have been screened into the HRA Screening Assessment and are shown on figures in Appendix N.

7.3.1.2 In addition to the SWLW SPA and Ramsar site, there are a further five statutory designated sites; Dumsey Meadow SSSI; Wraysbury Reservoir SSSI; Thorpe Hay Meadow SSSI; Thorpe Park No1 Gravel Pit SSSI and Ham Lands Local Nature Reserve (LNR) and 18 non-statutory designated sites for nature conservation within the project boundary for EIA scoping. There are a further 18 statutory and 82 non-statutory designated sites for nature conservation wholly or partially within 2km of the project boundary for EIA scoping, and one statutory site present within 30km of the project boundary for EIA scoping which has bats as a qualifying feature; the Mole Gap to Reigate Escarpment SAC.

7.3.1.3 There are no additional existing or potential/proposed/candidate SPA, SAC, or Ramsar sites that contain groundwater dependent terrestrial ecosystems, designated for mobile species as qualifying features, or otters within their relevant HRA study areas (see Appendix N).

7.3.1.4 A summary of statutory and non-statutory designated nature conservation sites, including their reasons for designation, is provided in Appendix E.

Habitats and Flora

7.3.1.5 The area within the project boundary for EIA scoping is heavily disturbed by quarrying activities, which are still ongoing in places. The old quarries have been used for landfill or have been restored to a series of interconnected lakes. River and lake waterbodies contribute to much of the biodiversity of the area.

7.3.1.6 Existing habitats within the project boundary for EIA scoping include; open mosaic (former landfill), a series of interconnected lakes (former gravel workings), wet woodland, lowland mixed deciduous woodland, neutral grassland, modified grassland, mixed scrub, running water (ditches, streams, rivers), hedgerows, lines of trees and individual trees. These habitats and their associated species / populations have been mapped in accordance with UKHab (eCountability, 2021) and described in the respective P1HS Validation reports (GBJV 2021f; 2021g; 2021h, 2021i; 2021j; 2021k and 2021l) and PH1S Validation Maps (GBV 2020h; 2020i; 2020j; 2020k; 2020l; 2020m).

7.3.1.7 Eight Habitats of Principal Importance (HPIs) lie within the project boundary for EIA scoping; open mosaic on previously developed land, wet woodland, river, lowland mixed deciduous woodland, hedgerow, eutrophic standing water, pond and reedbed (eCountability, 2021).

7.3.1.8 The following paragraphs describe some of the existing most frequent/widespread habitats within the project boundary for EIA scoping:

Lakes

7.3.1.9 Standing water (lakes) accounts for a significant percentage of the habitat cover within the project boundary for EIA scoping. Many of these waterbodies are the result of restored gravel and sand extraction pits. All of the water bodies are likely to support a diversity of aquatic life including fish populations of varying sizes and assemblages (further detail is provided below). The margins of many of the lakes are dominated by willow tree species forming broadleaved semi-natural woodland. Where breaks in the woodland reduce shading, species such as reedmace, branched bur-reed*,* and common tall herbs are dominant.

Watercourses

7.3.1.10 RCAs were carried out in 2020 (GBJV, 2020) using the MoRPH5 methodology to assess the naturalness of the river channel and riverbanks, in accordance with the requirements of the Defra BNG metric. The majority of the watercourses including the River Thames (a Priority River), are in poor and fairly poor condition (with the exception of two discreet sections of the Abbey River which are in moderate condition). Presence of artificial features, invasive species and lack of riparian and marginal vegetation were the primary factors affecting the low condition scores.

Woodland

7.3.1.11 Lowland mixed deciduous, wet, and other broadleaved woodland habitats have colonised the narrow margins around and between many of the lakes, streams and road, forming a series of connecting corridors across the landscape.

7.3.1.12 Willow species dominate large proportions of the woodland habitats present, particularly those in close proximity to water. In places there are clusters of mature pedunculate and sessile oak that are likely to be the remnants of field boundaries and woodlands present prior to the quarries. Other frequent woodland species include common alder, hawthorn, sycamore, and ash.

7.3.1.13 The woodland areas on islands in the River Thames tend to be dominated by immature sycamore and ash, whilst the island at Teddington Weir is dominated by immature willow, ash, hawthorn, elder, apple, and some planted oak.

Open Mosaic of Previously Developed Land

7.3.1.14 Large areas of open mosaic of previously developed land are present; this is deemed a HPI that is indicative of former landfill and brownfield sites. Littleton Lane, Drinkwater Pit (both are potential HCAs) and Manor Farm situated near the proposed Spelthorne Channel alignment are dominated by open mosaic. This habitat type is of high ecological value for wildlife, supporting a range of terrestrial invertebrates and nesting birds including ground nesting species.

Modified Grassland

7.3.1.15 Modified grassland is present in several locations, including in proximity to the proposed alignment of the Runnymede Channel, and is the dominant habitat type in four of the potential HCAs. These species poor grassland types are indicative of the intense human usage and management, usually found in close proximity to urban areas, facilities, and recreational areas. Although species poor botanically, these grasslands can still provide potential habitat for protected species. Namely, within marginal habitats and landscape features such as rank grassland, which support amphibians, reptiles, nesting birds and terrestrial invertebrates.

Neutral Grassland

7.3.1.16 The areas of both semi-improved and unimproved neutral grassland in proximity to the proposed alignment of the Runnymede Channel provide supporting value for terrestrial invertebrates, birds, reptiles, and have a high biodiversity value compared to many other habitats within the project boundary for EIA scoping. These include Thorpe Hay Meadow SSSI, one of the last remaining unimproved hay meadows in Surrey.

Other Habitats of Ecological Value

7.3.1.17 Other habitats of note or of value for species within the project boundary for EIA scoping include the following:

7.3.1.18 Ephemeral / short perennial habitat which can potentially be of value to species including some ground nesting birds and reptile species where succession within this habitat has resulted in a suitable vegetation structure.

7.3.1.19 Species poor and species rich hedgerows which provide suitable habitat for a variety of fauna species including birds, and typically contain native flora species.

7.3.1.20 Scattered and dense scrub is also present throughout, along the margins of roads, railways, waterbodies and within some of the old landfill sites, especially at Manor Farm. Blackthorn provides an important habitat for brown hairstreak butterflies which are confirmed present in several places across the area within the project boundary for EIA scoping.

7.3.1.21 The existing built structures, (including bridges and culverts) and individual trees have potential to support roosting and foraging bats and breeding birds. The culverts also provide a dispersal corridor for a range of species.

7.3.1.22 The P1HS and their associated desk study identified suitable habitats for the following protected or notifiable species including: bats, otters, badgers, hazel dormouse, water vole, breeding and over wintering birds, Great Crested Newt, reptiles, fish, eels, aquatic, and terrestrial invertebrates, and identified the potential for INNS. Summaries for individual species are provided below.

Protected and Notable Species

Badgers

7.3.1.23 Incidental records of badgers were recorded during the 2020 P1HS Validation survey (GBJV, 2021n), which indicates the presence of at least one main badger sett and several outlier setts within the project for EIA scoping.

Bats

7.3.1.24 Suitable habitat for roosting, foraging and commuting bats is present across the area within the project boundary for EIA scoping. An updated bat Preliminary Roost Assessment (PRA) (including ground level trees assessments, tree climbing surveys, bat emergence and transect surveys) (BL Ecology, 2021) and transect surveys) found evidence of eight species of bat: brown long-eared, soprano pipistrelle, common pipistrelle, Nathusius’ pipistrelle, noctule, Leisler’s, serotine, and Myotis sp. Surveys also found likely roosts for soprano pipistrelle bats in buildings and structures plus climbing inspections of trees to date have found approximately 200 trees have potential for roosting bats.

Hazel Dormouse

7.3.1.25 The P1HS Validation survey undertaken for EIA scoping (GBJV, 2022) indicated potentially suitable hazel dormouse habitat was present at four locations. Hazel dormouse surveys were carried out in accordance with Bright 2006, but no evidence of this species was recorded. This is consistent with the desk study where the local records centres also did not return any records.

Otters

7.3.1.26 Substantial otter activity has been confirmed within the project boundary for EIA scoping and it appears that local otter populations have expanded into the Lower Thames since a previous survey in 2017. Records indicate otters have previously been recorded at various locations across the biodiversity study area. At present further otter surveys are ongoing to understand the usage of certain locations within the project boundary for EIA scoping. These surveys will inform species specific avoidance and mitigation strategies.

Water Voles

7.3.1.27 No evidence of water voles was recorded during desk top studies (GBJV, 2021o) or from site surveys which focused upon 15 suitable habitats within the project boundary for EIA scoping. Mink, a predator of water voles, was recorded within several waterbodies, during the 2021 water vole and 2022 otter surveys, which may indicate why water voles are likely absent in this part of the catchment.

Great Crested Newt

7.3.1.28 No evidence of Great Crested Newt has been found from records centre data and surveys completed to date (GBJV 2021b).

Reptiles

7.3.1.29 Low populations of grass snake *Natrix helvetica* have been recorded in surveys for reptiles undertaken in suitable locations within the project boundary for EIA scoping (AECOM, 2021a and GBJV, 2021m) to date. These results are largely consistent with the desk study which returned records of reptiles including grass snake and slow worm.

Breeding Birds

7.3.1.30 The area within the project boundary for EIA scoping has various suitable habitats for breeding birds that are of local importance for bird species conservation. Surveys for breeding birds conducted between April and June 2021 (AECOM, 2021b, APEM, 2021a) found that breeding assemblages predominantly comprised common and widespread species. Various specially protected and notable species were recorded including Cetti’s Warbler *Cettia cetti* and kingfisher *Alcedo atthis* (listed on Schedule 1 of the Wildlife and Countryside Act, 1981 (as amended)). Song thrush *Turdus philomelos* were also recorded, which is a species included on the Birds of Conservation Concern (BoCC) Red List and (SPI).

Terrestrial Invertebrates

7.3.1.31 There is an extensive array of terrestrial invertebrates within the project boundary for EIA Scoping (JBA Consulting, 2020 and 2021a). Over 1000 terrestrial invertebrate species have been identified from surveys completed to date. Of the 86 species of nature conservation status recorded in surveys completed in 2021, four are SPI; money spider *Agyneta mollis*, picture-winged fly *Dorycera graminum*, digger wasp *Cerceris quinquefasciata*; and small heath, a butterfly, *Coenonympha pamphilus*, and a further 14 identified species are considered Nationally Rare*.*

7.3.1.32 Important habitats for terrestrial invertebrate species assemblages include grassland, scattered scrub including woodland edge, reed-fen (including transitional), drier grasslands, open mosaic habitats and secondary woodlands.

7.3.1.33 An invertebrate survey (Jones, 2021) was carried out for the Environment Agency on 15 targeted sites along the Thames floodplain in West London. Each site was visited on a monthly basis between April and August 2021. In summary:

- 665 species were recorded;
- One species was discovered new to Britain – a small ‘false’ click beetle *Dromaeolus barnabita*;
- One species was discovered at its second British locality, a weevil *Lixus iridis*. This insect was thought extinct in Britain until rediscovered in Surrey in 2020; and
- Several nationally scare species were also found as well as various very local and unusual species.

7.3.1.34 Blackthorn and elm habitats within the project boundary for EIA scoping are of low to medium quality for white-letter hairstreak *Satyrium w-album* and low to high quality for brown hairstreak *Thecla betulae*. Surveys have identified brown hairstreak eggs in various locations (JBA Consulting, 2019 and 2021b).

7.3.1.35 A scoping survey for stag beetle *Lucanus cervus* was undertaken in 2019 (JBA Consulting, 2021a). Stag beetle is identified as a Nationally Scarce species of nature conservation significance. No suitable habitat for stag beetle has been noted within the project boundary for EIA scoping to date, although gardens adjacent to the boundary offer potentially suitable habitat.

Terrestrial INNS

7.3.1.36 Plant and animal INNS are abundant within the project boundary for EIA scoping. Seven terrestrial plant INNS have been recorded in previous surveys (GBV, 2021f; 2021g; 2021n) for the RTS; Himalayan (Indian) balsam, orange balsam, small leaved balsam, Japanese knotweed *Fallopia japonica*, two types of cotoneasters spp. and giant butterbur *Petisites japonicus*. Terrestrial INNS surveys are currently being undertaken within the project boundary for EIA scoping.

Fish

7.3.1.37 Electric fish surveys conducted by APEM in 2019 on the tributaries and minor watercourses within the project boundary for EIA scoping found a range of common species in low numbers.

7.3.1.38 Additionally, the River Thames is regularly surveyed by the Environment Agency fisheries team and Hull Institute of Fisheries, which provide a yearly picture of the fish populations. The most recent Environment Agency surveys (2020; 2021; 2022) have shown an increase in fish populations within the catchment with a larger than expected population in Mead Lake Ditch, reporting finding over 1200 individual fish in the 2022 surveys. Species recorded in the 2022 surveys included bleak, roach, ruffe, trench, silver bream and perch, species generally expected to be found in watercourses within the catchment. Fish surveys in watercourses and lakes are currently ongoing.

Aquatic Macroinvertebrates and Macrophytes

7.3.1.39 Macroinvertebrates and macrophyte surveys have been conducted on waterbodies directly or indirectly connected to the proposed Runnymede and Spelthorne channels (APEM, 2022). The results of the survey are summarised below:

- Where samples were collected macroinvertebrate species were reported in low numbers and percentage cover of algae was also low;
- No nationally or locally important macrophyte taxa were recorded in the summer of 2021;

- The River Thames macroinvertebrate communities sampled in spring and autumn were consistent with what is expected under Whalley Hawkes Paisley Trigg, for this type of river;
- One notable mayfly species was recorded *Caenis beskidensis* in spring 2021, upstream of Walton Bridge. This species is Nationally rare. The previous records were all on the River Lugg, Herefordshire; and
- No depressed river mussels were found during the surveys.

Phytoplankton and Zooplankton

7.3.1.40 Surveys were conducted in 2015 and 2016 for phytoplankton and zooplankton and found a range of species typical of lake ecosystems. Further surveys will be undertaken to validate these findings on all lakes, still waterbodies and flowing waterbodies affected by the project.

Aquatic Invertebrate, Macrophyte and Fish INNS

7.3.1.41 A total of 38 aquatic INNS have been identified through data searches and surveys (13 macroinvertebrates, 25 macrophytes) in waterbodies directly or indirectly connected to the proposed Runnymede and Spelthorne channels. Eleven of these species are high risk according to the WFD UK Technical Advisory Group (UKTAG) list, while five species are moderate or low risk. One horizon species, *Dreissena rostriformis bugensis*, which was found at the Thames Middle site, is classified as ‘Waiting’ on the WFD UKTAG list.

7.3.1.42 There is limited information on fish INNS within the project boundary for EIA scoping, however environmental DNA surveys have concluded that top mouth gudgeon is absent.

Aquatic Pathogens

7.3.1.43 There is no survey data for aquatic pathogens for the waterbodies located within the project boundary for EIA scoping and surveys are proposed in 2022. Pathogens have been noted within waterbodies in the north of the 1 in 100 year flood plain (i.e. the area with a 1 per cent chance of flooding in any given year).

7.3.2 Future Baseline

7.3.2.1 Changes to the ecological baseline in the absence of the project, have been considered and the predicted change is summarised within this section.

7.3.2.2 Designated sites are afforded protection provisioned through the legislative framework including the EU Habitats and Conservation of Species Regulations 2017 (as amended). Whilst this legal protection remains in place, the future baseline for these sites is likely to be safeguarded, additionally supporting sites could receive greater protection in future and therefore result in an improvement in local biodiversity in the absence of the RTS.

7.3.2.3 Non statutory designated sites such as Local Wildlife Sites are usually afforded protection through local planning policies. Larger landscape scale strategies containing various designated and non-designated sites may be identified as BOAs. As such changes to the future baseline of these sites is likely to be positive.

7.3.2.4 The Surrey Biodiversity Action Reporting Project 2011-2020 (Surrey Nature Partnership 2022), details various BOAs Policy statements, each of which contain objectives and targets.

7.3.2.5 Habitats including lowland mixed deciduous woodland, wet woodland, reedbed and lowland meadows are identified as EU Annex II and afforded legal protection under the EU Habitats and Conservation of Species Regulations 2017 (as amended). As such, it’s unlikely any significant loss or change to these habitat types will occur. However, lack of management including eradication and control of INNS may cause a degradation of the habitat condition overtime.

7.3.2.6 HPIs, ancient woodland, ancient trees and veteran trees, whilst not afforded legal protection, are conserved, and managed under local planning policies. Strategic landscape strategies, including the Thames Basin (National Character Area (NCA) 115), also recognises more common habitats such as grassland as important, hereby providing a platform that drives long-term retention, management, and enhancement. The future baseline for these habitat types is therefore likely to be positive with a potential improvement to habitat condition.

7.3.2.7 Priority Rivers, including the River Thames and its tributaries, are subject to long-term protection and management defined under local catchment plans, ongoing management and mitigation provisioned under the WFD is further likely to result in a positive future baseline for rivers.

7.3.2.8 A combination of legal protection, local planning policy and local catchment plans are likely to safeguard priority habitats, present within the project boundary for EIA scoping, one key exception is open mosaic of previously developed land. Whilst this habitat is identified as an HPI (eCountability, 2021), it is not identified as an important habitat within the Surrey Local Plan or NCA 115. This habitat type is indicative of former landfill and brownfields sites and is often under recorded or overlooked in terms of its importance for biodiversity, particularly terrestrial invertebrates.

7.3.2.9 Open mosaic is a diverse habitat which requires long-term ongoing management to retain its characteristic features (patches of bare ground, inundation areas, patches of scrub, grassland mosaics). A lack of protection and management will likely result in most of the open mosaic habitat within the RTS succeeding to grassland or succumbing to unsympathetic clearance to enable regeneration and expansion of urban developments.

7.3.2.10 Protected species including bats, otters, badgers, reptiles, breeding birds, fish including European eels *Anguilla anguilla* are afforded varying levels of legal protection. These species groups are safe guarded through the requirement for derogation licences, permits and consents for works which could affect the species or their habitat. In the absence of the RTS it is likely these species will continue to thrive in habitats across the RTS and potentially expand their range and territories to maintain a favourable conservation status.

7.3.2.11 Rare and notable species including hedgehogs, rare invertebrates, and other aquatic species are often overlooked in terms of legal protection and loss of habitat, control of INNS and human disturbance are the primary factors likely to affect the success of these taxa in the future and in the absence of the RTS, potentially resulting in local extinctions.

7.3.2.12 As per the long list projects considered for the Cumulative Effects Assessment (Appendix L), it is noted that the baseline habitats and associated species in proximity to Littleton North lake may alter prior to construction of the RTS, given that the site owner, plans to carry out continued restoration of the former mineral workings at the site. Also, Merlin Entertainment Ltd proposes partial infilling of small lake and installation of a rollercoaster within the Thorpe Park complex from 2022-2024, a small part of which lies within the project boundary for EIA scoping. No other substantial habitat changes are anticipated within the project boundary for EIA scoping in the near future.

7.3.3 Key Environmental Considerations and Opportunities

7.3.3.1 The main biodiversity considerations for the project include:

- Availability of land for HCAs;
- Numerous stakeholders involved;
- Protected species and protected habitat constraints;
- Hydrology/water quality and effect on aquatic species
- Invasive species; and
- The need to retain non-designated habitats, species/vegetation.

7.3.3.2 The main biodiversity opportunities to the project include:

- Net gain for biodiversity;
- Improve connectivity, networks and corridors;
- Enhancement of existing habitats (including low-quality habitats) and provision of new habitats;
- Planting opportunities including native species planting including marginal planting along the water bodies associated with the project;
- Management and removal of invasive species; and
- Health and wellbeing benefits to people being able to enjoy nature and have opportunities to interact with local biodiversity.

7.4 Likely Significant Effects Requiring Assessment

7.4.1 Construction Effects

7.4.1.1 Project activities and associated likely significant effects during construction are identified below:

- Bed lowering and river bank lowering have the potential to cause adverse effects on protected and notable aquatic species and habitats due to disturbance of river bed and river banks;
- General construction activities and movement of vehicles, equipment and site operatives have the potential to result in significant adverse effects on the following features:
    - Potential adverse effect on statutory designated and non-designated sites, habitats, trees, protected and notable species during construction due to vegetation clearance, soil compaction, reduction in the availability of foraging and commuting habitat, resting or breeding sites, habitat severance and fragmentation or direct injury / death of species;
    - Potential adverse effect of disturbance on designated site features (e.g. birds), terrestrial and aquatic habitats and terrestrial and aquatic protected and notable species due to increase in noise, vibration, lighting and visual disturbance from construction activities;
    - Potential adverse effect on designated sites (i.e. Thorpe Hay Meadow SSSI) or disturbance and displacement of protected and notable species due to potential harm and nuisance caused by generation of dust from construction activities; and
    - Spread of INNS resulting in adverse effects on designated and non-designated terrestrial and aquatic habitats and protected and notable species.
- Construction works in and around water bodies have the potential for adverse effects on aquatic habitats and protected/notable species in water bodies through changes in the water quality (including temperature), hydromorphology, flow regime or sediment processes during construction;

- Aquatic INNS and pathogens management through chemical treatment, removal or lowering of water levels in lakes has the potential to result in adverse effects on aquatic habitats and protected or notable species through changes in the water quality, levels, hydromorphological, flow regime or sediment processes;
- Dewatering of waterbodies, during construction (e.g. from earthworks, channel excavation or drawdown of lakes for management of aquatic INNS), which could be released to surface waters, potentially altering hydrological regime in local surface water bodies, with subsequent effects on and affecting aquatic and water dependent species (including entrainment of small fish in pumps);
- Demolition of built structures (buildings, bridges, culverts) could have potential adverse effect of loss of bat roosts and bird nesting locations;
- Transportation of waste/ materials and placement of non-hazardous material offsite could result in the transfer of INNS, or in disturbance to receiving habitats and species at the destination; and
- Sheet piling along sections of the flood channel resulting in increased sediment and damage to aquatic and riparian habitats where it interacts with watercourses.

7.4.2 Operational Effects

7.4.2.1 Project activities and associated likely significant effects during the operational phase are identified below:

- Existence of the flood channel and other project components resulting in a potential loss of aquatic habitats beneath flow control structures, fish passes, capacity improvements at weirs, or for structures to prevent transit of mobile species;
- Fish pass creation and modification works may result in a potential benefit on protected and notable aquatic species, due to improved fish passage in the River Thames and tributaries, which will enable fish and other aquatic mobile species to disperse more freely/unhindered;
- Introducing an augmented flow and operational flow in the flood channel (and intersected waterbodies) may result in potential changes in water quality (e.g. from changes in suspended sediment, nutrient

levels and scour of contaminated sediments) with subsequent adverse effects on designated sites, aquatic habitats and protected and notable aquatic species;

- Introducing an augmented and operational flow in the flood channel (and intersected waterbodies) may result in a potential adverse effect on designated sites, aquatic habitats and protected and notable aquatic species resulting from infestation of lakes or marginal habitats by new INNS and aquatic pathogens present in surrounding water bodies and River Thames brought in by the augmented or flood flows. Increased public usage of the channel (by canoes etc) could also cause increased spread of INNS and aquatic pathogens, with resulting effects on habitats and species;

- Change in land use from terrestrial to aquatic habitat through the presence of the flood channel has potential adverse effects on terrestrial habitats and protected and notable species due to reduction in the availability of foraging and commuting habitat, resting or breeding sites and habitat fragmentation;

- Potential beneficial effect of net gain in biodiversity during operation via provision of enhanced or new habitats (and new habitat corridor);

- Provision of new areas of open green space and landscaping works could cause disturbance of designated and non-designated habitats and protected and notable species through increased public access;

- Creation of navigable sections of flood channel and presence of boats using the new channel (most likely canoes or boats using mooring facilities) may disturb water dependant habitats and species as well as spread INNS and pathogens;

- Provision of habitat improvements and enhancements to existing lake edges (edge shallowing) and creation of new wetland habitats would enhance supporting habitats for wildfowl, including wintering birds which are designated features of the SPA, fish, invertebrates and macrophytes resulting in positive effects;

- Use of the flood channel and capacity improvements during times of flood will result in effects on Thorpe Hay Meadow SSSI from changes in nutrient enrichment. At Thorpe Hay Meadow SSSI, the project will lower the groundwater level which will improve drainage in spring and reduce the incidence of flooding from the Mead Lake Ditch and significantly from the River Thames. While the biggest effect on the site is currently thought to be management, the potential significant positive effects on flood reduction/improved drainage will be assessed further;

- Creation of flow control structures around St Ann's Lake have potential adverse effects on protected species (such as otters and eels) and notable aquatic species due to altered habitat and creation of a barrier to migration between St Ann's lake and Abbey Lake and other existing connections; and
- Dredging or other possible management activities to reinstate the design profile of the flood channel have the potential for adverse effects on water quality due to the mobilisation of sediment and pollutants, with subsequent effects on aquatic and water dependant habitats and species.

7.4.2.2 The following potential operational effects are considered within the surface water, groundwater and WFD sections of the ES, and draws on the assessment of effects on key WFD biological indicators (such as fish, macrophytes and macro-invertebrates) considered in this section:

- Potential adverse and beneficial effect on the hydromorphology of WFD and non WFD lakes;
- Potential beneficial effect on hydromorphology and biology of WFD and non WFD surface water (as a result of increased diversity of water and flow dependent habitat);
- Potential adverse effect on the flow, hydromorphology, water quality and ecology of rivers (WFD, non-WFD and within surface water safeguard zones) intersected by the flood relief channel through operation of the project due to potential differences in flows, water quality and biological conditions of the flood relief channel and the downstream sections of these rivers; and
- Potential adverse effect on water quality of WFD and non-WFD lakes from the introduction of River Thames water (in normal conditions and during floods) to previously unconnected lakes.

7.4.3 Scoping of features

7.4.3.1 Those ecological features that are of greater importance than low or that are subject to legal protection, will be scoped into the EIA where there is potential for them to be affected by the activities above. Features of low or negligible value are considered sufficiently widespread, unthreatened, and resilient to project changes and will remain viable and sustainable. Impacts to these features will be mitigated by good construction practice and the overall BNG strategy.

7.4.3.2 At this stage, it is envisaged that the following features will be scoped into the biodiversity assessment within the study areas defined in 9.3.3:

- International and national statutory designated sites as well as sites that could support designable feature ‘supporting sites’ within 2km or the extent of the 1 in 100 year floodplain affected by the RTS where greater (i.e. the area with a one per cent chance of flooding in any given year), including: SWLW SPA and Thorpe Hay Meadow SSSI;
- Sites of Nature Conservation Interest (SNCIs);
- HPIs;
- Other terrestrial habitats (excluding HPIs);
- Waterbodies (lakes, ditches, ponds);
- Bats;
- Otters;
- Hazel dormouse;
- Badgers;
- Water vole;
- Birds: Schedule 1 and SPA species;
- Other breeding birds;
- Great Crested Newt;
- Reptiles;

- Fish (certain species) and eels;
- Nationally rare terrestrial and aquatic invertebrates including freshwater pearl mussel, and stag beetle as Species of Principal Importance in England; and
- Terrestrial and aquatic invertebrates including brown and white letter hairstreak butterflies.

7.4.3.3 Macrophytes, phytobenthos, phytoplankton and zooplankton will be considered under Lake and Rivers HPIs as ecosystem indicators.

7.4.3.4 At this stage, it is not possible to scope out any features, as surveys for habitats and protected species have been focused on areas of land that were included within previous iterations of the design. Additional areas of land have since been included and now form part of the area within the project boundary for EIA scoping. Consequently, all habitats will be required to be re-assessed in terms of their suitability for bats, badger, otters, terrestrial invertebrates including stag beetle, wintering and breeding bird, reptiles, aquatic ecology, hazel dormice, water vole, Great Crested Newt, White Clawed Crayfish, and stag beetle before these features can be scoped out.

7.5 Effects Not Requiring Assessment

7.5.1 Construction Effects

7.5.1.1 Project activities and associated effects that are deemed not likely to be significant during construction, and are therefore proposed to be scoped out of the EIA, are identified below:

- Transportation of hazardous material from the major road network to, and placement at, licensed sites offsite causing the transfer of INNS or other effects upon biodiversity. An INNS management plan will be put in place and all movement of hazardous material/ waste will by licensed carriers and to sites with existing permits; and
- Potential adverse effects on designated sites, terrestrial and aquatic habitats, or protected and notable species, from accidental spillage or run-off from stored chemicals or fuel. A CEMP will be produced and define control measures to minimise the risk of spillage.

7.5.2 Operational Effects

7.5.2.1 Project activities and associated effects that are deemed not likely to be significant during operation and are therefore proposed to be scoped out of the EIA, are identified below.

- Existence of capacity improvements at the River Thames weirs could change the hydromorphological conditions downstream of the weir (such as weir pools) causing potential adverse effect upon aquatic habitats, protected and notable species. The changes to conditions arising from the RTS works are expected to be within the scale of natural changes caused by major flow events (a review of historical bathymetric surveys conducted between 2002 and 2015 for the RTS reveals that slight changes in depth occur around these features). Measures have also been built-in to avoid the main weir pools. The new structures at Sunbury Weir and Teddington Weir are downstream of the main weir pools and the works at Molesey Weir are approximately 250m upstream of the main weir pools;

- Operational failures of flow control structures on channel, new weir gates or fish passes not operating as planned could cause adverse effects on soil erosion or water quality with subsequent effects on habitats and protected and notable species (e.g. flooding of adjacent habitat types and submerged badger setts, otter holts). There will be an operating procedure for augmented flow and control structures which will be managed by the Environment Agency post construction (pursuant to the DCO) and subject to regular maintenance checks and repair; and

- Damage to habitats and disturbance to designated sites and protected and notable species from general maintenance activities. It is considered that good practice measures, including sensitive timing, will be implemented to avoid effects and are therefore able to be scoped out.

7.5.2.2 As discussed, above, any designated statutory or non-statutory sites more than two km from the project boundary for EIA scoping or beyond the extent of the 1 in 100 year floodplain (i.e. the area with a one per cent chance of flooding in any given year) affected by the RTS (where greater) that are not designated for mobile species, otters, bats or hydrologically connected to the area within the project boundary for EIA scoping have been scoped out of the assessment; this is in accordance with CIEEM guidance on zone of influences for ecological features.

7.6 Approach to Mitigation

7.6.1.1 This section should be read in conjunction with Chapter 5: Approach to EIA Scoping, which sets out further definition for the DCO application regarding primary (embedded) mitigation, secondary (additional) mitigation, and tertiary (best practice) mitigation.

7.6.2 Construction

7.6.2.1 Secondary mitigation measures that are under consideration for the construction phase are identified below. These are likely to be secured through a mixture of DCO requirements and the CEMP:

- To minimise disturbance to internationally designated site interest features maintain a buffer of at least 100m from designated sites, time sheet piling to avoid the peak breeding and wintering bird time periods as well as restrict the use of artificial lighting at night;
- Habitat creation, enhancements and dispersal corridors will be undertaken in advance of the main works where possible, to mitigate effects, avoid deficit (losses) of priority habitats and deliver BNG, using the Defra Biodiversity Metric. Where habitat trading deficits occur, all high and moderate distinct habitats will be mitigated through replanting on site, or offsite through an offsetting provider where insufficient land is available;
- An INNS management plan for both aquatic and terrestrial INNS will be produced, detailing mitigation measures for each site to avoid or minimise the spread of INNS and aquatic pathogens to designated sites and other terrestrial and aquatic habitats. Mitigation regarding pathogens in aquatic environments will be required and determined as a result of the surveys and this may result in the requirement for pathogen management plans to be produced alongside the INNS management plan;
- Piling methods with minimal vibration and noise (i.e. non-percussive methods) will be used wherever practical in order to avoid or minimise disturbance to aquatic and terrestrial species;

- Noise barriers/screens will be erected around construction areas located within close proximity to the SWLW SPA or where noise has the potential to affect lakes and habitats, where Schedule 1 birds are present;
- Use of artificial lighting will be restricted one hour prior to dusk until one hour prior to dawn in sensitive areas and will be directed away from habitats and foraging routes to control light spill;
- Install road underpasses and dry pipes to provide alternative means of dispersal for terrestrial mammals, including otters and badgers. Mitigation to be sited immediately adjacent to the existing dispersal corridors;
- Vegetation clearance will be timed to avoid the peak breeding seasons and carried out in accordance with sensitive clearance methods e.g. two stage clearance methods and destructive searches. Where species specific derogation licences are required, defined mitigation measures including vegetation clearance methodology will be detailed;
- Demolition of buildings at the northern end of the Runnymede Channel, existing bridges, culverts and/or the removal of trees will be timed to avoid peak breeding and hibernation seasons for roosting bats as appropriate. Where a roost is confirmed present and likely subject to effects, a European Protected Species Mitigation Licence and/or Bat Class Mitigation Licence (BMCL), derogation licence to be obtained and works to be carried out in accordance mitigation measures defined within the licence;
- Demolition will be timed to avoid bird nesting season (March to August) or pre-demolition bird surveys will be conducted to confirm absence of nesting birds;
- Include creation of linear habitats (hedgerows, ditches, road underpasses, dry pipes, woodland, wetland) to mitigate for loss of foraging resources, navigational features, transit corridors and places of shelter;
- Mitigation for effects on otters will be detailed within a European Protected Species Mitigation Licence. Compensation measures are likely to include provision of new artificial holts, planting of new woodland and dense scrub habitats to provide shelter free from human

disturbance. Provision of new road underpasses and dry pipes where access through culverts is severed to prevent fragmentation;

- Mitigation for effects on bats will be detailed within a European Protected Species Mitigation Licence. Compensatory new roosts for soprano pipistrelle bats to be provided within a built structure to compensate for the loss of a soprano pipistrelle bat maternity colony. Loss of other low significant roosts within trees to be compensated through the provision of bat boxes on trees within existing woodland habitats. Restrictions on timings for demolition and use of artificial lighting will form part of the mitigation;

- Mitigation for effects on badgers will be provided under a badger licence including closures of existing setts and creation of new compensatory setts across the project. Timings for sett closures will be applied to avoid the breeding season;

- Mitigation for effects on birds will include restrictions within 100m of a Schedule 1 species and/or a qualifying species associated with the SPA during the breeding and/or overwintering season. Lake edge shallowing for qualifying species (gadwall, shoveler) and waders, provision of artificial riverbank nest holes (kingfisher), enhancement to open mosaic habitats (little ringed plover). Creation of wetland and scrub habitats (Cetti's warbler). Provision of bird nest boxes for passerine species;

- Mitigation for effects on reptiles will include creation of compensatory habitats (compost heaps located close to water) for grass snakes and enhancements of existing terrestrial habitats;

- Mitigation for effects on brown hairstreak butterflies will include compensatory planting of blackthorn scrub (used for egg laying) and enhancements to existing habitats;

- Mitigation for rare/scarce terrestrial invertebrates will include avoidance and creation of sparsely vegetated mounds within existing open mosaic habitats. Long-term management of open mosaic habitats to retain features of interest; and

- Mitigation for rare/scarce aquatic invertebrates will include provision of habitat for a variety of habitats including a range of flow dynamics and slack water areas.

7.6.3 Operation

7.6.3.1 Secondary mitigation measures that are under consideration for the operation phase are identified below. These are likely to be secured through a mixture of DCO requirements and compliance with various operational management plans that may be developed:

- Undertake remediation action where the spread of aquatic INNS and pathogens into adjacent habitat types occurs (or is above the level deemed in excessive of natural occurrences);
- INNS and pathogen management implemented in accordance with the INNS and pathogens management plan; and
- Ongoing habitat management of newly created habitats in accordance with the habitat management and landscaping plans to be secured via the DCO.

7.6.3.2 Alongside the above mitigation, it will be important to undertake post monitoring surveys where required, to establish the ecological baseline post construction and in accordance (where applicable) which species-specific licences (possible examples being otter, bats, badger and birds). Updated aquatic INNS and pathogens surveys to assess potential spread into adjacent waterbodies will also be important.

7.6.3.3 There is also the opportunity to update the RCA surveys to assess if the new channel habitat and other river reaches attain the target condition score, and where necessary make further recommendations for enhancement if target condition is not reached.

7.7 Assessment Methodology

7.7.1 Scope of Assessment

7.7.1.1 An EcIA will be undertaken to assess the effects of the project on statutory and non-statutory nature conservation sites, important habitats and legally or notable species of flora and fauna (both aquatic and terrestrial), arising from the construction and operation of the project.

7.7.1.2 CIEEM has published guidance on methods of assessing effects on ecological features under *Guidelines for Ecological Impact Assessment in* *the UK and Ireland: Terrestrial, Freshwater and Coastal* (CIEEM, 2018), and all ecological effects will be assessed in line with this guidance.

7.7.1.3 Consultation has also been undertaken and will continue with the relevant stakeholders as the project proceeds (see Section 7.2.2. above and Chapter 20: Stakeholder Engagement).

7.7.1.4 The methodology to assess effects of the potential spread of INNS and aquatic pathogens is being discussed with Environment Agency specialists and will include the following principles:

- A risk rating of species specific to the DCO application project boundary will be developed;
- Widely distributed species will be scoped out;
- New introductions and species that have the potential to cause a large effect to ecosystems will be identified. Targeted surveys may be required to confirm distribution;
- The risk of spread of species caused by the project will be assessed;
- Whether species would have an effect on the waterbodies they may be spread to will be assessed; and
- Mitigation, INNS management plan and monitoring identified.

HRA

7.7.1.5 As noted previously, an HRA is being undertaken due to the project's potential effects on National Site Network sites. National Site Network, previously known as Natura 2000 sites, are a UK wide network of designated habitat for a range of species and habitats e.g. SPAs, SACs and Ramsar sites.

7.7.1.6 An HRA stage 1 screening assessment (Appendix N) concluded that the project will have likely significant effects on the interest features of the SWLW SPA and Ramsar site (populations of wintering and migrating gadwall and shoveler), through potential direct effects or disturbance to three lakes within the SWLW SPA and 17 further lakes within the study area that have been identified as 'supporting sites'). Therefore, an Appropriate Assessment (AA) will be required in close consultation with NE in respect of the RTS alone and in-combination with other plans and projects. No likely significant effects on other European Sites within the

HRA study area were identified in the HRA screening assessment and these are therefore scoped out from further assessment.

7.7.1.7 Whilst the HRA is a separate standalone assessment, it will be undertaken in co-ordination with the EcIA for the EIA.

7.7.2 Significance Criteria

Determining the Importance of Ecological Features

7.7.2.1 The CIEEM guidelines uses the term ‘importance’ as opposed to sensitivity in categorising ecological features. The CIEEM guidelines note that the importance of features considers many factors such as:

- The importance and biodiversity value of the receiving habitat, for example in terms of its relative extent, fragility (including its ability to recover) and rarity;
- The nature and significance of any nature conservation designations that apply to the receiving site/habitat; and
- The presence and sensitivity of any scarce, rare, protected or otherwise notable species of flora and fauna.

7.7.2.2 The CIEEM guidelines also recommend that the importance of each ecological feature is considered within a defined geographic reference. The following geographical references will be used to determine the importance of ecological features:

- International;
- UK / National;
- Regional (South-East England);
- County (Greater London/Surrey);
- Borough (within a Borough Council area);
- Local (Parish/Neighbourhood); and
- Biodiversity Study Area

7.7.2.3 Example levels of importance of designated sites/habitats scoped into this assessment are provided in the following bullet points below using a defined geographical reference as per the CIEEM Guidelines (2018).

- **Very High -** Internationally important site e.g. SPA and SAC;
- **High -** Nationally important site e.g. SSSI and NNR;
- **Moderate -** County/regional important site e.g. important large Local Nature Reserve. HPIs at a county or regional importance e.g. large areas of ancient woodland;
- **Low -** Borough/local important site e.g. SNCIs, smaller Local Wildlife Site or Local Nature Reserves. HPIs at a borough and local importance e.g. small woodland areas; and
- **Negligible** - Non-HPIs. Biodiversity study area only.

7.7.2.4 The importance of a flora and fauna species is more dependent on local geographical context of the species population. As noted in the bullet points below, where a species is protected but is relatively common in the local area the importance may be reduced in that geographical context. If the species is not common in the local area or on the edge of its range for example, then the importance may be increased. Professional judgement will be applied to determine species importance based upon the available data and a rationale provided in the assessment.

- **Very High -** Species protected under international legislation e.g. the Habitats Regulations, interest species of a SPA and SAC;
- **High –** Species protected under national legislation e.g. Wildlife and Countryside Act. Nationally important populations;
- **Moderate -** Species, populations or assemblages considered important above a local level. Likely to be one or more of the following:
    - Species protected both as individuals and within nationally important populations under national legislation e.g. Wildlife and Countryside Act;
    - SPI; and
    - British red data list species.
- **Low -** Species, populations or assemblages considered important at a local level only. Likely to be one or more of the following:

  - Species protected under national legislation e.g. Wildlife and Countryside Act and of local value;
  - SPI; and
  - British red data list species.
- **Negligible** - Widespread, common species.

Characterisation of Effects

7.7.2.5 In accordance with CIEEM guidelines, the potential effects of the project to ecological features will be considered and will be characterised according to the following parameters where applicable:

- Magnitude;
- Positive or negative;
- Complexity;
- Extent;
- Duration;
- Reversibility;
- Timing; and
- Frequency.

Magnitude of Change

7.7.2.6 The magnitude of a potential change in biodiversity will depend upon whether it would cause a fundamental, material or detectable change to the structure or function of ecological features upon which habitats and species depend - including for example, available resources (such as food and water, shelter and roost sites, breeding sites and corridors for migration and dispersal), ecological processes (such as population cycles, competition, predation and seasonal behaviour) and human influences (such as the site’s management regime).

7.7.2.7 The criteria for assessing the magnitude of potential changes to biodiversity are categorised as high, moderate, low, very low or none.

- **High** – Effect on site integrity, in terms of coherence of ecological structure or function. Effect on population/conservation status/conservation objectives;
- **Moderate** – Effect on site's ecological objectives. Risk of effect on individuals but no likely effect on overall population;
- **Low** – A change from the baseline conditions. Neither integrity nor ecological objectives of the site or population status compromised;
- **Very Low** – A very slight change from baseline conditions which has no observable change; and
- **None** - No change from existing baseline.

Positive and Negative Effects

7.7.2.8 Effects from the project can be positive or negative. For the biodiversity assessment these are defined as:

- **Positive** - a change that improves the quality of the environment, or slows/halts existing decline in quality or population, for example increasing the extent of a habitat of conservation value; and
- **Negative** – a change that reduces the quality of the environment or population, for example destruction of habitat or increased noise disturbance.

7.7.3 Assessment of Overall Significance of Biodiversity Effects

7.7.3.1 Once a significant effect has been identified (i.e. it is considered likely to affect the integrity/favourable conservation status of the ecological feature), the assessment of the overall level of significance of the effect on the receptor is produced by combining the sensitivity of the feature and the magnitude of change.

7.7.3.2 The approach to determining significance in the biodiversity assessment differs from the standard significance assessment methodology adopted for this project, where the significance of an effect is based on three levels of feature sensitivity. The biodiversity assessment uses five levels of sensitivity in line with CIEEM (2018) guidance as shown in Table 7.1 below, which outlines the assessment of how the level of significance is evaluated. After establishing the sensitivity of the feature and addressing the magnitude of change, the overall effect to the feature can be determined as significant (major or moderate effects) or not significant (minor or negligible effects).

Table 7-1: Assessment of Significant Environmental and Residual Effects.

	Very High Sensitivity (International)	High Sensitivity (National)	Moderate Sensitivity (Regional/ County)	Low Sensitivity (Borough/ Local)	Negligible Sensitivity (Study Area only)
High Magnitude	Major (Significant)	Major (Significant)	Major (Significant)	Moderate (Significant)	Minor
Moderate Magnitude	Major (Significant)	Major (Significant)	Moderate (Significant)	Minor	Negligible
Low Magnitude	Moderate (Significant)	Moderate (Significant)	Minor	Minor	Negligible
Very Low Magnitude	Minor	Minor	Negligible	Negligible	Negligible
No Change	None	None	None	None	None

Construction/Operational Effects and Mitigation

7.7.3.3 The likely significant construction and operational effects to features resulting from the project will be assessed using a combination of the feature importance criteria and the significance criteria. Assessment of effects (with primary and tertiary mitigation assumed to be in place) will be presented initially. Any further (secondary) mitigation that may be required to address any remaining significant adverse effects will be identified and residual effects assessed with such additional secondary mitigation in place as a second stage of the assessment.

7.7.3.4 Mitigation will follow standard best practice guidelines and the mitigation hierarchy. It should be recognised that where possible the mitigation strategy will be to ‘avoid and ‘minimise,’ however due to various constraints this will not always be possible. Licence applications will be sought as required and mitigation such as exclusion and translocation of species, habitat manipulation, creation and enhancement will be undertaken.

7.7.4 Assessment of Cumulative Effects

7.7.4.1 Other projects that are consented, likely to be consented or have similar construction programmes may establish new or change existing ecological receptors and result in new effects to receptors when combined with the RTS. These may result in a change to the significance of effects. These, together specific interactions with other topics (in-combination effects) will be assessed within the ES using the approach as detailed in Chapter 19: Cumulative Effects Assessment.

7.8 Assumptions and Limitations

7.8.1.1 All surveys have been conducted using methodologies based on applying a reasonable survey effort to determine presence or likely absence of a species within the survey area. The surveys are not exhaustive, and therefore cannot determine the absence of a species as a total certainty.

7.8.1.2 At the time of writing not all of the area within the project boundary for EIA scoping has baseline data. As such, new records will be requested and further surveys undertaken to inform the ES and due to this limitation, all features are scoped in at this stage.

7.8.1.3 General limitations that were common occurrences during the surveys to date are noted below. Further detail on assumptions and limitations can be found in the respective species reports:

- Access issues, landowner refusals, no access to certain areas and other access related constraints (due to Health and Safety, impenetrable vegetation, unpassable land e.g. quicksand, deep silt or water, and proximity to high-speed roads);
- Time constraints (including time-specific deadlines due to consents and land agreements for certain sites and seasonality of species and surveys);
- Desk study data being dependent on people and organisations having submitted records for areas of interest which means there may be a

lack of records for a particular species or records for a particular species which may now not occur in the biodiversity study area; and

- Mobile species (such as reptiles amongst others) potentially moving into the biodiversity study area after the surveys have occurred.

7.8.1.4 Despite the limitations, the desk study and surveys are still considered to deliver a good initial assessment of the baseline to inform the EIA Scoping. The limitations are not deemed severe enough to significantly affect the outcomes described within this report.

7.8.1.5 Most of the current limitations will be reduced by the time the ES is produced through the ongoing survey effort. As such, is it expected that overall the limitations are not likely to significantly affect the EcIA.

8 Climatic Factors

8.1 Introduction

8.1.1.1 This chapter describes the scope of the assessment in relation to climatic factors. It outlines the baseline conditions, the likely significant effects of the project and mitigation measures proposed to alleviate these. It also outlines the methodology that will be used for the assessment of potential climatic factors effects arising from the construction and operation of the RTS within the ES.

8.1.1.2 The assessment will consider the effects the RTS has upon the UK's ability to meet science based targets for climate change (aligned with limiting global temperature rise to 1.5°C above pre-industrial levels), and the resilience of the project to climate change effects. For the purpose of this assessment, the term 'climate change mitigation' refers to the project's effect on climate, whereas 'climate change adaptation' refers to the effect from projected future climate change on the project. Although these two things are intrinsically linked, they are considered separately for assessment purposes, as they affect vastly different spatial scales and follow distinct methodologies.

8.1.1.3 This section will therefore include subheadings to cover:

- Climate change mitigation (identification and management of greenhouse gas (GHG) emissions associated with construction and operation of the project); and
- Climate change adaptation (risks and resilience to future climate change) and potential ICCI with other EIA topics.

8.1.1.4 A core goal of the project is to reduce flood risk to dwellings, businesses and infrastructure. Reduced flood risk can be quantified in many ways, not just in a reduction in the properties flooded in different flood scenarios. Correcting the damage caused by flooding can result in carbon emissions being avoided as a result of the project.

8.1.1.5 Another project goal is to enable delivery and design that contributes to the achievement of Environment Agency and Surrey County Council goals in relation to carbon use. More than half of the Environment Agency's GHG emissions currently come from construction of flood defences, accounting for 148,000 tonnes of carbon emissions each year on average. By 2030, this will need to be reduced by 45 per cent to 81,400 tonnes across the flood defence programme, in accordance with the 'Environment Agency: Reaching net zero by 2030' commitment (Environment Agency, 2021l).

8.1.1.6 This chapter overlaps with the following other Chapters in the Scoping Report including Chapter 7 – Biodiversity, Chapter 10 – Flood Risk, Chapter 11 – Health, Chapter 13 – Materials and Waste and Chapter 15 Socio-economics, Chapter 18 – Water Environment.

8.1.1.7 A summary of the key legislation, policy and guidance relevant to climatic factors is provided in Appendix M.

8.2 Baseline Methodology

8.2.1 Information Sources

Climate Change Mitigation

8.2.1.1 Baseline levels of GHG emissions are required in order to assess net changes in emissions of the RTS.

8.2.1.2 This will involve identifying emissions from land uses within the study area that are anticipated to be affected by the construction and operation of the project. This will make up the baseline for the assessment. Where buildings, operations, habitats and other land uses are within the study area, but are not expected to be directly or materially affected, these will be excluded.

8.2.1.3 Where such emission sources may be directly and materially affected, these will be set out in an inventory of existing GHG emissions. Where possible, emissions factor data will be sourced from the UK's National Atmospheric Emissions Inventory programme (National Atmospheric Emissions Inventory, 2017), the UK Government Greenhouse Gas Conversion factors for Company Reporting (DBEIS, 2021) whilst activity data will be gathered from the proposed development plan, materials used and on-site activities to determine their contribution to GHG emissions. This information is required to inform the EIA assessment.

8.2.1.4 It should be noted that a Carbon Management Plan will be produced as part of the DCO application. This document follows a process aligned with PAS2080, which considers the baseline emissions to be those associated with an early iteration of the project design (from the Outline Business Case, as amended), in order to seek GHG reductions. Although this will be used to demonstrate the mitigation of this effect, it will not be used as the baseline in the EIA.

Climate Change Adaptation

8.2.1.5 The project is in many respects a climate change resilience project, to alleviate the flooding risk posed to communities, infrastructure and businesses, and an opportunity to reduce flood damages which can contribute to reducing future GHG emissions, improving the quality of life of residents and enhance biodiversity and amenity. Future climate projections relating to peak rainfall events have been used to demonstrate the need for the project and develop the appropriate scale of interventions that consent is now being sought for. Over time, and because of climate change, the RTS channels will function more frequently as high flows become more frequent on River Thames, hence the need for intervention. However, climate change will result in more challenges than higher levels of peak rainfall, and therefore this assessment will bring together the various ways in which climate change may manifest itself upon the local area (such as the risks to infrastructure shown in Table 10.1, along with other relevant risks set out in the Third Climate Change Risk Assessment, and seek to identify further measures that may be required in order for the project to be well placed to adapt to these over its design life (taken to be 100 years).

8.2.1.6 The existing baseline also includes current weather conditions and is based on the Met Office's climate profile for Southern England (Met Office, 2016).

8.2.2 Stakeholder Engagement

8.2.2.1 Surrey County Council in their capacity as a regulator provided a Scoping Opinion on the EIA Scoping Report submitted for the project under the Town and Country Planning Act in 2017. As part of that Scoping Opinion request the project proposed to scope out the likely contribution of the project to the causes of climate change. Surrey County Council, however, responded that the relevant LPAs would expect a review of the baseline in terms of the GHG emissions attributed to the project to be included as part of the EIA. The preparation of this chapter has been informed by the 2017 Scoping Opinion which set out the policy and climate target requirements in relation to climate mitigation. These local policy requirements and how they evolve will be equally as important to the assessment as national and topic specific guidance and targets.

8.2.2.2 A start up meeting with the wider RTS project team including the Environment Agency and Surrey County Council was undertaken in February 2022 to introduce the Carbon Management Plan for the project and carry out workshops to identify potential carbon saving opportunities. Further carbon management workshops were undertaken in June 2022.

8.2.2.3 In terms of climate change resilience, a large amount of engagement has been carried out with all affected local authorities around flood resilience and the effects of climate change in order to understand the key risks from climate change and agree the initial concept for the flood alleviation scheme.

8.2.2.4 Further engagement is proposed as more design details become available, which includes discussion with Surrey County Council with respect to the Carbon Management Plan, traffic management, habitats and offsetting, landscape and green infrastructure and active travel. The outcomes of this consultation will be considered within the ES.

8.2.3 Study Area

8.2.3.1 The study area for both climate change mitigation and adaptation comprises the area within the project boundary for EIA scoping, plus a 500m buffer, or if greater, the area of the 1 in 100 year floodplain (i.e. the area with a one per cent chance of flooding in any given year) that will experience a change in flood extent as a result of the project (see Figure 8-1 in Appendix A). The buffer combined with the floodplain that could be changed as a result of the RTS means that the likely significant changes in relation to resilience and climate mitigation can be fully captured; it is a suitably precautionary study area given the nature of assessing climate effects. During operation, changes in trip generation for roads in the local area will not be significant to require additional assessment for climate change mitigation (GHGs). This is considered appropriate as it will incorporate the spatial extent where changes in emissions are likely to occur as a result of the RTS.

8.2.3.2 Many GHG emissions will also indirectly result from supply chain activities such as materials manufacture/production and travel to and from site during construction and operations. Although these will arise outside of the study area, for the purposes of the assessment these are captured within the Environment Agency carbon calculator (which is part of the Whole Life (Construction) Eric Carbon Planning Tool) and assessed as part of emissions likely to arise as part of the project.

8.2.3.3 During the PEIR stage, the study area will be reviewed to discount areas where no net changes in emissions are expected as a result of the project.

8.3 Baseline

8.3.1 Existing Baseline

Climate Change Mitigation

8.3.1.1 The baseline for this assessment of GHGs, against which net emissions changes will be calculated, will consider:

- Any land uses or activities within the study area that currently lead to material emissions, such as from buildings;
- Ecosystem services and biogenic carbon sequestration; and
- Consideration of current surface transport scenario within a given study area.

8.3.1.2 Where emissions from existing land uses or activities are not going to change as a result of the RTS, these will be excluded.

8.3.1.3 It is recognised that a future baseline projection under a 'do minimum' scenario may be applicable as that considers decarbonisation of the power grid and transport. This will also be considered for the operational phase.

8.3.1.4 It should be noted that although the assessment will rely on data obtained through the Carbon Management Plan, this Plan refers to the baseline as the emissions that would arise from an amended OBC scheme design, and thus differs from the approach in the EIA (which defines the baseline as the current observable conditions and those which are reasonably foreseeable). This will be used as a secondary 'alternative baseline' as described later in this section.

8.3.1.5 As the RTS is located in Surrey, it is appropriate to consider the South of England as the appropriate geographical location. The climate baseline for the study area is therefore taken from the Met Office (2016) climate profile of Southern England. Most of Southern England is less than 100 metres

(m) Above Ordnance Datum (mAOD), however, it contains hills and downland landscapes over 100 mAOD. The Thames drains the northern half of the Southern England and flows eastward. Southern England can be subject to continental weather given its proximity to continental Europe, bringing cold spells in winter and hot, humid weather in summer.

Climate Change Adaptation

8.3.1.6 The Met Office’s climate profile for Southern England will be used to establish the climatic baseline.

8.3.2 Future Baseline

Climate Change Mitigation

8.3.2.1 To reflect the ongoing decarbonisation of grid energy and traffic, a future year of 2035 (to reflect targets associated with the Sixth Carbon Budget) will be considered, and assumptions applied as to what this future baseline might look like in terms of GHG emissions during the operational phase. Data will be sourced on current and projected underlying GHG emissions intensity for electricity supply from the latest set of updated energy and emissions projections for the UK available at the time of the assessment (Department for Business & Industrial Strategy, 2019).

Climate Change Adaptation

8.3.2.2 UK Climate Projections from the 2018 Met Office modelling (UKCP18) have been reviewed in order to establish an appropriate future baseline (Met Office, 2019).

8.3.2.3 Using a future assessment timeframe of 2081-2100 (representing a period when the RTS is expected to still be in operation), over land there will be a move towards warmer, wetter winters and hotter, drier summers. However, natural variations mean that some cold winters, some dry winters, some cool summers and some wet summers will still occur.

8.3.2.4 UK Climate Projections (UKCP) uses Representative Concentration Pathways (RCPs), which are named according to the concentration of GHG modelled to occur in the atmosphere in 2100. There are 4 RCPs available in the UKCP18 climate projections: 2.6, 4.5, 6.0 and 8.5, and RCP 8.5 is the most conservative, highest-impact scenario. Therefore, this scenario will be used as worse case. The different concentrations refer to the amount of radiative forcing (difference between the incoming and outgoing radiation in the atmosphere, measured in Watts per square meter (W/m^2)) in the atmosphere by 2100, relative to pre-industrial levels.

8.3.2.5 The choice of RCP and time period for which climate projections are selected is an important step in defining the future climate baseline. Therefore, the RTS will be designed to account for these changes, and increased frequency and magnitude of extreme weather events.

8.3.3 Key Environmental Considerations and Opportunities

8.3.3.1 The RTS is a climate change adaptation project in itself by reducing flood risk overall as one measure to improve resilience. As part of the RTS, landscape and green infrastructure will be designed to be resilient and adapted for climate change i.e. so that they will continue to function even during flood events and particularly with future climate change as flood levels will continue to increase.

8.3.3.2 The RTS has the potential to affect climate by causing emissions of GHGs into the atmosphere during its construction and operational life. However, it is possible that the RTS will cause a reduction in emissions during operation. Such opportunities will be explored throughout the project development to minimise GHG emissions and where possible sequester carbon or generate renewable energy.

8.3.3.3 Based on the UKCP18 predictions, it is widely accepted that on average, the UK will experience hotter and drier summers, and warmer, wetter winters. Additionally, it is likely that climate change will increase the intensity and frequency of extreme weather events such as storms, heavy rainfall and heatwaves. The project has an opportunity to be designed to alleviate the effects of these events.

8.4 Likely Significant Effects Requiring Assessment

8.4.1 Construction Effects

Climate change mitigation

8.4.1.1 Project activities and associated likely significant effects on climate change mitigation (GHG emissions assessment) are identified below:

- Use of construction plant and site compounds can cause a potential adverse effect on climate, from the excavation and transporting the materials to, from and around the site and operation of site compounds (e.g. lighting and heating);

- Embodied carbon within design elements such as sheet piling, concrete, and other building materials can cause a potential adverse effect on climate change due to embodied carbon generated for the creation of building materials;
- Removal of areas of trees and other vegetation and disturbance of healthy soils can cause a potential adverse effect on climate, by removing carbon sinks (ecosystem services) which reduce the amount of GHG in the atmosphere, contributing to climate change. The addition of vegetation, creation of new habitats and appropriate management of land and soils can cause potential beneficial effect on climate, as they would act as additional carbon sink;
- The movement of waste / material, and placement of non-hazardous material offsite can cause a potential adverse effect on climate change through generation of GHGs;
- Mobilisation of methane (CH_4) and other GHGs from the disturbance of landfills, causing potential adverse effects and contributing to climate change;
- Gravel will be produced as by-product, which can potentially cause an indirect beneficial effect on climate change (through avoided emissions), as this will be used, and less gravel will be excavated and transported from elsewhere; and
- Creation of site compounds, temporary materials processing sites and storage of excavated material, establishment of compounds, depositing material and vehicle use to construct embankments causing damage to soil structure, compaction, erosion or bank instability with adverse effect on carbon footprint.

Climate change adaption

8.4.1.2 There are no likely significant effects on climate change adaptation during construction. Potential effects to flood risk, transport, ecology, human health etc. during the construction phase will be assessed in the relevant PEIR/ES Chapter.

8.4.2 Operational Effects

Climate change mitigation

8.4.2.1 Project activities and associated likely significant effects on climate change mitigation are identified below:

- Maintenance of the structures and replacement parts can cause potential adverse effects on climate due to the embodied carbon in the materials, contributing to climate change;
- Maintenance activities, such as transportation used by maintenance workers and for materials can cause potential adverse effects on climate contributing to climate change from the fuel associated with transportation;
- Active pumping, operation of weir gates and any other site activity can cause potential adverse effects on climate, contributing to climate change due to the energy associated with these activities;
- Provision of habitat improvements through planting and maturation of vegetation and trees can cause a potentially positive effect on climate and therefore climate change, as this vegetation will act as a carbon sink and absorb GHGs;
- Operational energy associated with any proposed buildings, and lighting associated with new outdoor spaces can cause potential adverse or positive effect on climate from energy generation;
- Generation of renewable energy on site (if incorporated into the design) can cause potential positive effects on climate through low or zero carbon sources of energy;
- Operational traffic on site associated with visitor trips can cause a potential adverse effect from GHG emissions released from traffic; and
- Indirect GHG emissions from visitors to the new amenities, or changes to traffic through provision of new paths and cycleways, which can alter traffic flows and either cause potential adverse or positive effects on climate change.

Climate change adaption

8.4.2.2 Project activities and associated likely significant effects on climate change adaptation and resilience are identified below:

- Provision of the project will protect many properties and spaces, making them inherently more resilient to future climate change;
- Use of flood channel, associated features and capacity improvements during times of flood, can reduce flood risk in the study area, thereby reducing or avoiding flood damages that result in GHG emissions; and
- Changing climate and intensified weather conditions during the life span of the RTS can cause a potential adverse effect on the project and its users due to extreme weather conditions, as well as potential in-combination effects with other EIA topics.

8.5 Effects Not Requiring Assessment

8.5.1 Construction Effects

8.5.1.1 Project activities and associated effects that are deemed not likely to be significant and are therefore proposed to be scoped out of the EIA are identified below:

- Potential adverse effects on carbon footprint from the creation of site compounds, processing material and vehicle use to construct embankments causing damage to soil structure, compaction, erosion or bank instability. The potential effect is considered to be temporary and will be managed, avoided, prevented and/or reduced through the CEMP; and
- Transportation of hazardous materials/waste from the major road network to licensed sites and placement therein, as this will be managed through existing licences.

8.5.2 Operational Effects

8.5.2.1 All operation stage climate change mitigation and adaptation effects will be treated as potentially significant until it can be confirmed otherwise through reliable data and professional judgement.

8.6 Approach to Mitigation

8.6.1.1 This section should be read in conjunction with Chapter 5: Approach to EIA Scoping which sets out further definition for the project regarding primary (embedded) mitigation, secondary (additional) mitigation and tertiary (best practice) mitigation.

8.6.2 Climate Change Mitigation

8.6.2.1 Mitigation relating to GHGs reduction and management will be taken from the Carbon Management Plan and other DCO documents, including the Natural Capital Assessment, MMS and Transport Assessment.

8.6.2.2 Secondary mitigation measures that are under consideration for the construction phase are identified below:

- Evaluate carbon reduction opportunities in the design and construction of the project, following the PAS 2080: Carbon Management in Infrastructure carbon reduction hierarchy; and
- Reusing materials cleared and excavated to form the channels, to indirectly reduce the carbon impact of the project.

8.6.2.3 Secondary mitigation measures that are under consideration for the operational phase are identified below:

- Evaluate carbon reduction opportunities through ongoing maintenance works, following the PAS 2080: Carbon Management in Infrastructure carbon reduction hierarchy;
- Using nature-based carbon sequestration solutions. The proposed HCAs and new green open spaces will deliver co-benefits across the project for climate change mitigation and adaptation, soil health, water management and society, whilst enhancing biodiversity;
- Delivering renewable energy opportunities that are directly related to the project, including integrated renewables. For example, solar photovoltaic panels mounted on new control buildings or new bridges; and
- The RTS has been designed so that it will require little active management and maintenance over its design life of 100 years. The project creates more space for water with two new channels that will operate with minimal intervention (a mainly passive project). The

passive and deliberately low maintenance approaches across all aspects of the project will be assessed and optimised where feasible.

8.6.3 Climate Change Adaptation

8.6.3.1 Secondary mitigation measures that are under consideration for the construction and operational phases are identified below:

- Ensure the structures are designed to withstand extreme weather, such as heatwaves, periods of drought and storm events;
- The HCAs and new green open spaces to provide, where appropriate, microclimatic regulation for example through shading and shelter and planting that is suitable for the predicted changes in climate; and
- All EIA topics to consider the future climate change projections, in terms of potential in-combination effects.

8.7 Assessment Methodology

8.7.1 Climate Change Mitigation

8.7.1.1 Construction phase GHG emissions may be associated with:

- Earthworks activity (emissions from construction plant);
- Careful management of soils (storage and movement) as carbon sink;
- Movement of materials to, from and around the site and operation of site compounds;
- Embodied carbon with design elements such as sheet piling, concrete, and other building materials;
- Removal and/or addition of areas of trees and vegetation and disturbance of soils and other habitats;
- Movement of non-hazardous material offsite and placement at end destination;
- Mobilisation of methane (CH_4) and other GHGs from the disturbance of landfills;

- Creation of site compounds, temporary materials processing sites and storage of excavated material; and
- Indirect – gravel being produced as by-product to the project from excavated material.

8.7.1.2 Operational phase emissions may be associated with:

- Maintenance of the structures/replacement parts;
- Transportation used by maintenance workers and for materials;
- Any active pumping/operation of weir gates, etc;
- Planting/maturation of vegetation and trees, function of soils and other habitats (ecosystem services) and ongoing maintenance;
- Operational energy associated with any proposed buildings, and lighting associated with new outdoor spaces;
- Generation of renewable energy;
- Operational traffic; and
- Indirect – transport emissions from visitors to the new amenities, or reduction of traffic through provision of new paths and cycleways.

8.7.1.3 For both the construction and operational phase, an inventory of direct and indirect emissions associated with the project will be created and quantified.

8.7.1.4 The assessment will consider GHG emissions data identified in the Carbon Management Plan, which will align with PAS2080. Any sources of emissions that are not expected to result in a material contribution to the overall total emissions (c. <5 per cent of the total) will be identified and excluded from further assessment.

8.7.1.5 An assessment of 'embedded' GHG emissions associated with the materials used to construct the project will be produced. For those materials used, a set of robust GHG 'emissions factors' (i.e. GHG emissions resulting from a given unit of a source activity or material) will be applied, to enable a like for like comparison to be made. These emissions factors will be sourced primarily from the UK Government

Greenhouse Gas Conversion factors for Company Reporting as well as the project Carbon Management Plan.

8.7.1.6 Residual GHG emissions (following mitigation) will be compared against future UK carbon budgets in order to view the project's GHG contribution in the context of this. This aligns with the draft NPS on Water Resources Infrastructure which states: "The applicant should provide evidence of the carbon impact of the project (including embodied carbon), both from construction and operation, such that it can be assessed against the government's carbon obligations, including but not limited to carbon budgets".

8.7.1.7 The IEMA guidance also allows for assessment against an alternative baseline, and so this narrative will be provided as context, based upon the alternative baseline in the Carbon Management Plan (i.e. the amended OBC design).

8.7.1.8 To determine the significance of the effect, the IEMA guidance considers this can be based upon the judgement of the practitioner but is ultimately defined on whether the project will prevent the achievement of a science based target, as described below. In the absence of clear thresholds for significance, it is based upon the relationship between the sensitivity of the receptor and the magnitude of the effect.

8.7.1.9 A carbon budget places a restriction on the total amount of GHG gases that can be emitted over a certain period of time. In the UK, carbon budgets cover a period of five years. They have been set up to the sixth carbon budget, which covers the period between 2033 and 2037. For each budget, GHG emission levels are reduced (e.g. from 965 MtCO2e for the 6th carbon budget compared to 1,725 MtCO2e for the fifth budget (2028-2032) (DBEIS, 2016). The receptor will be the Global climatic system (more specifically, the contribution to carbon budget during which the emissions occur, underpinning science based targets). The receptor is of a high sensitivity in the carbon budgets, to reflect how close globally we are to the scientifically defined limit. A carbon budget places a restriction on the total amount of GHG gases that can be emitted over a certain period of time. In the UK, carbon budgets cover a period of five years. They have been set up to the sixth carbon budget, which covers the period between 2033 and 2037. For each budget, GHG emission levels are reduced (e.g. from 965 MtCO2e for the 6th carbon budget compared to 1,725 MtCO2e for the fifth budget (2028-2032)) (DBEIS, 2016).

8.7.1.10 There is no established guidance to determine thresholds of different magnitudes of change, and so this will be confirmed at PEIR stage. A new IEMA guidance on GHG emissions has been published, however, the changes in guidance need time in practice to confirm how the assessment proceeds. However, a proposed set of thresholds to contextualise the change could be as set out in Table 8-1 below.

Table 8-1: Proposed Impact Magnitude Thresholds for Climate Change Mitigation.

Contribution to National Carbon Budgets	Magnitude and type of change
<0.01% of carbon budget	Negligible
0.01 – 0.1% of carbon budget	Small (adverse)
0.1 - 1% of carbon budget	Medium (adverse)
>1% carbon of budget	Large (adverse)

8.7.1.11 The significance of effect will be determined through applying magnitude (net change of residual GHG emissions) with sensitivity (future carbon budgets), as per other EIA assessments. However, according to the IEMA GHG Guidance “the crux of significance therefore is not whether a project emits GHG emissions, nor even the magnitude of GHG emissions alone, but whether it contributes to reducing GHG emissions relative to a comparable baseline consistent with a trajectory towards net zero by 2050”.

8.7.1.12 The IEMA Guidance refers to the following categories of significance, which will be applied to the project:

- Moderate or Major Adverse (significant), where a project follows a business as usual approach and is not aligned with carbon trajectories or targets (with the differentiation of these the responsibility of the practitioner);
- Minor Adverse (not significant), where a project is “compatible with the budgeted, science-based 1.5°C trajectory (in terms of rate of emissions reduction) and which complies with up-to-date policy and ‘good practice’ reduction measures”;

- Negligible (not significant), where a project achieves emissions mitigation "substantially beyond the reduction trajectory, or substantially beyond existing and emerging policy compatible with that trajectory, and has minimal residual emissions"; and
- Beneficial (significant), where a project causes "GHG emissions to be avoided or removed from the atmosphere".

8.7.2 Climate Change Adaptation

8.7.2.1 Climate change adaptation will consider the effect of climate on the project itself. Given the short relative timescales associated with construction, it is not envisaged that climate will have any effect on the project during the construction phase.

8.7.2.2 The assessment for the operational phase uses a risk-based approach, whereby the severity of outcome accounts for the sensitivity of the parts of the project that would be affected in different ways and at different magnitudes by climate change.

8.7.2.3 To assess the adaptation of the project to climate change, the following steps will be undertaken:

- Consider the receptor types (rather than individual receptors) assessed in the EIA as well as components of the project, and identify which are most sensitive to climate change (based upon professional judgement);
- Identify how climate change could affect the predicted environmental effects in other EIA topics assessed in a future year (the 'reported effects') by way of ICCI; and
- Set out measures by which certain components of the project can adapt to climate change over its lifetime and to mitigate any worsening of effects caused by climate change.

8.7.2.4 The output of the climate change adaptation assessment will be an Outline Climate Change Adaptation Plan that will identify those parts of the project's design or management procedure that relate to resilience/adaptation (as well as those that could be the responsibility of others, such as future operators, LPAs and neighbouring landowners). The EIA will then:

- Assess whether these adopted measures are likely to be sufficient for the project's whole lifespan, or whether further interventions are likely to be required in the future;
- Identify those parts of the project management measures that should be kept under periodic review, and/or passive provision be made for their incorporation; and
- Suggest a mechanism for how the effects from climate change can be monitored in the future, and the plan is implemented and updated over the project's lifespan.

Cumulative Effects

8.7.2.5 Effects of GHG emissions from specific cumulative projects will not be individually assessed, as according to the IEMA Guidance, there is no basis for selecting any particular (or more than one) cumulative project that has GHG emissions for assessment over any other. The contextualisation of GHG emissions, as described in the Climate Change Mitigation Methodology, by its nature takes account of the cumulative contributions of other GHG sources which make up that context.

8.7.2.6 In terms of climate change adaptation, relevant cumulative schemes will be investigated to consider their resilience to the future climate scenario, and any changes to climatic risks in conjunction with the RTS. ICCIs will be prepared through discussion with the technical specialists for the other ES Chapters, whereby the effects identified will be reviewed in terms of the future climate scenarios' ability to affect both the sensitivity of the receptor and the magnitude of the change.

8.7.2.7 The ICCI is different to the cumulative impact that is to be covered as part of Chapter 19 which considers multiple cross-topic impacts upon a single receptor group, whereas ICCI considers a future climate scenario (that will be shared with EIA topic authors) and will assess if that has the potential to influence the effects reported in other topic chapters. It will only apply to operational effects, as construction effects are over too short a programme for climate change predictions to be realised.

8.7.2.8 For example, climate projections (UKCP18) for a future assessment year (2080) will be shared with other technical topics to explore whether operational effects have the potential to change in 2080. This will be repeated for all topics qualitatively, and any potential to lead to future significant effects will be subject to further discussions and ways to avoid/mitigate these will be set out in a long-term adaptation plan (that will be appended to the ES chapter).

8.7.3 Assumptions and Limitations

Climate Change Mitigation

8.7.3.1 Where assumptions need to be made, they will be selected to present the worst-case scenario for that particular item/factor. A Carbon Management Plan will also be produced as part of the DCO application, from which GHG emissions data for the RTS will be used. Data will also be obtained from other DCO documents, such as changes to travel patterns and outputs from the Natural Capital Assessment.

8.7.3.2 It is also assumed that operational energy use and transport linked to the RTS will produce less GHG emissions over time, as the grid is decarbonised.

8.7.3.3 Detailed data may not always be available for particular emissions sources, and in these cases a description of the assumptions made (such as using benchmarks) will be stated.

Climate Change Adaptation

8.7.3.4 This will provide an indication of the potential effects of climate change on the RTS based on professional judgement and engagement with the project team.

8.7.3.5 The climate projections used will be from UKCP18. At the time of writing, these represent the most up to date representation of future climate in the UK.

8.7.3.6 The UKCP18 projections do not provide a single precise prediction of how weather and climate will change years into the future. Instead UKCP18 provides ranges that aim to capture a spread of possible climate responses. This better represents the uncertainty of climate prediction science. It should also be noted that the level of uncertainty of the projections is dependent on the climate variable, for example, there is greater confidence around changes in temperature than there is on changes in wind. In the climate vulnerability assessment this will be considered when assessing the likelihood of effects. Key assumptions and limitations of UKCP18 data can be found on the Met Office Website (Lowe et al., 2018).

9 Cultural Heritage, Archaeology and Built Heritage

9.1 Introduction

9.1.1.1 This chapter describes the scope of the assessment on cultural heritage aspects. It outlines the baseline state of the cultural heritage resource, the likely effects of the project, and the avoidance or mitigation measures proposed to alleviate these. It also outlines the methodology that will be used for the assessment of potential effects arising from the construction and operation of the RTS within the PEIR/ES.

9.1.1.2 The cultural heritage resource is considered to comprise archaeological remains, historic buildings and historic landscapes. A cultural heritage asset is considered to be an individual archaeological site or building, a monument or group of monuments, and historic building or group of buildings, an historic landscape etc., which together with its setting, can be considered as a unit for assessment (after the DMRB Volume 11 Sections 3, Part 2).

9.1.1.3 This chapter draws largely on key assessments carried out as part of an ongoing process to establish the cultural heritage baseline. An initial DBA was produced in 2016 and a general written scheme of investigation (GWSI, Trent & Peak Archaeology 2017) written setting out the methods for fieldwork. Stage 1 investigations include non-intrusive geophysical survey and earthwork survey. Stage 1a includes further geophysics and geoarchaeological investigations. Stage 2 includes trial trench evaluation. This staged approach is currently being followed and the Generic Written Scheme of Investigation (GWSI) still applies. Further DBA has been carried out followed by staged fieldwork as the project boundary has changed as a result of previous iterations of the design. Archaeological reports have been produced for all stages of fieldwork (Trent & Peak Archaeology 2018a-b, 2019a-d, 2021). The DBA produced in 2022 (Appendix G) is the culmination of previous research and incorporates the results of all fieldwork conducted to date by York Archaeology. An initial Setting Study was conducted in 2018 and will be revised to reflect the DCO project boundary.

9.1.1.4 Aspects of this chapter have overlap with the following Chapters; Chapter 10: Flood Risk (for potential effects of flood risk change), Chapter 12:

Landscape and Visual Amenity (for key views in relation to the setting of heritage assets), Chapter 13: Materials and Waste and Chapter 18: Water Environment (for potential effects of groundwater changes).

9.1.1.5 A summary of the key legislation, policy and guidance relevant to cultural heritage, archaeology and built heritage is provided in Appendix M.

9.2 Baseline Methodology

9.2.1 Information Sources

9.2.1.1 The cultural heritage baseline for the RTS has been defined through a combination of DBA, setting study, archaeological and palaeoenvironmental risk modelling, and a staged programme of field-based archaeological and geo-archaeological evaluation (see Figure 9-1 in Appendix A).

9.2.1.2 An initial archaeological DBA was produced in 2015 (TPA, 2015). A new version was produced in 2021 (TPA, 2021) and updated in 2022 (YA, 2022) (Appendix G) to reflect changes to the boundaries of the project and to update searches of local and national databases relevant to the project.

9.2.1.3 The DBA draws on the following information sources to assess the archaeological potential within the RTS DBA study area:

- LiDAR (Light Detection and Ranging) data, initially supplied by the Environment Agency and subsequently released under Open Government Licence;
- Aerial photographic records held in the HE database;
- Cartographic sources gathered from searches of the Berkshire Record Office, Surrey History Centre, and the London Metropolitan Archive;
- LPA Historic Environment Records (HER) for Berkshire, Surrey, and Greater London;
- Historic Landscape Characterisation data for Berkshire, Surrey and Greater London;
- The National Heritage List for England (NHLE);

- Site visits comprising visual inspection to assess ground conditions and identify any factors which might affect the survival or condition of known or potential assets; and
- The results of archaeological evaluation carried out between 2017 and 2022 at multiple sites along the route of the RTS (see below).

9.2.1.4 Historic England guidance (2017) defines a requirement for five stages of assessment, the completion of which will provide a comprehensive setting study, comprising:

- *Stage 1*: Identify which heritage assets and their settings are affected;
- *Stage 2*: Assess the degree to which these settings and views contribute to the significance of the heritage asset(s) or allow significance to be appreciated;
- *Stage 3*: assess the effects of the project, whether beneficial or harmful, on the significance or on the ability to appreciate it;
- *Stage 4*: explore the way to maximise enhancement and avoid or minimise harm; and
- *Stage 5*: make and document the decision and monitor outcomes.

9.2.1.5 The first two stages of this setting study were undertaken in 2018. These now require updating to reflect changes to the boundary of the project for inclusion in the PEIR. Stages 3 to 5 of the setting study will be undertaken concurrently with the EIA assessment to inform the impact assessment.

9.2.1.6 Stages 1 and 2 of the setting study considered the effects the RTS might have on the settings of designated heritage assets in the wider cultural and historic landscape. The existing setting study drew on the following information sources:

- The NHLE curated by HE; and
- District Council Conservation Area (CA) data for Windsor and Maidenhead, Richmond, Runnymede, Elmbridge and Spelthorne.

9.2.1.7 The geoarchaeological deposit model, initially produced as a stand-alone document, and later incorporated into the updated DBA, drew on the following information sources:

- British Geological Survey (BGS) data relating to previous borehole surveys carried out in the study area;
- BGS mapping;
- A geoarchaeological watching brief conducted during geotechnical investigations carried out by WYG, Fugro UK and Opus;
- Borehole data relating to the above investigations; and
- The results of Stage 1a geoarchaeological evaluation carried out at multiple sites along the route of the RTS (see below).

9.2.1.8 Between 2017 and 2022 a programme of field-based archaeological evaluation was carried out at multiple sites. The strategy informing this was laid out in the GWSI.

9.2.1.9 This strategy consisted of two stages: Stage 1 comprised non or minimally invasive forms of survey and Stage 2 of invasive survey. Each survey stage was designed to inform the next, in order to target more invasive forms of survey as precisely as possible.

9.2.1.10 Sites were initially selected for Stage 1 survey based on assessment of their archaeological potential in the DBA and supplemented by use of the geoarchaeological deposit model to identify further areas of potential archaeological or geoarchaeological interest. Information gathered from Stage 1 survey was then used to narrow down sites where Stage 2 survey techniques might be productive.

9.2.1.11 The survey stages can be broken down as follows.

Stage 1:

- Earthworks survey targeting extant earthworks;
- Field survey consisting of fieldwalking and metal detector survey over ploughed fields; and
- Geophysical survey consisting of magnetometer survey of open areas of ground to identify potential archaeological sites.

Stage 1a:

- Electromagnetic survey of open areas of ground to identify deposits with archaeological or geoarchaeological potential; and

- Geoarchaeological window samples designed to refine the deposit model for the sites targeted and to provide palaeoenvironmental and dating evidence.

Stage 2:

- Archaeological Trial Trench evaluation consisting of 2mx30m trenches designed to identify archaeological features at sites identified as having high potential for such during Stage 1 evaluation; and
- Archaeological test pits (at sites inaccessible to heavy machinery).

9.2.1.12 Further works to inform the ES baseline are ongoing. These include:

- Site investigation (SI) works downstream of Desborough Cut which are to be subject to archaeological monitoring and sampling; and
- Stage 1 and 1a evaluation works at Land South of Wraysbury Reservoir and Land Between Desborough Cut and Engine River.

9.2.1.13 Additional works to inform the ES baseline are required at Laleham Golf Course (Stage 2 Survey) and may be required at:

- Abbey River (initially Stage 1 and 1a Survey);
- Desborough Island (additional Stage 2 Survey);
- Land South of Wraysbury Reservoir (Stage 2 Survey); and
- Land Between Desborough Cut and Engine River (Stage 2 Survey).

9.2.1.14 Should further areas of high or moderate archaeological potential be identified as the design develops these will require a similar staged programme of archaeological evaluation.

9.2.2 Stakeholder Engagement

9.2.2.1 Extensive consultation with a wide range of stakeholders has been carried out since the beginning of archaeological involvement in the project (see 9.2.2.6). This has informed the nature of the archaeological programme; in particular, the GWSI was produced with extensive stakeholder input.

9.2.2.2 Additionally, stakeholders have been consulted on an area-specific basis before and during the various stages of archaeological assessment and evaluation.

9.2.2.3 HE provided the following advice in response to the 2017 Scoping Report:

- *The area covered by the assessment of impacts on designated heritage assets (including Scheduled Monuments, Listed Buildings, Conservation Areas, and Registered Parks & Gardens of Special Historic Interest) should be expanded, to ensure that all effects on context and setting are fully identified and assessed. An arbitrary radial search (500 metre study area) is unlikely to accurately reflect the impact of the development on heritage assets in the wider area; and*
- *The assessment should fully consider the potential impacts of the development on non-designated features of historic, architectural, archaeological or artistic interest. Account should be taken of the potential effects of both the main development and associated activities (e.g. traffic, maintenance works, recreational use, etc.), and of physical changes (e.g. to drainage and groundwater), that could impact upon, the integrity, context or setting of non-designated assets.*

9.2.2.4 It was further noted by the MMO that, although the heritage environment has been appropriately scoped into further assessment in relation to the importance of the local area to the heritage environment, further information is required to determine potential effects of the project in relation to buried heritage assets and both designated and undesignated heritage assets in relation to potential effect from disturbance during construction works.

9.2.2.5 The comments from HE and the MMO have been incorporated into the consideration of features to be incorporated into the assessment.

9.2.2.6 The archaeological advisors consulted during the archaeological investigations on the RTS are as follows:

- Archaeological Advisor to SBC and EBC, Surrey County Council Heritage Conservation Team;
- Archaeological Advisor to RBC, Surrey County Council Heritage Conservation Team;
- Archaeological Advisor to LBRUT and RBKUT, Historic England;
- Historic England, Historic England lead for RTS;

- Science Advisor for the South-East, Historic England;
- Archaeological Advisor to RBWM, Berkshire Archaeology;
- Heritage, Landscape, and Tree Section Manager, SBC;
- Heritage, Landscape, and Tree Section Manager, EBC;
- Team Leader (Development Management West Team), LBRUT;
- Conservation Architect (Development and Urban Design), RBKUT;
- Senior Conservation Officer, RBWM; and
- National Environmental Assessment and Sustainability Archaeologist, Environment Agency (internal project advisor).

9.2.2.7 Valuable feedback on investigation methodologies was received from stakeholders and used to refine these and gain stakeholder agreement. It is expected that a similar range of stakeholders will be consulted as appropriate during ongoing evaluations of new areas added to the project.

9.2.2.8 A Written Scheme of Investigation (WSI) laying out the general principles to be followed for mitigation of effects to the archaeological resource is to be produced as part of the ES. The above stakeholders will be consulted extensively during the production of this WSI, as was the case for the GWSI which informed the evaluation stage of archaeological investigations.

9.2.3 Study Area

9.2.3.1 Three study areas have been defined for cultural heritage baseline assessment. The construction and operation of the project has the potential to affect heritage resources in these study areas in a variety of ways (see Figure 9-1 in Appendix A).

9.2.3.2 The study area used for cultural heritage DBA is defined as a 500m buffer from the project boundary for EIA scoping. This considers the landscape feasibility parameter (discussed in Section 4), assessing the areas which could be affected under the reasonable maximum extent of construction and operation scenarios. A major purpose of this study area is to establish the archaeological potential of sites likely to be disturbed by the construction of the project, the likely significance of archaeological deposits and identify areas requiring investigative fieldwork to establish baseline conditions at these sites.

9.2.3.3 The following are included within the project boundary for EIA scoping; the flood channel sections, bed lowering at Desborough, downstream capacity improvements at Sunbury, Moseley and Teddington Weirs, the proposed HCAs, proposed areas of green open space, waste management and compound areas at various locations. Therefore a 500m buffer has been attached to these areas (see Figure 9-2 in Appendix A).

9.2.3.4 The study area for the geoarchaeological deposit model is the same as that for the DBA.

9.2.3.5 The extent of the 1 in 100 year flood limit (i.e. the area with a 1 per cent chance of flooding in any given year) is also considered in the DBA as heritage assets within that study area will be affected by the change in flood regime.

9.2.3.6 A study area was agreed with HE for the Setting Study produced in 2018, which was greater than the 500m buffer. The Setting Study assesses the broader effect of the project. Its study area therefore encompasses all areas to which the presence of the project might make a change to the setting of heritage assets and historic landscapes. This will mainly align to the extent of Zones of Theoretical Visibility (ZTVs) relating to Heritage Assets and Key Views.

9.2.3.7 These three areas have been combined and the greatest extent forms the Cultural Heritage study area for EIA scoping.

9.3 Baseline

9.3.1 Existing Baseline

9.3.1.1 The River Thames catchment is an area of high archaeological importance. It has been a focus for human activity from the earliest humans to the present day. As recorded in the DBA, there is much heritage interest within the study area. Numerous designated assets (Scheduled Monuments, Listed Buildings and Registered Parks & Gardens), undesignated heritage assets (including archaeological sites, monuments, previous finds etc.) and areas of archaeological interest (for example archaeological remains, palaeochannels, and deposits containing preserved palaeoenvironmental information) have been identified through archaeological evaluations in the study area. However, the area is also a densely occupied and developed modern landscape characterised by extensive areas of aggregate extraction which must be taken into account when considering potential changes that may result from the project.

9.3.1.2 Recently in this reach of the River Thames there have been several large-scale excavations, at Eton Dorney Rowing Lake (1994-2004 Oxford Archaeology), Kingsmead Horton Quarry (2003 onwards Wessex Archaeology) and Heathrow Terminal 5 (1999-2007 Framework Archaeology, 2010), which have served to underline the density and complexity of the development of human occupation of the Thames gravels over time. Numerous surveys and excavations, large and small scale, over many decades have provided detailed information (as discussed in detail in the DBA and briefly summarised below).

9.3.1.3 Evidence of human activity within the River Thames valley stretches back to the Palaeolithic (c.950,000 - 9,500 BCE), with multiple sites from this and the later Mesolithic (c.9,500 - 4,000 BCE) period testifying to the activities of hunter-gatherers in the valley. The multi-period prehistoric site at Kingsmead Quarry and Neolithic corridor settlement evidence represents a key heritage asset from the time period within the study area. During the Neolithic (c.4,000 - 2,200 BCE) more permanent settlements are established, along with the first signs of a monumentalising of the landscape; these first farmers constructed cursus monuments and other ceremonial enclosures within the landscape. By the Middle-Late Bronze Age (1,500 - 800 BCE) however, resources and land appear to have been apportioned not through ceremony but through the physical demarcation of the landscape by field boundaries belonging to distinct settlements or farmsteads, both separated and connected by tracks and droveways.

9.3.1.4 By the Middle Iron Age (c.800 BCE - AD 43), nucleated settlements of roundhouses, four-post structures and livestock enclosures, with the inhabitants practicing an entirely subsistence-based agricultural regime biased towards the pastoral economy are found. Such settlements often became a focal point for continuing settlement through the late Iron Age and Roman periods with an increased emphasis on cereal crops and construction of new field systems and droveways in response to the wider social political and economic changes throughout the Roman period (AD 43 – c.410). Greater centralisation in the Roman period led to the growth of larger settlements - e.g. the small town of Pontibus, located in the north-west of modern Staines where the Roman road from London to Silchester and Winchester crossed the River Thames.

9.3.1.5 During the Early Medieval period (c.AD 410 – 1066), London and its surrounding towns experienced growth as the River Thames was used as a trade route, bringing goods upstream from the coast and Europe. The middle Thames lay at the heart of the early Anglo-Saxon kingdoms at once a major communications artery and a disputed boundary between Mercian and Saxon kingdoms. An early Royal palace was established at Old Windsor (later superseded by the Norman castle at Windsor).

9.3.1.6 The main population centres along this reach of the River Thames were all in existence by the time of the Domesday survey of 1086. Earlier origins are evident for many, e.g. Chertsey, the 'Ceroti insula' of Bede (c. 750), and its Abbey with charters dating back to the 7th century, also mentioning land holdings in Egham, (Egham) Hythe and Thorpe. Datchet and Shepperton also receive mention in charters as early as the 10th century.

9.3.1.7 The town of Windsor grew around the castle, founded by William the Conqueror in the 11th century. It first became a royal residence during the reign of Henry II (1154-89), and it has remained so for 900 years, although after the 15th century much of the royal focus in this area transferred to Hampton Court, downstream at Molesey. The High/ Late Medieval period (1066–1485) saw the initial construction phases of many of the churches in and around the study area. Their associated settlements subsequently developed into the towns which continued to grow into the modern period.

9.3.1.8 The post-Medieval period (1485–1750) saw the size of settlements within the landscape continue to increase, with the overwhelming majority of Listed Buildings within the study area dating to this period. The twentieth century has seen major changes to the area with continuing expansion and redevelopment within towns, the construction of large storage reservoirs to feed the growing population of the city downstream, and continuing expansion of the aggregates extraction industry.

9.3.1.9 Several areas have been identified which contain evidence from multiple periods on the same site. Within the study area a diverse range of finds from the Early Medieval and Medieval have been uncovered near Chertsey associated with the former Abbey site in Chertsey, the historic core of the area.

9.3.1.10 The following sections summarise heritage assets by area. These are derived from the existing DBA (Appendix G).

9.3.2 Runnymede Channel

9.3.2.1 The Runnymede Channel is within the county of Surrey and as such is covered by the Surrey HER.

9.3.2.2 Baseline information about the setting of key designated assets (Scheduled Monuments and Listed Buildings) within the Runnymede Channel is provided in the paragraphs below. An enumeration and more detailed discussion can be found in Section 5.2 of the DBA.

9.3.2.3 A period synthesis discussing in detail the evidence of human activity within the Runnymede Channel and the potential for archaeological remains is provided within Section 10.1 of the DBA.

9.3.2.4 The site of the Chertsey Abbey Scheduled Monument (Figure 9-2, Appendix A) enjoys a positive setting within the Chertsey CA (which also includes a series of listed structures). Much of the site is well wooded, with mature trees in Abbeyfields and the grounds of houses. The focus is southwards towards the town centre and screened from views northwards towards the floodplain and route of M3. The M3 significantly affects the setting to the north and effectively severs the connection between the Abbey Meads land lying to the north of the M3 and the Abbey itself.

9.3.2.5 The Scheduled Monument of Chertsey Bridge (Figure 9-2, Appendix A) has vistas to north and south on the River Thames which enhances the significance of the structure. The adjacent Chertsey Lock House (183) also derives significance from its riverside setting by the lock.

9.3.2.6 The majority of the Listed Buildings within the Runnymede Channel study area cluster around the historic core of Chertsey.

9.3.2.7 There are 63 recorded non-designated heritage assets within Runnymede Channel study area. These include a variety of prehistoric assets, including Mesolithic and Neolithic finds, a late Bronze Age spearhead and bronze dagger, an Iron Age shield and Roman pits and pottery, as well as a Roman road. Medieval pottery, a pewter cruet, Monks Walk and the medieval settlement of Chertsey all represent medieval growth in the area. Corporation of London tax posts and Chertsey Lock are examples of more recent monuments within the area.

9.3.2.8 Studies of aerial photography and LiDAR evidence carried out as part of the DBA have identified: potential Iron Age features (including linear and ring ditches); Early Medieval features at Chertsey Abbey (a possible rectangular enclosure, drainage works, a moat and a fishpond related to the Abbey); Medieval earthworks (possible stock enclosures related to Chertsey Abbey and ridge and furrow remnants at Laleham Burway and Laleham Park). These features are discussed further in Section 6 of the DBA.

9.3.3 Spelthorne Channel

9.3.3.1 The Spelthorne Channel is within Surrey and covered by the Surrey HER.

9.3.3.2 Baseline information about the setting of key designated assets within the Spelthorne Channel is provided in the paragraphs below. An enumeration and more detailed discussion can be found in Section 5.3 of the DBA.

9.3.3.3 A period synthesis discussing in detail the evidence of human activity within the Spelthorne Channel and the potential for archaeological remains is provided within Section 10.2 of the DBA.

9.3.3.4 The Surrey HER shows designated entries including a Scheduled Monument (the Anglo-Saxon or Medieval Cemetery surviving as buried archaeological remains at Saxon Primary School) (Figure 9-2, Appendix A). The setting of the monument detracts slightly from its significance, as the immediate hinterland is significantly different to its original landscape.

9.3.3.5 Aside from the Listed Buildings which span both the Runnymede and Spelthorne Channel study areas, all of the Listed Buildings within the Spelthorne Channel study area are clustered at the eastern end and are mostly 18th and 19th century in date.

9.3.3.6 There are 61 recorded non-designated heritage assets within this channel section. These heritage assets range from Mesolithic to modern in date. Although they are present throughout the study area, they tend to be more common at the eastern end. One of the most significant of these, an Area of High Archaeological Potential (AHAP) (SP032; see Figure 9-1 in Appendix A) lies near Shepperton; a late Roman or early medieval timber structure – identified as a fish weir - was discovered during gravel quarrying in this area, and it is likely that further remnants of this structure survive within the preserved margins of the quarry (Bird,1999). The AHAP is located near the outlet of the Spelthorne Channel in the vicinity of Ferry Lane Lake.

9.3.3.7 Studies of aerial photography and LiDAR evidence carried out as part of the DBA have identified possible Medieval features at Shepperton, Mead Farm. These features are discussed further in Section 6 of the DBA.

9.3.4 Downstream Capacity Improvements: Bed Lowering

9.3.4.1 A programme of works to lower the bed of an approximate 1km stretch of the River Thames downstream of Desborough Cut will take place to improve capacity. DBA concluded that the riverbanks and riverbed had potential for prehistoric, Anglo-Saxon and medieval remains. Alluvial deposits also have potential to preserve organic remains such as wooden structures and palaeoenvironmental data. A geophysical survey of the riverbed was conducted in February 2021. A total of 61 features of archaeological potential were identified in the sidescan sonar data which likely represent modern debris. No features of palaeoenvironmental interest were identified in the sub-bottom profiler data and no definitive evidence of a historic dredge surface.

9.3.5 River Thames weirs – Sunbury, Molesey and Teddington

9.3.5.1 The three River Thames weirs are located across two different counties and HER centres. Sunbury Weir complex is located wholly within Surrey. Molesey Weir complex crosses the county boundary between Surrey (to the south) and Greater London (to the north). Teddington Weir is located wholly within Greater London.

9.3.5.2 Records from the corresponding HERs for each weir include entries for designated and non-designated sites within each study area. There is a Scheduled Monument (Hampton Court) and four Registered Parks and Gardens (gardens at Hampton Court, gardens at Hampton Court House, gardens at Garrick’s Villa, and Bushy Park) within the Molesey Weir study area. The other designated sites at the three River Thames weirs are Listed Buildings and Conservation Areas.

9.3.5.3 There are numerous non-designated heritage assets recorded within the study areas of the three River Thames weirs. These are predominantly finds recovered/ dredged from within the River Thames and range in date from the lower Palaeolithic to the Modern era.

9.3.5.4 Baseline information about the setting of key designated assets within the Spelthorne Channel is provided in the paragraphs below. An enumeration and more detailed discussion can be found in Sections 5.15 – 5.17 of the DBA.

9.3.5.5 Sunbury Weir: the cluster of Listed Buildings within the Sunbury Weir study area, and the Lower Sunbury CA (see Figure 9-2 in Appendix A), is largely shielded from view of the weir by vegetation.

9.3.5.6 Molesey Weir: there are 27 Listed Buildings located within the Molesey Weir study area; predominantly at the eastern end. The weir is not visible from any of these at ground level; it is doubtful that it would be visible from any of the upper storeys of the structures, although it was not possible to determine this for certain. Similarly, the weir was not visible at ground level from Hampton Court Palace. It is possible that it may be viewed from some of the upper floors; however, this would not be in any detail given the distance between the weir and the palace.

9.3.5.7 Given the proximity to the River Thames, the site has the potential to preserve palaeoenvironmental remains within alluvial deposits and if these have remained waterlogged, may also preserve organic archaeological remains.

9.3.5.8 Teddington Weir: the proposed works are situated within the Teddington Lock CA (see Figure 9-2 in Appendix A). The nearest Listed Structure to Teddington Weir is the Grade II Teddington Footbridge, which commands excellent views of the weir. The Boathouse, also Grade II Listed, is located at the southern end of the footbridge and is also within sight of the weir. Other Listed Structures within the CA have no view of the weir.

9.3.5.9 A period synthesis discussing in detail the evidence of human activity within the study areas of the three River Thames weirs and the potential for archaeological remains is provided within Sections 5.17, 5.19, 5.20 and 10.16, 10.18 and 10.19 of the DBA.

9.3.5.10 Studies of aerial photography and LiDAR evidence have been carried out as part of the DBA (as discussed in Section 6 of the DBA). No features of note have been identified within the study areas of the three River Thames weirs.

9.3.6 Habitat creation areas and new green open spaces

9.3.6.1 11 HCAs are under consideration as part of the project. New green open spaces could be created within the project boundary for EIA scoping at areas such as Royal Hythe, and fields to the east (Manor Farm) and west of Sheep Walk (Chertsey Road Tip HCA). Royal Hythe has been assessed separately in the DBA. Fields to the east and west have been included with the assessment of Chertsey Road Tip HCA. The baseline data is summarised below.

9.3.6.2 Records from the Surrey HER for each HCA include entries for designated and non-designated assets within each study area. Designated assets were mostly Listed Buildings, with three Scheduled Monuments and one Registered Parks or Gardens. Non-designated assets within the HCA study areas include the very significant multi-period site at Kingsmead Quarry, and the Area of High Archaeological Potential (SP032 – fish weir) at Shepperton.

9.3.6.3 Land south of Wraysbury Reservoir is covered by the Surrey HER. The records include both designated and non-designated entries within the study area, but none within the site itself. Designated entries include two Grade II listed buildings located in Wraysbury, and 21 non-designated assets ranging from the prehistoric to modern periods. The majority of these relate to the excavations at Kingsmead Quarry excavations to the west of the site (see Figure 9-1 in Appendix A) include evidence of Upper Palaeolithic and Mesolithic, activity as well as evidence for Neolithic structures, a Bronze Age field settlement and cemetery and evidence of Iron Age and Roman activity.

9.3.6.4 Land South of Wraysbury Reservoir is scheduled for Stage 1 archaeological evaluation, though this has not yet been carried out.

9.3.6.5 Laleham Reach is covered by the Surrey HER. The records include both designated and non-designated entries within the study area, and non-designated assets within the site itself. Designated assets include the Scheduled Monument (DSE6624, NHLE1005949) at Laleham Burway, 145m south of the site, and two listed buildings: the Lockeeper’s House at Penton Hook Lodge and Fleetmere. A further 11 listed buildings lie within the study area on the opposite side of the River Thames.

9.3.6.6 Two non-designated heritage assets are recorded within the site. These are prehistoric assets recovered during gravel extraction. A further 11 non-designated assets are recorded within the wider study area, largely consisting of finds encountered during gravel extraction activities. The Scheduled earthworks on Laleham Burway are of uncertain date; they were initially identified as a Roman marching camp but may be more likely to represent a post-medieval stock enclosure.

9.3.6.7 Drinkwater Pit is covered by the Surrey HER. There are no designated or non-designated assets within the site. It is shown as historic landfill and the LiDAR shows that the ground has been disturbed.

9.3.6.8 Norlands Lane is covered by the Surrey HER. The records include both designated and non-designated entries within the study area. The site was part of Longside's gravel pit, and a late Bronze Age pit was discovered within the site (MSE582). Extraction for the gravel pit and the Coldharbour Quarry has resulted in disturbance and the HCA is now landfill.

9.3.6.9 Littleton North is covered by the Surrey HER. No designated heritage assets and 10 non-designated assets are recorded with the study area. The site is part of the Shepperton Gravel pits (see 9.3.6.13) and has been disturbed by extraction.

9.3.6.10 Chertsey Road Tip is covered by the Surrey HER. The records include both designated and non-designated entries within the study area, and non-designated assets within the site itself. Designated assets include the Scheduled Monument at Saxon County School and two listed buildings.

9.3.6.11 Two non-designated heritage assets are recorded within the site. These are Roman and Early Medieval sites that were discovered during gravel extraction.

9.3.6.12 Eight non-designated assets are recorded within the study area. These range from the prehistoric to the Roman period.

9.3.6.13 The site and the study area form part of the Shepperton Gravel Pits (MSE19813). These were a large group of flooded gravel pits, the excavation of which commenced in the inter-war period and eventually encompassed 100ha (Mills 1993). The HCA and the field to the west, a potential new green open space, fall within these areas of prior extraction. The Manor Farm area to the east was also subject to extraction.

9.3.6.14 A trial trench evaluation was carried out in the site's south-west corner; no archaeological remains were discovered.

9.3.6.15 Land South of Chertsey Road is covered by the Surrey HER. The records include both designated and non-designated entries within the study area, and non-designated assets within the site itself. Designated assets include fourteen Grade II listed buildings within the study area.

9.3.6.16 Seven non-designated heritage assets are recorded within the site and a further eleven within the study area. These consist largely of findspots of artefacts ranging from the prehistoric to the Early Medieval periods, recovered during gravel extraction.

9.3.6.17 Two archaeological events, a trial trench evaluation and a watching brief, took place in 1993 and 1994 at The Margins, 30m from the site's south-east corner, where a Bronze Age axe and a Roman pewter plate had previously been recovered from a silted river channel. No finds were discovered during trial trenching, but a watching brief on gravel extraction produced animal bone (including aurochs) and two human skulls from buried channels.

9.3.6.18 Desborough Island is covered by the Surrey HER. The records include both designated and non-designated entries within the site and the wider study area. Designated assets within the site include two listed Corporation of London tax posts for coal and wine duty, erected c.1860. Twenty-five listed buildings are recorded within the study area.

9.3.6.19 Three non-designated heritage assets are recorded at Desborough Island. These are 19th-century Corporation of London Tax Posts and an undated area of differential grass growth (MSE6902) on Point Meadow, in the north-west part of the site. The latter may be a former river channel. Eight non-designated assets are recorded within the study area. These range from the prehistoric to the modern period. Assets within the site include prehistoric and medieval material dredged from the River Thames, Roman artefacts found during gravel extraction, and a late Roman/Saxon fish weir on the opposite bank of the River Thames to the south-west of the site.

9.3.6.20 Stage 1 and 2 evaluations were carried out at Desborough Island in 2017 and 2018 as part of the RTS. These are summarised in paragraphs 9.3.8.23 to 9.3.8.26 below.

9.3.6.21 Land Between Desborough Cut and Engine River is covered by the Surrey HER. The records include non-designated entries within the site and designated and non-designated within the wider study area. Designated assets within the study area include Oatlands Palace Scheduled Monument and Registered Park or Garden, and seven Listed buildings.

9.3.6.22 Two non-designated assets are recorded within the site, one prehistoric, and one medieval and possibly related to Oatlands Palace. A further 14 are recorded within the study area; the most notable of these are the Roman wooden structure at Shepperton, and associated artefacts. Other non-designated assets largely consist of individual find spots ranging from prehistoric to modern.

9.3.6.23 Grove Farm is covered by the Surrey HER. The records include four designated and four non-designated assets within the site or study area. The site contains two non-designated assets of the Grove Farm complex and a possible Iron Age pit. It is also adjacent to a multi-period site discovered at Cranmere School to the east of the HCA which included Mesolithic and Neolithic flint working sites and Bronze Age settlement features. Evidence of early medieval settlement were also found at Grove Farm and the Cranmere School site. The southern part of the site is considered to be of High Archaeological Importance as the evidence discovered at the school is likely to extend into the site.

9.3.6.24 Grove Farm is recorded as historic landfill but given the archaeological remains and field boundaries which are shown on 19th century mapping, the level of disturbance is unclear.

9.3.6.25 Studies of aerial photography and LiDAR evidence have been carried out as part of the DBA (as discussed in Section 6 of the DBA). Within the study area of Land between Desborough Cut and Engine River are curvilinear cropmark features suggestive of possible former watercourses or part of the former Oatlands Park pale. The earthworks at Laleham Burway, noted in paragraph 9.3.6.6 also lie within the Laleham Reach study area.

9.3.6.26 The potential area of new green open space at Royal Hythe is mainly landfill with an intact area of land that falls within the Thorpe Hay Nature Reserve. No heritage assets are recorded within the site. There are four listed buildings in the 500m study area and the Surrey HER records 37 non-designated heritage assets. The non-designated assets range in date from the Mesolithic to the modern period. A palaeochannel also runs through the associated study area. The small area of Royal Hythe which is not landfill will have high potential for palaeoenvironmental evidence.

9.3.7 Summary of archaeological potential

9.3.7.1 The key heritage assets / areas of archaeological potential within the study area are summarised below; the areas of archaeological potential are also mapped on Figure 9-1 in Appendix A. The key heritage assets / areas of archaeological potential have been graded as high, moderate, or low according to their importance and the potential for disturbance. A full analysis of the archaeological potential of the areas included in the RTS can be found in Section 10 of the DBA.

Runnymede Channel

- Multi period findspots from the River Thames at Staines in areas of undisturbed ground / riverbed: **low potential**;
- Land at or near Thorpe Hay Meadow - undisturbed ground with potential early deposits noted in trial pits: **moderate-high potential**;
- Multi-period findspots and settlement evidence from gravel pits - previously undisturbed areas: **low-moderate potential**;
- Presumed site of former earthwork enclosure on Abbey Mead (there is confusion in the record between different antiquarian sources, so location remains uncertain): **moderate potential**; and
- Abbey Mead - intact area of gravels/channels: **high potential**.

Spelthorne Channel

- Medieval burh (defended site) suggested from documentary evidence; no physical remains, possibly entirely quarried away: **low potential**;
- Multi-period findspots in gravel pits across the study area in previously undisturbed areas: **low-moderate potential**;
- Anglo-Saxon cemetery (Saxon School) immediately adjacent to the Channel study area (areas inside proposed route have been quarried away): low potential; and
- A cluster of Roman-medieval fish-weir/timber structures on riverside at Shepperton: high potential.

Desborough Bed Lowering

- Artefacts, structures, or palaeoenvironmental remains in river bed or banks: **moderate potential.**

Sunbury Weir

- Multi-period findspots (Bronze Age to Post Medieval) from the River Thames: **low-moderate potential.**

Molesey Weir

- Multi-period findspots (Lower Paleolithic to Post-Medieval) from the River Thames in areas of undisturbed ground/ riverbed: **low-moderate potential.**

Teddington Weir

- Multi-period findspots (Mesolithic to Post-Medieval) from the River Thames in areas of undisturbed ground/ riverbed: **low-moderate potential.**

HCAs and New Green Open Spaces

- Land South of Wraysbury Reservoir - Palaeolithic, Mesolithic, Neolithic finds, and Bronze Age finds or settlement evidence related to the settlements excavated nearby at Kingsmead Quarry: **moderate-high potential;**

- Laleham Golf Course - palaeoenvironmental remains within palaeochannels identified on LiDAR images, settlement remains on gravel terraces, post-medieval field systems, earthworks associated with Scheduled Monument: **high potential;**

- Land South of Chertsey Road within southern strip of potentially intact ground - finds of prehistoric, Roman, and Early Medieval Date: **low potential;**

- Desborough Island - palaeoenvironmental remains within palaeochannels identified on LiDAR images: **high potential;**

- Desborough Island - settlement remains on gravel terraces: **moderate-high potential;**

- Land Between Desborough Cut and Engine River - palaeoenvironmental remains within palaeochannels identified on

LiDAR images, post-medieval features connected to Oatlands Park: **high potential;**

- Land Between Desborough Cut and Engine River - Neolithic, Bronze Age, Roman, or Early Medieval finds: **low-moderate potential; and**
- Grove Farm – Mesolithic, Neolithic, Bronze Age or Early Medieval finds: **moderate potential**.
- Royal Hythe new green open space – palaeoenvironmental remains, **high potential** (in area of Thorpe Hay Nature Reserve).

9.3.7.2 Areas with no archaeological potential were also identified in the study area. These are areas where the original ground surface is no longer present, and any potential deposits have been made inaccessible or destroyed by quarrying, landfill, and reservoirs. As well as substantial parts of the Channels, these areas include the HCAs at Drinkwater Pit, Norlands Lane, Littleton North, Laleham Reach, Chertsey Road Tip (including the potential green open spaces in fields to the east and west), and the majority of Land South of Chertsey Road.

9.3.7.3 Archaeological evaluations of several of these areas were carried out between 2017 and 2019, and further evaluations in 2022 (Figure 9-3, Appendix A). The results of these evaluations are summarised in Section 9.3.8 below.

9.3.8 Summary of Archaeological Evaluations

9.3.8.1 Following the assessments summarised in Section 9.3.7 above, several sites were selected for archaeological evaluation. This followed the staged programme outlined in Section 2. The sites selected are listed below.

Table 9-1: Sites selected for archaeological evaluation.

Site	Survey Stage and Type, and Status
Land South of Wraysbury Reservoir	1: Geophysical Survey – survey not complete 1a: Geoarchaeological Survey – survey not complete
Thorpe Hay Meadow	1: Geophysical Survey – survey complete 1a: Geoarchaeological Survey - survey complete 2: Trial Trench Evaluation – not possible

Site	Survey Stage and Type, and Status
Laleham Golf Course	1: Geophysical Survey – survey complete 1a: Geoarchaeological Survey – survey complete 2: Trial Trench Evaluation – survey not complete
Abbey Meads, Chertsey	1: Earthworks Survey – survey complete 1: Geophysical Survey - survey complete 1a: Geoarchaeological Survey - survey complete 2: Trial Trench Evaluation - survey complete
Shepperton	1: Geophysical Survey - survey complete 1a: Geoarchaeological Survey - survey complete 2: Trial Trench Evaluation – not possible
Desborough Island	1: Geophysical Survey – survey complete 1a: Geoarchaeological Survey – survey complete 2: Trial Trench Evaluation – survey complete – may require further work dependent on design
Land Between Desborough Cut and Engine River	1: Geophysical Survey – survey complete 1a: Geoarchaeological Survey – survey not complete
Desborough Bed Lowering	Sonar survey of riverbed – survey complete Archaeological monitoring of bed lowering – survey non complete
Sunbury weir	1a: Geoarchaeological Survey (Power Auger) – survey complete 2: Test Pit Evaluation – survey complete
Teddington weir	1a: Geoarchaeological Survey (Power Auger) – survey complete 2: Test Pit Evaluation – survey complete

9.3.8.2 The following paragraphs summarise the findings of archaeological investigations at the above sites. A more extensive summary can be found in Sections 7 and 10 of the DBA (Appendix G).

Thorpe Hay Meadow

9.3.8.3 A geoarchaeological watching brief showed deep stratified Holocene deposits with high paleoenvironmental potential. Intact in situ archaeological remains, including preserved wood were encountered.

9.3.8.4 Stage 1 Geophysical evaluation encountered no magnetic responses that could be interpreted as being of archaeological interest.

9.3.8.5 Stage 1a Geoarchaeological evaluation revealed deposits of organic-rich alluvium. These represent both in-channel and overbank sedimentation. Deposits considered to derive from a substantial palaeochannel have been dated to the early Holocene and have the potential to provide high quality palaeoenvironmental records. Overbank alluvial deposits encountered also date to this period and have a high potential to preserve former land surfaces as well as wooden structural archaeological remains.

9.3.8.6 An area of dense woodland cover encountered gravels at shallower depths (1.55 – 2.7 below ground level); this is likely to represent a gravel island between palaeochannels.

9.3.8.7 Stage 2 trial trench evaluation was recommended to follow up the possibility of further intact in situ archaeological remains. However, the logistical challenges of safely excavating very deep trial trenches below the water table meant that this could not be carried out.

9.3.8.8 The site is considered to be of high archaeological and palaeoenvironmental potential, with archaeological remains likely to be encountered at depths up to 3.9m below current ground level.

Laleham Golf Course

9.3.8.9 Field survey of earthworks investigated features initially identified from LiDAR images. Earthworks encountered included the historic Burway Ditch and the outer ditch and inner raised bank of the Scheduled Monument. It was noted that golf course landscaping had truncated many features, including those of the Scheduled Monument. Areas of ridge and furrow identified on the LiDAR images were not visible on the ground.

9.3.8.10 Stage 1 geophysical evaluation noted linear anomalies corresponding to the Scheduled Monument earthwork, and small pit-like anomalies within the enclosure, though the latter are likely to be of natural origin. Linear trends probably corresponding to past agricultural activity were noted across the site, along with former field boundaries.

9.3.8.11 Stage 1a geoarchaeological evaluation determined that channel deposits were present along the western edge of the site, suggesting that the extant drain forming the boundary of the golf course represents a re-purposed palaeochannel. This was dated to the middle Bronze Age or earlier. Excellent preservation of plant macrofossils and insect remains was noted within these deposits.

9.3.8.12 Stage 2 trial trench evaluation was recommended, in particular to determine the age and significance of the Scheduled Monument. This has not yet been carried out.

9.3.8.13 The site is considered to be of high archaeological and palaeoenvironmental potential.

Abbey Meads, Chertsey

9.3.8.14 Field survey of earthworks investigated features initially identified from LiDAR images. Earthworks encountered were largely very faint and ephemeral, with most being attributable to recent field drainage activities. A possibly palaeochannel was identified. A square enclosure noted in the SMR as a possible medieval stock enclosure was not apparent either on LiDAR images or on the ground; it is suggested that this has been wrongly located in the SMR.

9.3.8.15 No magnetic responses were recorded during Stage 1 geophysical evaluation that could be interpreted as being of archaeological interest.

9.3.8.16 Stage 1a geoarchaeological evaluation demonstrated a complex fluvial landscape, with at least one major channel and probably several smaller channels present at the site. Deposits were encountered dating from the Mesolithic to the Middle Bronze Age. Areas of higher gravels between the channels were considered to be of high archaeological potential for settlement activities in the higher areas, and seasonal activity within lower-lying areas between the palaeochannels. Within the channels there was considered to be high potential for deposits of palaeoenvironmental significance and preserved wood.

9.3.8.17 Stage 2 trial trench evaluation involved the excavation of 105 30m trenches across the site. Dryland archaeological remains were encountered dispersed across the higher gravel areas. These include a possible Bronze Age and later drainage network, and smaller quantities of flint dating from the Mesolithic to the Bronze Age. Preserved wooden structures were encountered in lower-lying areas of the site, dating to the Iron Age and to the late medieval to early post-medieval period. Palaeobotanical evidence suggests that the lower-lying areas of the site were characterised by a complex mosaic wetland of channels and pools during the Mesolithic and Roman periods.

9.3.8.18 The site is of high archaeological and palaeoenvironmental potential, with a very strong likelihood that multi-period archaeological and palaeoenvironmental remains survive in those areas of the site not targeted by the evaluation. In particular, it has the potential to make a valuable contribution to the understanding of wetland management from the prehistoric period onwards.

Shepperton

9.3.8.19 Stage 1 geophysical survey did not identify any responses of archaeological interest.

9.3.8.20 Stage 1a geoarchaeological survey demonstrated that substantial organic alluvial deposits are present at the site, though there was some suggestion that gravel extraction may have disturbed the sequence. Gravels were encountered between 1.2 and 5.85m below ground level.

9.3.8.21 Stage 2 trial trench survey was recommended to follow up the possibility of further intact in situ archaeological remains, especially in the Area of High Archaeological Potential around the late Roman/Saxon fish weir to the south of the site. However, the intact ground in the area between the former gravel pit and the River Thames is very narrow, and the logistics of excavating trenches in this situation proved too challenging.

9.3.8.22 The site is considered to be of high archaeological potential, with the possibility of encountering organic remains associated with the known timber structure especially high in the south of the site.

Desborough Island

9.3.8.23 Stage 1 geoarchaeological survey mapped a palaeochannel of the River Thames in the south-eastern survey area. The survey otherwise noted only evidence of recent field boundaries and agricultural activities.

9.3.8.24 Stage 1a geophysical survey demonstrated both wider floodplain and in-channel deposits at the site. Gravels were encountered between 0.52 and 4.1m below ground level, with gravel islands present between deeper palaeochannel areas. Palaeochannel deposits were demonstrated to have been accumulating from at least the Roman period and potentially earlier. The macrofossil assemblage demonstrated good preservation of palaeoenvironmental remains and good conditions for preservation of potential wooden archaeological remains.

9.3.8.25 Stage 2 trial trench evaluation involved the excavation of 51 30m trial trenches. These demonstrated the presence of a ring-ditched feature representing a possible barrow located in the centre of the site. This is likely to be late prehistoric in date. Remaining features are undated but likely to also be of prehistoric date. The north-western half of the site was more deeply alluviated. Several palaeochannels were recorded; these correspond to those identified through LiDAR imagery and Stage 1 survey.

9.3.8.26 The site is of high archaeological and palaeoenvironmental potential, with a very strong likelihood that archaeological and palaeoenvironmental remains survive in those areas of the site not targeted by the evaluation.

Desborough Bed Lowering

9.3.8.27 A geophysical survey of the riverbed of the River Thames was conducted in February 2021. A total of 61 features of archaeological potential were identified in the sidescan sonar data, these probably represent modern debris. No features of palaeoenvironmental interest were identified in the sub-bottom profiler data and no definitive evidence of a historic dredge surface (which would indicate the removal of historic riverbed deposits up to that point).

9.3.8.28 Due to the potential that bed-lowering activity will affect previously undisturbed sediments surviving historic deposits, a programme of ground-truthing has been recommended.

Sunbury Weir

9.3.8.29 A Stage 2 test pit and power auger survey was carried out by Trent & Peak Archaeology at the site of Sunbury Weir in 2018 (TPA 2019d). This recorded a series of post-18th-century made ground deposits, derived from dredged river gravels and brickmaking waste, that overlay the superficial geology of Kempton Park Gravels. No features or deposits of archaeological or palaeoenvironmental significance were encountered, and the site is considered to be of low archaeological potential.

Teddington Weir

9.3.8.30 A Stage 2 test pit and power auger survey was carried out by Trent & Peak Archaeology at the site of Sunbury Weir in 2018 (TPA 2019d). No features or deposits of archaeological or palaeoenvironmental significance were encountered, and the site is considered to be of low archaeological potential.

9.3.9 Future Baseline

9.3.9.1 The future baseline for cultural heritage, archaeology and built heritage is likely to be broadly similar to the current baseline. Designated assets are protected through planning policy such that significant changes are unlikely to occur. Non-designated heritage assets are more likely to be subject to change, with some assets being altered or removed and new assets identified as a result of new development and/or any new mineral extraction within the study area.

9.3.10 Key Environmental Considerations and Opportunities

9.3.10.1 The key considerations with respect to cultural heritage, archaeology and built heritage are:

- Scheduled Monuments, Registered Parks and Gardens, Listed Buildings, Conservation Areas and historic landscapes present in the cultural heritage study area for EIA scoping;
- buried archaeological deposits identified by HERs as non-designated heritage assets (including AHAPs) or identified during archaeological evaluations in the cultural heritage study area for EIA scoping; and
- buried archaeology not identified or not yet identified during archaeological evaluations.

9.3.10.2 The key opportunities with respect to cultural heritage, archaeology and built heritage are:

- Potential to reduce flooding of Scheduled Monuments, Registered Parks and Gardens, and Listed Buildings;

- Potential to uncover further new archaeological and paleoenvironmental finds during construction of the project, thereby expanding the archaeological record of the River Thames floodplain;
- Potential outreach and wider dissemination associated with such finds; and
- Potential heritage input into scheme design, thereby enriching the River Thames environment, increasing community connections with the historic landscape and further assisting wider dissemination and outreach.

9.4 Likely Significant Effects Requiring Assessment

9.4.1 Construction Effects

9.4.1.1 Project activities and associated likely significant effects are identified below:

- Material excavation (including channel excavation, bed lowering/river bank lowering) has a potential to remove, damage or disturb buried or riverbed archaeology. Areas likely to be affected have been identified through various archaeological investigations including field surveys, geophysical surveys, geoarchaeological assessments and trial trenching;
- General construction activities and movement of vehicles, equipment and site operatives may cause damage to buried archaeology due to ground disturbance resulting from enabling or construction works such as damaged caused by piling, and ground compression caused by use of materials, tracking of construction vehicles, or other construction-related activities. As above, areas likely to be affected have been identified through various archaeological investigations;
- Transportation of material / waste, and placement / processing of non-hazardous material at end destination has the potential for either beneficial or adverse effects on the setting of surrounding designated features depending on design. There is also the potential for disturbance to unknown buried archaeology and palaeoenvironmental deposits through compression effects of reused materials, compression from vehicle tracking or other construction activities;

- Movement of vehicles, equipment, erection of temporary screens and fences, creation of site compounds, materials processing sites and temporary storage facilities on-site has the potential to affect the setting (both visual and conceptual) of designated assets, non-designated assets and historic landscapes;
- Likely significant effects from traffic movement off site, including noise and vibration during construction have been scoped into this assessment on a precautionary basis; traffic movements have not yet been fully defined and therefore it is not practical to suggest a study area which can be used for the cultural assessment at this stage. When traffic movements are defined, this information will be used to inform the assessment of effects;
- Effects on preservation of buried archaeological deposits from a localised change of ground water level as flood channels are excavated; and
- Effects on preservation of standing features and buried archaeological deposits from a general change in water (ground and surface) through temporary change of flood regime.

9.4.2 Operational Effects

9.4.2.1 Project activities and associated likely significant effects are identified below:

- The use of the flood channel and capacity improvements during times of flood may result in a beneficial reduction in flood risk to designated heritage features. The reduction in flood risk, both in terms of flood extent and frequency will remove/ reduce flood damage to certain designated heritage features (Scheduled Monuments, Conservation Areas and Listed Buildings) and also allow for better access to, and fuller appreciation of these heritage assets;
- The use of the flood channel and capacity improvements during times of flood may have beneficial effects on the preservation of unknown buried archaeology;
- The existence of the flood channel and HCAs may result in a change to water levels causing damage to organic deposits or structures of

palaeoenvironmental or archaeological significance. This may extend beyond the areas directly affected by the project;

- The existence of the flood relief channel, flood embankments, new green open spaces and HCAs may have an adverse effect on historic landscapes and the setting (both visual and conceptual) of key designated and non-designated heritage assets. The flood relief channel and associated features have the potential to create a permanent change in setting of certain key designated heritage features which may affect the appreciation of these heritage assets; and
- The existence of research outputs, material archives and on site interpretation may have a beneficial effect on the better understanding and presentation of heritage assets within the remit of the project.

9.5 Effects Not Requiring Assessment

9.5.1 Construction Effects

9.5.1.1 Project activities and associated effects that are deemed not likely to be significant and are therefore proposed to be scoped out of the EIA are identified below:

- Transportation of non-hazardous material from the major road network and placement at licensed sites is not considered to have a significant effect on heritage assets; the material to be removed would be of minimal archaeological potential or heritage value and will be removed to existing licensed sites.

9.5.2 Operation Effects

9.5.2.1 Project activities and associated effects that are deemed not likely to be significant and are therefore proposed to be scoped out of the EIA are identified below:

- General maintenance activities could result in increased traffic and plant on local roads and within the project boundary, causing a potential adverse effect on cultural heritage, archaeological or built heritage receptors. However, it is anticipated that the effect will not be significant because maintenance activities will follow standard good practice procedures, are likely to be infrequent and of short duration, resulting in minimal effects.

9.6 Approach to Mitigation

9.6.1.1 This section should be read in conjunction with Chapter 5: Approach to EIA Scoping which sets out further definition for the project regarding primary (embedded) mitigation, secondary (additional) mitigation and tertiary (best practice) mitigation.

9.6.1.2 In general, the RTS avoids areas of archaeological potential as far as is possible. Much of the channel, the majority of new green open spaces and many of the HCAs are situated across land which has been heavily affected by gravel extraction such that there is little to no remaining potential for the preservation of archaeological or palaeoenvironmental remains.

9.6.1.3 The setting of some heritage assets and elements of historic landscapes may be adversely affected by the RTS. The Setting Study to be carried out as part of the EIA will lay out steps to avoid this where possible and to mitigate the effects where this is unavoidable.

9.6.1.4 Following planned updates, the Stage 1 and Stage 2 results will inform the remaining stages of the Setting Study. Stages 3 to 5 will be carried out once design is completed as part of the EIA and will be combined with the Stage 1 and 2 report to form a technical appendix to the ES. Stages 3-5 of the study will consider all potential development effects (including the creation of new green open spaces, HCAs and potentially traffic routes) on the settings of these designated heritage assets.

9.6.1.5 Where archaeological potential has been identified and/or confirmed during DBA and Stage 1 and 2 archaeological evaluation, scheme design has been adjusted where possible to avoid damage to the archaeology present. This process has been conducted in close consultation with stakeholders. Where areas of archaeological potential cannot be avoided, mitigation measures will be considered.

9.6.2 Construction

9.6.2.1 Secondary mitigation measures that are under consideration for the construction phase are identified below.

9.6.2.2 For situations resulting in the removal of, damage to or disturbance of unknown buried archaeology potential mitigation measures might include:

- Strip, map and sample excavation on identified archaeological sites (for example Chertsey Abbey Meads and Desborough Island);
- Archaeological monitoring of excavations in areas where sites where strip, map and sample excavation is not practicable;
- Archaeological monitoring of excavations in areas where sites were not identified during evaluation but where the potential for archaeological or palaeoenvironmental remains exists;
- Additional evaluation during enabling works in areas where evaluation could not be carried out at an earlier stage;
- Archaeological monitoring and sampling of river-bed deposits during riverbed lowering activities;
- A programme of geoarchaeological investigation and palaeoenvironmental sampling to understand deposits which are to be destroyed by channel construction; and
- Post-excavation activities following all of these measures, to include archiving and long-term storage of excavated remains and reporting on and dissemination of the results as appropriate.

9.6.2.3 The above measures should mitigate the majority of detrimental effects on the heritage resource caused by the construction phase of the RTS. Residual effects are likely to include the destruction of some archaeological and palaeoenvironmental remains, and potentially may include some adverse effects on the settings of heritage assets.

9.6.2.4 The measures will be secured through the production of a Mitigation WSI, based upon existing knowledge as outlined in this chapter, and to be agreed with all relevant stakeholders. This will form part of the EIA submission.

9.6.3 Operation

9.6.3.1 Secondary mitigation measures that are under consideration for the operation phase are identified below.

9.6.3.2 For situations where changes in ground water levels might have an adverse effect on the preservation of unknown buried archaeology potential mitigation measures will include a programme of geoarchaeological investigation and palaeoenvironmental sampling. This will help to understand deposits which are threatened by changes to groundwater levels.

9.6.3.3 Potential mitigation measures for adverse effects upon historic landscapes and the setting of designated heritage assets might include:

- Enhancing existing views or creating new views;
- Restoring historic views;
- Masking detrimental features; and
- Improving public access, understanding and awareness of heritage assets.

9.6.3.4 The above measures should mitigate the majority of detrimental effects on the heritage resource caused by the operation phase of the RTS. Residual effects potentially may include the destruction or degradation of some organic archaeological and palaeoenvironmental remains, and some adverse effects on the settings of heritage assets.

9.6.3.5 The measures relating to buried archaeology and palaeoenvironmental deposits will be secured through the production of a Mitigation WSI, based upon existing knowledge as outlined in this chapter, and to be agreed with all relevant stakeholders. This will form part of the ES submission. The measures relating to the setting of designated heritage assets will be secured through the production of a Setting Study to be carried out in conjunction with the relevant stakeholders. This will form part of the ES submission.

9.7 Assessment Methodology

9.7.1.1 This section forms the assessment methodology for the cultural heritage, archaeology and built heritage aspect of the RTS that will be applied in the ES.

9.7.1.2 Previous versions of this methodology were produced to seek upfront approval and consensus with LPAs on relevant legislation, guidance and policy, and the current methodology incorporates feedback gained from this exercise.

9.7.1.3 The sensitivity of receptors and magnitude of change are considered together to give an overall significance of effect. A moderate or major effect is considered significant under EIA terms.

Significance Criteria

9.7.1.4 The criteria for assessing magnitude of change on cultural heritage, archaeology and built heritage are as follows:

9.7.1.5 A magnitude of change considered to be **high** might involve:

- Changes to all or most key archaeological materials or historic buildings and/or or settings, such that the resource is completely altered or lost;
- Changes to most or all key historic town and landscape elements, parcels or components, resulting in major change or complete loss of historic character or value;
- Extreme visual changes, resulting in major change or complete loss of historic character or value;
- Major changes in sound or noise quality, resulting in major change or complete loss of historic character or value; and
- Fundamental changes to use or access, resulting in major change or complete loss of historic character or value.

9.7.1.6 A magnitude of change considered to be **moderate** might involve:

- Changes to many key elements or considerable changes to the setting of an archaeological asset or historic building, such that the historic character of same is significantly modified;
- Changes to many key historic town or landscape elements, parcels or components, resulting in moderate changes to historic character or value;
- Noticeable differences in sound or noise quality resulting in moderate changes to historic character or value; and

- Considerable changes to use or access, resulting in moderate changes to historic character or value.

9.7.1.7 A magnitude of change considered to be **low** might involve:

- Very minor changes to archaeological materials or setting;
- Very minor changes to historic building elements or setting;
- Very minor changes to key historic landscape elements, parcels or components resulting in very minor change to historic landscape character;
- Virtually unchanged visual effects resulting in very minor change to historic landscape character;
- Very minor changes in noise levels or sound quality resulting in very minor change to historic landscape character; and
- Very minor changes to use or access resulting in very minor change to historic landscape character.

9.7.1.8 A magnitude of change considered to be **very low** might involve:

- Changes to key materials or settings of an archaeological asset, historic building, historic townscape or historic landscape such that an asset/building/town or landscape or its setting is slightly altered, resulting in limited changes to its historic character and significance.

9.7.1.9 Situations where the magnitude of change is assessed as **none** might involve:

- No change to assets, buildings landscapes or elements or parcels or components of same;
- No visual or audible changes; and
- No changes arising in amenity or other factors.

9.7.1.10 The criteria for assessing sensitivity of cultural heritage, archaeology and built heritage receptors are as follows:

9.7.1.11 **High** sensitivity involves receptors such as:

- World Heritage Sites;

- Assets, buildings and historic landscapes of acknowledged international importance which can contribute significantly to acknowledged international research objectives;
- Extremely well-preserved historic landscapes with exceptional coherence, time-depth or other critical factors;
- Sites and buildings of national importance (i.e. that can contribute to national research objectives), including Scheduled Monuments and Grade I and II* Listed Buildings;
- Designated landscapes of outstanding interest;
- Assets and buildings (either designated or non-designated) that are shown to have exceptional qualities in their fabric or historical associations not adequately reflected in the listing grade;
- Conservation Areas containing very important buildings;
- Non-designated historic landscapes of high quality and importance, and of demonstrable national value;
- Well-preserved landscapes exhibiting considerable coherence, time-depth or other critical factors;
- Burial grounds; and
- Non-designated buried archaeological remains that are demonstrably of national importance (which may include Areas of High Archaeological Potential).

9.7.1.12 **Moderate** sensitivity involves receptors such as:

- Sites and landscapes of regional importance (i.e. that can contribute to regional research objectives);
- Registered sites such as Parks and Gardens, Grade II Listed Buildings, Conservation Areas, designated special historic landscapes;
- Non-designated historic landscapes that would justify special historic landscape designation;

- Averagely well-preserved landscapes with reasonable coherence, time-depth or other critical factors;
- Buried archaeological sites (including Areas of High Archaeological Potential) and landscapes of regional importance;
- Historic townscape or built-up areas with important historic integrity in their buildings or built settings; and
- Non-designated historic buildings that can be shown to have exceptional qualities in their fabric or historical associations

9.7.1.13 **Low** sensitivity involves receptors such as:

- Sites of local importance (designated and non-designated, that can contribute to local research objectives);
- Non-designated heritage assets;
- Assets compromised by poor preservation and/or poor survival or contextual associations;
- Locally listed buildings;
- Unlisted buildings of modest quality in their fabric or historical association;
- Historic townscape or built-up areas of limited historic integrity in their built settings;
- Robust undesignated historic landscapes or those of importance to local interest groups;
- Historic landscapes whose value is limited by poor preservation and/or poor survival of contextual associations
- Assets with very little or no surviving cultural heritage interest;
- Buildings of no architectural or historical note;
- Buildings of an intrusive character; and
- Landscapes with little or no significant historical interest.

9.7.1.14 Sensitive receptors that will be subject to direct effects will be taken forward for assessment, where these fall within areas of the project boundary for EIA scoping in which intrusive groundworks will take place:

- Designated assets recorded by HE;
- Non-designated assets recorded by HERs;
- Palaeochannels preserving palaeoenvironmental and organic remains as identified through LiDAR, boreholes, Stage 1 and Stage 2 archaeological works; and
- Previously unknown archaeological features discovered through Stage 1 and Stage 2 archaeological works.

9.7.1.15 Sensitive receptors that will be subject to indirect effects (effects on setting) will be identified through the Setting Study using the following criteria:

- Intervisibility, either direct line of site or ZTV for raised landforms;
- Relationship with contemporary assets that could be altered or disrupted; and
- Relationship to surrounding historic landscape which could be altered or disrupted.

9.7.1.16 In addition, previously undiscovered archaeological deposits will also be considered a receptor due to the high potential for archaeology within those areas deemed to be of high or moderate risk in the DBA.

9.7.1.17 The significance of effect is determined by combining the magnitude of change with the sensitivity of the receptor, using the matrix displayed in the table below.

Table 9-2: Significance of effect matrix.

	High Sensitivity	Moderate Sensitivity	Low Sensitivity
High Magnitude	Major (Significant)	Major (Significant)	Moderate (Significant)
Moderate Magnitude	Major (Significant)	Moderate (Significant)	Minor
Low Magnitude	Moderate (Significant)	Minor	Negligible
Very Low Magnitude	Minor	Negligible	Negligible
No Change	None	None	None

9.7.1.18 If a change is negative, then the resulting effect is described as being adverse; if a change is positive the resulting effect is classed as being beneficial. A moderate or major effect is considered significant under EIA terms. The degree of significance as it relates to effects on cultural heritage, archaeology and built heritage receptors is defined as follows:

9.7.1.19 A major (significant) effect involves significant change in environmental conditions resulting in loss of heritage values, and therefore significance. It can affect designated and non-designated heritage assets through total removal of archaeological remains or by affecting setting to such a degree that significance is lost.

9.7.1.20 A moderate (significant) effect involves a change in environmental conditions that also results in the loss of some heritage values, thereby affecting significance. It can affect designated or non-designated heritage assets though partial removal of archaeological remains or affect setting to such a degree that significance is reduced.

9.7.1.21 A minor effect involves a change in environmental conditions resulting in a minor change to heritage values which does not affect the overall significance of the asset.

9.7.1.22 A mitigation hierarchy has been implemented to avoid, reduce, or compensate for predicted significant effects on receptors. Primary (embedded) or designed in mitigation should avoid and/or reduce many significant effects. For those effects which cannot be fully avoided secondary (additional) appropriate mitigation will be formulated for each receptor. Following this, assessment of the significance of residual effects will be determined.

Construction Effects

9.7.1.23 Adverse effects to non-designated heritage assets during construction phase arise where known and unknown buried archaeology and palaeoenvironmental deposits are damaged or disturbed by construction activities, resulting in both temporary and permanent effects. Adverse effects to designated heritage assets arise where construction activities have a detrimental effect on their setting.

9.7.1.24 Where such adverse effects cannot be reversed, these must be considered to endure alongside any positive effect (or reduced adverse effect) gained from mitigation. However, where the physical and visual adverse effect can be reversed this may result in no effect in the operational phase.

Operational Effects

9.7.1.25 Physical and visual adverse effects to heritage assets during site development and operational phases may result in temporary or permanent effects.

9.7.1.26 Adverse effects to non-designated heritage assets during operation phase arise where known and unknown buried archaeology and palaeoenvironmental deposits are damaged or disturbed by the operation of the project, resulting in largely permanent effects. Adverse effects to designated heritage assets arise where the existence and operation of the project has a detrimental effect on their setting. These effects area also largely permanent.

Cumulative Effects

9.7.1.27 Other projects consented or planned in similar timescales to the RTS have the potential to change the effects on cultural assets, for example when the setting of a receptor is important for the assessment of significance, which means it cannot be assessed in isolation. Further detail on the approach is provided in Chapter 19: Cumulative Effects Assessment.

9.7.1.28 Such effects will be assessed as part of the Cultural Heritage contribution to the ES in accordance with the approach set out in the Cumulative Effects Chapter of this Scoping Report.

9.8 Assumptions and Limitations

9.8.1.1 In areas where the original ground surface is no longer present and any potential deposits have been made inaccessible or destroyed by quarrying or landfill, these have been recorded as having no archaeological potential. It is possible that very deep deposits under these areas may exist, however it is not expected that the project will affect these due to their depth.

9.8.1.2 Similarly, it is possible that very small areas of intact ground may exist at the margins or former quarry or landfill areas. Such areas have been evaluated where possible, but it is possible that some areas of unidentified intact ground containing archaeological remains may exist.

9.8.1.3 Areas of high archaeological potential could not be fully evaluated due to logistical issues at Thorpe Hay Meadow and Shepperton (which includes AHAP SP032 – fish weir); these sites will need to be carefully investigated at construction stage, with time and facilities to do this built into the programme.

9.8.1.4 The area of high archaeological potential at Laleham Golf Course has not yet been fully evaluated; stage 2 evaluations will inform the ES.

9.8.1.5 Trial trench evaluations at Desborough Island were tightly tailored to the plans for this HCA; changes to these might require further evaluation to be carried out to establish the baseline at this site.

9.8.1.6 Planned evaluation at Land South of Wraysbury Reservoir and Land Between Desborough Cut and Engine River to establish their baseline status will inform the ES. These, and any other areas to be added to the project, will need to be evaluated prior to mitigation strategies being completed.

10 Flood Risk

10.1 Introduction

10.1.1.1 Flood risk as a topic is usually included in the Water Chapter for EIAs but given one of the project core goals is flood risk management and specifically to reduce flood risk overall, it is necessary to assess flood risk as being a source, pathway and receptor of potential environmental change. This does also mean that the definition of mitigation for a flood risk EIA chapter is nuanced in that the project purpose is flood risk mitigation itself, hence the majority of mitigation is always embedded.

10.1.1.2 The Flood Risk Assessment (FRA) will be written before the full EIA is undertaken because flood risk is used to both define and design the project. The reduction in flood risk overall defines the RTS but it is also the design tool used as part of the EIA process to determine the location and design of project elements across the site. This is known as the sequential approach to design, as defined by the NPPF which is the same for all developments: all elements of a scheme need to be located and designed to be in an appropriate flood setting relative to their sensitivity and they should not increase flood risk on or off site.

10.1.1.3 The scope of this flood risk chapter therefore follows the FRA in terms of the NPPF, Lead Local Flood Authority (LLFA) and LPAs approach i.e. to assess all sources of flooding posed to and from the project for the lifetime of the project, but also necessarily augments the assessment following the EIA guidance. This includes the assessment of significance and importantly the interaction with other environmental topics including cumulative and in combination effects, which a compliant NPPF FRA does not necessarily need to cover for planning compliance. The EIA process has enhanced the ability of the assessment of flood risk (fluvial, tidal, surface water, groundwater, sewers and drainage, and artificial sources) to optimise the designs of the RTS and address the need for “holistic” mitigation across the project.

10.1.1.4 A detailed NPPF compliant technical FRA (with Environment Agency approved modelling) and drainage assessment report will form part of the Appendices to the ES.

10.1.1.5 Given the nature of the RTS and the site setting being majority floodplain, flood risk overlaps with most other environmental topics and these chapters should be read in conjunction with this chapter.

10.1.1.6 A summary of the key legislation, policy and guidance relevant to flood risk is provided in Appendix M.

10.2 Baseline Methodology

10.2.1 Information Sources

10.2.1.1 Data on flood risk has been obtained from multiple sources over several years to inform the hydraulic modelling that underpins the design of the flood reduction and environmental benefits of the project. To inform EIA scoping, a review of publicly available resources has been undertaken. These resources include:

- Flood Map for Planning (.gov.uk Open Data);
- Risk of Flooding from Rivers or the Sea (.gov.uk Open Data);
- Risk of Flooding from Surface Water (.gov.uk Open Data);
- Risk of Flooding from Reservoirs (.gov.uk Open Data);
- Records of local flood history from Lead Local Flood Authorities / Local Authorities;
- Preliminary and Strategic Flood Risk Assessments (PFRA / SFRA) from Lead Local Flood Authorities / Local Authorities;
- Surface Water Management Plans from Lead Local Flood Authorities / Local Authorities;
- Thames Area Climate Change Allowances; and
- Surrey Local Flood Risk Management Strategy.

10.2.1.2 The Lower Thames 1D-2D Flood Mapping Model (Environment Agency, 2019), has been obtained from the Environment Agency. The model has been updated using a better understanding of the flood mechanisms within the area. Flood modelling runs have been undertaken for different flooding scenarios in agreement with the Environment Agency to demonstrate current, future without the project and future with the project flood extents, taking account of climate change and climate projections. These model runs have been undertaken for different types of flood scenarios that are known to occur in the River Thames catchment, considering the latest Thames Area Climate Change Allowances (Environment Agency, 2021b).

10.2.1.3 As the project design progresses, the Lower Thames 1D-2D Flood Mapping Model will be updated further to incorporate updates in relation to the latest RTS project design. The model will be used to model construction and operation scenarios for flood risk, to inform the FRA for the project, and the ES.

10.2.2 Stakeholder Engagement

Feedback received from consultation on EIA Scoping and draft assessment methodologies

10.2.2.1 Surrey County Council, in their capacity as a regulator, provided a Scoping Opinion on the EIA Scoping Report submitted for the project under the Town and Country Planning Act in 2017. The County Planning Authority recommended that the submitted ES must take account of the following:

- The Environment Agency (in their capacity as a statutory consultee) noted that: '*an environmental statement, associated flood risk assessment and detailed hydraulic flood modelling will be submitted by the proponent to demonstrate that flood risk will not be increased elsewhere, both during the construction and operational phases of the scheme. However, they advised that the proponent should be aware that flood water storage compensation may also be required for any work or storage compounds and that these should also be assessed, and if required mitigated, within the applications that are submitted and their accompanying assessments';*

- Transport for London advised that: '*they would be interested in measures designed to minimise impacts on rail infrastructure, the highway network and transport operations and to mitigate any negative impacts, both during construction and in operation. In particular, London Underground Infrastructure Protection would want to see further details of areas that may be affected by flooding during construction works in order to update contingency plans'.*

10.2.2.2 Construction stage flood risk will be assessed, including effects on highways, rail and tube infrastructure with the aim of ensuring that the flood risk posed to transport infrastructure is not increased as a result of construction works.

10.2.2.3 Surrey County Council also recommended that ‘due to the nature and scale of the developments proposed we would expect a detailed FRA to be produced for each site. The FRA should consider all sources of flooding, including surface water, establish the baseline flood risk using all available published sources and supplemented by site specific surveys where necessary. The effect of climate change should be considered in accordance with the latest Environment Agency guidance. The FRA should include details of any mitigation proposed for the facilities that would be constructed as part of the wider scheme, including floor and key infrastructure levels, flood flow routes, flood storage and access and egress. The Flood Risk chapter of each ES should cover the construction and operational phases of the development. In each case the FRA can form a technical appendix to the ES’.

10.2.2.4 A FRA will be produced that will objectively assess the project. It will consider all sources of flooding and is anticipated to be a qualitative assessment for the RTS, informed by fluvial and groundwater modelling. The FRA will include any details of proposed mitigation, the effect of climate change in line with Environment Agency guidance and consideration of construction and operation stages of the project.

10.2.2.5 The MMO were also asked to provide a Scoping Opinion. In relation to flood risk, the MMO noted that ‘a flood risk assessment including modelling is required to demonstrate that the works will not result in any increased flood risk downstream. This must include potential impact on tidal flood defences.

10.2.2.6 The hydraulic model includes agreed tidal scenarios (worst-cases) and the fluvial modelling extends to Putney Bridge. The model includes scenarios that identify the changes to fluvial risk downstream of Teddington Lock and the changes to tidal risk upstream of Teddington Lock; this will therefore be fully documented and addressed in the FRA and the ongoing EIA process.

10.2.2.7 Surrey County Council, in their capacity as a regulator, also provided the informal comments on the draft EIA methodology in 2019 to assist in the process of refining the methodology for the FRA. The Principal Environmental Officer noted that the adopted Surrey Minerals Plan and the

Surrey Waste Local Plan contain policy relevant to flood risk that should be considered. This policy is being considered in the FRA for EIA.

10.2.2.8 Surrey County Council also note that the Local Flood Risk Management Strategy for the RBWM should be considered. This is still relevant given hydraulic connectivity does not stop at administrative boundaries and this Local Flood Risk Management Strategy will be used in the assessment.

Feedback received from pre-application consultation under Town and Country Planning Act

10.2.2.9 Pre-application consultation was undertaken in 2019 with Surrey County Council (in their capacity as a statutory consultee), LPAs, GLA, the Environment Agency Sustainable Places Team and the MMO.

10.2.2.10 Surrey County Council pre-application feedback included comments on how the RTS needed to demonstrate compliance with the NPPF policy for reuse of material in Flood Zones 2 and 3.

10.2.2.11 The Environment Agency Sustainable Places team provided pre-application feedback in 2019. The key issue raised in relation to flood risk was that no evidence was provided to demonstrate that the proposed landscape works have passed the sequential test. They noted that '*Visitor centres and car parks are 'less vulnerable' in accordance with Table 2: Flood risk vulnerability classification of the NPPG to the NPPF. Tables 1 and 3 of this PPG [Planning Practice Guidance] make it clear that this type of development is not compatible with this floodplain [functional floodplain] and therefore should not be permitted.'* In addition to this, they stated they '*would not want to see any land raising within Flood Zone 3b – the functional floodplain'.* The team stated that the '*FRA should clearly demonstrate that the proposed beacons are located outside of Flood Zone 3b – the functional floodplain by taking a sequential approach to the site. Further studies, such as a site-specific topographical survey and/or detailed flood modelling, may be required to demonstrate the proposed LEAs are located outside of Flood Zone 3b – the functional floodplain.'*

10.2.2.12 The Environment Agency Sustainable Places team stated that if it can be demonstrated that the LEAs are not located within the Flood Zone 3b – the functional floodplain the following would need to be demonstrated:

- That climate change has been assessed and an appropriate allowance applied;

- That the proposed development does not increase flood risk elsewhere; and
- That any loss of floodplain storage within the 1:100 year floodplain (i.e. the area with a one per cent chance of flooding in any given year), plus an appropriate allowance for climate change, caused by the proposed development, including land raising in the floodplain, can be mitigated for.

10.2.2.13 Two pre-application advice meetings were held in March and September 2019 with the Environment Agency Sustainable Places team following the initial pre-application response received for flood risk aspects.

10.2.2.14 We have amended the sensitivity criteria in direct response to the Sustainable Places feedback. Detailed flood modelling and assessment of the flood zones will inform landscape design work to ensure required scheme elements are located in appropriate flood zones for their flood risk vulnerability classification and demonstrate compliance with NPPF, which responds to both the LPAs and Environment Agency feedback.

Other topic specific engagement

10.2.2.15 Consultation has been undertaken with local stakeholders such as landowners, community groups, parish councils and recreation groups. Discussion Group workshops with representatives from a wide variety of interests were held, and there have been numerous public drop-in sessions throughout the wider study area. This consultation assisted with collation of baseline data on flood risk. Ongoing consultation with the LLFA is providing important information on ordinary watercourses and surface water flooding.

10.2.2.16 Questions from the public included the desire to understand any downstream changes as a result of the RTS. This is included in the scope of the assessment and the FRA.

10.2.3 Study Area

10.2.3.1 The study area for flood risk comprises the area within the project boundary for EIA scoping with a 500m buffer and areas likely to receive a change in flood extent and depth, as defined by the ongoing hydraulic modelling (see Figure 10-1 in Appendix A). Due to the geographical separation from the main area of works, the upstream and downstream boundaries of the 1:100 year floodplain (i.e. the area with a one per cent chance of flooding in any given year)o be affected by the project beyond Datchet and Teddington Lock delineates the upstream and downstream extent of the flood risk study area. It is known that there are fluvial influences downstream of the Teddington Lock and tidal influences upstream of Teddington Lock and this is identified in the modelling. The assessment thus uses data verified on site and modelling to assess flood events.

10.2.3.2 This area has been selected as it is considered to cover all areas with the potential to experience changes to flood risk as a result of construction and operation of the project.

10.2.3.3 As the design and consultation processes progress, the flood risk study area may evolve to accommodate any changes that are generated. If the flood risk study area does change prior to submission of the ES, baseline data collection and consideration of potential likely significant effects will be reviewed and updated as appropriate.

10.3 Baseline

10.3.1 Existing Baseline

10.3.1.1 The project is within the floodplain of the River Thames and relevant tributaries. The floodplain within the flood risk study area (Figure 10-1, Appendix A) includes the full range of the likely flooding scenarios from very low to very high risk. This variance contributes to the opportunity to reduce the flood risk overall to sensitive receptors. The flood risk study area includes the full range of potential sources of flooding to different degrees and due to the nature of the floodplain, communication between the sources is high and of critical importance to the ongoing EIA process. The sources of flooding include fluvial, tidal, surface water, groundwater, sewers & drainage and artificial sources, including reservoirs and canals.

10.3.1.2 The surface water and groundwater bodies present within the study area are discussed in detail in Section 18: Water Environment.

Fluvial Flood Risk

10.3.1.3 Fluvial sources relate to non-tidal watercourses. The flood risk study area includes Environment Agency “Main River” watercourses and “ordinary” watercourses. Floodplains in England are divided into fluvial flood zones, usually based on the modelled different probabilities of a flood event occurring in any given year, referred to as the Annual Exceedance Probability (AEP). These are defined within the NPPF and PPG – Flood Risk and Coastal Change (DLUHC, 2022). Probability of fluvial flooding, ignoring the presence of defences, are categorised as detailed below:

- Flood Zone 1 (Low Probability): Land having a less than 1 in 1,000 year (0.1 per cent) AEP of river or sea flooding (all land outside Flood Zones 2 and 3);
- Flood Zone 2 (Medium Probability): Land having between a 1 in 100 year (1 per cent) and 1 in 1,000 year (0.1 per cent) AEP of river flooding; or land having between a 1 in 200 year (0.5 per cent) and 1 in 1,000 year (0.1 per cent) annual probability of sea flooding;
- Flood Zone 3a (High Probability): Land having a 1 in 100 year (0.1 per cent) or greater AEP of river flooding; or land having a 1 in 200 year (0.5 per cent) or greater AEP of sea flooding; and
- Flood Zone 3b (The Functional Floodplain): This zone comprises land where water has to flow or be stored in times of flood. When required, usually due to lack of detailed floodplain modelling, LPAs define the areas of functional floodplain as a policy designation in different ways as part of their Strategic Flood Risk Assessments in consultation with the Environment Agency. We have used the most up to date 1 in 30 year floodplain (i.e. the area with a 3.3 per cent chance of flooding in any given year) in accordance with the PPG issued in 2022.

10.3.1.4 Figure 10-1 (Appendix A) shows Flood Zones 2 (0.1 – 1 per cent AEP) and 3a (1 per cent AEP) from the flood map for planning, as well as the Functional Floodplain (3.3 per cent AEP) determined also by the SFRA's in the study area where appropriate. The principal source of fluvial (and tidal) flood risk is the River Thames. It is acknowledged that the existing baseline study area falls largely within Flood Zone 3b. It should also be noted, as stated in the legend for Figure 10-1 (Appendix A), that the data used for the flood extents are the best available based on the most recent Environment Agency approved Thames hydraulic model for this catchment area. Areas where the functional floodplain isn't shown are due to these stretches of watercourse being outside of the model extents. These areas of functional floodplain are also being updated as part of the change in the definition from 1 in 20 year to 1 in 30 year as part of the August 2022 PPG update. The assessment and modelling are ongoing and the best and most comprehensive data will be used.

10.3.1.5 Many of the existing rivers, lakes and groundwater bodies are hydraulically connected; this has an influence on flood risk as they can pose as both sources and receptors in flood risk terms and also act as pathways for flood waters. Connectivity between existing rivers, lakes and groundwater bodies is discussed further in Chapter 20: Water Environment. As seen in Figure 10-1 (Appendix A), areas of Flood Zone 3b associated with the River Thames and its tributaries correspond also to adjacent lakes and their immediate surrounding areas. As an example, during the 2013-14 floods, the Sheepwalk West lakes were flooded from the River Thames via Littleton North and Littleton East.

10.3.1.6 The inter-connectedness of flood sources, pathways and receptors in this geographical location, together with the specific hydraulic nature of the River Thames results in a baseline of flood events that are slow to generate a peak amount of water and flooding extents that remain for a long duration. Recent flood events have demonstrated that areas can remain inundated for several days and weeks. The “slow to flood” and long duration of flooding events is considered a baseline nuance to the flood risk, demonstrating how the project needs to consider flood risk as a source, a pathway and a receptor. It should be noted that being a slow catchment to result in flooding combined with a very comprehensive monitoring network means that flood events come with well advanced warning and the nature of the flood itself i.e. amount of likely water can also be reasonably accurately estimated. There are always exceptions in flood risk such as due to sudden long duration storms in upper catchments. However, the Thames modelling scenarios address extreme events proportionate to the well understood flood mechanisms and operation of the Thames.

10.3.1.7 Tidal and combined fluvial / tidal flood risk downstream of Teddington Lock is managed principally by the Environment Agency using defences such as flood walls, the Thames Barrier and other associated defences and monitoring with flood warnings. As stated previously, it is acknowledged that there is a tidal change upstream of the Teddington Lock and this is also covered by the modelling and the scope of the assessment.

10.3.1.8 The River Thames between Teddington and Twickenham has a tidal flood risk of 0.1 per cent AEP (1 in 1000), with flood depths of up to 2m if the flood defences fail (Environment Agency, 2012).

10.3.1.9 There is a combined fluvial and tidal flood risk from the River Thames in West London in the reach between Teddington and Twickenham with a flood risk of >1 per cent AEP (>1 in 100), with flood depths of up to 3m (Environment Agency, 2012).

Surface Water (Pluvial) Flood Risk

10.3.1.10 Surface water (pluvial) flooding is flooding that may occur as a result of exceedances of the local drainage system and infiltration capacity due to the increased intensity of storms and / or localised surcharging and ponding of surface runoff. Surface water flooding in terms of extents and severity therefore varies greatly due to the complexity of existing infrastructure, topography, changes in permeability between areas and the interaction with watercourses and other drainage features. This is particularly true for urban areas. Local councils all now identify areas at risk of surface water flooding within their SFRAs, using their own modelling and also modelling from the Environment Agency. The Environment Agency and LPAs Surface Water modelling and mapping will be used.

10.3.1.11 The SFRAs note that the risk of surface water flooding is widespread, primarily along road networks and following the network of watercourses. The SFRAs also identify that surface water ponding has also been noted in other low-lying areas of the floodplain. Surface water risk in combination with long duration fluvial flooding from the Thames will be assessed as part of the ongoing FRA and EIA.

10.3.1.12 The ES will also be informed by consultation with the LPAs and the LLFA as to any investigations carried out under Section 19 of the Flood and Water Management Act into local surface water flooding incidents; anecdotal and local information is particularly important to FRAs.

Groundwater Flood Risk

10.3.1.13 There are areas of increased potential for elevated groundwater in the flood risk study area, which could have the potential to cause flooding. The risk of groundwater flooding is categorised in the Areas Susceptible to Groundwater Flooding Susceptibility dataset by the Environment Agency as detailed below:

- Limited potential for groundwater flooding to occur;
- Potential for groundwater flooding of property situated below ground level; and

- Potential for groundwater flooding to occur at surface.

10.3.1.14 The potential for groundwater flooding in the study area is greatest in areas adjacent to the River Thames, particularly in Egham, Thorpe, Staines-upon-Thames and land to the north of Desborough Cut. This is attributed to the geology and topography of these areas; these locations are generally lower lying and underlain by Thames Gravels.

10.3.1.15 The presence of permeable superficial geology in direct linkage with the River Thames, and other watercourses in the flood risk study area, creates pathways for groundwater and the potential for groundwater flooding to occur, which is exacerbated when water levels in the watercourses are raised. It has been suggested that previous development within these areas have altered the natural groundwater drainage regime. The construction of reservoirs and backfilling of gravel pits with materials of different permeability to those present originally, could have altered groundwater storage flow paths.

10.3.1.16 Historic flooding from groundwater has been reported in various parts of the flood risk study area. Surrey County Council’s Flood Investigation Report indicates that groundwater flooding was widespread throughout the study area following the 2013/2014 flood event, primarily in the towns of Staines-upon-Thames, Shepperton and Sunbury-on-Thames. These groundwater flooding reports are believed to have been closely linked with the fluvial flood event that was occurring at the same time (Surrey County Council, 2017b).

Risk of Flooding from Sewers and Drainage Systems

10.3.1.17 Within the flood risk study area, Thames Water Utilities Limited (Thames Water) is responsible for surface water drainage from development via adopted sewers and for maintaining public sewers into which much of the highway drainage connects (RBC, 2018). Within the flood risk study area, causes of sewer flooding include:

- Rainfall exceeding capacity of the sewer system / drainage system;
- The system becomes blocked by debris or sediment; and
- The system surcharges due to high water levels in receiving waterbodies.

10.3.1.18 Records from Thames Water show that the areas close to or within the project boundary for EIA scoping that have been most affected by sewerage flooding in the last ten years in Runnymede include; Thorpe, Thorpe Lea, Thorpe Gren, Pooley Green, Hurst Lane, parts of Egham Hythe, Penton Hook, Laleham Burway, Egham, Englefield Green, and Chertsey. In Spelthorne, the areas most affected by sewerage flooding over the last 20 years include Stanwell, Shepperton, the south of Staines-upon-Thames, and Egham Hythe (RBC, 2018).

10.3.1.19 During the 2013/2014 flood event, flood water inundated the sewers, especially in Egham and Egham Hythe areas in Runnymede, and in Staines-upon-Thames in Spelthorne. During this time, the sewerage system was inundated with extensive precipitation. Rising groundwater and increasing volume of surface water flooding was noted to also contribute to sewer overflow during this time (RBC, 2018).

Risk of Flooding from Reservoirs and Other Artificial Sources

10.3.1.20 There are a large number of reservoirs located within the study area, several of which were formed following gravel extraction activities. Reservoirs in the study area include:

- Virginia Water lake (Runnymede);
- Wraysbury Reservoir (Spelthorne);
- King George VI Reservoir (Spelthorne);
- Staines North Reservoir (Spelthorne);
- Staines South Reservoir (Spelthorne);
- Queen Mary Reservoir (Spelthorne);
- Queen Elizabeth II Storage Reservoir (Elmbridge);
- Bessborough Reservoir (Elmbridge);
- Knight Reservoir (Elmbridge);
- Island Barn Reservoir (Elmbridge);
- Stain Hill West Reservoir (LBRUT);
- Stain Hill East Reservoir (LBRUT);

- Sunnyside Reservoir (LBRUT); and
- Grand Junction Reservoir (LBRUT).

10.3.1.21 The Environment Agency Reservoir Flood Extent datasets (Environment Agency, 2021i) provide an indication of the flood extent associated with these artificial water bodies during a ‘dry day’ scenario (flooding that would occur if the dam or reservoir failed when rivers are at normal levels) and a ‘wet day’ scenario (flooding that would occur if a dam or reservoir flood coincided with a fluvial flood event). The flood extent from these reservoirs covers most of the study area under a ‘dry day’ scenario.

10.3.1.22 Thames Water are responsible for the management of these reservoirs and ensuring all required safety standards are met. The operation and maintenance of the reservoirs is regulated by the Reservoirs Act (1975), which ensures that the design was fit for purpose, and that maintenance, including frequent inspections by trained individuals, is undertaken. As a result, the chance of reservoir embankments breaching and giving rise to flooding is extremely unlikely. These reservoirs therefore present a minimal flood risk.

10.3.1.23 Canal networks are another potential artificial source of flood risk. The canals within the study area include the Grand Union Canal in West Drayton, which is connected to the River Colne, and the Basingstoke Canal / Wey Navigation in Byfleet, which is connected to the River Wey.

10.3.1.24 The control of flow in canals via weirs and gates means that the levels should not be overtopped from a fluvial flood event. If there were to be a breach of the canal structures in these areas, then the water would likely make its way into the fluvial network, eventually reaching the River Thames. Similar to reservoir flood risk, the probability of a breach in the canal structures is very small as there is a regime of regular maintenance and inspections. In addition to this, the regular interval of locks along the canals results in the ability to confine residual risk of breach or failure to small, localised sections (RBC, 2018).

10.3.2 Future Baseline

10.3.2.1 The flood risk in the study area is predicted to increase as a result of the climate change scenarios, irrespective of development. The Environment Agency’s UK climate change projections for peak rainfall intensity predict rainfall intensity to increase in the future. The Environment Agency’s

Adapting to a Changing Climate Report (Environment Agency, 2016a) highlights that wetter winters and more intense periods of rainfall will result in increased surface water runoff. The future baseline will include changes as a result of developments, for example those that would alter the hydraulic model such as new flood compensation schemes (e.g. potentially at Thorpe Park) and built development.

Fluvial Flood Risk

10.3.2.2 In the future, areas of unprotected floodplain in West London will flood more frequently as river levels rise. Scenarios for future flood risk with the latest Environment Agency Climate Change allowances for peak river flow in the Maidenhead and Sunbury Management Catchment and the London Management Catchment using UK Climate projections (Environment Agency, 2021a) have been modelled. The up to date model outputs will be used to assess the increase in extent and depth of flooding.

10.3.2.3 Climate change will increase the number of closures required to protect against rising tides. The Thames Barrier will therefore be increasingly less available to assist with managing fluvial flood risk, as it will need to be conserved for tidal flood risk management to limit the number of barrier closures, to reduce the risk of failure and ensure the readiness for tidal surge flood conditions (Environment Agency, 2012).

Tidal Flood Risk

10.3.2.4 Despite the increase in flood risk in the future due to climate change, the Thames Estuary TE2100 Plan (TE2100) notes that the Thames Barrier will continue to provide a high standard of protection against tidal flood conditions in the tidal extent of the River Thames between Teddington and Twickenham up to 2070 (LBRUT, 2021c and Environment Agency, 2012).

Surface Water (Pluvial) Flood Risk

10.3.2.5 The future baseline for surface water flood risk is heavily influenced by current surface water management policies, infrastructure capacity, changes in impermeable surfaces and climate change, especially the increase in frequency and intensity of heavy rain events. Developments must not increase surface water flows and also have to demonstrate betterment in terms of reducing flows and volumes using Sustainable Drainage Systems (SuDS). The surface water modelling will provide the future baseline based on suitable scenarios. Additional data from the

Environment Agency and the LPAs will be sought and used where appropriate.

Groundwater Flood Risk

10.3.2.6 Groundwater levels are influenced by pluvial, fluvial and tidal interactions and human abstractions. The influence of climate change is nuanced as it depends on the source and the uses. The modelling of groundwater using different scenarios specific to the site and setting will generate the future scenarios likely both with and without development.

Risk of Flooding from Sewers and Drainage Systems

10.3.2.7 In addition to the increase in surface water runoff, population growth and loss of green spaces that provide natural drainage are stated by Thames Water as being factors that are putting increasing pressure on the sewerage network in the study area. As a result, sewer flooding may also become more frequent in the future.

Risk of Flooding from Reservoirs and Other Artificial Water Bodies

10.3.2.8 Due to the extremely good safety record for reservoirs in the UK (a regulated maintenance and inspection regime), it is unlikely that this flood risk will change in the future. In addition to this, Thames Water are addressing increased flood risk to and from their assets as a result of climate change, through their 2020-2025 Business Plan and 2050 Vision, as detailed in their Climate Change Adaptation Report for 2015-2020 (Thames Water, 2021) together with additional scrutiny of water resources planning in general due to recent drought periods. The future status of canals is considered to not likely differ significantly. Nevertheless, the key information on canals including management and flow controls and any works etc will be included in the FRA and ongoing EIA as appropriate.

10.3.3 Key Environmental Considerations and Opportunities

10.3.3.1 The key environmental considerations in relation to flood risk are:

- The need to ensure the project will be safe for its lifetime, without increasing flood risk elsewhere, particularly downstream; and
- A large portion of the project is located in the functional floodplain (Flood Zone 3b). Within the site, the most vulnerable development needs to be located in areas of lowest flood risk, unless there are

overriding reasons to prefer a different location, therefore a sequential approach needs to be taken.

10.3.3.2 The key opportunities in relation to flood risk are:

- Increased flood resilience for an area of low lying floodplain that has no defences or future resilience;
- A reduction in fluvial flood risk within the study area;
- A reduction in surface water flooding through design and new SUDS; and
- Removal of “More Vulnerable” uses such as landfill from the floodplain

10.4 Likely Significant Effects Requiring Assessment

10.4.1 Construction Effects

10.4.1.1 Project activities and associated likely significant effects are identified below:

- Temporary changes in land levels throughout the site area (including site compounds, stockpiling, processing plants) have the potential to both reduce and increase floodplain storage and also alter flood flow paths; flood risk is a key design tool and the NPPF will be followed but it is not possible due to the stage of the project at scoping to fully design any flood compensation scheme hence this is scoped in;
- Movement of material / waste and placement / processing of non-hazardous material at end destination offsite has the potential for adverse effects on flood risk if placed in Flood Zone 2 or Flood Zone 3; and
- There is potential for increased surface water flood risk due to increases in areas of hard standing and other unvegetated surfaces leading to reduced infiltration (compaction of soils) and increased run-off, interrupting land drainage systems leading to changes in overland flow patterns; it is not possible due to the stage of the project at scoping to fully design the temporary drainage hence this is scoped in.

10.4.2 Operational Effects

10.4.2.1 Project activities and associated likely significant effects are identified below:

- A significant beneficial effect of reduction in fluvial flood risk in the study area due to use of the flood channel during times of flood;
- Provision of new areas of green open space and landscape works have the potential to change fluvial flood risk posed to and from the project and to the surrounding area due to land raising in the floodplain (but noting flood risk is a key design tool and the design will be compliant with the NPPF);
- Sheet piling along sections of the flood channel has the potential to increase groundwater flood risk to sensitive receptors due to the creation of barriers within aquifers and the River Thames, causing an alteration of groundwater flows and subsequent potential changes to locations, extents and frequency of groundwater flooding; and
- Use of the flood channel during times of flood has the potential to cause an accumulation of sediment in the flood channel, which will potentially affect its ability to convey capacity during flood events. Sediment modelling is informing design and possible mitigation measures, if required.

10.5 Effects Not Requiring Assessment

10.5.1 Construction Effects

10.5.1.1 Project activities and associated effects that are deemed not likely to be significant and are therefore proposed to be scoped out of the EIA are identified below:

- Transportation of hazardous material / waste from the major road network and placement at licensed sites will not affect flood risk as materials / waste will be sent to and handled by a licensed waste facility;
- Dewatering during construction has the potential to cause adverse effects of increased surface water flood risk if dewatering during channel excavation and earthworks is released to surface waters, potential altering their hydrological regime. Dewatering of lakes is

covered by specific licences and the control measures are well understood and not complex or novel (the discharge can be reduced and stopped as part of a management and monitoring plan). Relevant consents and permits including Flood Risk Activity permits (or equivalent provision within the DCO application) will also be obtained which will ensure surface water is managed appropriately. Surface water run-off will be managed through the Construction Surface Water Management Plan, to be prepared as part of the DCO application;

- Dewatering during construction has the potential to cause adverse effects of increased sewer flood risk if dewatering during channel excavation and earthworks is released to the local sewer network. If water from dewatering activities is required to be released to the sewer network, the Environment Agency and Thames Water will be consulted to obtain consent and ensure this activity will not result in increased sewer flood risk;

- Construction works in and around water bodies have the potential to cause adverse effects of increased fluvial flood risk e.g. through the construction of coffer dams for construction works on Molesey Weir C. This activity will also be managed through the CEMP. Methodologies detailed in the CEMP and Flood Risk Activities Permit (or equivalent provision within the DCO application) will be informed by more detailed hydraulic modelling;

- The project is not anticipated to change the flood risk posed to and from reservoirs. The RTS design avoids physical damage to reservoirs and furthermore these are subject to regular safety audits. Therefore, the chance of reservoir embankments breaching and giving rise to flooding is extremely unlikely. Hence, no construction or operation effects on reservoir flood risk are anticipated, and reservoir flood risk is therefore scoped out of further assessment; and

- The risk of flooding posed to and from canals is considered minimal therefore the risk of flooding from canals as a result of construction or operational effects is scoped out of further assessment.

10.5.2 Operational Effects

10.5.2.1 Project activities and associated effects that are deemed not likely to be significant and are therefore proposed to be scoped out of the EIA are identified below. It should be noted that the FRA will cover the assessment of all relevant effects so those scoped out here will still be covered by assessment that is appropriate in detail and scale.

- Use of the flood channel during times of flood may have the potential to cause adverse effects on fluvial flood risk downstream of the flood channel. Embedded mitigation (flood risk as a design tool) in the project design such as capacity improvements at the weirs, bed lowering downstream of Desborough Cut and modifications to the Thames Water abstraction regime will ensure there is no increase in flood risk downstream of the flood channel;
- Use of the flood channel during times of flood has the potential to cause an accumulation of sediment in the flood channel, which will potentially affect its ability to convey capacity during flood events. Sediment modelling is informing design and possible mitigation measures if required;
- Existence of the flood channel and other project components has the potential to cause changes in ground levels and increases in areas of hard standing or other unvegetated surfaces. This may have an adverse effect on land drainage patterns, and potentially increase surface water runoff resulting in an increase in surface water flood risk. The FRA will include the relevant assessment and the required consents and permits for management of surface water flood sources are appropriate to ensure there would be no increase in surface water flood risk; and
- General maintenance activities are not anticipated to affect flood risk as they will follow standard good practice procedures, are likely to be infrequent, low impact and of short duration.

10.6 Approach to Mitigation

10.6.1.1 This section should be read in conjunction with Chapter 5: Approach to EIA Scoping which sets out further definition for the project regarding primary (embedded) mitigation, secondary (additional) mitigation and tertiary (best practice) mitigation.

10.6.2 Construction

10.6.2.1 Given flood risk is a core design tool, the majority of secondary mitigation is management of the detail of activities (e.g. construction methodologies) and the use of tertiary mitigation through the various approvals that will be required pursuant to the DCO and in other licences and permits.

10.6.2.2 A flood protocol will be put in place to minimise flood risk from the construction activities, including but not limited to the excavation of the channels and stockpiling of material in the floodplain. This may include the requirement to store material parallel to the direction of flood flows in the floodplain so that stockpiles do not impede flood pathways.

10.6.2.3 A Construction Surface Water Management Plan will be developed as part of the CEMP and is likely to include measures such as: use of geotextile matting; avoiding tracking of heavy machinery in the floodplain where practicable to reduce the risk of surface water flooding due to soil compaction.

10.6.2.4 Measures such as opening coffer dams to allow flows to pass through will be considered to ensure use of coffer dams for in-channel works does not cause an increase in fluvial flood risk.

10.6.2.5 To minimise temporary increased flood risk, the Environment Agency's Area Operations requirements will be followed which could include for example only one weir being worked on in a given year and timing construction to be undertaken during the summer to avoid periods when high flows are more likely.

10.6.3 Operation

10.6.3.1 Secondary mitigation measures that are under consideration for the operation phase are identified below.

- To ensure accumulation of sediment in the flood channel or in the River Thames downstream of Desborough Cut does not adversely affect the projects conveyance capacity during flood, sediment modelling will be completed, and will inform the design and possible mitigation measures. Potential measures include creating an area to trap sediment in upstream sections of the flood channel; designing the shape and positioning of the flow control structures to reduce the volume of sediment reaching the flood channel; and periodic reinstatement of the flood channel design profile.

10.6.3.2 Bathymetric surveys will be undertaken periodically to detect any changes in siltation and erosion over time. Work to reinstate the design profile may be needed to maintain the design capacity of the flood channel and bed lowering downstream of Desborough Cut.

10.7 Assessment Methodology

10.7.1 Significance Criteria

10.7.1.1 The sensitivity of the various receptors for flood risk will, as a basis use a combination of the NPPF vulnerability categories as per Table 10-1 below and the guidance and criteria set out in the DMRB LA113 Road Drainage and the Water Environment (Ref 9-19) and LA 104 (Ref 9-20) adapted for this assessment where required. Although the DMRB was devised for highways road infrastructure projects, this method is widely used on other developments because it is robust and a well-tested method for predicting the significance of effects.

10.7.1.2 For this assessment, specific receptors or types of receptors not fully captured by the NPPF categorisation (construction sites in the temporary phase) or those requiring a more detailed analysis (ecological receptors with a higher susceptibility to change in their current flooding regime) will be further elaborated and their sensitivity justified and will also be covered in the assessment of the relevant topic.

Table 10-1: General criteria for classifying the sensitivity of flood receptors.

Sensitivity	Criteria
High	Essential infrastructure including: • Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk; • Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood; and • Wind turbines.

Sensitivity	Criteria
	Highly vulnerable development including: • Police stations, ambulance stations and fire stations and command centres and telecommunications installations required to be operational during flooding; • Emergency dispersal points; • Basement dwellings; and • Caravans, mobile homes and park homes intended for permanent residential use; and Installations requiring hazardous substances consent.
Moderate	More vulnerable developments including: • Hospitals; • Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels; • Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels; • Non–residential uses for health services, nurseries and educational establishments; • Landfill and sites used for waste management facilities for hazardous material/ waste; and • Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan. Less vulnerable developments including: • Police, ambulance and fire stations which are not required to be operational during flooding; • Buildings used for shops, financial, professional and other services, restaurants and cafes, hot food takeaways, offices, general industry, storage and distribution, non–residential institutions not included in "more vulnerable", and assembly and leisure; • Land and buildings used for agriculture and forestry; • Waste treatment (except landfill and hazardous material/ waste facilities); • Minerals working and processing (except for sand and gravel working); • Water treatment works which do not need to remain operational during times of flood; and

Sensitivity	Criteria
	• Sewage treatment works (if adequate measures to control pollution and manage sewage during flooding events are in place).
Low	Water compatible developments: • Flood control infrastructure; • Water transmission infrastructure and pumping stations; • Sewage transmission infrastructure and pumping stations; • Sand and gravel working; • Docks, marinas and wharves; • Navigation facilities; • Ministry of Defence installations; • Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location; • Water-based recreation (excluding sleeping accommodation); • Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan; • Lifeguard and coastguard stations; and • Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms.

10.7.1.3 The criteria to determine the magnitude of changes for flood risk are summarised in Table 10-2 below. It should be noted that any increase in flood risk that occurs due to the project is classified as a 'high' magnitude.

Table 10-2: General criteria for classifying the magnitude of change.

Magnitude	Criteria
High	Any increase in flood risk. Reduction of a receptor's flood risk from the 'very significant risk flood category'. Reduction of groundwater flood risk from 'very high'. Reduction of the surface water flooding extent below the 3.3% AEP category.
Moderate	Reduction of a receptor's flood risk from the "Significant Risk" flood category. Reduction of groundwater flood risk from 'high'. Reduction of the surface water flooding extent below the 1% AEP category.
Low	Reduction of a receptors flood risk from the "Moderate Risk" flood category. Reduction of groundwater flood risk from 'Low'. Reduction of the surface water flooding extent below the 0.1% AEP category.
Very Low	Reduction of a receptors flood risk from the "Low Risk" flood category.
None	No change in flood risk.

2.5.1.11 After establishing the sensitivity of the receptor using criteria within Table 10-1 above and assessing the magnitude of change using the criteria within Table 10-2 above, the effect to the receptor can be determined as either significant (major or moderate effects) or not significant (minor or negligible effects) for consistency with other technical Chapters in the ES. The assessment of environmental effects will therefore use the criteria as shown in the matrix in Table 10-3 below.

Table 10-3: Assessment of environmental effects.

	High Sensitivity	Moderate Sensitivity	Low Sensitivity
High Magnitude	Major (Significant)	Major (Significant)	Moderate (Significant)
Moderate Magnitude	Major (Significant)	Moderate (Significant)	Minor
Low Magnitude	Moderate (Significant)	Minor	Negligible
Very Low Magnitude	Minor	Negligible	Negligible
No Change	None	None	None

10.7.1.4 The duration of effects used will be those as described in Chapter 5: Approach to EIA Scoping.

10.7.2 Assessment of Effects

10.7.2.1 The FRA will cover all areas and stages of the project. The flood channel elements are required to be in the floodplain hence the Sequential Test itself is considered passed. However, the FRA will need to objectively assess the project design options using the sequential approach and where necessary the Exception Test, including for construction matters.

10.7.2.2 The sequential approach is the mechanism for the FRA to further assist in the ongoing design of the RTS in order to ensure each element of the project is located appropriately within the floodplain. This is the same for any development in order to be NPPF compliant.

10.7.2.3 In line with NPPF requirements, the FRA will demonstrate that:

- Within the site, the most vulnerable development is located in areas of lowest flood risk (this is the sequential approach), unless there are overriding reasons to prefer a different location;
- The development is appropriately flood resistant and resilient;
- It incorporates SuDS, unless there is clear evidence that this would be inappropriate;
- Any residual risk can be safely managed; and

- Safe access and escape routes are included where appropriate, as part of an agreed emergency plan.

10.7.2.4 As part of the FRA, the project will assess effects on flooding from surface water drainage by identifying the extent of proposed new areas of hardstanding / landscaping and the likely effects of these upon surface water flooding. The drainage assessment including the incorporation of SuDS will provide the necessary embedded mitigation to demonstrate no unacceptable increase in surface water flooding on or off site.

10.7.2.5 The site-specific FRA will inform the assessment of the construction and operational effects.

10.7.3 Construction Effects

10.7.3.1 A qualitative assessment of the temporary effects of a potential increase in flood risk to homes and businesses and essential infrastructure (including effects on land drainage), due to the creation of areas of hard standing and stockpiling of excavated material within the floodplain during the construction of the flood relief channels will be completed.

10.7.3.2 A quantitative assessment will be completed of the potential effect of temporary increased flood risk to properties, infrastructure and existing operations (e.g. businesses) in the study area as a result of the project during construction. This will be done by reviewing hydraulic modelling of predicted flood risk for different construction scenarios (for example partially built channels, phasing of the project in terms of land raising), and what effects there will be on flood risk to receptors within the study area.

10.7.3.3 The effects will be assessed in accordance with the significance criteria above. Assessment of effects (with primary and tertiary mitigation assumed to be in place) will be presented initially. Any further (secondary) mitigation that may be required to address any remaining significant adverse effects will be identified and residual effects assessed with such additional secondary mitigation in place as a second stage of the assessment.

10.7.4 Operational Effects

10.7.4.1 The nuance of flood risk as a separate EIA chapter is that it is reduction in flood risk overall that is itself a prerequisite for the project. Hence, flood risk is part of the development description and purpose. By using the sequential approach to designing the RTS, the EIA process is objectively designing the project to optimise the reduction in flood risk overall. The various elements of the project will be located and designed to meet the requirements of reduction in flood risk, which is the intended operational effect overall.

10.7.4.2 The potential effect on reducing flood risk to relevant receptors / land uses properties in the study area as a result of the project will be quantitatively assessed. The effects on the safety and wellbeing of local business will also be assessed. The hydraulic modelling will demonstrate the operational benefit with due consideration for climate change effects, and what effects there will be on flood risk to receptors within the study area. This will also include the contribution from the sediment modelling. This will be documented in detail in the FRA.

10.7.4.3 As part of the project therefore, the FRA will include the areas of green open space and all other changes in land levels across the site and the location and design of all different land uses proposed.

10.7.4.4 The effects on flood risk (including land drainage) from changes to and from groundwater, local surface water tributaries / ordinary watercourses and other features entering or being permanently changed by the project will be quantitatively assessed where appropriate.

10.7.4.5 Operational effects from the project will be assessed using the same criteria as construction effects as described above.

10.7.5 Cumulative Effects

10.7.5.1 Given there is the NPPF requirement for each development to not increase flood risk elsewhere, it is likely that most other developments would not result in cumulative effects that require additional assessment in terms of flood risk. However, other cumulative developments will be considered where appropriate. Due to the nature of flood risk also being a pathway for impacts, effects on a receptor arising from more than one environmental topic (in-combination) will be carefully considered. The approach is detailed in Chapter 19.

10.8 Assumptions and Limitations

10.8.1 Assumptions

10.8.1.1 The indication of potential effects to date is based on the data and the design options available at this time and the design input is based on the ongoing refinement of the hydraulic model; the design, consultation and EIA processes are ongoing.

10.8.1.2 Data from Third Parties used will be accurate and appropriate for the assessment.

10.8.1.3 The PEIR and ES will set out the full set of assumptions.

10.8.2 Limitations

10.8.2.1 The design of the project and the assessment are based on modelling (i.e. various input data, topographic data, level of design, climate change projections, etc) for the various sources of flooding and water resources. This therefore accommodates inherent limitations common to all models. The model however will be reviewed and approved independently following a well-established protocol that is used by the Environment Agency, for example for fluvial modelling, to update their official online flood map on a regular basis. The limitations to the new definition of functional floodplain do not alter the scoping approach and these will be appropriately addressed in the same way as the general modelling requirements.

11 Health

11.1 Introduction

11.1.1.1 This chapter describes the proposed scope of the assessment on health aspects. It outlines the baseline conditions, the likely effects of the project and the avoidance or mitigation measures proposed to alleviate these. It also outlines the methodology that will be used for the assessment of potential human health effects arising from the construction and operation of the RTS within the PEIR/ES.

11.1.1.2 The World Health Organisation (WHO) Europe defines health as “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity” (WHO, 2020). Public health encompasses general wellbeing, not just the absence of illness. The assessment of likely health effects therefore takes a broad view of physical and mental health and wellbeing. It will assess how a range of factors determine health outcomes (the determinants of health). These include but are not necessarily limited to the following:

- **Socio-economic** – including access to employment opportunities;
- **Environmental factors** – including exposure to poor air quality, noise or access to open space and wildlife;
- **Lifestyle factors** – that can be influenced by the physical environment, e.g. exercise levels; and
- **Physical environment** – safe houses, communities and roads.

11.1.1.3 In order to determine the potential for significant health and wellbeing effects during construction and operation of the RTS, this chapter will draw on the outputs of other topics within the EIA Scoping Report, in particular:

- Air Quality (Chapter 6): Potential effects as a result of changes in air quality and how this will affect local populations;
- Biodiversity (Chapter 7): Potential effects as a result of changes to biodiversity on population/conservation status/conservation objectives;
- Flood Risk (Chapter 10): Potential changes to flood depths and extents as a result of changes in flood risk and land drainage patterns;

- Landscape and Visual Amenity (Chapter 12): Consideration of effects on landscape character and visual amenity for local communities and residents;
- Materials and Waste (Chapter 13): Potential effects of former landfills on the health of construction workers and the local population;
- Noise and Vibration (Chapter 14): Potential changes to the noise baseline may have subsequent effects on local populations;
- Socio-Economics (Chapter 15): Changes in socio-economic effects that have the potential to affect local populations;
- Traffic and Transport (Chapter 17): Changes in traffic patterns have the potential to affect local populations and their use of local resources; and
- Water Environment (Chapter 18) and supporting WFD compliance assessment: Potential changes in the water environment causing implications for health.

11.1.1.4 A summary of the key legislation, policy and guidance relevant to air quality is provided in Appendix M.

11.2 Baseline Methodology

11.2.1 Information Sources

11.2.1.1 The baseline year used in this assessment is 2021. When information for the year 2021 is not available, the assessment refers to the latest available information.

11.2.1.2 A DBA has been undertaken to prepare the health baseline, using a range of data sources including the following:

- Public Health Profiles for the affected local authorities (Office for Health Improvement and Disparities, 2022);
- English Indices of Deprivation (EID, 2019);
- Office for National Statistics (ONS) socio-demographic data concerning age, gender and ethnicity, self-reported health at a Lower Super Output Area (LSOA) – taken from the 2011 Census and Mid-Year Population estimates;

- Details regarding local health issues and priorities set out in respective Local Joint Strategic Needs Assessments (JSNA) for each individual council;
- Access to social, green and health infrastructure, such as that set out in Surrey's 2050 Place Ambition Draft Implementation Framework (Surrey Future, 2019);
- Specific data received as part of the previous 2018 Scoping Opinion or other engagement;
- Data obtained from Non-motorised User (NMU) surveys of affected PRoW, being undertaken as part of the RTS design development. Datasets are yet to be completed. Therefore, NMU surveys will inform the PEIR and ES stages of assessment;
- Strategic Health Asset Planning and Evaluation (SHAPE mapping tool) – an evidence-based web application that includes various health datasets to support the strategic planning of health services and assets. SHAPE has been used to source baseline health data used in this chapter;
- Defra UK Air (Defra, 2022c);
- UK Health Security Agency (UKHSA) (formerly Public Health England (PHE)) Air Quality Toolkit 2021; and
- Defra Strategic Noise Mapping (2017).

11.2.2 Stakeholder Engagement

Feedback received from consultation on EIA Scoping and draft assessment methodologies

11.2.2.1 This section summarises the feedback received from the previous consultation exercises on the RTS. The feedback received has informed the overall approach to scoping for health, as well as the proposed scope of health effects to be considered in the EIA.

11.2.2.2 During 2018, the relevant LPAs for the RTS provided a response to the EIA Scoping Report. Several issues were raised by the LPAs relating to health, including the following:

- Noise survey positions should consider the nearest noise sensitive receptors to the north, south, east and west;
- For the construction phase, the assessment should be directed to the effects of the proposed piling works on the amenities of the nearby residential dwellings;
- For the operational phase, the assessment should consider the potential noise impact of the maintenance and use of the flood alleviation channels and associated facilities on residential receptors;
- Mitigation and/or remedial action from the proposed excavation for landfill cannot be sufficiently informed by only DBA, with field studies required to understand the effect on human health as a receptor;
- The relevant LPA will need to agree the scope and methodology for investigations and the risk assessments; and
- There was a prior absence of human Health Impact Assessment (HIA) on changes and closures to PRoWs and recreational activities due to the project. This was assessed and scoped out as it was considered a temporary and localised effect, with diversions offered. However, the ES will include an assessment of the construction effects for the possible closures and diversions.

Feedback received from pre-application consultation under Town and Country Planning Act

11.2.2.3 Informal comments were also provided by Surrey County Council in their capacity as a regulator on the draft EIA methodologies in 2019. At that time it was proposed to incorporate an assessment of health in to a wider ‘population’ chapter. Feedback received from Surrey County Council was that the scope of the assessment was too broad and that there should be a clearer focus on the areas that are most likely to cause a significant effect from the construction and operation of the RTS.

11.2.2.4 Guided by the feedback received from Surrey County Council the approach to EIA scoping was amended to provide a separate chapter on human health.

11.2.2.5 LBRUT stressed the need to undertake thorough and meaningful publicity and community engagement before the planning application is submitted. There were also several comments on how a change of access to open spaces, such as meadowland and the River Thames, could be addressed in the ES.

Other topic specific engagement

11.2.2.6 A key element of a robust HIA is obtaining data relating to health and wellbeing and the needs/ vulnerabilities of the specific local communities affected by the RTS. Engagement with the local community has been undertaken historically as part of the establishment of the early RTS designs, and further liaison will be undertaken prior to DCO submission and reported as part of the subsequent EIA stages (e.g. PEIR/ES).

11.2.2.7 Where relevant, information from previous wider consultation activities with other local stakeholders has also been used. This includes landowners, community groups, parish councils and recreation groups who provided pertinent information during organised discussion group workshops and public drop-in sessions that were held in 2016. This consultation has influenced the design of the project and assisted with the collation of baseline data.

11.2.2.8 The Environment Agency have undertaken extensive consultation with landowners, occupiers and tenants to understand their aspirations and concerns for the project and to ascertain the potential effect of the project. Further consultation with landowners, occupiers and tenants will take place prior to DCO submission.

11.2.2.9 Additional engagement with stakeholders will also be undertaken in order to fully understand baseline characteristics, significance of effect and potential approaches to mitigation for health effects. This is likely to include engagement with:

- RBWM – public health officer;
- RBKUT – public health officer;
- LBRUT – public health officer;
- Surrey County Council – public health team (Surrey County Council are responsible for the public health services related to EBC, RBC and SBC);
- Frimley Clinical Commissioning Group (CCG);
- National Health Service (NHS) Surrey Heartlands CCG;

- South West London CCG;
- North West London CCG;
- National organisations/providers of standards and guardians of community receptors (e.g. Sport England / Sustrans);
- Owners, operators and tenants of social infrastructure (e.g. schools, nurseries, sports and leisure facilities, healthcare providers, libraries, community centres, community-facing businesses (e.g. pubs and local shops), other businesses, places of worship or special educational needs facilities);
- User groups associated with community facilities (e.g. sports and recreation clubs, faith and religious groups, and resident's groups);
- Local police force; and
- Other stakeholders identified by the Environment Agency, Surrey County Council or other RTS partners.

11.2.3 Study Area

11.2.3.1 The health study area for EIA scoping (the health study area) is the area within the project boundary for EIA scoping plus a 500m buffer or the area within the 1 in 100-year floodplain (i.e. the area with a one per cent chance of flooding in any given year) that is expected to experience a change in flood risk as a result of the project, whichever is the greater (see Figure 11-1 in Appendix A). The buffer combined with the floodplain that could be changed as a result of the RTS means that the likely significant changes in relation to health can be fully captured; it is a suitably precautionary study area for the HIA.

11.2.3.2 The health study area has been selected as it covers all areas with the potential to experience significant human health effects as a result of construction and operation of the project. As the design and consultation processes progress, this study area may evolve to accommodate any changes that are generated. If the study area does change prior to submission of the ES, baseline data collection and consideration of potential likely significant effects will be reviewed and updated as appropriate.

11.2.3.3 The health study area will be reviewed at the PEIR stage to incorporate any changes to the project boundary for EIA scoping (e.g. proposed areas of new green open space) and any updates to the 1 in 100-year floodplain (i.e. the area with a one per cent chance of flooding in any given year) extent as a result of updated modelling outputs.

11.2.3.4 The health study area is a bespoke geography which does not align exactly with the datasets required to complete the health baseline. For this reason, the health baseline section will focus on ward-level datasets. The health study area for EIA scoping is spread across parts of 42 wards (2019 ward definitions) which are listed below:

- **RBWM** (Three wards within the health study area)
  - Datchet, Horton and Wraysbury / Eton & Castle / Old Windsor wards;
- **RBC** (Nine wards within the health study area)
  - Addlestone South / Chertsey Riverside / Chertsey St Ann's / Egham Hythe / Egham Town / Englefield Green West / Longcross, Lyne & Chertsey South / Thorpe / Virginia Water wards;
- **SBC** (Ten wards within the health study area)
  - Halliford and Sunbury West / Laleham and Shepperton Green / Riverside & Laleham / Shepperton Town / Staines / Staines South / Sunbury East / Stanwell North / Ashford Town / Ashford East wards;
- **EBC** (Eleven wards within the health study area)
  - Long Ditton / Hinchley Wood and Weston Green / Molesey East / Molesey West / Thames Ditton / Walton Central / Walton North / Walton South /Weybridge Riverside / Esher / Oatlands and Burwood Park wards;
- **LBRUT** (Five wards within the health study area)
  - Hampton / Hampton Wick / Ham, Petersham and Richmond Riverside / South Twickenham / Teddington wards;
- **RBKUT** (Four wards within the health study area)
  - St Mark’s / Grove / Canbury / Tudor wards.

11.2.3.5 Taken together the 42 wards form a wider geographic area than the health study area. For that reason, the term ‘approximately’ is used to highlight health indicators that cover the 42 wards rather than the health study area. See Figure 11-1 (Appendix A) for a map of the health study area. The map shows the relationship between the health study area and the 42 wards.

11.2.3.6 Some effects scoped into the HIA relate to traffic, noise and air quality. It is important to note that the traffic, noise and air quality topics use study areas that cover different geographies from the health study area. Further details on the study areas for the traffic, noise and air quality topics are provided in Chapter 6: Air Quality, Chapter 14: Noise and Vibration, Chapter 17: Traffic and Transport respectively.

11.3 Baseline

11.3.1 Existing Baseline

Population

11.3.1.1 In 2020, the population of the health study area was approximately 345,300. Between 2011 and 2020, it was estimated that the resident population in the study area had grown by around 8 per cent. Population growth in the study area surpassed population growth at national levels (+6 per cent) but was similar to London and the South East (+8 per cent).

11.3.1.2 In 2020, the health study area had a similar proportion of people aged 16 to 24 (10 per cent) compared to national (11 per cent), London and South-East levels (both 10 per cent). Furthermore, the study area had a slightly higher share of older people (65+, 17 per cent of residents) in comparison to London and the South-East (both 16 per cent). However, the study area had a lower proportion of older people compared to national levels (19 per cent) (ONS, 2020).

Deprivation

11.3.1.3 The English Indices of Deprivation provide the official measure of relative deprivation in England. It is based on seven distinct domains of deprivation – income, employment, health deprivation and disability, education and skills training, crime, barriers to housing and services and living environment, which are combined and weighted to form the overall index.

11.3.1.4 Currently, the English Indices of Deprivation does not publish data at ward level, only at LSOA and LPA levels. Therefore, this baseline section focuses on English Indices of Deprivation data at LPA level.

11.3.1.5 All six local authorities are ranked within the 40 per cent least deprived local authorities within England. Three out of the six authorities (EBC, LBRUT and RBWM) are ranked within the 10 per cent least deprived councils within the country.

11.3.1.6 Furthermore, none of the six local authorities have any LSOAs amongst the 10 per cent most deprived neighbourhoods nationally.

11.3.1.7 In the domain of health deprivation, which measures the proportion of the population experiencing deprivation relating to health, four out of the six local authorities (including EBC, RBKUT, LBRUT and RBWM) are among the least deprived decile of local authorities nationally. The remaining two local authorities (RBC and SBC) are within the least deprived 30 per cent of local authorities nationally in relation to health deprivation (MHCLG, 2019b).

UKHSA Local Health Profiles

11.3.1.8 The latest UKHSA profile information only contains datasets for 2019 wards. For this section, the focus on health profiles for the study area will be compared to national levels. Table 11-1 below provides a comparison between the health indicators for the health study area compared to the national average.

11.3.1.9 The life expectancy at birth for women (85.4 years) recorded in the health study area is above the national figure (83.2 years). The life expectancy for men (81.8) recorded in the study area is also above the national figure (79.7).

11.3.1.10 The health study area exhibits 23.8 per cent fewer cases of premature deaths (from all causes) than the general population in England. Both causes of premature death from cancer (-13.9 per cent) and from circulatory diseases (-21.9 per cent) are significantly lower in the study area than for the whole of England.

11.3.1.11 In 2011, approximately 13.0 per cent of the study area residents were suffering from limiting or long-term illnesses or disabilities. This is marginally above the national rate (12.9 per cent).

11.3.1.12 The health study area has a higher proportion (34.7 per cent) of people aged over 65 living alone compared to the national levels (31.5 per cent).

11.3.1.13 The health study area recorded 40.3 per cent fewer cases of hospital stays for self-harm compared to the national level.

11.3.1.14 In terms of childhood obesity, the health study area had fewer instances (14.5 per cent) of obesity amongst children aged between 10-11 years old, compared to the national levels (20.4 per cent).

Table 11-1: Health Indicators for the Study Area (2017 to 2019).

Indicator	HSA	England
Life expectancy at birth for females (2017 to 2019)	85.4	83.2
Life expectancy at birth for males (2017 to 2029)	81.8	79.7
Deaths from all causes, under 75 years (Standardized Mortality Ratio* - SMR) (2017 to 2019)	76.2	100
Deaths from all cancer, under 75 years (Standardized Mortality Ratio - SMR) (2017 to 2019)	86.1	100
Deaths from circulatory disease, under 75 years (Standardized Mortality Ratio - SMR) (2013 to 2017)	78.1	100
People over 65 living alone (%)	34.7	31.5
Hospital stays for self-harm, Standardised Admission Ratio** (SAR)	59.7	100
Limiting long-term illness or disability (2011)	13.0	17.6
Primary School Year 6 (children): Prevalence of obesity (including severe obesity) (%)	14.5	20.4

Source: Public Health England, Fingertips and ONS (2011 Census)

** Standardised Mortality Ratio (SMR) is related to deaths from causes considered preventable, aged under 75 years.*

*** Standardised Admission Ratio (SAR) is a summary estimate of admission rates relative to the national pattern of admissions and takes into account differences in a population's age, sex and socio-economic deprivation.*

11.3.2 Future Baseline

11.3.2.1 The existing health baseline may change during the construction and operation phases of the project. These potential changes may include:

- Health changes such as (but not limited to) life expectancy, deprivation, disease levels, cancer and mortality rates;
- Increased in-migration to the study area which could potentially increase demand for local healthcare services;
- Future increase in the number of families and older residents within the health study area could lead to an increase in the demand for local social care services (such as care homes and hospices);
- Increased demand in social infrastructure associated with health and wellbeing such as open space, access to nature, recreational and community facilities; and
- Increase in the number of people within the health study area for EIA scoping suffering from mental health issues could lead to increased demand for healthcare services.

11.3.2.2 Each of the six councils has produced a JSNA. These JSNAs outline each council's various priorities related to future health trends, as explained below:

RBKUT

11.3.2.3 According to the latest population projections, net migration into the RBKUT is projected to account for approximately 34 per cent of population growth in Kingston between 2018 and 2028. This population increase is expected to be driven by birth rate, mortality rate and inward and outward migration.

11.3.2.4 In 2019, RBKUT released their latest Annual Public Health Report highlighting one potential future trend affecting the borough which was issues linked to service accessibility. For instance, the borough is anticipated to see an increase in the proportion of people from a black and minority ethnic group by 37 per cent between 2018 and 2028. Some of these new residents could be expected to have issues accessing services including older people, people with disabilities, those with English as a second language and those from more deprived backgrounds. The report highlighted the following:

11.3.2.5 “Language barriers are one reason someone may have limited access to a service. Kingston has an ethnically diverse population and has a significant Korean community. In a 2018 needs assessment both North and South Koreans reported difficulty accessing health care, partly due to the language barrier and also due to not being familiar with the system” (RBKUT, 2019b).

11.3.2.6 RBKUT has undertaken in the Kingston Health and Wellbeing Strategy and Kingston Health and Care Plan to take a ‘health in all policies’ approach to address potential future health inequalities. These include the following three policy priorities:

- Understanding of population health needs and health inequalities;
- Understanding of the most effective interventions to improve population health; and
- Commitment to maximising the positive health impact of all council functions (RBKUT, 2019a).

RBWM

11.3.2.7 RBWM’s Health and Wellbeing Strategy 2021 to 2025 highlighted that the borough is expected to see a rise in their residents that are aged over 65 years. The Strategy identified both positive and negative trends that will affect the borough in the future which included:

- Strong parishes and communities providing a strong foundation for partnership working;
- High performing primary, secondary and acute health provision;
- High performing children's and adult social care provision;
- Good access to open space;
- Increasing inequalities gap across all ages – exacerbated by the impact of Covid-19;

- An ageing population resulting in increasing levels of frailty, dementia and falls;
- Wide variation of need across the whole borough and within neighbourhoods;
- Increasing cost of housing and lack of affordable, social housing; and
- Loneliness and social isolation (RBWM, 2019a).

LBRUT

11.3.2.8 Richmond's most recent Joint Health and Wellbeing Strategy 2016 to 2021 aims to promote 'prevention and joined up services throughout people's lives to enable all residents to start well, live well, and age well' (LBRUT, 2016a).

11.3.2.9 Furthermore, 'The Richmond Story 2017/18' highlighted that the population is ageing. The number of people aged 65 years or over is projected to increase by almost 50 per cent in the next 20 years (from 28,900 in 2015 to 43,100 in 2035). Another key theme highlighted in the report was that almost half of people aged over 75 years in Richmond live alone.

11.3.2.10 Other trends that may be persistent in the future with the borough relate to younger people. For instance, the average mental wellbeing score for 15 year-olds in Richmond is the fourth worst in London. Also the report highlights that:

11.3.2.11 "Over a fifth of 15 year-olds in Richmond have 3 or more risky behaviours, including smoking, drinking, cannabis, other drugs, diet and physical health, which is the highest in London" (LBRUT, 2018b).

11.3.2.12 Despite some of the future health challenges facing the borough, there are several positive health indicators. For instance, 28 per cent of residents use outdoor space for exercise for health reasons. This is the second highest percentage in London. Furthermore, publicly accessible parks (regional, metropolitan, district, local, small and pocket parks) make up 40 per cent of the total area of Richmond.

Surrey County Council

11.3.2.13 Surrey County Council is responsible for operating the health services across EBC, RBC and SBC.

11.3.2.14 According to Surrey County Council's Health and Wellbeing Strategy, people in Surrey on average are relatively healthy, with obesity prevalence in children at almost 7 per cent lower than the national average. Over the next 10 years, the number of people aged 65+ living in Surrey is expected to rise by over 18 per cent. The ageing population is likely to lead to an increase in people with complex conditions such as dementia, chronic kidney disease and other conditions related to ageing. It is estimated that by 2023, the number of carers aged 85+ will have increased by 31 per cent compared to 2017 levels.

11.3.2.15 To tackle some of the challenges the county is facing, three priority areas have been identified which include:

- Helping people in Surrey to lead healthy lives;
- Supporting the mental health and emotional wellbeing of people in Surrey; and
- Supporting people in Surrey to fulfil their potential.

11.3.2.16 Surrey County Council has identified five priority areas where residents experience the poorest health outcomes in Surrey. These five LSOAs are located in the following wards:

- Hooley, Merstham and Netherne (Reigate and Banstead Council);
- Canalside (Woking Council);
- Westborough (Guildford Council);
- Stoke (Guildford Council); and
- Stanwell North (Spelthorne Council).

11.3.2.17 Of these, only Stanwell North is within the health study area.

11.3.3 Key Environmental Considerations and Opportunities

11.3.3.1 The key environmental considerations for project design in relation to health are as follows:

- Potential land take from recreational or open space assets;
- Changes to water quality due to construction / operational effects;

- Existing recreational activities within the lakes, gravel pits and River Thames could be physically affected by the project; and
- The project will need to maintain the ability to navigate on the River Thames, to avoid adverse effects on the existing recreational activities which could in turn affect health and wellbeing.

11.3.3.2 Some of the key opportunities associated with the project include:

- Overall improvement of health and wellbeing and the reduction of health inequalities due to improved water quality and green space;
- Improved connectivity between communities due to increased access;
- Creating more sustainable and greener travel options, by introducing active travel routes;
- Creating new green open spaces and multi-functional landscaped spaces that are inclusive to the needs and abilities of different people, as well providing interaction between people and wildlife;
- Providing new accessible areas of waterway and opportunities for localised navigation and recreation;
- Providing new outdoor spaces for social interaction and good health;
- Reduced flood risk to vulnerable groups, residential dwellings, businesses and community facilities could increase health and wellbeing through a reduction in stress/anxiety;
- Potential for the creation of jobs and training opportunities plus provision of educational opportunities; and
- HCAs which may have public access and provide interaction with nature.

11.4 Likely Significant Effects Requiring Assessment

11.4.1 Construction Effects

11.4.1.1 The likely significant effects on health during construction are as follows:

- Transportation of material / waste, and placement / processing of non-hazardous material at end destination leading to risk of harm to health as a result of emissions;

- Creation of site compounds, temporary materials processing sites and storage of excavated material may lead to the temporary adverse effect of increase in flood risk to homes and businesses leading to additional risk of harm to health;
- Earthworks, general construction activities and movement of vehicles, equipment and site operatives may lead to a temporary adverse effect of dust and particulate matter generated from construction activities. This may lead to a reduction in air quality with potential implications for the health of local communities in close proximity to construction working areas or access routes;
- Material excavation, general construction activities and movement of vehicles, equipment and site operatives are likely to have a significant adverse effect (temporary closure/diversion) on PRoW, cycling and equestrian routes with potential implications for the health of local communities;
- Excavation through landfill and other sources of contamination may have temporary adverse effect on air quality and odour through release of landfill gases (including volatile vapours) with potential implications for the health of local communities and associated effects on livelihoods of commercial businesses;
- The management of aquatic INNS and pathogens through chemical treatment, removal or lowering water levels in lakes may have an adverse effect on recreational and commercial use of lakes. Subsequent changes in water quality, levels, hydromorphology, flow regime or sediment processes may have potential implications for human health;
- Construction works in and around water bodies may lead to a temporary adverse effect on recreation in lakes and rivers (such as commercial and club-based fishing, swimming, diving and sailing) due to construction activities, movement of construction plant, and diversions;
- Construction traffic on and off site may lead to a temporary adverse effect of traffic congestion from construction plant on local roads causing disturbance and stress to local communities;

- Earthworks and general construction activity has the potential for adverse effects to construction worker health from exposure to contaminated soils, leachate, ground gas or groundwater; and
- General construction activities including movement of vehicles, equipment and site operatives, creation of site compounds and temporary materials processing sites may lead to the potential temporary adverse effect of light pollution from construction works leading to disturbance of local communities in close proximity.

11.4.2 Operational Effects

11.4.2.1 The likely significant effects on health during the operational phase are as follows:

- Use of the flood channel and capacity improvements during times of flood will have the beneficial effect of reducing flood risk in the health study area, with subsequent beneficial effects on the health, safety and wellbeing of local communities and businesses;
- Provision of the new green open spaces and other landscape works (including new walking / cycle routes) may have beneficial and / or adverse effects on traffic movements on roads, public transport services and existing parking facilities. Adverse effects could cause disturbance and stress to local communities;
- Provision of the new green open spaces and other landscape works (including new walking / cycle routes) will have a beneficial effect on public health by encouraging more outdoor recreation in and around new areas of green open space;
- Provision of the new green open spaces and other landscape works (including new walking / cycle routes) will have a potential beneficial increase in public access (e.g. footpaths, cycle ways, navigable sections of flood relief channel) and provision of recreational facilities (e.g. moorings, fishing, bird watching and visitor facilities);
- Provision of the new green open spaces and other landscape works will potentially increase access, use and safety of amenity areas during times of flood. This may have a beneficial effect on public health by encouraging more outdoor recreation;

- The existence of the flood channel may lead to permanent adverse effects on the water quality of lakes from the introduction of River Thames water to previously unconnected lakes, with subsequent potential adverse effects on the recreational opportunities available for the public;

- The existence of the flood channel may lead to permanent adverse effects on the water quality of lakes from the introduction of River Thames water to previously unconnected lakes, with subsequent potential adverse effects on water quality from contaminants reaching surface water bodies with implications for the health of users; and

- Placement of material on landfill areas has the potential to result in release of ground gas (including volatile vapours), landfill leachate and/or other contaminants into groundwater. This could be a result of compaction and compression forcing ground gas and water or leachate laterally, or from direct pathways such as surface water runoff from the placed materials.

11.5 Effects Not Requiring Assessment

11.5.1 Construction Effects

11.5.1.1 The project activities and associated effects during construction that are deemed not likely to be significant and are therefore proposed to be scoped out of the assessment are as follows:

- Transportation of hazardous materials / waste from the major road network and placement of hazardous materials/waste offsite. It is assumed that these activities will be covered under existing licence;

11.5.2 Operational Effects

11.5.2.1 The project activities and associated effects during the operational phase that are deemed not likely to be significant and are therefore proposed to be scoped out of the assessment are as follows:

- Existence of the flood channel and other project components may lead to changes in ground levels. Also, areas of hard standing may have an adverse effect on land drainage patterns, and potentially increase runoff, increasing flood risk to homes and businesses and thereby increasing potential stress associated with flood risk. A FRA will be completed which will consider the potential effects on land drainage patterns. Areas of hard standing (such as those within the permanent site compounds, car parks and new green open spaces) will be designed with drainage to avoid flooding from runoff. An Environmental Permit for Flood Risk Activities (or equivalent provision within the DCO application) will be submitted detailing how the project will mitigate for increased runoff;

- Provision of the new green open spaces and other landscape works (including new walking / cycle routes) will lead to the existence of new areas of public access and may adversely affect the security of surrounding privately owned land. A PSRA will be completed as part of the design, with mitigation measures included that will identify where existing and future security issues may occur;
- Existence of the flood channel and other project components may lead to an adverse effect of risk to public health and safety through presence of project features (particularly new water bodies) and effects on flow dynamics downstream of the weirs. At Molesey Weir this could pose a health and safety risk (e.g. to houseboats downstream of Molesey Weir). A PSRA will be completed as part of the design, with mitigation measures included within the project design such as signage, walls, fences, handrails, grab chains and escape ladders;
- Creation of the new green open spaces with the potential for activities including stadium style lighting (up to a maximum of 12m in height) could lead to the adverse effect of light pollution leading to disturbance of local communities in close proximity. However, design of the new green open spaces will be undertaken in consultation with the relevant local authorities and in accordance with PPG on light pollution (DLUHC and MHCLG, 2019b), so that this potential effect is ‘designed out’ through primary (embedded) mitigation and tertiary mitigation in the form of management plans;
- Existence of the flood channel and other project components may lead to an adverse effect of decreased access to existing Public Open Spaces or recreational facilities for local communities in the health study area. This is scoped out on the basis that either none is affected or the project, through primary mitigation, would be providing replacement Public Open Spaces; and

- General maintenance activities could result in increased traffic and plant on local roads and within the project boundary as well as noise and emissions from routine activities such as vegetation management. However, it is anticipated that the effect will not be significant because maintenance activities will follow standard good practice procedures, are likely to be infrequent and low impact, resulting in minimal effects on health.

11.6 Approach to mitigation

11.6.1.1 This section should be read in conjunction with Chapter 5: Approach to EIA Scoping which sets out further definition for the project regarding primary (embedded) mitigation, secondary (additional) mitigation and tertiary (best practice) mitigation.

11.6.2 Construction

11.6.2.1 Secondary mitigation measures that are under consideration for the construction phase are as follows:

- A flood protocol will be put in place to minimise flood risk from stockpiling material in the floodplain (in accordance with relevant consents / permits such as a Flood Risk Activity permit or equivalent provision within the DCO application). This may include the requirement to store material parallel to the direction of flood water flows in the floodplain so that stockpiles do not impede drainage;

- An Odour and Air Quality Management Plan (or similar) will be completed, which may identify further mitigation measures. Active mitigation measures if gas/odour levels reach unacceptable levels could include the release of a non-toxic, odour neutralising solution, and limiting high risk processes to specific times of the day, temperatures or wind conditions;

- The MMS will seek to minimise traffic movements in accordance with the relevant guidance. A transport assessment will be completed to identify likely construction effects on congestion and any required mitigation. For other mitigation measures please refer to Chapter 6: Air Quality, Chapter 14: Noise and Vibration and Chapter 17: Traffic and Transport; and

- The levels of contaminants will be tested for significance against accepted industrial threshold standards including generic assessment criteria such as Environment Quality Standards, Land Quality Management (LQM) / Chartered Institute of Environmental Health (CIEH) Suitable for use Levels (LQM/CIEH S4ULs), and Contaminated Land Exposure Assessment (CLEA) to assess whether measured concentrations of contaminants present a potential risk to operatives' health. Furthermore, subject to the results of GI, there will be prior removal, isolation or treatment of contaminated sediments that may be disturbed during construction, and construction of the capacity improvements (particularly bed lowering downstream of Desborough Island).

11.6.3 Operation.

11.6.3.1 Secondary mitigation measures that are under consideration for the operation phase are as follows:

- Water quality modelling is being undertaken. This will inform mitigation measures associated with connecting previously unconnected lakes with the River Thames.

11.7 Assessment Methodology

Significance Criteria

11.7.1.1 There is no definitive single guidance or methodology for defining the significance criteria for health effects. However, the significance criteria adopted in this chapter have been informed by UKHSA's *"Advice on the content of Environmental Statements accompanying an application under the Nationally Significant Infrastructure Planning Regime"* (PHE, 2021).

11.7.1.2 The DMRB 'Population and human health' is another guidance document that provides advice on assessing human health effects. The DMRB outlines guidance for scoping, baseline and assessment, mitigation and reporting stages (Highways England, 2020a).

Magnitude

11.7.1.3 UKHSA's guidance will be used to define magnitude of change to determine the significance of effects.

11.7.1.4 The magnitude (scale) of change will be defined using the following criteria:

High magnitude

- Direct effects on the majority (>=50 per cent) of the health study area population;
- The exposure tends to be of high frequency and/or over a long-term duration across the regional level; and
- The health effects are deemed irreversible and permanent.

Moderate magnitude

- Direct effects on a minority (25 per cent to 50 per cent) of the population of the health study area; and
- The exposure tends to be of moderate frequency over the medium-term duration across the borough / district level.

Low magnitude

- They are generally nuisance level or relate to small improvements or reductions in quality of life and/or health;
- Direct effects on a low proportion (10 per cent to 25 per cent) of the population of the health study area; and
- The exposure tends to be of low frequency over a short-term duration across the localised level.

Very low magnitude

- Very low or no health effects are generally very low nuisance or quality of life effects;
- Direct effects on a minimal proportion (<=10 per cent) of the health study area population; and
- The exposure tends to be of infrequent over a short-term duration across a localised level.

Sensitivity

11.7.1.5 As mentioned in the UKHSA’s guidance, sensitivity assessments should consider determinants linked to vulnerable groups. However, it is important to note that several groups with protected characteristics as defined by the Equality Act 2010 are not necessarily considered as vulnerable. Therefore, the effects on protected characteristic groups will be assessed separately within the Equalities Impact Assessment as part of the DCO application.

11.7.1.6 The UKHSA guidance will be used to define receptor sensitivity to determine the significance of effects.

- The sensitivity of receptors pays particular attention to the ability of receptors to respond to change that may arise as a result of the project. The sensitivity of receptors will be categorised into high, moderate and low as outlined below. The categorisation of sensitivity is based on good practice, professional judgement and experience on other projects.

High sensitivity

- Vulnerable groups that have been identified as likely to be most affected by health effects, e.g. children and pregnant women, elderly people, low income households, disabled people or people with pre-existing health conditions.

Moderate sensitivity

- Local residents (that are not vulnerable) have been identified as most likely to be affected by health effects.

Low sensitivity

- Non-residents or people travelling through an area are identified as the people least likely to be affected by health effects.

11.7.1.7 The assessment of environmental effects will use the criteria shown in able 11.2 below. After establishing the sensitivity of the receptor and assessing the magnitude of change using the criteria above, the effect on the receptor can be determined as either significant (major or moderate effects) or not significant (minor or negligible effects).

Table 11-2: Determination of significance of environmental effects.

	High Sensitivity	Moderate Sensitivity	Low Sensitivity
High Magnitude	Major (Significant)	Major (Significant)	Moderate (Significant)
Moderate Magnitude	Major (Significant)	Moderate (Significant)	Minor
Low Magnitude	Moderate (Significant)	Minor	Negligible
Very Low Magnitude	Minor	Negligible	Negligible

11.7.1.8 The significant effects detailed in Table 11.2 are defined as follows:

- **Major (significant)** – there is likely to be a major change to health outcomes based on a major change to a key determinant of health;
- **Moderate (significant)** – there is likely to be a moderate change to health outcomes based on a moderate change to a key determinant of health;
- **Minor (non-significant)** – there is likely to be a minor change to health outcomes based on a minor change to a key determinant of health; and
- **Negligible (non-significant)** – there will be no change or an indiscernible effect is predicted.

11.7.2 Construction effects

11.7.2.1 Construction effects on health receptors will be identified using the criteria outlined above. Assessment of effects (with primary and tertiary mitigation assumed to be in place) will be presented initially. Any further (secondary) mitigation that may be required to address any remaining significant adverse effects will be identified and residual effects assessed with such additional secondary mitigation in place as a second stage of the assessment. The construction effects will be determined in consultation with affected stakeholders.

11.7.3 Operational effects

11.7.3.1 Operational effects to receptors will be identified using the criteria outlined above. As per the construction effects, the assessment of likely significant effects (with primary and tertiary mitigation assumed to be in place) will be presented initially. Any further (secondary) mitigation that may be required to address any remaining significant adverse effects will be identified and residual effects assessed with such additional secondary mitigation in place as a second stage of the assessment. Operational effects will also be determined in consultation with affected stakeholders.

11.7.4 Cumulative Effects

11.7.4.1 The potential for cumulative effects to arise from the identified effects of the RTS acting in-combination with other existing and/or approved projects is provided in Chapter 19: Cumulative Effects Assessment. This has included a review of further consented (or reasonably likely to be consented) projects within the local area that could give rise to cumulative effects.

11.7.4.2 The cumulative effects of health from the project alongside health effects from the other schemes considered in the assessment of cumulative effects will be assessed according to the same criteria as given above. In most cases, quantitative information is not expected to be available for other schemes, so a qualitative assessment will be carried out in these cases.

11.8 Assumptions and Limitations

11.8.1.1 The following assumptions and limitations are relevant to the assessment of health effects:

- HIA is underpinned by a public health focus, and therefore considers population groups and categories of receptors, rather than the health of individuals. Health can be strongly determined by ‘individual factors’ such as age and genetics, which cannot be affected by the RTS;
- As explained in Section 11.2.3, there is difficulty in obtaining specific data for the health study area. The health study area is a bespoke geography which does not align exactly with the datasets required to complete the health baseline. For this reason, the health baseline

section will focus on ward-level datasets. The health study area is spread across parts of 42 wards;

- Several LPAs across the RTS have emerging local plans that are yet to be adopted. However, these emerging local plans may be adopted in the future (during construction / operational phases); and
- Currently the 2011 Census provides the most comprehensive demographic information available. However, the 2021 Census results will be published in phases, following an initial data release on 28 June 2022. The newly available Census 2021 data will directly affect the existing health baseline information. The PEIR/ES will be based on the most up-to-date data available at the time of writing.

12 Landscape and Visual Amenity

12.1 Introduction

12.1.1.1 This chapter describes the proposed scope of the assessment on landscape (and townscape) and visual amenity. It outlines the baseline conditions, the likely effects of the project and the avoidance or mitigation measures proposed to alleviate these. It also outlines the methodology that will be used for the assessment on landscape and visual amenity within the PEIR/ES.

12.1.1.2 The assessment of landscape effects deals with the effects of change and development on the landscape as a resource in its own right. The assessment of visual effects deals with the effects of change and development on the views available to people and their visual amenity.

12.1.1.3 For the purposes of the LVIA the words ‘impact’ and ‘effect’ will be used per the guidance in GLVIA3 (Guidelines for Landscape and Visual Assessment 3rd Edition, published by the Landscape Institute and IEMA, 2013) which defines ‘impact’ as *‘the action being taken’* and the ‘effect’ as *‘the change resulting from that action’.*

12.1.1.4 GLVIA3 suggests that scoping studies should identify the area of landscape that needs to be covered and the full range of possible significant effects (i.e. the study area). Such study areas may be based upon the extent of the landscape character areas likely to be significantly affected and/or the extent of the area from which construction and operation of the project may be potentially visible i.e. a ZTV study.

12.1.1.5 Historic landscape character is considered within the LVIA as an aspect of Landscape Character Assessment (LCA) and has been informed by an ongoing collaboration between landscape and cultural heritage specialists. This has included the sharing of information on baseline studies, key viewpoints and photography, ZTV analysis and preliminary and final assessments of significance.

12.1.1.6 Whilst this collaboration has enabled consistency and combined professional skills, the LVIA and Cultural Heritage topics draw their own - potentially differing – assessments of effects, reflecting the area of focus of each topic.

12.1.1.7 Historic landscape character is also considered and further detailed within Chapter 9: Cultural Heritage, Archaeology and Built Heritage where effects on the heritage assets and their settings will be assessed.

12.1.1.8 Further information on references to ecological baseline information can be found within Chapter 7: Biodiversity.

12.1.1.9 A summary of the key legislation, policy and guidance relevant to air quality is provided in Appendix M.

12.2 Baseline Methodology

12.2.1 Information Sources

12.2.1.1 The landscape effects of the proposed development will be considered against the key characteristics of the landscape in which it is set. The degree to which the proposed development changes '*the distinct and recognisable pattern of elements, or characteristics, within the landscape that make one landscape different from another, rather than better or worse*' ('An Approach to Landscape Character Assessment' Natural England, 2014), enables a judgement to be made as to the significance of the effect in landscape character terms.

12.2.1.2 In order to reach an understanding of the effects of the development upon the landscape resource, different aspects of the landscape baseline are considered including its fabric/elements and key characteristics (including lighting). This includes individual features that can be described and quantified and any notable elements that individually or combined make a particular contribution to defining or describing the character of an area, including experiential characteristics.

12.2.1.3 Baseline conditions have been established from document reviews (published LCAs, design guidance and relevant planning policy data), desktop surveys as well as project specific LCA work that included several fieldwork surveys to gather information. This has determined appropriate Landscape Character Areas that have been developed at an appropriate scale for the project including the key characteristics of each, and the condition of elements. Further information on Landscape Character Areas can be found in Appendix H.

12.2.1.4 At a national level the English landscape is divided into NCAs as defined by NE. There are four NCAs within the LVIA study area: NCA 111

Northern Thames Basin, NCA 114 Thames Basin Lowlands, NCA 115 Thames Valley and NCA 129 Thames Basin Heaths (see Figure 12-3 in Appendix A)

12.2.1.5 At a county and district level the following LCAs and strategy documents are relevant to the LVIA study area:

- The Surrey LCA (LCA) 2015;
- RBWM Landscape Character Assessment 2004;
- The Lower Thames Flood Risk Management Strategy , Environment Agency 2009;
- The LTFRMS, Environment Agency Consultation Document – summary of comments and responses to consultation 2010;
- The Thames Landscape Strategy 1994;
- The London Landscape Framework 2011;
- LBRUT – Urban Design Study – Executive Summary 2021f;
- LBRUT – Public Space Design Guide – 2006; and
- Mayor of London, Environment Agency, NE and various Local Authorities: The All London Green Grid (2011).

12.2.1.6 Existing published LCA work is of varied dates and other than at national level, is without consistency across the LVIA study area. Given this relative inconsistency, an independent project level LCA was developed for the assessment of the landscape effects of the project (see the RTS LCA at Appendix H)

12.2.1.7 The visual baseline has been established through an understanding of the study area, professional judgements (reached through a combination of studying aerial imagery, site work and project familiarity) regarding the perceived zone of theoretical visibility and desk studies including topographical studies. Visual receptor groups have been identified and include users of the Thames Path National Trail, other rights of way within the study area and recreational users of areas such as waterbodies and the River Thames.

12.2.1.8 The landscape designations deemed relevant to the study area were taken from the adopted local plans of the relevant borough councils listed below:

- RBC – Adopted 2020;
- SBC – Adopted 2009 (The Emerging Local Plan 2020-2035 is yet to be adopted);
- EBC Local plan – Adopted 2011;
- LBRUT – Local Plan – Adopted 2018;
- RBKUT – Core Strategy – Adopted 2012; and
- RBWM – Adopted 2022.

12.2.2 Stakeholder Engagement

Feedback received from pre-app consultation under the Town and Country Planning Act

12.2.2.1 Consultation was undertaken with Surrey County Council (in their capacity as a consultee) and the six LPAs with regard to the proposed representative viewpoint locations for the previous phase of the RTS. Feedback from Surrey County Council from this 2019 consultation included queries regarding detail of references to peak construction years and reference being given to consideration of the Surrey County Council Waste and Minerals plans. A key issue for Surrey County Council was the principle of the development in relation to Green Belt land and the ‘need’ for the development (i.e. justification for developing on Green Belt land and the benefits of the project to supporting existing and future development). The appraisal of the project is considering relevant planning policies as part of the design development, including consideration of Green Belt.

12.2.2.2 Specific comments were also received from EBC and LBRUT. This was considered within the review of the viewpoints for the new phase of work.

12.2.2.3 Feedback was provided on various viewpoint location and their extents. For example, ‘VP 25 – Include views NW towards [the Runnymede Channel] at Norlands Lane, and NE/E towards Laleham Golf Course and Abbey Meads section of [the Runnymede Channel]’. These comments informed the location of the proposed representative viewpoints and the extent of the landscape and visual amenity study area.

12.2.2.4 Further consultation and agreement will be sought on the landscape receptors identified through the RTS LCA, and visual receptors including further discussion regarding representative viewpoint locations and visual receptor groups as a result of scheme and boundary changes.

EIA Scoping Feedback

12.2.2.5 A Scoping Opinion was sought from the LPAs which informed the likely significant effects to be scoped into the EIA. For landscape and visual amenity this included effects for both construction and operation of the project such as; “Adverse visual effects on leisure users of recreational facilities” and “Adverse visual effects on users of public highways”

Consultation Methodology Feedback

12.2.2.6 Informal feedback was received from Surrey County Council, in their capacity as a regulator, on the proposed LVIA methodology. This advised undertaking a study of landscape character at national and county level but then also undertaking a more localised level study to follow LCA guidance published by NE in 2012 and 2015. Furthermore, advice was provided as to the assessment of cumulative impacts and effects. It was decided to pursue a single LVIA for the project as a whole rather than per LPA in order to satisfy the EIA Regulations; and localised studies have been undertaken, culminating in the production of Appendix H.

Other consultation

12.2.2.7 Public consultation was undertaken in 2016. This looked at enhancement opportunities within the RTS. The consultation aimed to identify possible enhancement opportunities, consider how these opportunities aligned with the RTS vision and then a report was created to identify responsibilities to take forward further works relating to the opportunities. This consultation work was used as guidance to inform the landscape design work for the RTS.

12.2.2.8 Further engagement with stakeholders will be undertaken prior to the submission of the DCO in order to comprehend baseline characteristics, impact significance and potential approaches to mitigation for landscape and visual effect. This is likely to include engagement with:

- LPAs;
- National organisations/providers of standards and guardians of community receptors (e.g. Sport England / Sustrans);

- Community and social infrastructure (e.g. schools, sports and leisure facilities, healthcare providers, community centres, community-facing local, places of worship or special educational needs facilities;
- User groups associated with community facilities (e.g. sports and recreation clubs, faith and religious groups, and resident's groups);
- Local police force, and;
- Other stakeholders identified by the Environment Agency.

12.2.3 Study Area

12.2.3.1 The study area for landscape character and visual effects is shown in Figure 12-4 in Appendix A. This is shaped by the provisional perceived extents of any effects from the proposed channel works and the range of proposals being considered for the landscape and biodiversity design elements and from the changes to the flooding regime as a result of the project.

12.2.3.2 Project specific LCA work has been undertaken that extends to an area beyond the project boundary for EIA scoping and includes the 1 in 100 year floodplain (i.e. the area with a one per cent chance of flooding in any given year). This is included to allow consideration of any significant effects on landscape character from project elements including channel and associated structure construction and operation, landscape, heritage and biodiversity design elements and landscape and townscape receptors no longer intermittently flooding as a result of the RTS. The character areas identified in the LCA are mapped to what is considered to be the extents of their defining characteristics. As effects are currently unknown, and on the basis that changes to landscape character could occur as a result of impacts within any part of these defined areas the overall boundary of these areas created a widest extent of effects landscape study area.

12.2.3.3 The LVIA study area was established using professional judgement and existing familiarisation with the local landscape, how it is used by people, and an understanding of the visual context, combined with an understanding of the form of the development including landscape design works and the discussion and feedback from the viewpoint selection consultation previously carried out with the LPAs. As visual amenity and landscape character are intrinsically linked a combined study area has been established (see Figure 12.4 in Appendix A) influenced by the previous analysis for visual effects, and the existing representative viewpoints.

12.2.3.4 Once scheme elements are fixed the study area for the assessment of visual effects will be refined through the generation of a ZTV utilising LiDAR data and further verified through site work. If required a separate study area for visual effects will be established. This will be included within the final ES.

12.3 Baseline

12.3.1 Existing Baseline

Landscape Character and Visual Environment

12.3.1.1 The Landscape study area extends from Windsor to Teddington (see Figure 12-4 in Appendix A). The broad landscape context of the project is that of the Thames Valley (NE National Character Area 115), a wedge shaped area widening from Reading to include Bracknell and Slough, the southern part of the Colne Valley and the south-west London fringes (see Figure 12-3 in Appendix A.)

12.3.1.2 Within the study area there are no statutory landscape designations (i.e. National Parks or Areas of Outstanding Natural Beauty). The study area is contained mostly within the Green Belt and Metropolitan Open Land and includes part of the Colne Valley Regional Park, as well as several Registered Parks and Gardens of Special Historic Interest in England (non-statutory designation). There are multiple Conservation Areas across the various borough councils (statutory designation) and there are areas of Open Access Land (Countryside Rights Of Way Act 2000) and land designated as Local Green Space.

12.3.1.3 RBC contains several Local Green Spaces. The Local Green Space designation provides a high degree of protection to areas of importance to the local community against new development. There are assessments underway within the other local authorities within the study area to potentially designate further sites this way. The NPPF states that this designation should only be applied where the green area meets certain criteria, proving it is of special value to a local community and retains significance. Five examples of these special values are:

- Beauty;
- Historic Significance;
- Recreational Value;
- Tranquillity; and
- Richness of Wildlife.

12.3.1.4 Within the borough of Runnymede the following Local Green Spaces exist either in or near to the study area:

- Arboretum at Royal Holloway University of London;
- Chertsey Library Grounds;
- Gogmore Park Open Space;
- Hythe Park, Egham; and
- St. Peter's Churchyard, Chertsey.

12.3.1.5 All boroughs within the study area have recognised the importance of green infrastructure within their local plans. The Colne Valley Regional Park is one of several existing green infrastructure initiatives across the study area (see Figure 12-1 in Appendix A). Situated toward the north of the study area the park extends from Staines in Surrey to Rickmansworth in Hertfordshire, encompassing approximately 43 square miles, and encompasses some 11,000 hectares. The southern end of the park sits within the study area situated just north of Staines and Egham.

12.3.1.6 All or part of the following Parks and Gardens of Special Historic Interest (see Figure 12-2 in Appendix A and Chapter 9: Cultural Heritage, Archaeology and Built Heritage for further details) are located within or near to the study area. Public access to these sites varies, some being fully accessible as designated Open Space and others via the PRoW network or permissive rights. This designation applies to the following sites within the study area:

- St Ann's Hill and the Dingle (Grade II);
- St Ann's Court (Grade II);
- Great Fosters (Grade II*);

- Kennedy Memorial Landscape (Grade II);
- Woburn Park (Grade II);
- Oatlands Park (Grade II);
- Bushy Park (Grade I);
- Strawberry Hill House and Garden (Grade II*);
- Garrick's Lawn (Grade II);
- Hampton Court (Grade II); and
- The Royal Estate, Windsor; Windsor Castle and Windsor Home Park (Grade I).

12.3.1.7 Numerous Conservation Areas lie within or near to the study area (refer to Figure 12-2 in Appendix A and to Chapter 9: Cultural Heritage, Archaeology and Built Heritage for further details). The following sites are designated by the relevant LPA in order to protect their special architectural and historic interest:

- Englefield Green;
- Egham;
- Egham Hythe;
- Staines;
- Thorpe;
- Laleham;
- Chertsey;
- Old Shepperton;
- Manygate Lane Estate, Shepperton;
- Upper Halliford;
- Lower Halliford;
- Lower Sunbury;

- Walton Riverside;
- Walton Church Street / Bridge Street;
- Weighbridge Monument Green;
- Wey Navigation;
- Weybridge;
- Hampton Court Green;
- Hampton Court Park;
- East Molesey (Kent Town);
- East Molesey Old Village;
- East Molesey Bridge Road;
- Thames Ditton;
- Giggs Hill Green;
- Riverside North;
- Riverside South;
- Cadogan Road;
- Normansfield;
- Wick Road;
- Richmond Road;
- King Edwards Grove;
- Broom Water;
- Kingston Old Town;
- Hampton Wick;
- Hampton Village;
- High Street Teddington;

- The Grove;
- Ham Common;
- Ham House;
- Strawberry Vale;
- Mallard Place;
- Twickenham Riverside;
- Waldegrave Park;
- Teddington Lock; and
- Platts Eyot.

12.3.1.8 The study area contains multiple sites of Open Access Land (covered under the Countryside and Rights of Way Act 2000) in addition to those designated as Local Green Space above. Sites include:

- Runnymede and Coopers Hill;
- Ham Common;
- Piece of land south of Walton Lane, Piece of land north of Walton Lane;
- Land to west of Walton Lane;
- Lower Halliford Green;
- Shortwood Common, Knowle Green, Birch Green, Staines Moor and other lands; and
- Staines Lammas or Church Lammas.

12.3.1.9 Other publicly accessible open spaces, parks, nature reserves and local nature reserves occur within the study area. Key open spaces including those managed by the National Trust or English Heritage exist at:

- Ankerwycke Estate;
- Ham Lands;

- Hurst Park;
- Chertsey Meads;
- Dumsey Meadows;
- Desborough Island;
- Hampton Court Park;
- Bushy Park; and
- Laleham Park.

12.3.1.10 There are a significant number of PRoWs within the study area.

- **Promoted PRoWs** – these include the Thames Path (a National Trail) which runs alongside the River Thames;
- **PRoWs of regional significance** - the Colne Valley Way starts near the River Thames at Staines and runs north to Uxbridge through the Colne Valley Regional Park (refer to Figure 12-1 in Appendix A); and
- **Cycleway** - The most prominent cycle way is National Cycle Route 4 which mostly follows the Thames Path and covers the length of the study area. This cycle route connects at Chertsey to National Cycle Route 223.

12.3.1.11 The underlying landscape character of the Thames Valley is an open floodplain of flat grazing lands with scattered historic parklands on the higher ground. As the River Thames flows towards London the character is increasingly dominated by urban influences such as the M25, M4 and M3 motorways, pylon lines, railways, Heathrow Airport and Thorpe Park as well as lakes left from mineral workings, raised landfills and vast raised reservoirs. There are also several significant settlements that include Datchet, Wraysbury, Staines, Chertsey, Shepperton, Sunbury, East Molesey and Teddington. Overall, the impression is of a lack of cohesiveness and consistency. The character of this area is substantially shaped by infrastructure developments and extensive mineral workings, many of which are now naturally regenerated, and some used for recreation. The landscape, and in some location’s townscape, is fragmented by these infrastructure developments and influenced by the spread of settlements. Remnants of older villages survive in some seclusion, as do scattered areas of agricultural landscape and farms. The landscape character is described in more detail within the RTS LCA, Appendix H.

12.3.1.12 The RTS proposed new channel begins at Staines upon Thames and passes through Chertsey and Shepperton before ending near Weybridge and Walton on Thames with further works to the locks between Weybridge and Teddington. Along its route lie other villages including Laleham and Thorpe. The centres of these settlements are varied, with some retention of their original historic and individual identities, and many are designated by the relevant LPA as Conservation Areas in order to protect their special architectural and historic interest. At their edges narrow ribbons of development extend along connecting roads, giving the appearance of linked settlements. Other settlements exist along the banks of the River Thames and include the bankside areas of Penton Hook and Thames Meadow which are laid out as ‘plotland’ development, which by their nature are unplanned and originally at a lower density. This type of built form has gradually intensified as many of the plots have been re-developed, some many times over.

12.3.1.13 The landform of the floodplain of the River Thames is typically flat with only minor changes in the elevation of the natural topography (see Figure 12-5 in Appendix A). At some of the boundaries of the study area however there are more significant raised natural landforms such as the slopes of Coopers Hill southwest of Runnymede Meadows and St Ann’s Hill to the west of Chertsey, which have public access that allow for long views out across the floodplain and will be assessed as representative viewpoints.

12.3.1.14 Areas of raised land at Callow Hill and Royal Holloway, as well as locations within the Windsor Estate were identified within preliminary desktop visual studies but further to site work, are no longer included as there are no identified views of the study area.

12.3.1.15 Man-made changes in level that rise above the floodplain include the prominent raised reservoirs and the motorway embankments, in particular where they rise to bridge over other roads, railways and the River Thames.

12.3.1.16 The M25, M4 and M3 motorways together with the Staines to Windsor and Reading railways dissect the area and create distinct linear visual barriers and physical constraints to circulation through the landscape. The motorways along with the presence of the Heathrow Airport flight path, contribute to a continuing impression of movement, noise, lighting and activity.

12.3.1.17 The landscape within this part of the River Thames Valley has been heavily influenced by the gravel extraction industry and forms an important part of the historic character of the area. Where extractions remain active, there are visible signs of large-scale quarrying equipment such as towers, conveyor belts and silos, material stockpiles and security fencing. Those gravel pits where workings have ceased have either been left as water bodies, many being used for leisure activities, or have become sites for landfill. Thorpe Park Resort has been developed on the site of former gravel workings.

12.3.1.18 Most of the sites, whether active or worked-out are enclosed by wooded tree belts, that have either regenerated naturally or have been planted to mitigate the landscape and visual impact of quarrying work. These create a strong sense of visual enclosure and block long views that might otherwise be gained across the floodplain. Consequently, there are few opportunities to view the wider landscape from the many PRoW, several of which are retained between areas of quarrying (e.g. the Sheep Walk through Littleton East Lake) however planting does help to screen the quarrying activities from view.

12.3.1.19 Many of the gravel pits left as water bodies have become sites for water sports, fishing and recreation. Over time, the margins of some have softened with the regeneration of vegetation (e.g. Wraysbury Lakes) and appear more natural with many designated as or contributing to the SWLW SPA. The built elements within these sites, e.g. access roads, gates and fencing often retain the character of the original quarrying industry. Some older sites have been more sensitively restored, notably Halliford Mere, with a semi-natural character being created. The vegetated edges of sites such as Ferry Lane Lake have been significantly thinned allowing views through to the lake from the adjacent Thames Path National Trail and Desborough Island Public Open Space.

12.3.1.20 In those gravel pits used as landfill sites features of the former extraction are evident, such as artificial mounding e.g. at Wraysbury Landfill. Grassland habitats that have developed on these sites often appear patchy in quality, threatened by encroaching scrub and lacking typical features of the local landscape character such as hedged field boundaries.

Some are grazed by sheep and cattle and other are used as horse paddocks.

12.3.1.21 Only a few areas of agricultural land unaffected by landfill remain within the study area. Notable examples are Southlea Farm, Thorpe Hay Meadow SSSI and Abbey Meads. These areas and the land around them are mainly pasture, with occasional plots of arable farming and the low-lying landscape means that the associated field boundaries are often formed of ditches with hedgerows, some of which may be of historic significance. These farm holdings have often become fragmented by the crisscross of transport infrastructure along with large utility structures such as reservoirs and quarries.

12.3.1.22 Within the study area are several substantial areas of parkland and common or rough pasture, most notably at Windsor, Ankerwycke Farm and Runnymede Meadows (owned and managed by the National Trust), Chertsey Meads, Desborough Island, Staines Moor, Dumsey Meadows SSSI and Thames Meadow at Shepperton (all managed by the relevant LPA). Land at HR Owen (Land South of Chertsey Road HCA) and the now disused Laleham Golf Course are both used for cattle grazing. Most permit public access and are valued by the local community and are of considerable archaeological sensitivity.

12.3.1.23 The study area contains many outdoor recreation resources for formal sports including water sports, fishing clubs, golf courses, sports grounds, campsites and recreation grounds. Thorpe Park Resort is a major visitor attraction that occupies a large island within a series of water bodies formed from previous gravel extraction works.

12.3.1.24 There are a few areas of relative tranquillity despite the generally busy context of the study area. Most notably these include the environs of the River Thames (including sections of the Thames Path National Trail) where the river’s character is wide, meandering and semi-natural for example at Ham Island, Runnymede, Chertsey Mead and Laleham. For most of its course however the River Thames is hard-edged and dominated by plotland development and moorings, with areas of more intense activity at the weirs, locks and marinas.

12.3.1.25 To the west of Chertsey Lane, the land is an open floodplain, semi-rural in character and comprising a mixture of sporadic areas of agricultural and horticultural land and including operational and former landfill and gravel workings – some backfilled and some remaining as waterbodies. There are many unmanaged and overgrown areas that have reverted to open scrubby grassland and scrub woodland.

12.3.1.26 Laleham Burway (Laleham Golf Course HCA) is a localised but distinctive landscape associated with its recreational use as a former golf course. Mown amenity grass dominates in the area with some small patches of long grass and wildflower meadow. During the 7th Century a system of drainage ditches were constructed, known as the Burway, and these are still clearly visible. Additionally, a rectangular shaped 'enclosure' can also still be seen on the course and is an Ancient Monument. See Figure 12-2 in Appendix A (and Chapter 9 (Cultural Heritage, Archaeology and Built Heritage) for further detail.

12.3.1.27 Wraysbury Reservoir (Land South of Wraysbury reservoir HCA) is owned and managed by Thames Water and is part of the SWLW SPA and Ramsar. It is also a SSSI. The limited areas around the waterbody, including its steep embankments are managed grassland and mature tree belts grow around the site's perimeter. The land to the south of the reservoir is cut grassland with scrub and trees growing along some of its boundaries and in clusters within the linear shape. A public footpath runs along the southern boundary of the site, adjacent to the railway line. Electricity pylons run along its length and Thames Water facilities are located at the northern end of this southern stretch of land below the waterbody.

12.3.1.28 The land at Laleham Reach is a hook of land adjacent to Penton Hook Marina and Penton Hook Island. It is formed of waterside residences extending along its riverside perimeter around the internal open space that incorporates horse grazed grass and a manmade pond with broadleaf wooded edge. Hedgerows extend around the periphery of the site and filter views into the site from the surrounding access road and residences.

12.3.1.29 The areas of land north of Chertsey Road between Littleton Lane and Sheep Walk are formed of rough grassland with patches of bramble and blackthorn scrub including Japanese knotweed, areas of weathered concrete hardstanding and patches of broadleaved woodland. The land to the south of Chertsey Road between Docket Eddy Lane, Ferry Lane and the River Thames to the south has a small area of light industrial units, residential dwellings adjacent to the river and a broad area of grassland with native hedgerows, patches of scrub and wet and broadleaved woodland. There is no formal access or right of way through or near either area. The Thames Path National Trail hugs the left bank of the River Thames and is located adjacent to the southern boundary of the Land South of Chertsey Road. East of Ferry Lane, within the bend of the River Thames, is an open swimming lake. A farm, a few light industrial buildings and other scattered and clusters of residential and riverside properties are located along and to the south of Chertsey Road.

12.3.1.30 Desborough Island is dominated by rough grassland interspersed with clumps of mixed scrub and a broadleaved woodland edge. The River Thames defines the shape of the Island with a public footpath following the perimeter of the site. Where the path runs along the western edge of the site it is enclosed by the thick wooded edge, with only filtered views into the grassed internal area, and with greater visual connection to the adjacent Thames and land and water to the west of the Island. The open areas of grass, in particular at the northern end, provide attractive views to the northeast across the water towards the attractive waterside edge of Shepperton.

12.3.1.31 The land located to the south of Walton Lane, adjacent to the southern bank of Desborough Cut and Engine River to the south, incorporate paddocks interspersed with small patches of bramble scrub and with individual plots defined by hedgerows. Engine River runs around the southern edge of the site. There are wide, open and wooded views to the south, with the historic Oatlands Park Hotel located on the edge of Weybridge, visible within the view. There is no public access to or within this area.

12.3.1.32 The area of land enveloped by Lyne Road and Bridge Lane consists of a large area of grazed grassland, with a wooded perimeter and patches of dense broadleaf woodland on its western edge. A few properties can be found tucked into its edges, and the railway line runs close to its eastern boundary. The site is tightly enclosed on its northern edges by dense woodland but views across the site open up, in particular from the western edge of the site across the open grassed space toward the wooded backdrop and the spire of the historic Holloway Sanatorium clearly visible rising through the trees.

12.3.1.33 Grove Farm is a large area of rough grassland situated between the Esher Sewage Treatment Works and the residential dwellings to the west of Grove Way. A school is located at the southern end of the area with open views to the grass and wooded edges. The River Ember flows along the northern border. The grass is broken up by scattered native hedges and wooded copses to the corners of the grass plots.

12.3.1.34 The landscape/townscape setting of the three River Thames weirs is predominantly suburban with each located within the built-up area of north Surrey/south-west London. The character is however broken up by areas of well-vegetated private and Public Open Space located along the River Thames and including the river islands (or aits), towpaths in particular at Sunbury and Teddington where they are especially wide, adjoining areas of Public Open Space and the many generous gardens that front the River Thames.

12.3.2 Future Baseline

12.3.2.1 Changes to the landscape and visual baseline in the absence of the project have been considered and the predicted change summarised within this section.

12.3.2.2 As much of the study area is within the Green Belt, major changes to landscape through the future implementation of built development would seem to be unlikely. In addition, there are numerous current landscape planning policies to protect and enhance the landscape, as well as other landscape strategies and landscape restoration schemes currently in hand across the study areas that are also seeking landscape improvement. Therefore, the condition and appearance of the landscape resource is more likely to improve rather than degrade with the future baseline similar to but slightly enhanced over the current position.

12.3.2.3 Provision for public amenity is also likely to improve with potentially more areas being opened up for public access or areas of importance to the local community provided with increased protection e.g. designed as Local Green Space.

12.3.3 Key Environmental Considerations and Opportunities

12.3.3.1 The main landscape considerations for the RTS include:

- Difficult ground conditions (i.e. the landfill sites that may restrict the scope of landscape improvements);

- Extent of landfill generally that may limit the construction approach and engineering design to options that are less sympathetic to the local landscape context than if the conditions were for example undisturbed green field;
- Existing vegetation within the land take of the project that may be lost or affected, though the project will include for the mitigation of and enhancement of this change through BNG;
- Existing engineered infrastructure and utilities including the motorways, railways and pipelines that could restrict access and opportunities to improve the landscape; and
- Green Belt planning policies that may restrict the provision/extent of some built features.

12.3.3.2 The principal landscape opportunities that may be realised by the project include:

- The creation of a range of environmental opportunities as described within the project description (Chapter 4);
- Identifying existing characteristics of the landscape that will be used to inform the developing landscape design for the project;
- Overall landscape enhancement through the provision and long-term management of landscape and green infrastructure initiatives. This will include tree, woodland and hedgerow planting, wildflower meadows and marginal and aquatic planting of water bodies (adjoining and associated with the project). This will also provide an opportunity to reconnect with historic landscape character elements through the reinstatement of lost features including woodlands and hedgerows and other historical elements accessible through relevant data;
- Enhancements throughout to public access including pedestrian, cycle and equestrian with wider associated benefits to the local PRoW network and increase public access to nature. identify potential connections to existing sites of Open Access Land and Local Green Spaces; and
- Opportunities to improve connectivity within a fragmented landscape.

12.4 Likely Significant Effects Requiring Assessment

12.4.1 Construction Effects

12.4.1.1 The following project activities identified below could have associated potential adverse visual effects on users of the Thames Path (National Trail), National Cycling Routes, other PRoW and Public Open Space, leisure users of recreational facilities (such as moorings, fishing lakes, sailing lakes, watersports lakes), residents at home and users of public highways (i.e. motorways, roads and railways) and potential adverse effects on the character and quality of national, regional, and local landscape designations, the character of the Green Belt and Metropolitan Open Land and landscape character areas:

- Transportation of material / waste, and placement / processing of non-hazardous material at end destination. General construction activities including movement of vehicles, equipment and site operatives; and
- Creation of site compounds, temporary materials processing sites, temporary lighting, utilities diversions, storage of excavated material.

12.4.2 Operational Effects

12.4.2.1 The project activities identified below have the potential for associated potential adverse or beneficial visual effects on users of the Thames Path (National Trail), National Cycling Routes, other PRoW and Public Open Space, leisure users of recreational facilities (such as moorings, fishing lakes, sailing lakes, watersports lakes), residents at home and users of public highways (i.e. motorways, roads and railways) and potential adverse or beneficial effects on the character and quality of national, regional and local landscape designations and the character of the Green Belt and Metropolitan Open Land.

- Existence of the flood channel and other project components including flow control elements including inlet and outlet structures and enhancements to existing structures;
- Creation of green spaces, educational signage, sustainable drainage, enhanced lighting and urban tree planting;

- Provision of biodiversity improvements;
- New landforms; and
- Operation and future maintenance of flood channel, associated features, including loss of moorings and capacity improvements during times of flood.

12.4.2.2 Provision of the new areas of open green space and other landscape works (including new walking / cycle routes) has the potential for beneficial effects to public access and the public realm.

12.5 Effects Not Requiring Assessment

12.5.1 Construction Effects

12.5.1.1 Project activities and associated effects that are deemed not likely to be significant and are therefore proposed to be scoped out of the EIA are identified below:

- Transportation of hazardous waste / material from the major road network and placement offsite, as the licensed site will be subject to a separate existing environmental assessment and consideration of landscape effects.

12.5.2 Operation Effects

12.5.2.1 Project activities and associated effects that are deemed not likely to be significant and are therefore proposed to be scoped out of the EIA are identified below:

- General maintenance activities could result in visual disturbance from increased traffic and plant on local roads and within the project boundary as well as disturbance from routine activities such as vegetation management. However, it is anticipated that the effect will not be significant because maintenance activities will follow standard good practice procedures, are likely to be infrequent and low impact, resulting in minimal effects on landscape and visual amenity.

12.6 Approach to Mitigation

12.6.1.1 This section should be read in conjunction with Chapter 5: Approach to EIA Scoping which sets out further definition for the project regarding primary (embedded) mitigation, secondary (additional) mitigation and tertiary (best practice) mitigation.

12.6.2 Construction and Operation

12.6.2.1 It is considered that careful planning, siting and design of the RTS will potentially design out significant adverse landscape and visual effects and result in beneficial landscape and visual effects during operation. This will be confirmed by the visual impact assessment as part of the EIA and therefore visual effects cannot be scoped out at this time. Where this approach is not possible or feasible, further mitigation measures (secondary measures) will be implemented to help address any adverse effects.

12.6.2.2 Secondary mitigation measures will include identifying opportunities for designing a channel with natural edges in certain sections of the flood channel and around the edges of some existing lakes and watercourses. This will promote bankside vegetation growth and with further planting to assist in screening effects integrating channel features into the surrounding landscape. Where the use of hard edges is unavoidable this will be mitigated as far as practicable through appropriate design.

12.6.2.3 Mitigation and measures for the enhancement of the landscape for nature and people will be described within the LVIA with consideration for the viability i.e. whether it is feasible, deliverable and sustainable.

12.7 Assessment methodology

12.7.1 Scope of Assessment

12.7.1.1 In order to follow good practice and effectively satisfy the requirements of the DCO process, LVIA methodology will follow the principles set out in GLVIA3 (IEMA, 2013).

12.7.1.2 GLVIA3 aims not to be prescriptive or formulaic, instead providing guidance on principles and practice and emphasising the importance of professional judgment in applying these principles, to form an appropriate and proportionate approach and methodology for specific projects.

12.7.1.3 LVIA is dealt with as two discreet parts within the EIA. This assessment considers physical changes to the landscape as well as changes in landscape character, and the visual impacts of the proposed development as perceived by people. It also considers changes to areas designated for their scenic or landscape qualities. The separation of the two aspects of LVIA is in accordance with the recommendations of GLVIA3. The two parts, whilst presented separately in this section, remain closely related and will inform and cross reference each other where appropriate.

12.7.1.4 The LVIA will follow a process of describing and assessing;

- The key landscape characteristics, including lighting, and visual context of the site and its surrounds;
- The baseline landscape character and landscape receptors on which the impact of the development is assessed;
- The sensitivity of the landscape and visual receptors based on their value and their susceptibility to change (as based on the definitions set out in GLVIA3);
- The ZTV for the development and the visual receptors within this on which the impact of the development is assessed;
- A selection of viewpoints that are specific to or represent these receptors, with photographic records taken, where possible, in both summer (best case scenario) and winter months (worst-case scenario) at completion of all phases at that timepoint, both at Year 1 and Year 15;
- Visualisations will be prepared for selected and agreed viewpoints to illustrate the project in the landscape. Visualisations will illustrate the project at Year 1 and Year 15.
- Aspects of the proposals that have been embedded in the design to avoid, reduce or compensate for any adverse landscape and visual effects or to achieve beneficial effects, and other related mitigation and enhancement measures; and
- The nature of the resulting impact that is likely to occur, i.e. the magnitude of change, brought about by the RTS, to landscape character and visual receptors at key points in time, combined with each receptor’s sensitivity, to produce an assessment of level of significance of effect. This includes effects:
  - During the proposed construction phasing;

- At year 1, after an aspect of the project is completed and/or full completion of the project; and
- At year 15, after an aspect of the project is completed and /or full completion of the project (when the last of any structural planting would have suitably established).

12.7.1.5 Potential direct, indirect, cumulative and temporary significant effects to the landscape resource and visual amenity of the site and its surrounding area (within defined distances) as a result of the proposed development will be considered. Specifically, the LVIA will consider the following potential effects:

Construction and Operation

12.7.1.6 Effects to the visual amenity of:

- Users of the Thames Path (National Trail), National Cycling Routes, other PRoW and public open space;
- Leisure users of recreational facilities (such as moorings, fishing lakes, sailing lakes, water-sports lakes, Thorpe Park and golf courses);
- Residents at home;
- Users of public highways (i.e. motorways, roads and railways; and
- People at their places of work.

12.7.1.7 Effects on the character and quality of:

- National and local landscape designations; and
- Undesignated local landscape character areas including those identified in Appendix H.

12.7.2 Significance Criteria

Visual Effects

12.7.2.1 Visual assessment is an assessment of the effect on views and visual amenity experienced by people.

12.7.2.2 Visual receptors are “the different groups of people who may experience views of the development” (GLVIA3). In order to identify those groups who may be significantly affected the ZTV study, baseline desk study and site visits would be used.

12.7.2.3 Baseline studies have identified the different types of people within the area who will be affected by the changes in views and visual amenity. These include users of the Thames Path (National Trail), National Cycling Routes, other PRoW and public open space, people using key viewpoints, leisure users of recreational facilities, residents at home, users of public highways and people in their places of work. Receptors will be grouped into areas where effects are expected to be broadly similar, or that share common factors. In particular sequential views will be considered such as those by users of the Thames Path as they pass through the landscape.

12.7.2.4 A provisional list of representative viewpoints has been identified and shown on Figure 12-4 in Appendix A, for inclusion within the assessment and to illustrate the visual effects on visual receptors from publicly accessible places. This has been previously reviewed and agreed by the relevant LPA officers at the time, at SBC, RBC, EBC, LBRUT and RBWM. The previous viewpoints along with new representative viewpoints will be presented to the LPAs for further discussion during the EIA consultation process, once the project elements, including landscape and biodiversity design features, are fully understood and identified.

12.7.2.5 The representative viewpoints are used as a sample on which to base judgments of the scale of effects on visual receptors.

12.7.2.6 Judgements of sensitivity of a receptor are made in relation to the particular receptor's susceptibility to change, in combination with the value attached to particular views. The susceptibility of different visual receptors to changes in views relates to their occupation or activity whilst experiencing the view, and the resultant extent to which their attention or interest may therefore be focussed on the views and the visual amenity experienced.

12.7.2.7 Typical ratings of visual receptor susceptibility to change:

Susceptibility to Change

- **High:** Receptors are likely to be within a designated landscape and could be attracted to visit more frequently, or stay for longer, by virtue of the view. May typically include residents of dwellings, including private houses, caravans, B&Bs, guest houses and hotels where the main view is orientated towards the project, or people undertaking recreation where the landscape within which the RTS is seen, is the primary reason for attraction or primary reason for visiting (e.g. tourists, walkers and hikers on recognised footpaths, open access land, rights of way and promenades, scenic route users, yachts and inshore recreational boat users);

- **Moderate:** Receptors are less likely to be within a designated landscape and could be attracted to visit more frequently or stay for longer by virtue of the facilities and features of the particular attraction, rather than by the value of the view. May typically include outdoor workers (e.g. fishermen, farmers, dock workers) and people undertaking recreational pursuits where the landscape within which the RTS is seen is not the primary reason for attraction (e.g. golf, water-based sports, historic sites). May also include residents of dwellings where the RTS would form an ancillary view; and
- **Low:** Receptors are unlikely to be within a designated landscape and are most likely to be present at a given viewpoint by virtue of some other need or necessity unrelated to the appreciation of the landscape or visual value. May typically include people travelling through the landscape by car, train, bus, ferry etc; people in community facilities, industrial / office / shop workers.

12.7.2.8 In determining visual sensitivity, professional judgment is applied to the value attached to the view. Considerations about value typically include any special recognition / importance directly associated with certain views, such as in relation to heritage assets, dark sky areas, or through planning designations. Further indicators of value may include an appearance on tourist maps / guide-books, specific provision for enabling enjoyment of the view (e.g. scenic car parks, sign boards and interpretive materials).

12.7.2.9 Where relevant, these factors are considered when making professional judgments about the sensitivity of visual receptors.

Level of Value of Views

- **Very High/National Value;** A scenic view in a landscape that has been designated at a national level, e.g. National Parks or Areas of Outstanding Natural Beauty, particularly views from a national long-distance trail or promoted routes in these landscapes, or a recognised view to or from a distinctive feature designated at a national level, e.g.

Scheduled Ancient Monument, Listed Building and Registered Historic Park & Garden;

- **High/Regional Value:** A view from within a designated landscape or a popular view recognised in publications and/or visitor guides for promoted routes and locations of interest;
- **Moderate/Local Value:** A view in an undesignated landscape that may be locally valued and displays evidence of responsible use; and
- **Low/Unvalued Views:** Where the landscape has been despoiled and there is evidence that society does not value the view or landscape.

12.7.2.10 The sensitivity of the visual receptor is dependent on their susceptibility to change, combined with the value attached to the view.

12.7.2.11 The general principles that are used to inform and guide the assessment of visual sensitivity at each viewpoint are as follows:

Sensitivity of Visual Receptors

- **High Sensitivity:** Receptors highly responsive to new visual elements of the type proposed, because of their location, nature and/or existing visual qualities and elements. Receptors will be highly susceptible to change and considered to be at a location of high value;
- **Moderate Sensitivity:** Receptors can accommodate some new visual elements of the type proposed, because of their location, nature and/or existing visual qualities and elements. Receptors may be susceptible to change, although less likely to be at a location of recognised value; and
- **Low Sensitivity:** Receptors where new visual elements of the type proposed may be readily accommodated, because of location, nature and/or existing visual qualities and elements. Receptors are not likely to be highly susceptible to change or at a location of recognised value.

12.7.2.12 Each of the visual effects will be assessed in terms of the magnitude of change likely to result from the RTS. This will be evaluated in terms of its size or scale, the geographical extent of the area influenced and its duration or reversibility.

12.7.2.13 The magnitude of change likely to result from the RTS is classified within this assessment as high, moderate, low, very low or no change.

12.7.2.14 Descriptions of these magnitude categories are summarised below.

Summary of Magnitude of Visual Effects

- **High:** The addition or loss of a visually prominent feature, resulting in an immediate change to the overall appearance or scene;
- **Moderate:** The RTS would form a recognisable new element within the overall view and would be readily observed without changing the overall nature of the view. Overall quality of the view may remain intact. The RTS is likely to be visually prominent;
- **Low:** The RTS would form a relatively small component of a wider view, and might be missed by the casual observer, or if noticed is likely to be of little interest or concern. The RTS would not affect the overall quality of the view. The RTS is likely to be visible;
- **Very low:** The RTS would form a very small component of a wider view which would be barely perceptible, or imperceptible, with no effect on the overall quality of the view; and
- **No change:** The RTS would not be visible. No loss, damage or alteration to existing views would result.

Landscape Effects

12.7.2.15 This is an assessment of the effect on the landscape as a resource in its own right. It considers the different elements that make up the landscape, its aesthetic and perceptual aspects, its distinctive character and the key elements that contribute to this. These include defined landscape character areas, landscape quality, topography, watercourses, vegetation and tree cover, light environment, Public Open Space, recreational areas, access routes, historic landscape and cultural heritage influences.

12.7.2.16 Assessment of landscape sensitivity is made through application of professional judgement, rather than the use of a prescribed formulaic approach. Landscape sensitivity is assessed through considering the susceptibility of the landscape receptor to the change arising from the type of development proposed, combined with the value attached to the receptor. The LCA (Appendix H) will be used to inform these judgements and the Landscape Character Areas used as landscape receptors.

12.7.2.17 To support this process a structure of high, moderate and low categories for susceptibility to change, landscape value and the resultant landscape sensitivity are provided with descriptions of what might fall within each category provided below.

Landscape Susceptibility to Change

- **High Susceptibility to Change:** A landscape where most attributes are unlikely to withstand change of the type proposed without causing a fundamental change to overall character to the extent that it would be difficult or impossible to restore. Planning policies and/ or strategies may be in place relating to this landscape which impose a presumption against development of the type proposed;

- **Moderate Susceptibility to Change:** A landscape with a combination of attributes that can absorb some degree of change of the type proposed, without fundamentally affecting overall character or resulting in significant deterioration of condition; and

- **Low Susceptibility to Change:** A landscape where most attributes are sufficiently robust and/ or tolerant of change of the type proposed, that the RTS would have little or no effect on overall character or condition. It is likely to be easily restored. Development of the type proposed may assist in the achievement of planning policies and/or strategies relating to this landscape.

Level of Landscape Value

- **Very High / International Value:** Landscapes recognised for their scenic quality and condition, where the landscape has been designated at an international level, e.g. a World Heritage Site, and the purposes of which include landscape and/or recreational opportunities;

- **High / National Value:** Landscapes recognised for their scenic quality and condition, perhaps with elements or features that are rare or good examples of their type. They may be important tourist destinations of national importance as defined by statutory and LPA designations (e.g. Areas of Outstanding Natural Beauty, National Parks, Registered Parks and Gardens, Conservation Areas, Blue Flag Beaches). They may also be non-designated landscapes in good condition with a distinctive positive character and/or valued elements. They are likely to be areas of recognised value through use (e.g. recreational use where experience of the landscape is important), perception, historic and cultural associations, or conservation interest. They may exhibit perceptual qualities of (for example) wildness or tranquillity. They are likely to contain features and elements that are rare and could not be replaced;

- **Moderate:** Landscapes with picturesque attributes, which are aesthetically pleasing. Their character may be less well defined / more fragmented than above, but still in reasonable condition and some sense of place. They may be close to or within centres of population. The area may have some tourist associations, though tourism is not the primary attraction. They may be locally designated, or their value may be expressed though non-statutory local publications. They may contain some features of value through use, perception or historic and cultural associations and some features that could not be replaced; and

- **Low:** Landscapes with limited aesthetically pleasing scenes. They will be commonplace landscapes with poorly defined / incoherent character and a weak sense of place. They typically comprise features and elements that are discordant, derelict or in decline. They may be located within centres of population. They are unlikely to contain tourist attractions, or to be of local importance as defined by LPA designations. They are likely to contain few, if any, features of value through use, perception or historic and cultural associations. They are likely to contain few, if any, features and elements that could not be replaced.

12.7.2.18 Landscape sensitivity can be defined as the stability of landscape character and resilience to withstand change, and the ability to recuperate from loss or damage due to this change.

12.7.2.19 By combining judgements of susceptibility to change and landscape value, an assessment of sensitivity is made to determine the degree to which each landscape receptor can accommodate or mitigate the project without unacceptable detrimental effects on its character.

12.7.2.20 The general principles that are used to inform and guide the assessment of landscape sensitivity are as follows.

Landscape Sensitivity

- **High Sensitivity:** A landscape where most attributes are unlikely to withstand change of the type proposed without causing a fundamental change to overall character to the extent that it would be difficult or impossible to restore. There are likely to be large numbers / high frequency of sensitive attributes;

- **Moderate Sensitivity:** A landscape with a combination of attributes that can absorb some degree of change of the type proposed without fundamentally affecting overall character. There are unlikely to be large numbers / high frequency of sensitive receptors; and
- **Low Sensitivity:** A landscape where most attributes are robust and/ or tolerant of change of the type proposed. To the extent that change, or development would have little or no effect on overall character. It is likely to be easily restored and the numbers / frequency of sensitive receptors are likely to be low.

12.7.2.21 Judgments about the magnitude of landscape change likely to result from the RTS are supported by the framework provided below. This classifies the possible magnitude of change in high, moderate, low, very low or no change categories and provides a description of the landscape effects to be expected within each category.

Magnitude of Landscape Change

- **High:** The RTS would be immediately apparent and would result in major loss or major alteration to key elements of landscape character to the extent that there is a fundamental change to character. The proposed development involves the introduction of new, incongruous / uncharacteristic and highly conspicuous elements to the landscape;
- **Moderate:** The RTS would be apparent in views and would result in the loss or alteration to key elements of landscape character to the extent that there is a partial change to character. The change may occur over a limited area. The proposed development may involve the introduction of new, incongruous / uncharacteristic and noticeable elements to the landscape;
- **Low:** The RTS would result in minor loss or alteration to key elements of landscape character to the extent that there may be some slight perception of change to character. The change may be temporary and occur over a limited area. The proposed development may involve the introduction of new elements to the landscape, but they are unlikely to be starkly uncharacteristic or very noticeable;

- **Very low / negligible:** The RTS would result in a barely noticeable loss or alteration to key elements of landscape character, with overall character fundamentally unchanged. The subtle change may be temporary and occur over a limited area. The RTS may involve addition of new elements to the landscape but they will not be uncharacteristic or noticeable; and
- **No Change:** No loss, damage or alteration to character or features.

12.7.2.22 The magnitude of change is described as text and summarised arranging judgments against individual criteria to provide an overall profile of each identified effect.

12.7.2.23 The overall assessment of the level of significance of landscape effects for each receptor is made by combining judgments about sensitivity and magnitude of effect.

12.7.3 Overall significance of Landscape and Visual Effects.

12.7.3.1 For both landscape and visual effects, the assessment of the overall level of significance is made by combining the evaluations of receptor sensitivity and the predicted magnitude of change. Below is described how the level of significance is evaluated.

Table 12-1: Significance of effect matrix.

	Medium Sensitivity	Medium Sensitivity	Low Sensitivity
High Magnitude	Major (Significant)	Major (Significant)	Moderate (Significant)
Moderate Magnitude	Major (Significant)	Moderate (Significant)	Minor
Low Magnitude	Moderate (Significant)	Minor	Negligible
Very Low Magnitude	Minor	Negligible	Negligible
No Change	None	None	None

12.7.3.2 Major and moderate levels of effect are considered to be significant, whereas minor and negligible effects are considered not to be significant. In accordance with GLVIA3 however only those impacts that are considered likely to bring about significant effects will be carried forward into the assessment.

12.7.3.3 Landscape effects that are considered significant (insofar that a fundamental alteration to a receptor's key landscape components, characteristics and perceptual and aesthetic qualities would occur) are those that would negatively (or positively) and irreversibly (after considering the design, embedded and tertiary mitigation and enhancement measures) alter its overall integral character.

12.7.3.4 Significance should be assessed through the application of professional judgment, and application of general principles set out within GLVIA3 in relation to the specifics of both the development and its location.

12.7.4 Assessment of Cumulative Effects

12.7.4.1 Cumulative effects will be considered as part of the LVIA. The assessment of cumulative landscape and visual effects will deal with the effect of the project interacting with the effects of other developments, either associated with or separate to the RTS. This is in recognition that the overall combined landscape and visual effects of similar developments concentrated in one area may be greater than the sum of the effects from the same developments if considered individually.

12.7.4.2 GLVIA3 provides the following definition:

- ***Cumulative effects*** *are '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 landscape effects*** *are effects that 'can impact on either the physical fabric or character of the landscape, or any special values attached to it';*
- ***Cumulative visual effects*** *are effects that can be caused by a 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 to another viewpoint to see different developments'.*

12.7.4.3 Consideration will be given to the way in which any sequential views will be experienced, including the duration of views of other developments in combination with the RTS.

12.7.4.4 A combined visual effect such as where the observer is able to see two or more developments from one viewpoint, both in combination (where two or more developments are or would be within the observers arc of vision at the same time without moving their head) and in succession (where the observer has to turn their head to see the various developments, actual and visualised.

12.7.4.5 A sequential visual effect such as where the observer has to move to another viewpoint to see the same or different developments. Both frequently sequential (where the features appear regularly and with short time lapses between instances depending on speed of travel and distance between viewpoints).

12.7.4.6 GLVIA3 advises 'In most cases the focus of the cumulative assessments will be on the additional effect of the project in conjunction with other developments of the same type'. It does however acknowledge 'In some cases, development of another type will be relevant and may help to give a more complete picture of the likely significant cumulative effects.'

12.7.4.7 It is considered that other major infrastructure schemes such as road building or expansion, or mineral workings and associated industries are those most likely to be included within the cumulative assessment.

12.8 Assumptions and Limitations

12.8.1.1 The LVIA will be undertaken based on information available at the time of the assessment. It is anticipated that some of the information may not be known or may change during the EIA. Any assumptions and limitations will be reported in the ES.

12.8.1.2 This chapter has assumed that all third-party data used to generate the landscape and visual baseline is fit for purpose and accurately reflects the current status of the study area.

12.8.1.3 The methodology sets out that field work will be undertaken from publicly accessible places which is accepted industry practice. Whilst effects on residents at home will be considered through the identification of residents as receptor groups, private property has not been accessed at this time. The ES will report on the field work that has been undertaken. It is considered that this will not affect the validity of the assessment, nor the conclusions drawn through the LVIA process.

13 Materials and Waste

13.1 Introduction

13.1.1.1 This chapter describes the proposed scope of the assessment on materials and waste. It outlines the baseline conditions, the likely effects of the project and the avoidance or mitigation measures proposed to alleviate these. It also outlines the methodology that will be used for the assessment of effects related to materials and waste in the PEIR/ES.

13.1.1.2 This chapter will identify and characterise baseline conditions for relevant materials including natural resources and locations of existing waste deposit sites inclusive of landfill sites, both active at the time of writing and historical locations.

13.1.1.3 A materials management feasibility study (to include analysis of waste infrastructure capacity, availability and options including restoration) is being developed in parallel to the DCO process, alongside a MMS and overall material management planning which will also contribute to the permitting route. This information will inform ongoing design and be incorporated into the ES and associated management plans.

13.1.1.4 This chapter should be read in conjunction with other Chapters in the Scoping Report including Chapter 10: Flood Risk (for effects related to flood risk), Chapter 16: Soils and Land (for effects related to the quality of farmland in the context of Agricultural Land Classifications (ALC)) and Chapter 18: Water Environment (for effects related to water / cross over with WFD regulatory mechanisms).

13.1.1.5 A summary of the key legislation, policy and guidance relevant to materials and waste is provided in Appendix M.

13.2 Baseline Methodology

13.2.1 Information Sources

13.2.1.1 In order to establish baseline conditions for materials and waste a DBA has been undertaken. The following resources have been used to inform the DBA:

- BGS mapping of potential mineral areas;

- Historical and existing landfill data from the Environment Agency;
- Information on mineral safeguarding areas, existing mineral and waste extraction sites and future areas identified for mineral extraction;
- Relevant publicly available environmental records, including Waste Consultation Areas (WCAs) and future preferred areas for extraction which were obtained from the RBWM and Surrey County Council;
- Waste and landfill records (.gov.uk Open Data);
- BGS data; and
- Results from relevant GI.

13.2.1.2 Baseline ground conditions have been established from GI surveys undertaken in 2006 and 2015/17 (see Chapter 16: Soils and Land for further details).

13.2.1.3 Local waste and mineral plans and current waste capacity information has been used to indicate which licensed waste facilities are likely to be available during construction and operational phases of the project.

13.2.1.4 An evaluation of the current minerals' markets will be undertaken to identify supply and demand within the region and reported upon in the ES. Third-party projects will be identified where there is a definitive demand for mineral resources within the vicinity of the RTS.

13.2.1.5 The likely future baseline conditions during the years of anticipated project construction and operation will be determined based upon our understanding of the changeability of existing conditions and the influence of external factors such as legislation, local plans and development.

13.2.2 Stakeholder Engagement

Feedback received from consultation on EIA Scoping and draft assessment methodologies

13.2.2.1 Surrey County Council, in their capacity as a regulator, provided informal comments on the draft EIA methodologies in 2019. The following feedback was received from Surrey County Council on this consultation: *"The proposed methodology indicates that adopted minerals and waste plans and other published waste capacity information would be reviewed to ascertain the availability of landfill void space during the construction and* *operational phases of the scheme. Given that the scheme aims to recover a large proportion of the material excavated during the construction of the channels, which would be used to construct the proposed earth mounds within the four landscape enhancement areas at Sunnymeads, Hythe End, Royal Hythe and Sheepwalk East, it is unclear why an assessment of landfill void capacity is necessary".*

13.2.2.2 "It is recommended that the following Surrey Minerals Plan policies are also referenced:

- Policy MC5 – Recycling and secondary aggregate: This policy will be of relevance to the proposed waste management facilities, as some of the material imported and process may have potential as recycled aggregate;
- Policy MC11 – Mineral extraction outside preferred areas: This policy will be of particular relevance to the proposed mineral extraction at Laleham Golf Course, as that area of land is not allocated for mineral working under the adopted Plan;
- Policy MC15 – Transportation of Minerals: This policy will be of particular relevance to the proposed mineral extraction at Laleham Golf Course, as the material will need to be exported from the site which would most likely be achieved by road. Also as raised material suitable for processing may arise from the construction of those sections of the channel that pass through previously undisturbed ground, which material would need to be transported to suitable processing facilities, again most likely by road".

13.2.2.3 A review of such information is required to ascertain the availability of landfill capacity in the surrounding area, due to the potential to encounter unexpected hazardous material/ waste and other materials, such as asbestos containing materials, during construction which will be unsuitable for use within the project, or any materials that cannot be processed to be suitable for use and are likely to require offsite placement to a suitably permitted facility, most likely a landfill. As per the Waste (England and Wales) Regulations 2011 and associated guidance documents, the principals of the waste hierarchy will be followed during construction and operation phases of the project. The materials management feasibility study and MMS that are being developed in parallel to the DCO process, shall provide further clarity on the waste management proposals and waste streams for the project. At the time of writing this Scoping Report, the exact quantity and types of material is unknown. The MMS will include consideration of how any surplus material not required by the RTS will be utilised.

13.2.2.4 Polices MC5, MC11 and MC15 have been included for consideration in Appendix M. Policies MC11 and MC15 were included in the feedback with regards to the proposed HCA at Laleham Golf Course which is a Mineral Safeguarding Area (MSA). Any removal of materials during excavation works within the MSA at Laleham Golf Course would only be undertaken following a review of the above policies.

13.2.2.5 Surrey County Council's comments referred to the use of proposed policies in the emerging Surrey Waste Local Plan, which at the time of the feedback had not been adopted. The comments made reference to policies to be considered under the adopted Surrey Waste Plan 2008 instead. These comments have since been superseded due to the adoption of the '*Surrey Waste Local Plan 2019-2033'* in 2020. Surrey County Council's comments also referred to the requirement of scoping in of effects to minerals and waste with particular reference to effects on existing waste management capacity and on restoration of former mineral workings. These effects have been incorporated into the Scoping Report.

Feedback received from pre-application consultation under Town and Country Planning Act

13.2.2.6 Pre-application consultation was undertaken in 2019 with Surrey County Council (in their capacity as a regulator), LPAs, GLA, the Environment Agency Sustainable Places Team and the MMO. Key issues identified were the associated impacts with movement of waste for offsite placement, constructing landscaped beacons from materials that will be considered 'waste', due to being sourced from the excavation of landfill sites. Another key issue for Surrey County Council was that the subsequent waste development was deemed to be inappropriate development in the Green Belt. Lastly Sustainable Places indicated that they believed the re-use of material for the originally proposed *'Landscape Enhancement- Beacon concept'* for the project could be considered as 'sham recovery' under the Contaminated Land: Applications In Real Environments (CL:AIRE) Deposit of Waste Code of Practice (DoWCoP).

13.2.2.7 It was advised that site material could be 're-won' by remedial activities, which would be undertaken under appropriate waste legislation, or using

CL:AIRE DoWCoP process, so that it can be used for embankments and structures, where appropriate. Whilst this guidance provides good practice guidance for managing (in specific circumstances) the use of waste as a material, the nature of the baseline and the project means that other guidance and regulatory mechanisms are necessarily included in the methodology and detailed in this report.

Other topic specific engagement (including previous engagement, as well as engagement required)

13.2.2.8 Further preliminary engagement has been undertaken with LPAs in 2022 to obtain baseline data and inform EIA Scoping.

13.2.2.9 Consultation with Environment Agency Contaminated Land and Waste technical specialists has been undertaken and is ongoing, including with its National Permitting Service regarding material re-use, effects to landfills and waste recovery permits and applications. In addition, through consultation with the Environment Agency's technical waste specialists a 'Contamination and Waste' advisory group will be formed to guide the project design and MMS.

13.2.2.10 Where relevant, information from previous consultation activities with other local stakeholders has been used. This includes landowners of mineral extraction, waste processing and landfill sites, representatives of major operators in the area as well as other relevant bodies and stakeholder groups.

13.2.2.11 Additional engagement with stakeholders will be undertaken prior to the submission of the DCO, in order to fully understand baseline characteristics, significance of effect and potential approaches to mitigation and management for materials and waste, and the consenting approach.

13.2.3 Study Area

13.2.3.1 For the purposes of waste management (for which waste management infrastructure is considered), the study area encompasses the South East region of England. For hazardous material/ waste management, the study area is defined as the whole of England, due to the limited number of active sites that accept hazardous material/ waste. The waste management study areas may be subject to change, whilst the project evaluates the most appropriate options for waste management.

13.2.3.2 For the purposes of primary minerals and waste (the extent to which waste could be generated as a result of the project) the study area encompasses the full extent of the area within the project boundary for EIA scoping (as outlined in Figure 13-1 in Appendix A). The justification for this study area is based upon professional judgement, considering:

- The extent to which the project may affect the availability and viability of mineral resources e.g. through mineral sterilisation, or extraction;
- The extent to which the project may affect MSAs is within the site itself;
- There is no relevant direct pathway for changes to mineral resources and MSAs beyond the project boundary for EIA scoping; and
- Waste arising from the project is limited to the extent of the area within the project boundary for EIA scoping.

13.2.3.3 For the purposes of materials in the context of physical resources required to construct the project, the types and quantities of such materials are currently unknown. The likely quantities of materials required are deemed to be small in relation to national data but a study area of the whole of the UK is considered to capture the wider geographic context required at this stage.

13.3 Baseline

13.3.1 Existing Baseline

Materials

13.3.1.1 IEMA guidance '*Materials and Waste in Environmental Impact Assessment*' defines '*Materials*' as physical resources that are used across the lifecycle of a development such as steel, glass and timber (Danson, 2020). The term materials for this project encompasses both natural resources, such as primary minerals located within the study area and the main physical engineered resources required to construct aspects of the project, such as sheet piles, or engineered products such as aggregates.

13.3.1.2 At this stage the exact types and quantities of materials required in addition to site-won excavated arisings during construction of the project is unknown. It is likely that concrete, timber and engineered materials such as sheet piles or aggregates will be required for the construction of some project components and access routes. As such the volumes and sales of key relevant materials in the UK will be reviewed to update and maintain a valid materials baseline.

13.3.1.3 Surrey County Council divides minerals into two main categories: aggregates (bulk minerals such as rock, sand or gravel); and non-aggregates (all other minerals such as silica sand or clay) (Surrey County Council, 2011c). Mineral extraction is one of the primary industries within the study area (the full extent of the project boundary for EIA scoping), as a result of the valuable reserves of sharp sand and gravel that are present within the River Thames floodplain; these are the predominant minerals worked in Surrey.

13.3.1.4 MSAs are areas which contain specific mineral resources of local and national importance. There are several designated MSAs across the study area in place to ensure sustainable use of aggregate minerals, the conservation of mineral resources and the prevention of sterilisation by other forms of development. MSAs are designated by Surrey County Council as the Minerals Planning Authority and are therefore identified as locally and nationally important receptors.

13.3.1.5 MSAs within the study area are outlined in Figure13-1 in Appendix A. The MSAs within the study area cover the northern and southern sections of the Runnymede Channel (including Laleham Golf Course) and an MSA covers the extent of Littleton North lake located at the start of the Spelthorne Channel. Data provided by Surrey County Council shows that there are existing sand and gravel sites at Norlands Lane, at Shepperton Quarry and on Littleton Lane. However, environmental surveys for the RTS have confirmed that these are now largely inactive.

13.3.1.6 Hurst Park, located within the study area for Molesey Weir, has been designated as an MSA. There are no existing MSAs within the study area for Sunbury Weir or Teddington Weir, which are subject to capacity improvements.

13.3.1.7 There are MSAs covering potential HCAs including the western half of Desborough Island and at the Land Between Desborough Cut and Engine River. The eastern most extent of the study area around Drink Water Pit HCA is also covered by an MSA.

13.3.1.8 MSA designations outside of the study area shown in Figure 13-1 in Appendix A, are included due to being within the dataset received by Surrey County Council but do not form part of this assessment.

Mineral sales in Surrey

13.3.1.9 Many of the voids within the study area are either permanently filled with water once mineral extraction has finished or are used as landfill sites and are clay lined which can increase the severity of flooding in localised areas.

13.3.1.10 There are various primary minerals present in the county of Surrey, including soft sand, gravel, oil and gas, chalk, clay and peat; however, the predominant minerals worked in the county are sands and gravels according to Surrey County Council, 2011c). Aggregate production in Surrey between 1997 and 2002 remained relatively constant at between two and three million tonnes (McEvoy *et al*., 2003), but declined to 0.8 million tonnes in 2013.

13.3.1.11 Sales of recycled aggregates increased slightly by 21 per cent, to 1.3 million tonnes in 2019 (Surrey County Council, 2020a), which is above the Surrey Mineral Plan target of at least 0.9 million tonnes per annum by 2026 Surrey County Council 2011a). Sales of primary aggregates however, decreased by 22 per cent to 0.7 million tonnes in 2019 (Surrey County Council, 2020a).

13.3.1.12 Figure 13-1 below shows the quantity of Primary aggregate sales (in millions of tonnes) of both soft sand, and sand and gravel or hoggin for construction fill. The figures are provided for each year from 2010 to 2019. Between 2010 and 2019, total sales of land-won sand and gravel were generally below the previous 10-year average of 0.79 million tonnes (with the exception of 2010, 2014, 2017 and 2018). A full breakdown is provided below:

- **2010**
  - Soft sand: c. 0.3 million tonnes;
  - Sand and gravel or hoggin for construction infill: c. 0.58 million tonnes;
  - Combined total: c. 0.88 million tonnes.

- **2011**
    - Soft sand: c. 0.37 million tonnes;
    - Sand and gravel or hoggin for construction infill: c. 0.65 million tonnes;
    - Combined total: c. 1.02 million tonnes.
- **2012**
    - Soft sand: c. 0.38 million tonnes;
    - Sand and gravel or hoggin for construction infill: c. 0.23 million tonnes;
    - Combined total: c. 0.61 million tonnes.
- **2013**
    - Soft sand: c. 0.41 million tonnes;
    - Sand and gravel or hoggin for construction infill: c. 0.38 million tonnes;
    - Combined total: c. 0.79 million tonnes.
- **2014**
    - Soft sand: c. 0.57 million tonnes;
    - Sand and gravel or hoggin for construction infill: c. 0.41 million tonnes;
    - Combined total: c. 0.98 million tonnes.
- **2015**
    - Soft sand: c. 0.5 million tonnes;
    - Sand and gravel or hoggin for construction infill: c. 0.27 million tonnes;
    - Combined total: c. 0.77 million tonnes.
- **2016**

  - Soft sand: c. 0.41 million tonnes;
  - Sand and gravel or hoggin for construction infill: c. 0.39 million tonnes;
  - Combined total: c. 0.8 million tonnes.
- **2017**
  - Soft sand: c. 0.39 million tonnes;
  - Sand and gravel or hoggin for construction infill: c. 0.41 million tonnes;
  - Combined total: c. 0.8 million tonnes.
- **2018**
  - Soft sand: c. 0.44 million tonnes;
  - Sand and gravel or hoggin for construction infill: c. 0.48 million tonnes;
  - Combined total: c. 0.92 million tonnes.
- **2019**
  - Soft sand: c. 0.48 million tonnes;
  - Sand and gravel or hoggin for construction infill: c. 0.24 million tonnes;
  - Combined total: c. 0.72 million tonnes.

13.3.1.13 This was due to the completion of mineral extraction at several quarries, as well as the impact of the economic downturn between 2008 and 2013 (Surrey County Council, 2021). Total sales decreased in 2019 but between 2017 and 2018 there was a 14 per cent increase in total sales, therefore, the general trend is that sales have increased since 2012.

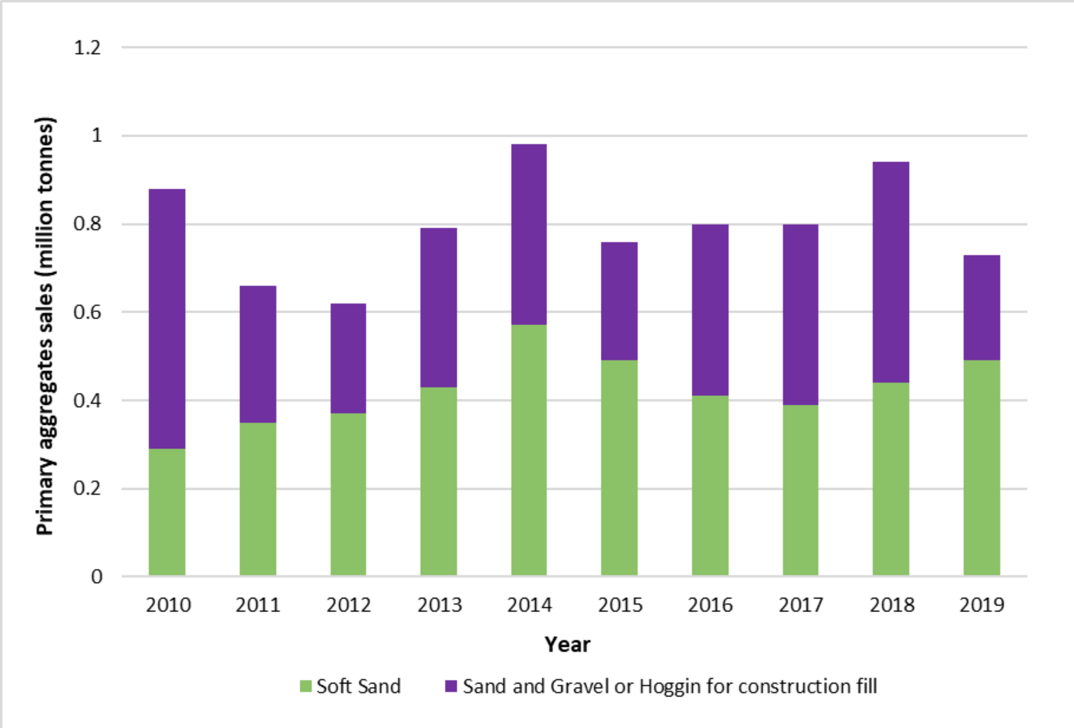

Figure 13-1 Sales of land-won primary aggregates in Surrey from 2010 to 2019 (Surrey County Council, 2021).

13.3.1.14 Surrey County Council have identified preferred areas for future primary aggregate extraction for the period 2009-2026 but none of these are located within the study area **(**Figure 13-1 in Appendix A). Surrey County Council, as the Minerals and Waste Planning Authority (MWPA), are preparing a new Minerals and Waste Local Plan (MWLP) which will replace the Surrey Minerals Plan, 2011. The MWLP is forecast to be in place in 2024 and is likely to identify additional mineral sites, therefore, this is subject to change.

Restoration of mineral workings

13.3.1.15 Within the study area, mineral sites have traditionally been restored using inert and non-inert materials. The sites have then been returned to agriculture, or water-based end uses following the soil replacement works (Surrey County Council, 2011d). However, it is predicted that the total inert waste stream in Surrey that will be available to be sent to restore mineral workings is likely to be insufficient to restore all sites to their pre-existing levels (Surrey County Council, 2011c). There are no indicative restoration schemes for preferred areas (those sites allocated by Surrey County Council for the working of aggregates and silica) within the study area (Figure 13-1 in Appendix A).

Waste: waste management infrastructure

13.3.1.16 Mineral extraction has been a predominant industry in Surrey, as such the voids created have resulted in the presence of a large number of landfill sites (both historic and authorised) within the footprint of the engineering works of the project (Figure 16-1 in Appendix A).

13.3.1.17 The area of land that would be affected by the proposed development includes closed licensed landfills and closed historic landfill. Historic landfills date from an era before current environmental and regulatory legislation and were likely installed following the “dilute and disperse” principle which is no longer acceptable; these sites have no environmental permit in force. The historic landfill sites will not likely have engineered containment, leachate control or gas management in line with current licence and permit requirements. Further information on these landfills and waste sources are detailed in Appendix I. These sites are also considered to be potential sources of contamination within the *‘land quality study area’* (see Chapter Section 16.2.3 in the Soils and Land Chapter and Figure 16-1 in Appendix A), some of which still require restoration. Information provided by Surrey County Council on existing minerals and waste sites states that Norlands Lane landfill site for example is currently in the restoration stage of its planning permission. Some of these sites have had further investigation, including GI, due to the project passing through them, primarily to determine the materials suitability for re-use.

13.3.1.18 There is a total of 44 historical and/or authorised landfills identified within the land quality study area (Appendix I). This consists of 30 landfill sites associated with the study area around the flood channel and locations identified as potential HCA areas. In addition, there are five landfill sites within the study area of Sunbury and Teddington River Thames weirs and the remaining nine landfill sites are located within the study areas of Drink Water Pit and Grove Farm HCAs (Figure 16-1 in Appendix A).

13.3.1.19 There are no WCAs within the Runnymede and Spelthorne Channels but there is a WCA within the study area around Drink Water Pit HCA (Figure 13-1 in Appendix A).

13.3.1.20 Industrial Land Areas of Search are sites likely to be considered suitable for the development of additional waste management facilities. The Industrial Land Areas of Search at Thorpe Industrial Estate is located within the study area adjacent to the potential HCA at Norlands Lane (Figure 13-1 in Appendix A).

Waste: landfill capacity

13.3.1.21 The Surrey County Council Waste Plan aims to increase recycling of waste and reduce landfill. Waste that cannot be managed through recycling and will not be sent to landfill, will need to be managed through other recovery methods including recovery to land (Surrey County Council, 2020a).

13.3.1.22 The Environment Agency's 2020 Waste Data Interrogator datasets provided in the '*2020 Waste Summary Tables for England'* (Environment Agency, 2022a) have been used to outline landfill capacities for all landfill types in England, the South East region of England and the sub-region of Surrey (Table 13-1).

13.3.1.23 The total landfill capacity in England for all landfill types at the end of 2020 was just under 389 million cubic metres, with just over 63 million cubic metres of landfill capacity in the South East region of England (Environment Agency, 2022a). The sub-region of Surrey accounted for a little over 13.5 million cubic metres of that landfill capacity (Table 13-1 below). As there is no capacity for hazardous material in Surrey, it is highly likely that any hazardous material will have to be transported for disposal to a suitably permitted facility within the south-east, or if there is no capacity there, to a site located within the wider UK.

Table 13-1: Landfill capacities at the end of 2020 for England, the South East region and the sub-region Surrey ('000s m^3)* (Environment Agency, 2022a).

Landfill Type	Surrey	South East region	England
Hazardous Merchant	-	146	15,571
Hazardous Restricted	-	117	809
Non-Hazardous with Stable Non-Reactive Hazardous Wastes (SNRHW)** cell	3,320	22,196	66,969
Non-Hazardous	36	13,557	137,457
Non-Hazardous Restricted	-	-	27,368
Inert	10,155	27,174	140,192
Total	**13,511**	**63,190**	**388,366**

**Contains Environment Agency information © Environment Agency and/or database right.*

***Some non-hazardous sites can accept some SNRHW into a dedicated cell, but this is usually a small part of the overall capacity of the site*

13.3.1.24 The permitted landfill sites as of 2020 in Surrey have been listed in Table 13-2 below. It is noted that even though these are all listed as landfills, it is likely that some of these sites are taking inert materials for restoration purposes only. There are several inert landfills in Surrey that no longer have capacity to take further materials, these include landfills within Spelthorne and Runnymede. It is likely that the capacities quoted in the table will have reduced further and may no longer be able to take wastes when the project is in the construction phase of works. This data provides an indication of current operational capacities of waste management infrastructure (landfills) in Surrey, thus supporting the need to extend the study area to the extent of the South East region of England and the wider UK for some waste types, such as hazardous or special wastes.

Table 13-2: Permitted landfill sites in Surrey with remaining landfill capacities (cubic metres) as of the end of 2020* (Environment Agency, 2022b).

Facility Name	LPA	Site Type	Remaining Capacity at the end of 2020 (m^3)
The Gravel Pit, Highstreet Harlington	Spelthorne	L05 - Inert Landfill	145,000
Lower Mill Farm	Spelthorne	L05 - Inert Landfill	40,000
Betchworth Sand Quarry Landfill	Reigate and Banstead	L05 - Inert Landfill	60,000
Home Farm Extension Landfill Site	Spelthorne	L05 - Inert Landfill	0
Stanwell III Landfill	Spelthorne	L05 - Inert Landfill	101,154
Coldharbour Lane Landfill	Runnymede	L05 - Inert Landfill	0
Stock Farm Stone Quarry	Waverley	L05 - Inert Landfill	0

Facility Name	LPA	Site Type	Remaining Capacity at the end of 2020 (*m*[3])
Home Farm South Landfill	Spelthorne	L05 - Inert Landfill	0
Oxted Quarry Landfill	Tandridge	L05 - Inert Landfill	1,970,287
Addlestone Quarry Landfill	Runnymede	L05 - Inert Landfill	555,145
Homefield Landfill Site	Waverley	L05 - Inert Landfill	974652
Laleham Quarry	Spelthorne	L05 - Inert Landfill	979,000
Alton Road Sand Pit	Waverley	L05 - Inert Landfill	2,210,000
Mercers South Landfill	Tandridge	L05 - Inert Landfill	2,650,000
Homers Farm Inert Landfill	Spelthorne	L05 - Inert Landfill	470,000
Redhill Landfill (North East Quadrant)	Reigate and Banstead	L02 - Non-Hazardous Landfill with SNRHW cell	3,319,892
Albury Landfill	Guildford	L04 - Non-Hazardous	0
Redhill Landfill (South West Area)	Reigate and Banstead	L04 - Non-Hazardous	0
Runfold South Landfills Areas A and C	Waverley	L04 - Non-Hazardous	35,871

13.3.2 Future Baseline

Materials

13.3.2.1 The future demand for aggregates in the UK will depend upon construction expenditure in the future. Demand from the commercial construction sector is expected to boost demand for stone over the next five years.

Construction and confidence spending on construction projects is expected to increase over the next five years (IBIS World, 2022).

13.3.2.2 The Department for Business Energy and Industrial Strategy published a research report called Future capacities and capabilities of the UK steel industry. It estimated that UK demand for finished steel (across all industries) would grow to 11 million tonnes by 2030 (Hutton, 2021). However, demand did fall during the first coronavirus lockdowns of 2020/2021. Demand and consumption of steel in the UK will depend on the strength of the construction industry, including spending on nationally important infrastructure projects and manufacturing.

13.3.2.3 In the UK, as with stone and steel, the future demand for timber will be directly linked to investment in house building, infrastructure projects and the strength of the UK building industry as a whole.

Mineral resources

13.3.2.4 Ground conditions are unlikely to change however, local authorities may update their Local Minerals Plans which may change the MSAs and their preferred locations for mineral extraction. Furthermore, landowners may apply to vary their mineral restoration schemes.

13.3.2.5 Surrey County Council as the MWPA are preparing a new MWLP which will replace the Surrey Minerals Plan, 2011. The MWLP is forecast to be in place in 2024 and is likely to identify additional mineral sites.

13.3.2.6 Mineral extraction is likely to continue in areas of un-worked gravels and existing sites may close and be restored as the gravel resources are exhausted. Within the study area, any future mineral extraction is likely to be focused in the identified preferred areas for future primary aggregate extraction for the period 2009 to 2026. None of these designated areas are located within the materials and waste study area (Figure 13-1 in Appendix A). The updated Surrey MWLP is forecast to be in place in 2024 and is likely to identify additional mineral sites and/or restoration areas.

Waste arisings:

13.3.2.7 The Surrey Waste Local Plan outlines forecast total waste arisings in Surrey for the plan period (2019 to 2033) to increase from 3,712,000 tonnes in 2017 to 4,115,000 tonnes in 2035 shown in Figure 13-2 below. It shows the forecast of the three main streams Local Authority Collected

Waste, Commercial and Industrial Waste, and Construction, Demolition and Excavation Waste. A full breakdown is provided below:

- **2017**
    - Local Authority Collected Waste: c. 500,000;
    - Commercial and Industrial Waste: c. 700,000;
    - Construction, Demolition and Excavation Waste: c. 2,450,000;
    - Total Waste: c. 3,650,000.
- **2020**
    - Local Authority Collected Waste: c. 500,000;
    - Commercial and Industrial Waste: c. 1,100,000;
    - Construction, Demolition and Excavation Waste: c. 2,100,000;
    - Total Waste: c. 3,700,000.
- **2025**
    - Local Authority Collected Waste: c. 500,000;
    - Commercial and Industrial Waste: c. 800,000;
    - Construction, Demolition and Excavation Waste: c. 2,450,000;
    - Total Waste: c. 3,750,000.
- **2030**
    - Local Authority Collected Waste: c. 500,000;
    - Commercial and Industrial Waste: c. 1,000,000;
    - Construction, Demolition and Excavation Waste: c. 2,500,000;
    - Total Waste: c. 4,000,000.
- **2035**
    - Local Authority Collected Waste: c. 500,000;
    - Commercial and Industrial Waste: c. 520,000;

- Construction, Demolition and Excavation Waste: c. 3,080,000;
- Total Waste: c. 4,100,000.

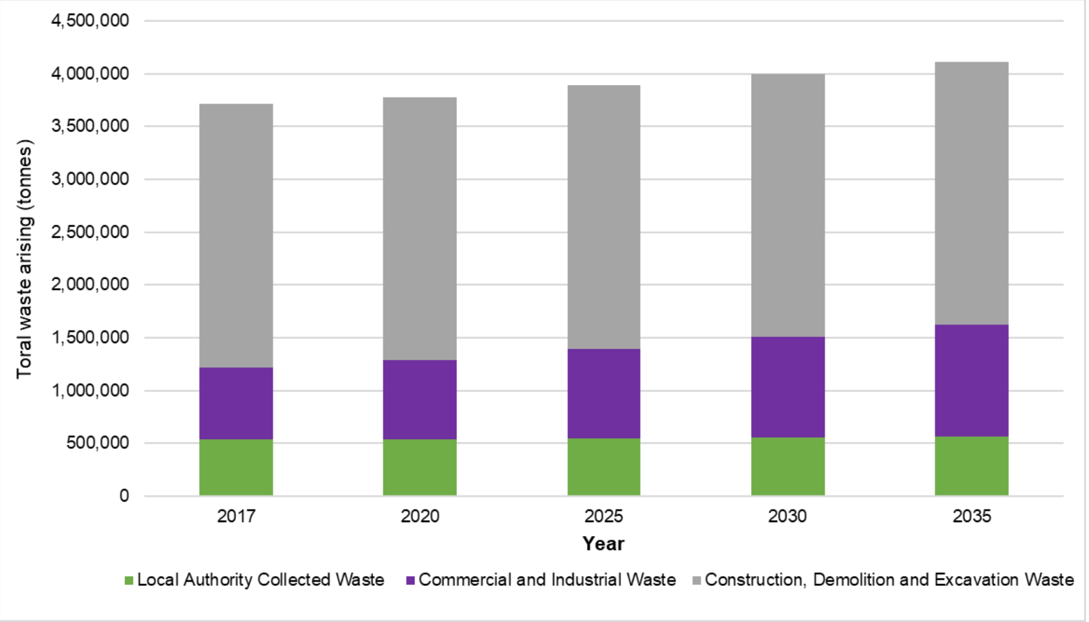

Figure 13-2 Forecast waste arising in Surrey between 2017 and 2035 from the three main waste streams (Surrey County Council, 2020a).

13.3.2.8 There is a gap between existing waste management capacity and the forecast requirements, particularly for disposal of waste to land (including both landfilling and land raising) (Surrey County Council, 2020a). This is largely due to non-inert landfill facilities in the South East region of England being limited in number, with remaining operational facilities accepting waste from wider areas.

13.3.2.9 A capacity gap of -1,159,000 tonnes is forecast in 2035 for construction, demolition and excavation waste recycling in Surrey (Surrey County Council, 2020a). The Surrey Waste Local Plan has identified capacity for recovery of waste to land up to 2025 however, approximately 6 million tonnes of additional inert landfill and/or recovery to land capacity (likely to be utilised in the plan period) has been identified; primarily as a result of future mineral extraction from the preferred areas in the Surrey Minerals Plan (Surrey County Council, 2020a). Currently no preferred areas are located within the study area (Figure 13-1 in Appendix A).

13.3.3 Key Environmental Considerations and Opportunities

13.3.3.1 The key environmental considerations in relation to Materials and Waste are:

- The presence and availability of primary material resources, existing mineral extraction sites and MSAs;
- The availability of material resources within the UK; and
- The availability and capacity of landfill sites, treatment centres and restoration sites.

13.3.3.2 The key environmental opportunities in relation to materials and waste are:

- To improve flood risk to industrial assets in the area and upstream of it, such as quarries and landfill sites;
- Excavation through landfill will contribute to landfill reclamation and subsequently reduce the volume of landfilled material within the study area, as excavated landfill arisings will be reclaimed and processed via an appropriate permitting route; and
- The potential to re-use or recover excavated arisings during construction of the project through application of the waste hierarchy.

13.4 Likely Significant Effects Requiring Assessment

13.4.1 Construction Effects

13.4.1.1 Project activities and associated likely significant effects are identified below:

- Construction of project components and the associated on-site generation of material that is not geotechnically and geochemically suitable for recovery and reuse has the potential to cause adverse effects to the operation and capacity of existing and/or any future waste management infrastructure arising from the placement of waste. Placement of waste may subsequently amplify the capacity gap between waste management capacity and forecast requirements in Surrey and adverse effects may also arise as a result from loss of land capacity from future mineral extraction areas, which may be used by

Surrey County Council for additional inert landfill and / or recovery to land (Surrey Waste Plan);

- Sediment removal associated with the channel construction may have the potential to cause adverse effects as a result of material that is not geotechnically and geochemically suitable for recovery and re-use within the project, requiring removal from site to suitably licensed waste management facilities; and
- The placement of hazardous materials/waste offsite has the potential to cause adverse effects due to only a small number of active hazardous material/ waste facilities in the UK. As no local waste management and disposal facilities are available for hazardous material to be transferred to (none within the Surrey region), this would add pressure to existing / further afield facilities;

13.4.1.2 Construction of flood channels will require excavation through landfill, this is a potentially significant beneficial effect, as a result of the project contributing to landfill reclamation and subsequently reducing the volume of landfilled material and subsequent betterment of land quality within the study area;

- Material excavation has the potential to cause adverse effects to the Minerals Planning Authority and/or other users as a result of extracting natural resources (i.e. sharp sands and gravel) and thereby depleting the availability of natural resources for sale in mineral markets; and
- Construction of project components could lead to an adverse effect resulting from the volume of materials required and subsequent effects on the availability of material resources in the UK including (but not limited to) steel or timber; and

13.4.1.3 Potential to generate adverse effects from material deposition and reprofiling on soil structure and chemical properties as a result of landscaping, assuming that material is geotechnically and/or geochemically suitable for re-use.

13.4.2 Operational Effects

13.4.2.1 Project activities and associated likely significant effects are identified below:

- Adverse effect from the existence of flood channels and other project components on natural resources through permanently preventing future extraction of mineral and subsequently sterilising of MSAs. The MSAs affected by the project, which contain viable mineral resources, may no longer be workable once the project is in place, preventing the Minerals Planning Authority from meeting its local minerals policies/plans;
- Activities to maintain the desired design capacity of the new flood channels have the potential for adverse effects arising from sediment removal as a result of the operation of the project. The exact types and quantities of waste arisings that are likely to be associated with the operation of the project are currently unknown; and
- The operation of flood channels, associated features and capacity improvements during times of flood, have a potential beneficial effect of reduced flood risk from all sources of flooding to MSAs. Reduced incidence of flooding to potential MSAs will increase the viability and ease of extracting minerals.

13.5 Effects Not Requiring Assessment

13.5.1 Construction Effects

13.5.1.1 Project activities and associated effects that are deemed not likely to be significant and are therefore proposed to be scoped out of the EIA are identified below:

- Demolition of the buildings at the northern end of the Runnymede Channel has the potential to cause potential adverse effects resulting from the generation of small volumes of demolition waste putting pressure on local waste management and disposal facilities. Any potential effects are deemed not significant, due to only a small number of buildings to be demolished; works will adhere to the project specific MMP and SWMP; and
- Potential adverse effects of waste management at established third party waste management facilities will be scoped out of the assessment. It is assumed these facilities will be operating under relevant planning and permitting authorisations and therefore will have been subject to site-specific assessments.

13.5.2 Operational Effects

13.5.2.1 Project activities and associated effects that are deemed not likely to be significant and are therefore proposed to be scoped out of the EIA are identified below:

- The exact types and quantities of material that are likely to be associated with the operation of the project are currently unknown. However, adverse effects on use of materials during maintenance activities are not likely to be significant because the project design will have embedded mitigation, whereby there will be limited additional works required post construction; and
- General maintenance activities could result in minor disturbance to materials and waste receptors. However, it is anticipated that the effect will not be significant because maintenance activities will follow standard good practice procedures, are likely to be infrequent and low impact, resulting in minimal effects.

13.6 Approach to Mitigation

13.6.1.1 This section should be read in conjunction with Chapter 5: Approach to EIA Scoping which sets out further definition for the project regarding primary (embedded) mitigation, secondary (additional) mitigation and tertiary (best practice) mitigation.

13.6.2 Construction

13.6.2.1 Secondary mitigation measures that are under consideration for the construction phase are identified below:

- The recovery and re-use of material that is not geotechnically and geochemically suitable for recovery and reuse on site will be considered where possible and detailed in a Waste Recovery Plan; Where feasible alternative options to utilise material on other projects will be sought, such as transferring excess inert materials to former mineral sites that require material for restoration activities at these sites;
- Materials will be managed efficiently through adherence to the waste hierarchy. Re-use, recycling and recovery of materials will be maximised to reduce the quantity of waste sent to landfill. This will be

outlined within the MMP and these details will be included in the SWMP;

- Wherever possible material will be reused on site, for example, for flood embankments or new green open spaces;

- The plan for the use of site won material will be outlined in the MMS. The project is aiming that all site-won material (where possible) from the project will be processed, recovered or re-used as appropriate, reducing the need to import materials from offsite sources and minimising the volume of unsuitable made ground requiring placement offsite. This will be achieved through the implementation of a MMS, in line with DoWCoP and relevant permitting requirements. Implementation and appropriate tracking and verification will be required as part of the development of this strategy;

- In line with the waste hierarchy, topsoil and subsoil required to deliver the project will use suitable site-won material as a preference. The project would then seek to put any surplus topsoil or subsoils to beneficial use outside of the project, rather than sending offsite as waste. The details of this are still to be confirmed; and

- Where surplus inert materials from the project are produced, we will consider suitability for use in mineral restoration sites within Surrey which have a deficit of suitable material. The practicalities of this will be examined during the materials management feasibility study.

13.6.3 Operation

13.6.3.1 No secondary mitigation has been identified for the operation phase in relation to Materials and Waste.

13.7 Assessment Methodology

13.7.1 Significance Criteria

13.7.1.1 The appraisal of significance will be based on general EIA assessment methodologies alongside professional judgement, best practice guidance and legislation (see Appendix M). The scoping exercise has identified potential for significant effects relating to materials and waste during the construction and operational phases of the project and therefore, an assessment will be undertaken in accordance with the appropriate guidance.

13.7.1.2 The assessment will define magnitude of change and receptor sensitivity to determine the significance of effects as outlined below.

13.7.1.3 To determine the sensitivity of environmental receptors, topic specific criteria have been developed that categorise sensitivity of receptors into high, moderate, low or negligible. Categorisation of the sensitivity of materials and waste receptors is discussed below, alongside the criteria relating to each of these categories specific to materials and waste receptors.

13.7.1.4 The criteria for determining sensitivity and magnitude are being explored in relation to the project contributing to landfill reclamation and subsequently reducing the volume of landfilled material and will be confirmed in the PEIR/ES.

High sensitivity

13.7.1.5 General criteria for classifying high sensitivity of materials and waste receptors include the following:

- Waste generated by the project; waste which needs to be landfilled or waste for which there are no suitable management options within the region - the study area is larger for consideration of sites that could receive particularly hazardous waste materials; and
- Importation of earthworks materials; use of majority of imported materials when suitable materials exist from construction of the project.
- Minerals extracted for sale on the market; minerals for which there is an oversaturated market or there is a high demand for mineral resources for other projects; and
- Mineral sterilisation; mineral resource of international or national importance.

Moderate sensitivity

13.7.1.6 General criteria for classifying moderate sensitivity of materials and waste receptors include the following:

- Waste generated by the project; waste which is sent for energy recovery;
- Importation of earthworks materials; use of imported materials when suitable materials exist from construction of the project but are materials that would require significant processing to be suitable for reuse;
- Minerals extracted for sale on the market; minerals for which there is a stable market or there is a moderate demand for mineral resources for other projects; and
- Mineral sterilisation; mineral resource of regional importance.

Low sensitivity

13.7.1.7 General criteria for classifying low sensitivity of materials and waste receptors include the following:

- Waste generated by the project; waste that is recycled or re-used outside of the project;
- Importation of earthworks materials; use of some imported materials where insufficient amounts of suitable materials exist within the study area;
- Minerals extracted for sale on the market; minerals for which there is an already well supplied market or there is a low demand for mineral resources for other projects; and
- Mineral sterilisation; mineral resource of local importance.

Negligible sensitivity

13.7.1.8 General criteria for classifying negligible sensitivity of materials and waste receptors include the following:

- Waste generated by the project; waste material is re-used within the project;
- Importation of earthworks materials; no requirement for the use of imported materials as no suitable materials exist within the study area;

- Minerals extracted for sale on the market; Minerals extracted in amounts that would have no market influence or no demand for mineral resources for other projects; and
- Mineral sterilisation; Mineral resource not identified in mineral safeguarding plans.

13.7.1.9 The magnitude of effects will examine the following criteria:

- Waste generated by the project by estimating the likely types and quantities;
- Consideration of what materials, including waste, that could be recovered for reuse, the proportion of secondary or recycled aggregate that would be used for construction of the project;
- A comparison between the likely recovery rate of materials and proportion of recycled and secondary aggregate to the relevant national targets;
- Importation of earthworks materials, including the site won / recovered materials; and
- Mineral sterilisation via establishing whether any identified mineral safeguarding sites will be sterilised and what the impact to the minerals extracted for sale on the market would be.

High magnitude

13.7.1.10 An effect will be classified as having a high magnitude of change if:

- The waste generated by the project is predominantly hazardous material/ waste;
- 75-100 per cent of earthworks materials required to construct the project are imported with / or the majority of material sent for placement offsite;
- Minerals extracted in quantities that negatively affect local mineral plans, relative to baseline market conditions; and
- Greater than 5 per cent of Surrey’s safeguarded mineral resources sterilised.

Moderate magnitude

13.7.1.11 An effect will be classified as having a moderate magnitude of change if:

- Waste generated by the project is predominantly non-hazardous material;
- 50-75 per cent of earthworks materials required to construct the project are imported, and / or with approximately half to a quarter of the material sent for placement offsite;
- Minerals extracted in moderate quantities, relative to baseline market conditions; and
- <5 per cent of Surrey’s safeguarded mineral resources sterilised.

Low magnitude

13.7.1.12 An effect will be classified as having a low magnitude of change if:

- Waste generated by the project is predominately inert waste;
- 10-50 per cent of earthworks materials required to construct the project are imported, or with 10-20 per cent of material sent offsite for disposal;
- Minerals extracted in low or minor quantities relative to baseline market conditions; and
- <3 per cent of Surrey’s safeguarded mineral resources sterilised.

Negligible magnitude

13.7.1.13 An effect will be classified as having a negligible magnitude of change if:

- Negligible amounts (<50 tonnes of inert or non-hazardous material, <5 tonne hazardous material/ waste) of a waste stream generated by the project;
- <10 per cent of earthworks materials required to construct the project are imported and no or negligible amounts of material disposed of offsite;
- Minerals extracted in negligible quantities (<10,000 tonnes) relative to baseline market conditions; and
- <1 per cent of Surrey’s safeguarded mineral resources sterilised.

13.7.1.14 The assessment of environmental effects will use the criteria as shown in the matrix in Table 13-3 below. After establishing the sensitivity of the receptor using criteria and assessing the magnitude of change using the criteria (outlined below), the effect to the receptor can be determined as either significant (major or moderate effects) or not significant (minor or negligible effects) for consistency with other technical Chapters in the ES.

Table 13-3: Significance of effect matrix.

	High Sensitivity	Moderate Sensitivity	Low Sensitivity
High Magnitude	Major (Significant)	Major (Significant)	Moderate (Significant)
Moderate Magnitude	Major (Significant)	Moderate (Significant)	Minor
Low Magnitude	Moderate (Significant)	Minor	Negligible
Very Low Magnitude	Minor	Negligible	Negligible
No Change	None	None	None

13.7.1.15 Definitions of the significant effects as in Table 13-3 above with regards to materials and waste are defined as:

13.7.1.16 A major (significant) significance is defined as where:

- Hazardous material/ waste generated by the project is designated for placement off site or sent for energy recovery and non-hazardous material sent to landfill;
- 75-100 per cent of earthworks materials imported to construct the project where suitable materials exist within the project, and / or suitable materials exist within the project but require significant processing and / or 50-75 per cent of earthworks materials imported to construct the project where suitable materials exist within the project;
- Mineral extraction in moderate or large quantities sold with ease / difficulty due to market; and

- >3 per cent of Surrey's mineral sterilised for which the minerals are of national importance and where >5 per cent of Surrey's mineral sterilised for which the minerals are of regional importance.

13.7.1.17 A moderate (significant) significance is defined as where:

- Hazardous material/ waste generated by the project is recycled, re-used or recovered outside of the project and / or non-hazardous material sent for energy recovery and / or inert waste sent to landfill;
- 10-50 per cent of earthworks materials imported to construct the project where suitable materials exist within the project, and / or 50-75 per cent of earthworks materials imported to construct the project where suitable materials exist within the project but require significant processing and / or 75-100 per cent of earthworks materials imported to construct the project where there are limited quantities of suitable materials within the project;
- Mineral extraction in moderate quantities sold to a stable mineral market, or where there is a moderate demand for the mineral resource and / or mineral extraction in large quantities sold to a mineral market where there is some available capacity, or where there is low demand for the mineral resource and / or low quantities of mineral resources sold to an oversaturated mineral market or where there is a high demand for the mineral resource; and
- 3-5 per cent of Surrey's mineral sterilised for which the minerals are of regional importance and / or 1-3 per cent of Surrey's mineral sterilised for which the minerals are of national importance and / or >5 per cent of Surrey's mineral sterilised for which the minerals are of local importance.

13.7.1.18 A low significance is defined as where:

- Non-hazardous material generated by the project is recycled, re-used or recovered outside of the project and / or inert waste generated by the project is sent for energy recovery. Hazardous material/ waste is generated by the project, but in small quantities;
- 50-75 per cent of earthworks materials imported to construct the project where there are limited amounts of suitable materials within the project and / or 10-50 per cent of earthworks materials imported to

construct the project where suitable materials exist within the project but require significant processing and / or <10 per cent of earthworks materials imported to construct the project where there are suitable materials within the project;

- Mineral extraction in negligible quantities sold to an oversaturated mineral market or where there is a high demand for the mineral resource and / or mineral extraction in moderate quantities sold to a mineral market where there is some available capacity, or where there is a low demand for the mineral resource and / or low quantities of mineral resources sold to a stable mineral market or where there is a moderate demand for the mineral resource; and
- 3-5 per cent of Surrey’s mineral sterilised for which the minerals are of local importance, and / or 1-3 per cent of Surrey’s mineral sterilised for which the minerals are of regional importance, and /or <1 per cent of Surrey’s mineral sterilised for which the minerals are of national importance and / or >5 per cent of Surrey’s mineral sterilised for which the minerals are not identified within mineral safeguarding plans.

13.7.1.19 A negligible significance is defined as where:

- Non-hazardous material generated by the project re-used or recovered within the project and inert waste generated by the project recycled or re-used within or outside of the project and / no hazardous material/ waste generated by the project;
- Up to 50 per cent of earthworks materials imported to construct the project where there are limited quantities of suitable materials within the project;
- Minerals extracted in low quantities for which there is a stable market or moderate demand for the mineral resource and / or, minerals extracted in low or negligible quantities for which they will have no market influence or there is no demand for the mineral resource; and
- <3 per cent of Surrey’s minerals of regional, local or minerals not listed within mineral safeguarding plans are sterilised due to the presence of the project and / or, 1-3 per cent of Surrey’s minerals of local importance are sterilised due to the presence of the project and / or <1 per cent of Surrey’s mineral sterilised for which the minerals are of regional importance.

13.7.2 Assessment of Effects

13.7.2.1 When assessing the effects on materials and waste, the following factors need to be considered:

- Waste producers have a legal duty of care to manage their waste in accordance with current regulations and to ensure that any waste leaving the site of production is transferred to a suitably licensed facility for further treatment, or disposal;
- All facilities transferring, treating or disposing of waste must be licensed or have an exemption from a licence. Effects arising from the operation of waste management facilities are considered elsewhere as part of the DCO and permitting process for such facilities; and
- Surrey County Council as the MWPA (as part of their planning function) are required to ensure that sufficient land is available to accommodate facilities for the treatment of all waste arising in the area, either within the Waste Planning Authorities area, or through export to suitable facilities in other areas. Similarly, the MWPA is required to ensure an adequate supply of minerals, sufficient to meet the needs of policies, and local development needs.

13.7.2.2 The receptors for this assessment are:

- Existing, and proposed future MSAs within the study area;
- Historic landfill sites within the study area;
- Materials used for the construction of the project, predominantly assumed to be site won or reprocessed material where possible;
- Landfill capacities within the study area;
- Landfill restoration requirements; and
- Waste management infrastructure within the study area.

13.7.2.3 Potentially significant effects on waste management infrastructure from waste arising during construction of the project, consider landfill capacity specifically and not all waste management infrastructure capacities for the following reasons:

- Disposal to landfill is a permanent affect and available landfill capacities are depleting in the UK (landfilling is largely irreversible).

13.7.3 Construction Effects

13.7.3.1 Assessment of effects (with primary and tertiary mitigation assumed to be in place) will be presented initially. Any further (secondary) mitigation that may be required to address any remaining significant adverse effects will be identified and residual effects assessed with such additional secondary mitigation in place as a second stage of the assessment. The assessment will consider the types and quantities of solid waste that will be generated during construction of the project, and the significance of the likely environmental effects that may arise with the management of waste, such as for re-use for planned landscaping within the areas of new green open space or HCAs and/or disposal, or waste generation itself. Furthermore, consideration will be given to how this aligns with local planning policies in the assessment.

13.7.3.2 The waste management routes generated during construction will be identified and the effects of these routes for the different types of waste will be assessed in accordance with the criteria above.

13.7.3.3 The assessment of the use of materials will be undertaken for the construction of the project. The assessment will determine the effects associated with importing materials for the construction of the project. The avoidance of using imported natural materials for the construction of the project, by reusing or recovering site-won materials from within the project boundary for EIA Scoping will also be assessed. This will be assessed quantitatively in accordance with the significance criteria above.

13.7.4 Operational Effects

13.7.4.1 Operational effects from the project will be assessed using the same criteria as construction effects as described above.

13.7.4.2 An assessment of the minerals that have been sterilised by the project will be undertaken. Where the project sterilises mineral resources and will not allow future extraction due to the presence of the project, this will be assessed quantitatively in accordance with the significance criteria outlined above.

13.7.4.3 The assessment will identify and quantify the type of wastes likely to be generated during the operational phases, such as maintenance required within the project. The likely disposal routes for these routine operational wastes will be identified and the potential effects of this is assessed quantitatively. Specifically, the assessment will also consider the effects from the generation of waste from any potentially significant sediment removal arising from the operation of the project.

13.7.5 Cumulative Effects

13.7.5.1 Consideration of other projects is required to identify where and what type of local waste infrastructure will be used as well as the quantities and type of waste likely to be generated. The project will also utilise the CL: AIRE Register of Materials system to provide a source of materials for development usages as a donor, or hub site. This is generally reserved nominally for inert materials. Any inert material not used in the project would be made available for mineral site restoration in accordance with the correct permitting route.

13.7.5.2 The approach for the assessment of potential for cumulative effects to arise from the identified effects of the RTS combined with other consented (or reasonably likely to be consented) projects is provided in Chapter 19: Cumulative Effects Assessment.

13.8 Assumptions and Limitations

13.8.1.1 The material assets and waste assessment will be undertaken based on information available at the time of the assessment. It is anticipated that some of the information required may not be known or may change during the EIA. Any assumptions and limitations will be reported in the ES.

13.8.1.2 This chapter has assumed that all third-party data used to generate the baseline is fit for purpose and accurately reflects the current status of the material assets and waste in the study area.

13.8.1.3 Waste arisings from extraction, processing and manufacture of construction components and products will be scoped out of the assessment. It is assumed that these products and materials are produced on sites with their own waste management plans, facilities and supply chains which are likely to be in different regions of the UK, or the world, and therefore outside the geographical scope of the assessment.

13.8.1.4 The information and level of detail on minerals and MSA locations varies across the study area depending on which LPA the MSAs fall under.

13.8.1.5 This scoping assessment has been based on the following assumptions:

- That all MSAs are listed in the local authorities Minerals Plans.

13.8.1.6 The majority of excavated material (other than inert material), will be recovered and processed for re-use on-site, with some material that is not geotechnically or geochemically suitable for project use and hazardous material/ waste which will require offsite disposal.

13.8.1.7 The available minerals information will be reviewed as part of undertaking the EIA.

13.8.1.8 The volume of excavated materials and waste may change during detailed design as the design is optimised or as minor changes to working methods are identified. Furthermore, the ongoing process of iterative design may further reduce the volumes of excavated materials and waste in accordance with the principals of the waste hierarchy (prevention, reuse, recycling, other recovery and disposal).

13.8.1.9 Further GI work is being undertaken in some areas of the project to establish a full baseline. This includes areas where excavation will take place to provide Waste Acceptance Criteria (WAC) information to satisfy pre-application information requirements following discussions with the Environment Agency’s National Permitting Service. Further targeted GI will be undertaken, for example during enabling works, to inform potential waste classification and impact assessments regarding waste generation as a result of the project.

14 Noise and Vibration

14.1 Introduction

14.1.1.1 This chapter of the EIA Scoping Report describes the scope of the assessment in relation to potential effects from noise and vibration. It outlines the baseline noise and vibration environment, the likely effects of the project during both construction and operation and the mitigation measures proposed to alleviate these. It also outlines the methodology that will be used for the assessment of effects related to noise and vibration in the PEIR/ES.

14.1.1.2 The noise and vibration impacts have the potential to lead to effects on local receptors including residential receptors (dwellings) and non-residential receptors such as schools, hospitals, hotels and offices etc.

14.1.1.3 This chapter draws upon desk-based data, site visits, information received from LPAs and noise surveys undertaken in 2019 and 2020. The ES will also consider the results of further noise surveys planned in future.

14.1.1.4 Aspects of this chapter have overlaps with other Chapters of the Scoping Report, including:

- Adverse disturbance to designated site interest features (e.g. birds) and other terrestrial and aquatic protected species from noise and vibration – see Chapter 7: Biodiversity and Appendix N (Habitats Regulations Screening Assessment); and
- Potential effects of noise and vibration on the health of local populations – see Chapter 11 – Health.

14.1.1.5 A summary of the key legislation, policy and guidance relevant to noise and vibration is provided in Appendix M.

14.2 Baseline Methodology

14.2.1 Information Sources

14.2.1.1 Ordnance survey (OS) address point data, site visits and feedback from local authorities have been used to determine the location of noise sensitive receptors.

14.2.1.2 Noise Surveys are used to attain baseline noise levels at sensitive locations around the RTS. Some of these were completed in 2019 and 2020 with additional surveys planned to inform the ES.

14.2.1.3 Publicly available Defra noise contours will be used to attain baseline levels of road, rail and aircraft noise where surveys are not possible (for example due to access restrictions).

Noise survey measurements

14.2.1.4 Noise surveys are undertaken at locations chosen to represent the noise climate at groups of identified residential and non-residential noise sensitive receptors which look to have a similar noise environment based on the location of local transport and other existing noise sources.

14.2.1.5 Noise survey measurements are either short-term daytime attended measurements or longer-term unattended measurements covering day and night as follows:

- The short-term attended measurements cover 3 hours duration between 10am and 5pm but may include shorter (e.g. 15 minute) samples within each hour if this is considered suitably representative of the full one-hour period; and
- The long-term unattended measurements cover up to seven days duration with continuous 15 minute measurement periods.

14.2.1.6 All measurements are completed according to BS7445-2: 1991 'Description and measurement of Environmental Noise' and are undertaken using calibrated sound level meters located 1.5m above local ground at a location representative of the sound environment at the relevant group of receptors. All measurements include measurement of local meteorological conditions as well as the following noise level metrics:

- The equivalent continuous noise level $L_{Aeq,T}$, this is the ambient noise level;
- The maximum noise level L_{AFmax}, this is the maximum noise level of short events such as trains passing by; and
- The background noise level L_{A90}.

14.2.1.7 In 2019, noise surveys at 57 locations were planned. Some of the surveys commissioned in 2019 were not completed due to the likelihood of getting unrepresentative data. This was because the Covid 19 pandemic caused atypical noise levels, as a result of national lockdown measures and reduced activity from March 2020 onwards.

14.2.1.8 Of the 57 locations, 20 are no longer required due to scheme design changes. Of the remaining 37 locations, 24 attended measurements and 3 unattended measurements were completed, so 10 locations remained un-surveyed.

14.2.1.9 In addition, 23 further new measurement locations are proposed to cover the area within the project boundary for EIA scoping. This gives 33 further locations to survey in total.

14.2.1.10 Locations of proposed noise measurement positions are identified in Figure 14-1 (Appendix A). Results of the previous measurements completed in 2019 and 2020 are included in a separate noise survey report (GBV, 2020f). Results of the surveys in 2019 and 2020 supplemented by the additional surveys will be used to define the baseline at sensitive receptors. Verification measurements may be completed in areas where there are potential for any changes since 2019/2020. Discussion with EHOs or any changes to the project design may lead to minor alterations to the location or number of measurement locations.

14.2.2 Stakeholder Engagement

Feedback received from consultation on EIA Scoping and Draft Assessment Methodologies

14.2.2.1 The following is a summary of feedback given in the EIA Scoping Opinion report from LPAs (Surrey County Council, RBWM, EBC, RBC, SBC, LBRUT and RBKUT, received September 2017):

- Surrey County Council’s landscape architect noted that where significant adverse effects are identified, the ES should identify a comprehensive package of mitigation. This should highlight any overlaps between topics such as landscape and ecology and any other mitigation required such as noise and visual attenuation, soil movement, lighting, access, drainage and phasing. It was noted that alternative ways of working and different types of cumulative effects should be considered, and at different stages of the project’s life cycle; and

- RBC's EHO provided feedback related to undertaking sheet piling close to areas of residential housing. It was requested that full details of the methodology for piling operations which will be adopted when operating close to residential dwellings are provided.

14.2.2.2 In relation to the above points, mitigation and details of likely construction methodologies (including proximity to receptors) will be detailed in the ES.

14.2.2.3 In the EIA Scoping Opinions LPAs and Surrey County Council (in their capacity as a regulator) recommended that the ES provides information in respect of baseline noise surveys, construction noise and vibration effects (particular attention should be directed to the effects of the proposed piling works on the amenity of nearby residential dwellings). It also noted that information should be provided with regards to operational noise effects from maintenance and use of the flood alleviation channels as well as from road traffic noise during construction and operation. The methodology presented within this EIA Scoping Report is consistent with these recommendations.

14.2.2.4 Informal comments on the draft EIA Methodologies from the Surrey County Council Principal EIA Officer (in their capacity as a regulator) were received in October 2019 and are summarised as follows:

- It was not clear whether noise and vibration effects would be addressed to an equivalent degree for every component of the proposed scheme; and
- Several Surrey County Council policies and guidance were not referenced.

14.2.2.5 In relation to the above points, all elements of the project will be assessed in the same manner and cumulative noise and vibration effects will be presented where construction activities overlap in close proximity. Furthermore, a summary of relevant guidance is provided in Appendix M.

Feedback received from pre-application consultation under the Town and Country Planning Act

14.2.2.6 Pre-application responses received from LPAs in 2019 have generally referred to the relevant local policies and guidance related to noise which are listed in Appendix M.

14.2.2.7 The LBRUT pre-application response also noted that the site is in close proximity to residential dwellings including the Lock Keepers House, residential moorings and flats and that there is concern regarding noise impact on these residents. Early engagement with the residents was recommended.

Other topic specific engagement

14.2.2.8 Correspondence with EHOs at SBC, RBC, EBC and RBWM was undertaken in 2019.The EHOs were contacted to obtain their feedback on the assessment methodology, noise survey locations and noise sensitive receptors.

14.2.2.9 The EHO from SBC raised that the duration of impacts during construction should be considered and a CEMP would be expected to set out appropriate mitigation measures. A CEMP will be produced for the RTS.

14.2.2.10 There were also specific observations related to the noise sensitive receptors and monitoring locations including:

- Identification of a nursery on Wheatsheaf Lane, Staines (Playtime Nursery);
- inclusion of additional measurement locations around Chertsey Bridge Road to cover the residential dwellings and an established traveller site; and
- inclusion of additional monitoring to cover the area around Milton Drive, Ashurst Drive, Laleham Road and Cranwell Grove which is residential.

14.2.2.11 The above comments have informed the selection of baseline noise measurement locations (see Figure 14-1 in Appendix A).

14.2.2.12 The EHO from RBC raised the potential for noise impacts from the weirs, which will be accounted for in the assessment of operational noise, and the use of Section 61 applications for construction noise.

14.2.2.13 The EHO from EBC gave background information on the noise environment in the area and queried the 300m study area distance that was proposed for the RTS. Further engagement was undertaken to address and resolve these queries.

14.2.2.14 The EHO from RBWM found the baseline survey methodology and the proposed measurement locations to be acceptable but commented on the suitability of one location which is no longer relevant to the updated scheme.

14.2.2.15 Further correspondence with the EHOs will occur prior to the completion of baseline surveys to obtain further feedback following changes to the project (e.g. removal of the channel section in Berkshire and the addition of new sites associated with potential HCAs).

14.2.3 Study Area

14.2.3.1 For the purposes of this topic, the study area for assessment of direct noise impacts includes noise sensitive receptors within 300m of construction or operation activities associated with the project and is shown on Figure 14-1 in Appendix A. The study area shown is approximate and may be expanded in areas where construction noise levels are predicted to exceed the thresholds for significant effects defined in Table 14-2 below.

14.2.3.2 For the assessment of indirect effects associated with changes in road traffic noise, the study area will include noise sensitive receptors that are adjacent to roads that are likely to experience a 1dB (decibel) change as a result of the project, such as construction traffic routes.

14.3 Baseline

14.3.1 Existing Baseline

Noise and vibration sensitive receptors

14.3.1.1 Noise and vibration sensitive receptors along the RTS are considered to be either:

- Residential receptors (dwellings); or

- Non-residential receptors including (not an exhaustive list):
  - Educational receptors (e.g. nurseries, schools, universities);
  - Hospitals and other health care facilities;
  - Hotels;
  - Places of meeting for religious worship;
  - Offices; and
  - Community halls.

14.3.1.2 Where identified, particularly sensitive equipment or infrastructure (e.g. utilities) will also be considered as a non-residential vibration sensitive receptor.

14.3.1.3 Figure 14-1 in Appendix A shows the locations of currently identified noise sensitive receptors within the noise study area for EIA scoping for the assessment of direct noise impacts from the RTS.

Existing noise and vibration baseline

14.3.1.4 The noise climate within the study area for EIA scoping is characterised by road noise from the surrounding major roads and railways and air traffic (primarily associated with Heathrow Airport) when present.

14.3.1.5 A summary of the main noise sources likely to be present at the various locations along the RTS is described below based on desktop analysis, previous noise surveys and information gathered from consultation. This is not intended to be exhaustive and when noise surveys are undertaken further detail will be presented in the ES.

14.3.1.6 Near the upstream extent of the Runnymede Channel (and new green open spaces and HCAs), receptors are likely to be exposed to road traffic noise from Chertsey Lane and the M25 as well as other local roads and intermittent noise from aircraft.

14.3.1.7 Towards the downstream extent of the Runnymede Channel, receptors are likely to be exposed to road traffic noise from the A320 Staines Road and the M3 as well as other local roads and intermittent noise from aircraft.

14.3.1.8 Near the Spelthorne Channel (and new green open spaces and HCAs), receptors are likely to be exposed to noise from the M3 as well as Chertsey Road and Laleham Road as well as other local roads and intermittent noise from aircraft.

14.3.1.9 Desborough Island and surrounding areas are likely to be fairly quiet and with low traffic noise.

14.3.1.10 The area around Walton Bridge is likely to be exposed to road noise from the A244 and other local roads.

14.3.1.11 The area around Sunbury Weir is likely to be fairly quiet and with traffic noise from Fordbridge Road and Thames Street.

14.3.1.12 The receptors near Molesey Weir are likely to be exposed to noise from the A308 Hampton Court Road, the A3050 Hurst Road as well as other local roads and river traffic.

14.3.1.13 In the area around Teddington Weir and Broom Road Recreation Ground, receptors are likely to be exposed to road traffic noise from Manor Road and Kingston Road as well as other local roads and river traffic.

14.3.1.14 Near Land South of Wraysbury Reservoir HCA, receptors are likely to be exposed to road traffic noise from the M25 and Coppermill Road, railway noise from the Staines to Windsor line and aircraft noise from Heathrow Airport.

14.3.1.15 The area near Drinkwater Pit HCA is likely to be exposed to noise from the M3 and the Waterloo to Reading railway line.

14.3.1.16 Receptors surrounding Grove Farm HCA are likely to be exposed to noise from the South West Mainline railway as well as local road traffic.

14.3.1.17 The vibration assessment methodology is based on assessing impacts due to exceedance of fixed thresholds. The vibration baseline is therefore assumed to be negligible at receptors. There may be noticeable vibration at some receptors close to railway lines or roads; in these cases the assumption is worst-case.

14.3.2 Future Baseline

14.3.2.1 There is assumed to be no change in noise levels between the existing baseline years and future baseline years for construction phase and operational phase assessments. Conditions may change prior to construction but it is expected that an assessment against the conditions measured during the baseline surveys will provide a reasonable worst-case estimate prior to construction starting (enabling works currently programmed for 2026) and the opening year. This is considered worst-case as noise levels are likely to increase marginally over time with increases in road traffic and transport noise as well as noise from other potential developments. Where traffic data or committed development data appear to show the potential for this not to be worst-case, corrections may be applied to noise levels as appropriate.

14.3.3 Key Environmental Considerations and Opportunities

14.3.3.1 The key environmental considerations for noise and vibration are nearby noise sensitive residential and non-residential receptors which will require mitigation to be adopted to minimise noise and vibration impacts during construction and operation of the project.

14.4 Likely Significant Effects Requiring Assessment

14.4.1 Construction Effects

14.4.1.1 Project activities and associated likely significant effects are identified below:

- Sheet piling along sections of the flood channel has the potential to lead to temporary adverse effects from noise and vibration causing a disturbance to residential and non-residential receptors near construction areas;
- Potential adverse effects of noise and vibration associated with the transportation of material / waste, and placement / processing of non-hazardous material at end destination;
- General on-site construction activities including, excavation and building activities and movement of vehicles, equipment, and site operatives. These have the potential to lead to temporary adverse effects from noise and vibration causing a disturbance to residential and non-residential receptors near construction areas; and
- Construction traffic on and off site, including traffic associated with the use and placement of excavated material and non-hazardous material, has the potential to lead to temporary adverse effects from noise and vibration. This could cause disturbance to residential and non-residential receptors adjacent to the roads used.

14.4.2 Operational Effects

14.4.2.1 Project activities and associated likely significant effects are identified below:

- There is a potential for adverse effects on residential and non-residential receptors from noise during maintenance activities, use of the flood alleviation channels and associated facilities.
- Changes in areas of public access have the potential to have a beneficial and / or adverse effect on traffic movements on roads. As a result of this, there is potential for beneficial and/or adverse effects from traffic noise at residential and non-residential receptors.

14.5 Effects Not Requiring Assessment

14.5.1 Construction Effects

14.5.1.1 Project activities and associated effects that are deemed not likely to be significant and are therefore proposed to be scoped out of the EIA in relation to noise and vibration are identified below:

- Any temporary noise or vibration effects associated with the transportation of hazardous waste from the major road network and placement at licensed locations are deemed not likely to be significant and have therefore been scoped out of the EIA as any noise at these sites is assumed to be within limits set by their existing licences.

14.5.1.2 Otherwise, there are no project construction activities and associated noise and vibration effects that can be scoped out of the EIA at this stage.

14.5.2 Operational Effects

14.5.2.1 Project activities and associated effects that are deemed not likely to be significant and are therefore proposed to be scoped out of the EIA in relation to noise and vibration are identified below:

- Activities associated with the provision of the new green open spaces and other landscape works have the potential for adverse noise effects on residential and non-residential receptors. These activities are scoped out as it is assumed that the design will be respectful of surrounding receptors and considered against their appropriateness within the countryside (for example, events with amplified music are not anticipated). It is not expected that noise from these activities will lead to a significant effect; and

- General maintenance activities could result in noise disturbance from increased traffic and plant on local roads and within the project boundary as well as disturbance from routine activities such as vegetation management. However, it is anticipated that the effect will not be significant because maintenance activities will follow standard good practice procedures, are likely to be infrequent and low impact, resulting in minimal effects on background noise levels.

14.6 Approach to Mitigation

14.6.1.1 This section should be read in conjunction with Chapter 5: Approach to EIA Scoping which sets out further definition for the project regarding primary (embedded) mitigation, secondary (additional) mitigation and tertiary (best practice) mitigation.

14.6.2 Construction

14.6.2.1 Secondary mitigation measures that are under consideration for the construction phase are identified below:

- Where despite the implementation of best practicable means (tertiary mitigation), the noise levels are likely to exceed criteria defined in the noise and vibration management plan, noise insulation or other mitigation may be required.

14.6.3 Operation

14.6.3.1 Secondary mitigation measures that are under consideration for the operation phase are identified below:

- To mitigate noise from activities in new green open spaces and other landscape works there may be consideration of reduction of noise of the activity at source through restrictions to the timing of operation; restrictions to the activity itself (including noise management such as setting noise limits) or the introduction of screening in the form of barriers;

- To mitigate noise from maintenance activities, there may be consideration of changes to the activity method including timings, use of quieter mechanical plant or screening in the form of barriers; and
- To mitigate the potential adverse effects of operational road traffic, traffic management and control may need to be developed and reviewed.

14.7 Assessment Methodology

14.7.1 Significance criteria

14.7.1.1 A noise or vibration impact is a change in the acoustic environment. This may be through the introduction of a new noise or vibration source or a change to an existing source causing change to the noise or vibration climate at existing receptors or the introduction of a new noise or vibration sensitive development.

14.7.1.2 The magnitude of the noise or vibration impact can depend on the absolute noise or vibration level, change in noise or vibration level, duration of exposure and the time of day of exposure.

14.7.1.3 Noise or vibration impacts can lead to effects on receptors, such as annoyance or sleep disturbance for residential receptors or disturbance to non-residential receptors.

14.7.1.4 The significance of noise or vibration effects can vary depending on the type of receptor, such as residential, commercial or educational, and its associated sensitivity.

14.7.1.5 In accordance with the Noise Policy Statement for England (NPSE), a Significant Observed Adverse Effect Level (SOAEL) and a Lowest Observed Adverse Effect Level (LOAEL) has been set for each type of noise or vibration for residential receptors to be assessed. In addition, an unacceptable adverse effect level has been set following guidance given in the PPG. For non-residential receptors, further specific effect threshold levels have been set where required. Section 14.7.3 sets these out for Construction noise effects and Section 14.7.4 for operational effects. These levels have been set based on the relevant policy, standards and guidance listed in Appendix M.

14.7.1.6 Table 14-1 below lists how the magnitude of change and therefore the potential significance of the adverse effect relates to the exceedance of the adverse effect levels.

Table 14-1: Potential Significance of Adverse Effect Related to National Noise Policy (NPSE).

Magnitude of Change	Potential Significance of Effect	Adverse noise or vibration effect related to NPSE effect level (for residential receptors)	Action to be taken (from PPG)
High	Major adverse (Significant)	Adverse noise or vibration effect exceeding an unacceptable adverse effect level	Prevent
Moderate	Moderate adverse (Significant)	Adverse noise or vibration effect exceeding SOAEL	Avoid
Low	Minor adverse	Adverse noise or vibration effect exceeding LOAEL, but below SOAEL	Mitigate and reduce to a minimum
Very Low	Negligible	Noise or vibration effect exceeding No Observed Effect Level (NOEL) but below LOAEL	No specific measures
None	None	No change from baseline	No measures required

14.7.1.7 To determine the significance of effect, in addition to the comparison to the adverse effect levels given in the table above, other project related factors will be considered including the duration and character of the effect.

14.7.1.8 All construction phase noise and vibration effects will be temporary and operational effects will be permanent.

14.7.1.9 For locations recognised and valued for their tranquillity, consideration of the potential significant effects will include comparison of the nature and character of the baseline noise climate in the area with the likely acoustic characteristics of the predicted noise from the RTS. For example, in these locations, which may be devoid of or subject to low levels of human-made noise, the noise from the project may be rated as a significant effect if it is likely to include sounds that are out of context with the baseline noise climate.

14.7.2 Assessment of Effects

14.7.2.1 Assessment of effects (with primary and tertiary mitigation assumed to be in place) will be presented initially. Any further (secondary) mitigation that may be required to address any remaining significant adverse effects will be identified and residual effects assessed with such additional secondary mitigation in place as a second stage of the assessment.

14.7.3 Construction Effects

Noise from On-Site Construction

14.7.3.1 Construction noise effects will be assessed through comparison of predicted noise levels with the assessment threshold levels set out below.

Noise Level Predictions

14.7.3.2 To quantify potential construction noise effects, typical worst-case construction activity noise levels, $L_{Aeq,T}$, from the assumed construction activities will be predicted in accordance with methods in BS5228 Part 1 at a point one metre from the façade of the relevant receptor. Calculations will be based on anticipated construction methods and the mechanical plant likely to be used and will consider the cumulative noise level from all activities which are likely to occur concurrently based on the programme information. The predictions will include corrections for façade reflections, angle of view, any appropriate screening and likely percentage on times for the construction plant.

Residential Receptors Assessment Thresholds

14.7.3.3 The SOAEL for residential receptors can vary depending on the existing ambient noise environment characterised by the existing ambient noise level as well as other factors such as the type of noise sources present.

14.7.3.4 The SOAEL has the threshold value given in Table 14-2 below. These criteria are based on the “ABC method” criteria in BS5228: Part 1; this method categorises the location into A, B or C categories based on the baseline noise level and the threshold value varies dependant on the category. The LOAEL is set as the ambient noise level. The unacceptable adverse effect level is set as 10 dB (decibels above the SOAEL threshold value.

Table 14-2: Thresholds of potential significant effect (SOAEL) at dwellings.

Assessment category and threshold value period	Threshold Value, in decibels (dB) ($L_{Aeq,T}$)		
	Category A A)	Category B B)	Category C C)
Night time (23:00 – 07:00)	45	50	55
Evening and Weekends D)	55	60	65
Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)	65	70	75

Explanatory notes for Table 14-2

NOTE 1 A potential significant effect is indicated if the $L_{Aeq,T}$ noise level arising from the site exceeds the threshold level for the category appropriate to the ambient noise level.

NOTE 2 If the ambient noise level exceeds the Category C threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a potential significant effect is indicated if the total $L_{Aeq,T}$ noise level for the period increases by more than 3 dB due to site noise

NOTE 3 Applied to residential receptors only.

NOTE 4 The acoustic character of the area will be considered along with the ambient noise level when assigning a category.

A) Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values.

B) Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as Category A values.

C) Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than Category A values.

D) 19.00–23.00 weekdays, 13.00–23.00 Saturdays and 07.00–23.00 Sundays.

Non-Residential Receptors Assessment Thresholds

14.7.3.5 For all non-residential receptors, noise levels generated by site activities will be deemed to be significant if the total noise (pre-construction ambient plus site noise) exceeds the pre-construction ambient noise by 5 dB or more, subject to lower cut-off values of 65 dB, 55 dB and 45 dB $L_{Aeq,T}$ from site noise alone, for the daytime, evening and night-time periods, respectively; and a duration of one month or more, unless works of a shorter duration are likely to result in a significant effect. Other factors such as the use and construction of the receptor building will be considered when determining if a significant effect is likely

Vibration From On-Site Construction

14.7.3.6 The effect of vibration from on-site construction will be assessed from works associated with the RTS which have the potential to lead to significant levels of vibration at receptors.

14.7.3.7 Typical vibration levels will be predicted using information and methods from BS5228: Part 2 for these activities at the closest receptors to the works.

14.7.3.8 Predicted vibration levels will be compared to the example vibration criteria contained within BS5228 Part 2 to assess the effect of perceptible vibration on people (residential and non-residential) and BS7385 Part 2 to assess the effect of vibration on buildings. For non-residential receptors, other factors such as the use and construction of the receptor building will be considered when determining if a significant effect is likely.

14.7.3.9

14.7.3.10 Table **14-3** below is reproduced from BS5228 Part 2. The vibration levels are in terms of Peak Particle Velocity (PPV) at the receptor. The 0.3mm/s level is considered to be the LOAEL and the 1mm/s level to be the SOAEL with 10mm/s as the unacceptable adverse effect level.

Table 14-3: Guidance on effects of vibration levels (from BS5228 Part 2).

Vibration Level (Peak Particle Velocity)	Effect
0.14 mm/s	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
0.3 mm/s	Vibration might just be perceptible in residential environments.
1.0 mm/s	It is likely that vibration of this level in residential environments will cause complaint but can be tolerated if prior warning and explanation has been given to residents.
10 mm/s	Vibration is likely to be intolerable for any more than a very brief exposure to this level in most building environments.

14.7.3.11 Table 14.4 overleaf is reproduced from BS7385 Part 2 The levels given represent guide values for the onset of cosmetic damage in buildings.

Table 14-4: Table from BS7385 Part 2 – Transient vibration guide values for cosmetic damage.

Type of Building	Peak component particle velocity in frequency range of predominant pulse	
	4 Hz to 15 Hz	15 Hz and above
Reinforced or framed structures, industrial and heavy commercial buildings.	50mm/s at 4 Hz and above.	50mm/s at 4 Hz and above.
Unreinforced or light framed structures, residential or light commercial type buildings.	15mm/s at 4 Hz increasing to 20mm/s at 15 Hz.	20mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above.

Explanatory notes for Table 14-4

Note 1: Values referred to are at the base of the building

Note 2: For unreinforced buildings, at frequencies below 4 Hz, a maximum displacement of 0.6mm (zero to peak) should not be exceeded.

14.7.3.12 Where particularly sensitive equipment or infrastructure (e.g. utilities) will be considered as a vibration sensitive receptor, bespoke criteria will be used specific to the requirements of the equipment or infrastructure.

Noise from Offsite Construction Traffic

14.7.3.13 The change in noise associated with increased construction traffic on the surrounding road network will be calculated in accordance with the Calculation for Road Traffic Noise. For roads with less than 1000 vehicles per 18 hours the methodology set out in the Noise Advisory Council measurement and prediction guide will be used.

14.7.3.14 The potential change in noise level as a result of offsite road traffic will be evaluated in accordance with the DMRB short-term traffic noise effect criteria provided in Table 14.5 below. The change will be calculated as the difference between the baseline 'do minimum' scenario and the construction phase year 'do something' scenario, both including growth and committed development traffic.

Table 14-5: DMRB Short-Term Traffic Noise Effect Criteria.

Noise Change, $L_{A10,18hr}$ dBA	Magnitude of change
5+	High
3 – 4.9	Moderate
1 – 2.9	Low
0.1 – 0.9	Very low
0	No Change

14.7.3.15 Using the scale as set out in the table above, the SOAEL is considered to be equivalent to a 3 dB change and the LOAEL a 1 dB change. The effect criteria apply to the total road traffic noise change at receptors.

Vibration from Offsite Construction Traffic

14.7.3.16 Heavy road traffic would only be expected to lead to potentially significant vibration levels if it is within 5 to 10m distance from the sensitive receptor and the roads are in poor condition. Proposed construction traffic routes and adjacent receptors will be reviewed to assess whether this is likely to occur. In general, road traffic is not expected to give rise to significant vibration effects due to the propagation distances required to maintain significant levels of vibration at the receptor. No further assessment of vibration from offsite construction traffic is therefore likely to be required.

14.7.4 Operational Effects

Noise effects from traffic movements during operation of the RTS.

14.7.4.1 Potential noise impact from traffic movements (including those associated with use of Public Open Spaces) will be evaluated in accordance with DMRB traffic noise effect criteria. The magnitude of change will be calculated as the difference between the future year ‘do minimum’ scenario and the future year ‘do something’ scenario (i.e. construction of the RTS project).

14.7.4.2 Short to medium-term effects from the project will be assessed against the short-term DMRB criteria given in Table 14-5 above.

14.7.4.3 Long-term effects of traffic noise will be assessed against the long-term DMRB criteria given in Table 14-6 below.

Table 14-6: DMRB Long-Term Traffic Noise Effect Criteria.

Noise Change, LA10,18hr dBA	Magnitude of change
10+	High
5 – 9.9	Moderate
3 – 4.9	Low
0.1 – 2.9	Very low
0	No Change

14.7.4.4 The SOAEL is considered to be equivalent to be a 3 dB change for short to medium-term effects and a 5dB change for long term effects; the LOAEL is a 1 dB and 3 dB change respectively. The effect criteria apply to the total road traffic noise change at receptors.

Noise from activities in new green open spaces, maintenance activities, use of the flood alleviation channels and associated facilities

14.7.4.5 An assessment of the effect on residential receptors from activities in new green open spaces, during maintenance activities, use of the flood alleviation channels and associated facilities will be carried out.

14.7.4.6 The assessment will be based on either a design target setting noise limits based on existing ambient baseline noise levels or quantitative predictions of the noise from these activities depending on the level of information available at the time of assessment, which is uncertain at this stage.

14.7.4.7 Typical noise limits will be set based on the noise effect criteria set out in Table 14.7 below or predicted noise levels will be compared to the assessment criteria. Any fixed mechanical plant associated with these activities will be assessed using methods from British Standard (BS) 4142: “Methods for rating industrial and commercial sound”.

14.7.4.8 The noise effect criteria are presented in Table 14.7 below are based on noise change compared to the existing ambient noise levels at receptors during the typical times that maintenance activities might occur. The noise effect criteria are based on IEMA and Institute of Acoustics guidelines which accounts for guidance from WHO ‘Guidelines for Community Noise 1999’.

Table 14-7: Noise Effect Criteria.

Noise Change, $L_{Aeq,T}$ dBA	Magnitude of Change
5+	High
3 – 4.9	Moderate
1 – 2.9	Low
0.1 – 0.9	Very low
0	No Change

14.7.4.9 The SOAEL would be equivalent to a 3 dB change and LOAEL a 1 dB change where the day time or night time $L_{Aeq,T}$ baseline exceeds 55 dB or 45 dB respectively, or simply these changes in level where the location is identified and valued for its tranquillity, or a 1 dB change would be SOAEL where the day time or night time $L_{Aeq,T}$ baseline exceeds 65 dB or 55 dB respectively.

14.7.5 Cumulative Effects

14.7.5.1 Cumulative effects arise, for instance, where developments have insignificant effects, but the interaction of developments together is likely to have a significant effect on a given receptor.

14.7.5.2 The cumulative effects of noise from the project alongside concurrent noise from the other schemes considered in the assessment of cumulative effects will be assessed according to the same criteria as given above. In most cases, quantitative information is not expected to be available for other schemes, so a qualitative assessment will be carried out in these cases.

14.8 Assumptions and Limitations

14.8.1.1 This section identifies the assumptions and limitations inherent to the noise and vibration assessment within this scheme for both construction and operational phases.

14.8.2 Construction Phase

Construction Noise

14.8.2.1 Predictions of construction noise will be based on the anticipated programme and construction methods.

14.8.2.2 The construction works are assumed to use best practicable means to minimise noise and vibration impact and be undertaken in standard core working hours the majority of the time. Where works are required to be undertaken out of hours (e.g. evenings, night time or weekends), this will be stated within the ES and assessed appropriately.

Construction Vibration

14.8.2.3 It is assumed that surface compaction has the potential to lead to significant levels of vibration at receptors.

Construction Road Traffic Noise

14.8.2.4 The assessment will be based on traffic data provided by the project's Transport Consultants.

14.8.3 Operation Phase

Operational Road Traffic

14.8.3.1 The assessment will be based on traffic data provided by the project's Transport Consultants.

14.8.3.2 The assessment of operational noise from activities in new green open spaces and during maintenance activities, use of the flood alleviation channels and associated facilities will be based on either a design target setting noise limits based on existing ambient baseline noise levels or quantitative predictions of the noise from these activities depending on the level of information available at the time of assessment, which is uncertain at this stage. Details of the proposed activities will be clarified further in the ES and the basis of the assessment will be made clear.

15 Socio-Economics

15.1 Introduction

15.1.1.1 This chapter of the EIA Scoping Report describes the scope of the assessment in relation to potential effects on socio-economics. It outlines the baseline conditions, the likely effects of the project during both construction and operation and the mitigation measures proposed to alleviate these. It also outlines the methodology that will be used for the assessment of effects related to socio-economics in the PEIR/ES.

15.1.1.2 The construction and operation of the RTS may have short or longer term economic and/or social impacts on local communities, businesses or services. The term ‘economic impacts’ covers issues such as employment and spending associated with the project. In the context of this chapter, ‘social impacts’ refer to the consequences on human populations of any project actions that relate to the ways in which people work, live, play and relate to one another.

15.1.1.3 The content of this chapter overlaps with the following other topics and utilises similar baseline information: Chapter 6: Air Quality, Chapter 10: Flood Risk, Chapter 11: Health, Chapter 12: Landscape and Visual Amenity, Chapter 13: Materials and Waste, Chapter 14: Noise and Vibration, Chapter 17: Traffic and Transport and Chapter 18: Water Environment.

15.1.1.4 In addition, a project-level Equality Impact Assessment (EqIA) is also proposed to be undertaken and will accompany the DCO application. The EqIA will focus on assessing the impacts on groups with protected characteristics defined in the Equality Act 2010. The EIA for socio-economics will share inputs such as demography, economic characteristics and social deprivation indicators with the EqIA.

15.1.1.5 An Economic Appraisal has been undertaken in accordance with relevant guidance to inform the Outline Business Case for the project and will inform the socio-economic impact assessment within the EIA. Details provided within the Economic Appraisal include the assessment of flood damages and benefits to residential and non-residential properties and a range of other receptors, including additional benefits provided by ecosystem services associated with the proposed channel.

15.1.1.6 A Natural Capital Assessment is being completed for the RTS to quantify the baseline ‘stock’ of natural resources and the ‘flow’ of benefits from these in order to inform the design of natural capital benefits within the project.

15.1.1.7 A summary of the key legislation, policy and guidance relevant to socio-economics is provided in Appendix M.

15.2 Baseline Methodology

15.2.1 Information Sources

15.2.1.1 A DBA has been undertaken using a range of data sources including borough level statistics on population, employment and recreation from Local Authorities and the ONS where available (e.g. 2011 Census data or Annual Population Survey data) as well as OS mapping, satellite imagery and web searches.

15.2.1.2 Where relevant, local planning policy documents have been reviewed. Strategies, assessments and other published evidence relating to community life and social cohesion and local provision of community facilities and social infrastructure have also been reviewed (e.g. Surrey JSNA).

15.2.1.3 NMU surveys will be used to determine the baseline usage of the PRoW network within the study area. The survey will take count readings of all NMU – walking, running, cycling and horse riders at 17 locations along all PRoW that are either intersected by or those that will be affected by the project. The survey will be completed in two parts, one survey in spring and one in autumn, with surveys undertaken on weekdays and weekends to capture both every day uses and the greatest levels of use. The first round of surveys was completed in May/June 2022 with the second round due to take place in September/October 2022. In addition to the count data, a questionnaire will also be used to obtain additional information from PRoW users on reasons for using the footpath, frequency of use, safety and accessibility. The results from the NMU survey will be presented in a standalone NMU Survey Report.

15.2.2 Stakeholder Engagement

Feedback received from consultation on EIA Scoping and draft assessment methodologies

15.2.2.1 Surrey County Council (in their capacity as a regulator) was given the opportunity to provide informal comments on draft EIA methodologies in 2019. In the methodology submitted for review it was intended that consideration of potential socio-economic effects would sit within the wider context of a 'Population' chapter. The following feedback was received from Surrey County Council on this consultation: *"The socio-economic impacts of the scheme should be dealt with in a stand-alone technical report rather than part of the EIA process, as the topic is highly complex and warrants dedicated and detailed assessment in its own right, and a full economic impact assessment would provide an important part of the evidence base for the determination of the individual planning applications that are to be submitted"* [9].

15.2.2.2 As a result of this response the Scoping Report has split the scope of the former Population Chapter to include the provision of a separate chapter specifically addressing socio-economics (similarly, a standalone chapter on Health is also provided – see Chapter 11). It is not proposed however to divorce this from the EIA process by provision of a standalone technical report. The socio-economic assessment within the EIA will draw upon other relevant project reports including the Economic Appraisal, EqIA and Natural Capital Assessment.

Feedback received from pre-application consultation under the Town and Country Planning Act

15.2.2.3 Pre-application consultation was undertaken in 2019 with Surrey County Council (in their capacity as a statutory consultee), LPAs, GLA, the Environment Agency Sustainable Places Team and the MMO.

15.2.2.4 It was advised that potential impacts upon sport and recreational facilities should be considered. In response to this feedback the potential effect on sport and recreational facilities during both construction and operation will be scoped into the assessment.

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[9] Note: Since consultation on the draft EIA methodologies was undertaken it has been agreed that the RTS will be subject to a DCO application rather than individual planning applications to each LPA.

Other topic specific engagement

15.2.2.5 Further preliminary engagement has been undertaken with LPAs in 2022 to obtain baseline data and inform EIA Scoping.

15.2.2.6 Where relevant, information from previous wider consultation activities with other local stakeholders has also been used. This includes landowners, community groups, parish councils and recreation groups who provided pertinent information during organised discussion group workshops and public drop-in sessions that were held in 2016. This consultation has influenced the design of the project and assisted with the collation of baseline data.

15.2.2.7 The project has undertaken consultation with the majority of directly affected landowners, occupiers and tenants to understand their aspirations and concerns for the project and to ascertain the potential impact of the project on businesses. Further consultation with landowners, occupiers and tenants within the DCO application project boundary will be undertaken prior to DCO submission.

15.2.2.8 Additional engagement with stakeholders (both statutory and non-statutory) will also be undertaken prior to the submission of the DCO in order to fully understand baseline characteristics, significance of effect and potential approaches to mitigation for socio-economic effects. This is likely to include engagement with:

- LPAs;
- Surrey County Council;
- National organisations/providers of standards and guardians of community receptors (e.g. Sport England / Sustrans);
- Owners, operators and tenants of social infrastructure (e.g. schools, nurseries, sports and leisure facilities, healthcare providers, libraries, community centres, community-facing businesses (e.g. pubs and local shops), other businesses, places of worship or special educational needs facilities; and
- User groups associated with community facilities (e.g. sports and recreation clubs, faith and religious groups, and resident’s groups);
- Local police force, and;

- Other stakeholders identified by the project partners.

15.2.2.9 Where available, user surveys of similar developments or facilities published by LPAs will be drawn upon.

15.2.3 Study Area

15.2.3.1 The study area for socio-economics is defined as the area within the project boundary for EIA scoping plus a 500m buffer combined with the area within the 1 in 100-year floodplain (i.e. the area with a one per cent chance of flood in any given year) that is expected to experience a change in flood risk as a result of the project (see Figure 15-1 in Appendix A for further information).

15.2.3.2 This area has been selected as it is considered to cover all areas with the potential to experience significant socio-economic effects as a result of construction and operation of the project and is in accordance with the guidance set out within the DMRB (LA112). Where effects have the potential to extend to the local area surrounding the study area these locations will also be considered.

15.2.3.3 As the design and consultation processes progress, the study area may evolve to accommodate any changes that are generated. If the study area does change prior to submission of the ES, baseline data collection and consideration of potential likely significant effects will be reviewed and updated as appropriate.

15.3 Baseline

15.3.1 Existing Baseline

Overview

15.3.1.1 The River Thames between Datchet and Teddington has the largest area of developed floodplain in England without flood defences. A major flood (a 1 in 100 year flood (i.e. a flood with a one per cent chance of happening in any given year)) would put approximately 15,000 residential and commercial properties at risk. A flood of moderate frequency (e.g. a 1 in 20 year flood (five per cent chance of happening in any given year)) would put approximately 4,700 of those properties at risk.

15.3.1.2 The greatest risk of flooding to human populations (i.e. socio-economic factors) is in the urban areas of Staines, Egham, Chertsey, Walton-on-

Thames, East Molesey, Teddington and Kingston upon Thames which have the greatest population densities (see Figure 15-2 in Appendix A).

15.3.1.3 Within the study area there are approximately 45,000 residential dwellings and over 2,100 commercial/industrial properties. Furthermore, there is a wide array of social infrastructure including approximately 50 educational establishments, 60 places of worship and over 100 recreational facilities (see Figure 15-3 in Appendix A). There is also a complex infrastructure network, including transport infrastructure and other critical utilities such as drinking water abstractions and electricity sub-stations.

15.3.1.4 Most of the project footprint and socio-economic study area is located in Surrey. The majority of the population of Surrey (83.5 per cent) reported their ethnicity as ‘White British’ in the 2011 census, with a further 6.9 per cent belonging to other white ethnic groups (e.g. Irish or ‘other white’). The next largest ethnic group was ‘Indian’ and ‘Pakistani’ accounting for approximately 1.8 per cent and 1 per cent of the population respectively.

15.3.1.5 The north-westerly extent of the study area is located within Berkshire, more specifically the RBWM. The majority of the population of RBWM (77.5 per cent) reported their ethnicity as ‘White British’ in the 2011 census, with a further 8.6 per cent belonging to other white ethnic groups (e.g. Irish or ‘other white’). The next largest ethnic group was ‘Asian/Asian British’ accounting for approximately 9.6 per cent, mixed/multiple ethnic groups accounted for 2.3 per cent of the population and black/ African/ Caribbean/ black British accounted for 1.2 per cent of the population.

15.3.1.6 The downstream extent of the works including Molesey and Teddington Weirs are located within the GLA.

15.3.1.7 There are a variety of land uses within the study area. The urban areas of Datchet, Wraysbury, Hythe End, Staines-upon-Thames, Egham Hythe, Chertsey, Shepperton, Walton-on-Thames, Sunbury-on-Thames, Molesey, Kingston upon Thames and Teddington are associated with various residential, commercial and industrial developments. These developments are supported by the complex infrastructure network. Figure 15-4 in Appendix A shows the locations of the key commercial and industrial areas within the study area and the distribution of residential dwellings.

15.3.1.8 Within the study area, water is abstracted from surface water and groundwater under licence. There are 22 licensed surface water abstraction points within the study area on the River Thames and its tributaries. The majority of these abstraction points are operated by either Thames Water or Affinity Water and are used for potable water supply. These abstraction points have been included within the study area for socio-economics to enable consideration of potential effects upon the statutory water undertakers, however, the water bodies that are supplied by the abstractions have not been included.

15.3.1.9 There are a variety of formal and informal recreational facilities within the study area. Key formal recreational facilities are described in relation to each section of the project below. Informal recreational facilities present throughout the study area include a complex footpath network consisting of various PRoW, the Thames Path National Trail and National and Local Cycle Network routes. Furthermore, there are a variety of Public Open Spaces and amenity areas across the study area. These are shown on Figure 15-3 in Appendix A.

15.3.1.10 The Index of Multiple Deprivation (IMD) (MHCLG, 2019b) provides an official measure of relative deprivation for small areas LSOAs in England. The IMD ranks every LSOA from most to least deprived and it is common to describe these areas by specifying whether they fall among the most deprived 10 per cent, 20 per cent or 30 per cent of LSOAs in England (although there is no definitive cut-off at which an area is described as ‘deprived’). The following sections provide baseline IMD information for each part of the study area. Figure 15-4 in Appendix A provides an overview of LSOA IMD rankings within the study area. Surrey is generally regarded as a wealthy county with a strong economy and low levels of deprivation[10] and this is also reflected more broadly across the study area as a whole, however small pockets of more deprived areas do exist.

15.3.1.11 In 2016, Surrey’s economy, measured by Gross Value Added was worth £40.1 billion. This amounted to 16 per cent of the economy of south east England, while in terms of population Surrey makes up just 13 per cent of the south east with higher than average annual earnings.

15.3.1.12 The following sections summarise the baseline within the study area, split broadly by borough.

[10] On a scale of average IMD, where 1 is the most deprived, at a county level, Surrey ranks 150 out of 152.

Sections of the study area within RBC and upstream areas within RBWM

15.3.1.13 The Runnymede Channel will be located within this part of the study area. Potential (HCAs) within Runnymede include Norlands Lane, Laleham Reach, Laleham Golf Course and Drink Water Pit (see below for further baseline information specific to each HCA). Works are proposed to the Abbey River south of the M3 near Abbey Meads, including low flow mitigation and fish passage improvements. Furthermore, the landscape feasibility parameter extends to include the new green open spaces and active travel.

15.3.1.14 The total population of Runnymede is approximately 80,500, with approximately 43,000 being economically active (Census, 2011).

15.3.1.15 The main urban areas near the Runnymede Channel are Staines upon Thames to the north (approximate population of 18,500), Chertsey to the south (approximate population 13,800), and the village of Thorpe to the west (approximate population 5,500).

15.3.1.16 In Runnymede, 69.5 per cent of residents own their dwelling (either mortgaged or outright) compared to the national average of approximately 63.4 per cent. Approximately 8.9 per cent live in council rented dwellings (national average 9.4 per cent); 15.2 per cent in privately rented accommodation (national average 16.8 per cent) and 4 per cent live in other social rented accommodation (national average 8.3 per cent).

15.3.1.17 The predominant industry types within Runnymede are Professional, scientific and technical (approx. 18.3 per cent), Information Technology (approx. 12 per cent) and Construction (approx. 11.6 per cent). The unemployment rate in 2021 was approximately 2.9 per cent compared to the national average of approximately 4.5 per cent.

15.3.1.18 Royal Hythe at the upstream extent of the Runnymede Channel consists of an agricultural field and a pastural field (cattle grazing).

15.3.1.19 The Thorpe Park Resort, including the surrounding recreational lakes (see Figure 15-3 in Appendix A), represent a significant commercial area and recreational destination in this part of the study area attracting approximately 1.9 million visitors per year. The theme park has dozens of rides, live events and other attractions and has approximately 200 permanent staff and over 1,200 temporary/supporting staff on a seasonal basis between March and November (Merlin Entertainment, 2020).

15.3.1.20 The Thorpe Park lakes (consisting of Fleet Lake, Abbey Lake and St. Ann’s Lake) host various commercial recreational activities. These include JB Waterski, Thorpe Park Resort and LBD Wake School. Runnymede Angling Association has access and use of several the lakes within the study area.

15.3.1.21 Thorpe Industrial Estate lies just north of Thorpe on the western extent of the study area.

15.3.1.22 Affinity Water operates the Chertsey Water Treatment Works adjacent to the River Thames at Abbey Meads. There are also many commercial areas associated with the urban areas of Chertsey and Staines-upon-Thames.

15.3.1.23 Areas upstream of the Runnymede Channel have been included within the study area due to the change in flood risk expected to be experienced. This includes the primarily residential settlements of Datchet, Wraysbury, Horton and Hythe End within the RBWM. Land South of Wraysbury Reservoir HCA (within SBC) also lies upstream of the Runnymede Channel, close to the border of RBWM.

15.3.1.24 This area also includes various waterbodies (lakes) many of which are used for commercial recreation ventures including angling, sailing, water skiing / wakeboarding and diving. Datchet lakes are also home to the Liquid Leisure inflatable aqua park. In addition, there are also various industrial facilities and sites.

15.3.1.25 The Runnymede Channel between the intake with the River Thames and Abbey Lake passes through areas which are recorded as being amongst the 30 per cent least deprived neighbourhoods in the country, or better. The downstream extent of the channel between Abbey Lake and the downstream connection with the River Thames passes through areas which are recorded as being amongst the 50 per cent most deprived neighbourhoods in the country. Areas surrounding the Runnymede Channel are predominantly ranked within the 50 per cent least deprived neighbourhoods or better, however there are pockets of areas within Chertsey which are within the 30 per cent most deprived neighbourhoods in the country. See Figure 15-4 in Appendix A for an overview of the IMD decile ratings within the study area.

15.3.1.26 The ethnic composition of LSOAs that the Runnymede Channel passes through is approximately 92 per cent white, 5 per cent Asian/Asian British, two per cent mixed/multiple ethnic groups and less than one per cent black, African, Caribbean or other ethnic groups.

15.3.1.27 There are numerous places of worship within the study area in Runnymede and RBWM (see Figure 15-1 in Appendix A). These primarily consist of churches of various denominations primarily clustered around Staines upon Thames, Egham and Chertsey. Other religious establishments include the Staines and District Synagogue located near Staines town centre and the Juergen Centre used by the Runnymede Muslim Society.

15.3.1.28 Upstream areas of the study area fall within the RBWM. No physical works are currently proposed within these areas; however, they have been included within the study area as they may experience a small reduction in flood risk. In these areas there are numerous LSOAs. These are typically all within the 50 per cent least deprived neighbourhoods in the country.

15.3.1.29 There are pockets of registered Common Land upstream of the Runnymede Channel (see Figure 15-3 in Appendix A). These include Staines Lammas / Church Lammas (approx. 2km north of the Runnymede Channel); Runnymede (approx. 2.5km north-west of the Runnymede Channel) and Shortwood Common, Knowle Green, Birch Green, Staines Moor and other lands (approx. 2km north and north-east of the Runnymede Channel).

15.3.1.30 There are various community facilities including the Staines Community Centre, the Hythe Centre, Thorpe Community and Village Halls and Chertsey Hall.

15.3.1.31 The upstream areas within the RBWM have predominant industry types of Professional, scientific and technical (approx. 24.3 per cent); Information Technology (approx. 11.6 per cent) and Business administration and support (approx. 9.8 per cent).

Sections of the study area within SBC

15.3.1.32 The Spelthorne Channel will be located within this part of the study area. Potential HCAs within Spelthorne include Littleton Lane, Chertsey Road Tip and Land South of Chertsey Road. Land South of Wraysbury Reservoir HCA is also located within Spelthorne, however, it is spatially separated from other aspects of the project (see below for further baseline information specific to each HCA and Figure 2-1 in Appendix A for the LPA boundaries). Part of the proposed bed lowering downstream of

Desborough Cut falls within Spelthorne (with a small section also in Elmbridge). Furthermore, the area of landscape design feasibility extends to include potential areas for materials management, new green open space and active travel improvements (see Figure 1-2 in Appendix A).

15.3.1.33 The total population of Spelthorne is approximately 95,500 with approximately 53,000 being economically active. The main urban areas near the Spelthorne channel are Shepperton (approximate population 6,700) and Shepperton Green (approximate population 8,000), which are both largely residential. There are also residential dwellings along Chertsey Bridge Road, Chertsey Road and Ferry Lane, between Chertsey and Shepperton.

15.3.1.34 In Spelthorne, 72.5 per cent of residents own their dwelling (either mortgaged or outright) compared to the national average of approximately 63.4 per cent. Approximately 1.6 per cent live in council rented dwellings (national average 9.4 per cent); 12.7 per cent in privately rented accommodation (national average 16.8 per cent); and 10.8 per cent live in other social rented accommodation (national average 8.3 per cent).

15.3.1.35 The predominant industry types within Spelthorne are Professional, scientific and technical (approx. 14.5 per cent); Information Technology (approx. 13 per cent) and Transport and storage (approx. 12.9 per cent). The unemployment rate in 2021 was approximately 4.3 per cent compared to the national average of approximately 4.5 per cent.

15.3.1.36 Brett Aggregates operate a site off Littleton Lane for landfill operations and plans are currently in place for restoration of the area. There are also various gravel and aggregate suppliers and other businesses including George Killoghery Ltd off Littleton Lane in Shepperton. The Waymeadows Business Park on Chertsey Road contains several vehicle and automotive businesses.

15.3.1.37 The Spelthorne Channel passes through and close to several lakes that are used for commercial and charitable recreational purposes (see Figure 15-1 and 15-3 in Appendix A). Littleton North lake is used by Spelthorne Waterski Club. Littleton East lake is owned by the Civil Service Sports Council and is home of Littleton Sailing Club. Sheepwalk lakes are utilised by angling clubs and the Halliford Mere Lakes complex are used for fly-fishing with an adjacent pavilion and restaurant area. Ferry Lane lake is home to Shepperton Open Water Swimming Club.

15.3.1.38 The Spelthorne Channel passes through areas which are recorded as being amongst the 50 per cent least deprived neighbourhoods in the country, or better. Most of the LSOAs within the study area around the Spelthorne Channel are also within the 50 per cent least deprived neighbourhoods in the country. See Figure 15-4 in Appendix A for an overview of the IMD ratings within the study area.

15.3.1.39 The ethnic composition of the LSOAs that the Spelthorne Channel passes through is approximately 94 per cent white, 3 per cent Asian/Asian British, two per cent mixed/multiple ethnic groups and less than one per cent black, African, Caribbean or other ethnic groups.

15.3.1.40 There are numerous places of worship within the study area in Spelthorne, including St Nicholas Church and Jubilee Church in Shepperton (see Figures 15-1 and 15-3 in Appendix A).

15.3.1.41 Community facilities within Spelthorne include the Greeno Centre in Shepperton, Shepperton Village Hall and Shepperton Youth Club.

15.3.1.42 There are three small areas of Common Land within Spelthorne to the east of the Spelthorne Channel. These include Land to the west of Walton Lane (0.5km); Lower Halliford Green (0.8km) and Land to the north and south of Walton Lane (approx. 1.2km)

15.3.1.43 The proposed location of bed lowering downstream of Desborough Cut is dominated by open space on both sides of the River Thames. On the left bank there are residential dwellings located on Thames Meadow. The downstream end of the works is located within the town of Walton-on-Thames on the right bank and Lower Halliford on the left bank, both of which contain a range of residential and commercial properties. The entrance to Walton Marina is located at the downstream extent of the proposed bed lowering on the left bank.

Sections of the Study Area within EBC

15.3.1.44 Sunbury Weir is located within EBC. Molesey Weir lies on the boundary between EBC and LBRUT. Potential HCAs within Elmbridge include Desborough Island, Land between Desborough Cut and Engine River and Grove Farm. Part of the River Thames bed lowering downstream of Desborough Cut will also lie within Elmbridge.

15.3.1.45 In Elmbridge, 73 per cent of residents own their dwelling (either mortgaged or outright) compared to the national average of approximately 63.4 per cent. Approximately 2.1 per cent live in council rented dwellings (national average 9.4 per cent); 15.1 per cent in privately rented accommodation (national average 16.8 per cent); and 7.7 per cent live in other social rented accommodation (national average 8.3 per cent).

15.3.1.46 The predominant industry type within Elmbridge is professional scientific and technical (approx. 27 per cent) and Information Technology (approx. 12.5 per cent). The unemployment rate in Elmbridge was approximately 3.9 per cent in 2021 compared to the national average of approximately 4.5 per cent.

15.3.1.47 There are numerous places of worship within the study area in Elmbridge, primarily concentrated around Walton-on-Thames and Molesey (see Figures 15-1 and 15-3 in Appendix A). These primarily consist of churches of various denominations. Other religious establishments include the Molesey Islamic Cultural Centre.

15.3.1.48 On the left bank of the River Thames near Sunbury Weir at Sunbury-on-Thames, there are a mixture of residential and commercial properties. Sunbury Gas Works and Walton Advanced Water Treatment Works are located on the right bank adjacent to Sunbury Lock and are neighboured by commercial recreational facilities including the Elmbridge Xcel Sports Hub Complex.

15.3.1.49 Wheatley's Eyot (Wheatley's Ait) is a small island on the River Thames (approx. 8 hectares), upstream of Sunbury Lock. It contains a small number of residential dwellings, a boatyard and moorings for the Environment Agency. This is located within a LSOA that is amongst the 40 per cent least deprived neighbourhoods in the country.

15.3.1.50 The land immediately surrounding Molesey Weir is predominantly urban with the exception of Hurst Park on the right bank of the River Thames. The area consists of residential and commercial properties. There are residential dwellings opposite the weir on the right bank of the River Thames, set back from the river behind the towpath. The left bank of the River Thames in this location is dominated by the open space of Hampton Court Green and Bushy Park, although does include some of the suburban area of Hampton. This suburban area includes Hampton Business Centre and Hampton Court Water Works, owned by Thames Water.

15.3.1.51 The weir is connected to the privately owned Ash Island which includes a boat yard and moorings, and several houseboats.

15.3.1.52 Molesey Weir is located within a LSOA that is amongst the 10 per cent least deprived neighbourhoods in the country.

15.3.1.53 There is no registered Common Land in the study area within EBC.

Sections of the study area within the LBRUT

15.3.1.54 The component of the RTS within the LBRUT is Teddington Weir and any associated temporary working area or site compounds within the project boundary for EIA scoping. The land surrounding Teddington Weir is predominantly urban, with a mixture of commercial and residential properties and Public Open Spaces. Much of the commercial land use on the immediate left bank relates to sporting facilities. The right bank is dominated by Ham Lands Local Nature Reserve with residential dwellings beyond.

15.3.1.55 Teddington Weir is located within a LSOA that is amongst the 10 per cent least deprived neighbourhoods in the country.

15.3.1.56 There is no registered Common Land in the study area within LBRUT.

Habitat Creation Areas

15.3.1.57 The proposed HCAs are typically located on undeveloped land or open space with relatively low surrounding population densities (see Figure 15-2 in Appendix A).

15.3.1.58 Land South of Wraysbury Reservoir HCA is located within SBC on Thames Water land to the north west of the Runnymede Channel. There are residential dwellings on Coppermill Road to the north. The south-west border of the site is dominated by the mainline railway (including Wraysbury Railway Station) and commercial/ industrial facilities, with the M25 located to the east.

15.3.1.59 Norlands Lane HCA is located to the west of the Runnymede Channel between Norlands Lane and Green Lane. The land in this area is managed by the Land Logical Group who have invested to improve and modernise the site’s currently outdated gas infrastructure, having gained planning permission for an additional 4 Megawatts as a gas powered short-term operating reserve facility to give the National Grid support in the area (Land Logical, 2022). Thorpe Industrial Estate lies to the north-west of the site and contains numerous industrial units. TASIS England School is located to the south west of the site. To the south of the site is the Eden Retirement Living Complex and Thorpe Park Resort.

15.3.1.60 Laleham Reach HCA is located to the north of the Runnymede Channel. It is bordered by residential dwellings on Laleham Reach to the north and east of the site and Penton Park to the west. Penton Hook Marina is also located to the west. The south of the site is dominated by the former Laleham Golf Course which is also being considered as a potential site for an HCA.

15.3.1.61 Laleham Golf Course HCA is located on a former golf course (closed in 2017) immediately north of the Runnymede Channel adjacent to the east of Abbey 1 lake and north of Abbey 2 lake. Chertsey Water Treatment Works (WTW) is located to the east of the site.

15.3.1.62 Littleton Lane HCA is located to the east of Littleton North lake adjacent to the Littleton Estate, which contains numerous industrial units and operations. Laleham Farm is located to the north of the site.

15.3.1.63 Chertsey Road Tip HCA and Land South of Chertsey Road HCA are both located directly adjacent to the Spelthorne Channel. Waymeadow Business Park is located between the two sites. Properties to the east of these HCAs in Shepperton are predominantly residential dwellings.

15.3.1.64 Desborough Island HCA is located opposite the Spelthorne Channel outlet. It is bounded by the River Thames to the west and north of the site and Desborough Cut to the south. To the east are the Weybridge Vandals playing fields consisting of rugby and cricket pitches, Hersham FC football pitches and Affinity Water’s Desborough Island WTW.

15.3.1.65 Land between Desborough Cut and Engine River HCA is located to the south of Desborough Cut. Surrounding land uses consist of horse paddocks and Weybridge Equestrian Centre to the south. Bannatyne Health Club and Spa is also located to the south. Beyond this is the town of Weybridge, containing numerous residential and commercial properties. To the west of the site is St George’s Junior School and playing fields.

15.3.1.66 Drinkwater Pit HCA is located approximately 4km to the west of the Runnymede Channel. The site is to the south of Virginia Water adjacent to A+S Caravan Storage, between the M3 and mainline railway.

15.3.1.67 Grove Farm HCA is located approximately 2.5km south of Molesey Weir in the village of Lower Green. It is bordered by Cranmore Primary School to the south, Esher Sewage Treatment Works to the west and Island Barn Reservoir to the north. Numerous residential dwellings are also present around the site perimeter. Sandown Park Racecourse and associated leisure facilities (including Sandown Park Golf Centre and Go-Karting) are located to the south of the site on the opposite side of the mainline railway.

15.3.1.68 There is no registered Common Land in the study area near any of the HCAs.

15.3.2 Future Baseline

15.3.2.1 The population within the study area is likely to increase. The population of England as a whole is expected to increase by 3.5 per cent by mid-2030, driven by an estimated 2.2 million people migrating into the country. The population of London is expected to increase by approximately 28 per cent to 11 million by 2039, whilst in the south-east there is expected to be an approximately 18 per cent increase over the same period (ONS, 2022).

15.3.2.2 There is anticipated to be an increasingly aging population, with the number of people aged 85 and over projected to double by 2045, likely resulting in a smaller proportion of economically active individuals (ONS, 2022). This change is likely to be driven by improved health care, though does not take into consideration the potential effects on long-term trends as a result of extreme events such as the Covid-19 pandemic. The aging population is expected to increase demand and pressure upon health care and specialised residential facilities (e.g. care homes).

15.3.2.3 The increase in population is likely to increase demand for housing development, economic activity and social amenities in the area, which in turn, could result in an increased risk of flooding to homes and businesses if development is permitted on the floodplain. However, more stringent planning controls as a result of greater awareness of flood risk may result in less new development in the floodplain and an improvement in flood warning, resilience and evacuation measures.

15.3.2.4 Future land use change is likely to occur following the frameworks set out within Local Plans and regional and local planning policy. These are likely to be subject to change in the future. A broad objective of local, regional and national policy is to ensure that management of development and infrastructure meet identified social, environmental and economic challenges. This is achieved by driving high levels of employment and enterprise whilst ensuring strategically identified sites are protected.

15.3.2.5 Residential, commercial, industrial and recreational assets will remain at risk of flooding (in the absence of the RTS or any other flood relief scheme), and this risk will gradually increase over time as the effects of climate change become more significant with likely increases in peak flows and flood frequencies. See Chapter 10 (Flood Risk) for further information.

15.3.2.6 Other baseline conditions that could interact with the socio-economic assessment include those relating to Air Quality (Chapter 6), Health (Chapter 11), Landscape and Visual Amenity (Chapter 12), Materials and Waste (Chapter 13), Noise and Vibration (Chapter 14) and Traffic and Transport (Chapter 17). An outline of the future baseline in relation to each of these topics are provided within the corresponding Chapters of this EIA Scoping Report.

15.3.3 Key Environmental Considerations and Opportunities

15.3.3.1 The key environmental considerations for project design for socio-economics are the effects of the project on residential and commercial properties within the study area. The RTS provides a significant opportunity to reduce flood risk to vulnerable populations through reduction in flood risk. Examples of vulnerable communities include the elderly, children, those with long-term health issues and populations with higher levels of deprivation.

15.3.3.2 The extensive social infrastructure across the study area, including recreational facilities and other community facilities are an important consideration for the project, however, the project provides an opportunity to reduce flood risk to these services.

15.3.3.3 From an economic perspective, the extensive number of businesses, industries and services with the potential to be affected directly or indirectly by the project are a key consideration. The RTS does however provide a significant opportunity to reduce flood risk to businesses, industries and services.

15.3.3.4 Key opportunities include the potential creation of jobs and training opportunities associated with construction and operation, plus natural capital enhancements through potential provision of educational or recreational facilities once the project is operational, which could provide benefit to local residents, businesses, facilities or services.

15.3.3.5 There is an opportunity to improve wellbeing of local communities through increased access to nature within the project boundary for EIA scoping once operational, particularly within the HCAs, areas of new green open spaces and other landscape feasibility areas (see Chapter 11: Health for further information).

15.3.3.6 The reduction in flood risk within the socio-economic study area for EIA scoping, coupled with the regeneration of derelict and brownfield sites and enhanced recreational opportunities (including active travel) within the project boundary for EIA scoping have the potential to facilitate economic growth.

15.4 Likely Significant Effects Requiring Assessment

15.4.1 Construction Effects

15.4.1.1 Project activities and associated likely significant effects are identified below:

- Construction of road bridges has the potential adverse effect of disruption and reduced accessibility to local businesses due to temporary road closures and diversions;
- Transportation of material / waste, and placement / processing of non-hazardous material at end destination has the potential for adverse effects on local communities as the placement volumes, routes and locations are not yet known;
- Earthworks and other general construction activity have the potential to result in temporary adverse effects to residential dwellings from loss or disturbance to land and potential changes to land drainage patterns;
- Earthworks and other general construction activity have the potential to result in temporary adverse effects which will affect social and community infrastructure, including their viability and/or functionality;
- Earthworks and general construction activity has the potential to result in temporary adverse effects on commercial businesses (such as lake based businesses and agricultural land) from loss / disturbance of land or waterbodies or effects on land drainage etc;
- Creation of site compounds, temporary materials processing sites and storage of excavated material could have the potential temporary

adverse effect of increasing flood risk to homes and businesses. The FRA for the project will address the risk and design mitigation as per the NPPF. The results of modelling and input to the design are ongoing and hence this effect has been scoped in as a precautionary measure (see also Chapter 10: Flood Risk);

- Excavation through landfill and other sources of contamination could result in the potential release of leachates to waterbodies which has the potential to result in effects on commercial and recreational land uses;
- Material excavation has the potential to benefit the economic and social development of the area by facilitating the extraction of natural resources (i.e. sharp sands and gravel) and thereby contributing to the economy, through the provision of raw materials, and employment opportunities;
- Influx of site personnel and job creation has the potential temporary beneficial effect of additional income generation for local businesses and communities during the construction period. There are also potential effects associated with potential employment generation and effects on businesses in the construction supply chain, including the potential for additional skills and training;
- General construction activities and movement of vehicles, equipment and site operatives has potential for temporary adverse effect to land-based recreation (such as PRoW, Thames Path National Trail, Public Open Spaces etc.) and water-based recreation (such as angling, boating and other water sports). This could include loss or reduced visibility of the resource, severance of communities and/or reduced access to public amenities. This effect will also be assessed in terms of health effects (see Chapter 10: Health); and
- Aquatic INNS and pathogens management through chemical treatment, removal or lowering water levels within lakes has the potential for adverse effects on the recreational and commercial use of lakes. This has the potential for changes in water quality, levels, hydromorphology, flow regime and/or sediment processes (see also Chapter 18: Water Environment).

15.4.2 Operational Effects

15.4.2.1 Project activities and associated likely significant effects are identified below:

- Use of the flood channel, capacity improvements and associated features during times of flood will reduce flood risk in the study area, with subsequent beneficial effects on the safety and wellbeing of local communities, businesses and social infrastructure (see also Chapter 11: Health);
- Use of the flood channel, associated features and capacity improvements during times of flood will reduce flood risk in the study area, thereby reducing or avoiding economic effects associated with flood events;
- The provision of new green open spaces and other landscape works (including new walking / cycle routes) will have the beneficial effect of creating opportunities for businesses to establish new ventures in and around areas of new green open space / public access;
- Existence of the flood channel and other project components has a potential adverse effect on businesses (such as farming and lake based businesses) from permanent loss /disturbance of land or waterbodies, effects on land drainage etc. This effect will also be assessed in terms of flood risk in Chapter 10 (Flood Risk);
- The provision of new green open spaces and other landscape works (including new walking / cycle routes) will have a beneficial effect upon local communities of improved public access and improved provision of recreational facilities (e.g. moorings, fishing, bird watching and visitor facilities) thereby enhancing the existing social infrastructure network. This effect will also be assessed in terms of health effects in Chapter 11 (Health);
- Existence of the flood channel and other project components has the potential adverse and/or beneficial effect of decreased/increased access to existing Public Open Space or recreational facilities in the study area for local communities;
- Introduction of an augmented flow (in normal conditions) and operational flow in the flood channel (and intersected waterbodies) has

the potential for permanent adverse effects on water quality. This effect arises in lakes from the introduction of River Thames water to previously unconnected lakes, with subsequent adverse effects upon the commercial viability and/or recreational use of these lakes. This effect will also be considered in terms of health effects in Chapter 11 (Health); and

- Introduction of an augmented flow into the flood channel will have a potential adverse effect on water utility businesses in the local area due to availability of water for surface water and groundwater abstraction, including public water supply, from the diversion of water away from the River Thames and potential changes to groundwater levels and groundwater fed lakes.

15.5 Effects Not Requiring Assessment

15.5.1 Construction Effects

15.5.1.1 Project activities and associated effects that are deemed not likely to be significant and are therefore proposed to be scoped out of the EIA in relation to socio-economics are identified below:

- Influx of site personnel has the potential to affect community cohesion and the nature of communities due to changes in population characteristics, but this is considered unlikely to be significant in the context of the study area and the anticipated number of site personnel required;
- Potential effects of construction on registered Common Land have been scoped out as no common land is anticipated to be directly affected by the works; and
- Potential adverse effects associated with the movement of hazardous waste / materials from the major road network and placement at end destination upon socio-economic receptors have been scoped out on the basis that these activities would be covered by existing licences.

15.5.2 Operational Effects

15.5.2.1 Project activities and associated effects that are deemed not likely to be significant and are therefore proposed to be scoped out of the EIA are identified below:

- The use of the flood channel, associated features and capacity improvements during times of flood will reduce flood risk to registered Common Land within the study area, however, this is not considered significant;
- Provision of the new green open spaces and other landscape works (including new walking / cycle routes) has the potential for effects on traffic movements on roads, public transport services and existing parking facilities which could cause minor (not significant) additional disturbance to local businesses (see also Chapter 11: Health and Chapter 14: Noise and Vibration);
- Existence of the flood channel and other project components has the potential adverse effect through the permanent loss of land from residential dwellings. Only a small number of private residential dwellings will need to be acquired. Landowners will be compensated, either by agreement or through the use of compulsory acquisition powers granted by the DCO;
- Demolition of existing buildings will result in a reduction in housing available. Only a small number of residential dwellings are planned to be demolished (five buildings, including one outbuilding and four residences) and therefore this is not considered significant in the context of wider community housing provision;
- Provision of new road bridges has the potential to alter road access for local communities and businesses, however this is not anticipated to be a significant enhancement to the existing network; and
- General maintenance activities could result in disturbance to socio-economic receptors from increased traffic and plant on local roads and within the project boundary as well as disturbance and emissions from routine activities such as vegetation management. However, it is anticipated that the effect will not be significant because maintenance activities will follow standard good practice procedures, are likely to be infrequent and low impact, resulting in minimal effects.

15.6 Approach to mitigation

15.6.1.1 This section should be read in conjunction with Chapter 5: Approach to EIA Scoping which sets out further definition for the project regarding primary (embedded) mitigation, secondary (additional) mitigation and tertiary (best practice) mitigation.

15.6.2 Construction

15.6.2.1 Secondary mitigation measures that are under consideration for the construction phase are identified below:

- Business owners affected by loss / disturbance of land will be compensated, either by agreement or through compensation measures in the DCO;
- Temporary diversions (as opposed to closure) of footpaths /bridleways will be implemented where possible with suitable signage to provide accurate information on anticipated closure period and diversion routes prior to construction. This will be managed through the CEMP; and
- Traffic movements will be controlled or reduced through the re-use of excavated material on site where appropriate, the use of Traffic Management Plans and a CEMP. See Chapter 17 (Traffic and Transport) for further details.

15.6.3 Operation

15.6.3.1 Secondary mitigation measures that are under consideration for the operation phase are identified below:

- Business owners affected by loss / disturbance of land will be compensated, either by agreement or through the compensation measures in the DCO; and
- Water quality modelling is being undertaken. This will inform mitigation measures associated with connecting previously unconnected lakes with the River Thames. See Chapter 18 (Water Environment) for further details.

15.7 Assessment Methodology

15.7.1 Significance Criteria

15.7.1.1 There is no definitive guidance or methodology for defining the significance criteria for socio-economic effects, however, the DMRB (LA 112) does provide a steer in relation to population receptors. The assessment is therefore proposed to be based on professional interpretation of relevant legislation and precedents set by other projects of a similar nature.

15.7.1.2 The assessment will define magnitude of change and receptor sensitivity to determine the significance of effects as outlined below.

15.7.1.3 The sensitivity of receptors is categorised as follows and gives particular attention to the ability of receptors to respond to change that may arise as a result of the project:

High sensitivity

- Receptor has a limited ability to respond to change (for example where a community, or a community or recreational facility has limited capacity to respond to population change or a business has limited capacity to respond to market change). The ability for a receptor to respond to change would be based on aspects including: the IMD, age and health indices, number and type of community or recreational facilities, and number and type of businesses;
- National Trails and PRoW used for both commuting and recreation that record frequent (daily) use with little / no potential for substitution; and
- Businesses solely located in the area within the project boundary for EIA scoping and reliant on that location, are a major employer in the local area or the entire business is affected by the project.

Moderate sensitivity

- Receptor has some ability to respond to change (for example where a community, or community or recreational facility has some capacity to respond to population change or a business has some capacity to respond to market change);
- PRoW and other routes used primarily for recreation and to a lesser extent commuting that record frequent (daily) use with some potential for substitution; and
- Businesses whose main presence is within the project boundary for EIA scoping but is present in other areas that are not affected by the business or could relocate with some difficulties.

Low sensitivity

- Receptor is particularly responsive to change or able to cope with change without substantial effects on existing status or viability;

- PRoW and other routes close to communities which are used for recreational purposes but for which alternative routes can be taken; and
- The business' main presence is within the project boundary for EIA scoping and has a major presence in other areas that are not affected by the project, could easily relocate premises or is not a major employer of local people.

15.7.1.4 The magnitude (scale) of effects will be defined as follows and will be defined using qualitative criteria:

High magnitude

- Where the effect has the potential to result in substantial change (adverse or beneficial) to a receptor or resource (for example, businesses, population, community facilities/social infrastructure and public services, PRoW or the labour market) at a spatial scale; and
- This could include closure or severe effect upon the viability of a business, community facility, public service or closure or restricted access to the PRoW network.

Moderate magnitude

- Where the effect has the potential to result in noticeable change (adverse or beneficial) to a receptor or resource (for example businesses, population, community facilities/social infrastructure and public services, PRoW or the labour market) at a given spatial scale; and

- This could include a moderate change to business revenues with potential job losses but no threat to the viability of the business, moderate change to the function or service of community facilities and public services, or a moderate reduction in access to the PRoW network.

Low magnitude

- Where the effect is a hardly perceptible change (adverse or beneficial) to a receptor or resource (for example businesses, population, community facilities/social infrastructure and public services, PRoW or the labour market) at a given spatial scale; and

- This could include a low change to business revenues with isolated job losses but no threat to the viability of the business, low change to the function or service of community facilities and public services, or low reduction in access to the PRoW network.

Very low magnitude

- Where there is no discernible change (adverse or beneficial) at a given spatial scale; and
- This could include very low change to business revenues with no job losses nor threat to viability of the business as an ongoing entity, very low change to the function or service of community facilities and public services, or no discernible change in access to the PRoW network.

15.7.1.5 The assessment of environmental effects will use the criteria as shown in the matrix in Table 15.1 below. After establishing the sensitivity of the receptor and assessing the magnitude of change using the criteria above, the effect to the receptor can be determined as either significant (major or moderate effects) or not significant (minor or negligible effects).

Table 15-1: Significance of effects matrix.

	High Sensitivity	Moderate Sensitivity	Low Sensitivity
High Magnitude	Major (Significant)	Major (Significant)	Moderate (Significant)
Moderate Magnitude	Major (Significant)	Moderate (Significant)	Minor
Low Magnitude	Moderate (Significant)	Minor	Negligible
Very Low Magnitude	Minor	Negligible	Negligible
No Change	None	None	None

15.7.2 Construction effects

15.7.2.1 Construction effects to receptors will be identified using the criteria outlined above. Assessment of effects (with primary and tertiary mitigation assumed to be in place) will be presented initially. Any further (secondary) mitigation that may be required to address any remaining significant adverse effects will be identified and residual effects assessed with such additional secondary mitigation in place as a second stage of the assessment.

15.7.2.2 The construction effects will be determined in consultation with affected stakeholders.

15.7.3 Operational effects

15.7.3.1 The operational assessment of effects applies the same method as construction outlined above. Operational effects will also be determined in consultation with affected stakeholders.

15.7.4 Cumulative effects

15.7.4.1 Cumulative effects arise, for instance, where other existing and/or approved developments have insignificant effects, but the interaction of the developments together is likely to have a significant effect on a given receptor. The potential for cumulative effects to arise from the identified effects of the RTS acting in-combination with other existing and/or approved projects is provided in Chapter 19: Cumulative Effects Assessment. This has included a review of further consented (or reasonably likely to be consented) projects within the local area that could give rise to cumulative effects.

15.7.4.2 The assessment of cumulative effects will consider the potential for socio-economic effects. This will be a qualitative assessment.

15.8 Assumptions and Limitations

15.8.1.1 Should the study area change in response to the evolving design, the need for any additional baseline data in relation to socio-economics will need to be reviewed and updated as appropriate.

15.8.1.2 In order to complete the detailed assessment for the ES, it is expected that additional information relating to resources and receptors is likely to be required and may need to be requested from third party organisations, including LPAs, governmental and non-governmental organisations, specific interest groups and landowners. Additional information likely to be required includes identification of key stakeholders within affected communities; data related to the function, users or operational requirements of constraints; more detailed demographic information and sensitivities; emerging standards, research or policy; walkover surveys of affected land.

15.8.1.3 The baseline of the socio-economic EIA assessment is expected to rely on 2021 census data, however, the results of this have not yet been fully released. The headline results were released in June 2022 but full data will be released within two years of the census date (i.e. in 2023) (ONS, 2021). Following the release of this data, the baseline will be reviewed and updated as part of the subsequent EIA stages (e.g. PEIR/ES), where available.

15.8.1.4 Socio-economic effects of the project are likely to vary significantly depending on specific receptors. In particular, there is limited evidence and understanding with regards to how businesses and society adapt to the effects of flooding or construction effects and how development may affect interdependencies between businesses or local investors. If new evidence comes to light during the assessment process this will be reviewed and were relevant will influence the assessment.

15.8.1.5 It is not always possible or feasible to obtain economic data regarding specific businesses. Therefore, regional business composition may be used as a proxy.

16 Soils and Land

16.1 Introduction

16.1.1.1 This chapter describes the proposed scope of the assessment on soils (including agricultural land), geology and land potentially affected by contamination. It outlines the baseline conditions, the likely effects of the project and the avoidance or mitigation measures proposed to alleviate these. It also outlines the methodology that will be used for the assessment of effects related to soils and land in the PEIR/ES.

16.1.1.2 This section considers the potential for:

- Effects on soil resources;
- Effects on bedrock geology and superficial deposits; and
- Effects from contamination on all receptors including but not limited to human health, water quality, ecology and water resources (surface water and groundwater).

16.1.1.3 Other Chapters in this EIA Scoping Report to be read in conjunction with this chapter are Chapter 10: Flood Risk, Chapter 11: Health, Chapter 13: Materials and Waste, and Chapter 18: Water Environment.

16.1.1.4 The scope of land potentially affected by contamination is limited to soils within this chapter. The assessment of groundwater and surface water quality are covered in Chapter 18: Water Environment. The cross over between Water and Soils and Land for the assessment of Controlled Waters is addressed by both Chapters.

16.1.1.5 The scope of agricultural soils in this chapter is limited to the quality of farmland (in the context of ALC). Any socio-economic aspects of agriculture and commercial businesses are covered in Chapter 15: Socio-economics. The carbon aspects of soils are included in Chapter 8: Climatic Factors.

16.1.1.6 Any disturbance or creation of new pollutant pathways has the potential to affect ecological receptors (during construction and operation). This is covered in Chapter 7: Biodiversity.

16.1.1.7 A summary of the key legislation, policy and guidance relevant to socio-economics is provided in Appendix M.

16.2 Baseline Methodology

16.2.1 Information Sources

16.2.1.1 In order to establish baseline conditions for soil, geology and land potentially affected by contamination, a DBA has been undertaken. The following resources have been used to provide up to date information to inform the DBA:

- ALC data;
- Authorised and historic landfill records from the Environment Agency;
- BGS data;
- Geological and hydrogeological mapping;
- Historical OS mapping;
- Relevant publicly available environmental or geological records;
- Results from relevant historical GI; and
- UK Soil Observatory data/soilscape geology and soil data (a Cranfield University soils dataset)

16.2.1.2 Baseline ground conditions have been established from GI surveys undertaken in 2006, 2015/17(see paragraph 16.3 for further details). These included tests for contaminants, soil conditions and geotechnical properties, including moisture content and particle size. Existing GI data for the RTS consists of:

- GI for Lower Thames Strategy [Vols 1 to 3], Norwest Holst Soil Engineering, 2006;
- RTS –Site Investigation for the channel section in Berkshire (now removed from the project), Fugro Geoservices Limited, 2015/17;
- RTS – Spelthorne Channel Site Investigation, WYG Environment, 2015;
- RTS – Runnymede Channel Site Investigation, OPUS, 2015; and
- Royal Hythe – Ground Investigation, T&P Regeneration, 2018.

16.2.1.3 The RTS ‘Geotechnical & Geo-environmental Interpretative Report – General Information’ (GBV, 2016) captures and summarises the key details from the GI work undertaken to date.

16.2.1.4 Further baseline surveys will be undertaken to support the final assessments of the soil, geology and land potentially affected by contamination. These surveys will be submitted as part of the DCO application.

16.2.2 Stakeholder Engagement

Feedback received from consultation on EIA Scoping and draft assessment methodologies

16.2.2.1 Feedback was provided by the Environment Agency and Surrey County Council on behalf of the relevant LPAs (in their capacity as statutory consultees) in a Scoping Opinion on the 2018 EIA Scoping Report. Informal feedback was also received from Surrey County Council (in their capacity as a regulator) on the draft assessment methodologies submitted in 2019.

16.2.2.2 The previous EIA Scoping Opinion identified that the relevant LPAs recommend that the submitted ESs should provide the following information in respect of the excavation of areas of contaminated or potentially contaminated land, which has been factored into the proposed methodology for the soils and land topic and the effects on soils and land proposed to be scoped in and out of the EIA:

- The area of land that would be affected by the proposed development includes closed licensed landfills and closed historic landfill;
- The GI that have been carried out to date confirm that there is a contamination hazard in soil, groundwater / leachate and landfill gas. Procedures for the Management of Land Contamination are set out in Land Contamination and Risk Management published by Defra and Environment Agency (2021j) summarises the process that should be followed;
- As the development of these sites could give rise to significant environmental effects, the full process of GI, risk assessment, options, appraisals and preparation of a mitigation and remediation strategy will be needed to support each planning application where the excavation for landfill is proposed, and to inform the supporting ES in

each case. In each case the mitigation and / or remediation strategy will need to be developed to the stage where the environmental impacts of implementing the strategy can be assessed as part of the EIA process. The planning applications and their supporting ESs cannot be adequately informed by DBA alone, and intrusive GI and Tier 2 contaminated land risk assessments will be required. Receptors for consideration in both the risk and impact assessments include human health, groundwater, surface water, ecology and buildings;

- The scope and methodology of all investigations and risk assessments will need to be agreed with the relevant LPA (in respect of human health and other receptors) for the application in question, and the Environment Agency (in respect of the controlled waters receptor) before any works are undertaken;

- The relevant LPAs recommend that the submitted ESs must take account of the advice provided by NE; and

- The impact of the proposed development on soils should be assessed in a way that takes account of the ecosystem services that they provide. The relevant LPAs note that the consideration of the impacts of the development on soils is limited to the question of leachate migration from landfill, and that the potential for impacts arising from the deposition of excavated material and the re-profiling of land as part of the construction of proposed ‘landscape enhancement areas’ has been discounted. Given the scale and extent of the proposed ‘landscape enhancement areas’ the relevant LPAs would expect the impact of soil importation, deposit and re-profiling on the physical and chemical properties of both the indigenous and imported soils to be considered as part of the assessment.

Feedback received from pre-application consultation under Town and Country Planning Act

16.2.2.3 Pre-application consultation was undertaken in 2019 with Surrey County Council, LPAs, GLA, the Environment Agency Sustainable Places Team and the MMO. Key issues identified were:

- Diverting new watercourses through areas of historic landfill and the potential for new pollution pathways to be created as the water channels will be in close proximity to the landfill;

- The need for banks to be water tight to prevent the escape of leachate;
- Any sheet piling or other foundation design for structures should not penetrate impermeable layers at the base of landfill. This would result in new vertical pollutant pathways; and
- Without proper management of leachate there may be the risk of hazardous substances entering the channel and impacting key drinking water abstractions in the main River Thames, which is a drinking water protected area.

Other engagement

16.2.2.4 Consultation with Environment Agency Contaminated Land and Waste technical specialists (in their capacity as internal advisors) has been undertaken and is ongoing, including with the National Permitting Service regarding material reuse and waste related permits and applications.

16.2.3 Study Area

Soils and land (including agricultural land)

16.2.3.1 For the purposes of soils and land the study area encompasses the full extent of the area within the project boundary for EIA scoping. The justification for this study area is based upon professional judgement on the following basis.

16.2.3.2 Soils and land are only likely to be significantly affected by the project's temporary and permanent activities where the activity directly impacts on the resource itself, such as land take within the project boundary and soil handling/storage during construction.

16.2.3.3 It is therefore considered that soils and land beyond the project boundary for EIA scoping will not be affected and thus no requirement for a buffer. This study area will be referred to as the 'soils and land study area' throughout the remainder of this chapter.

Land potentially affected by contamination

16.2.3.4 For the purposes of land potentially affected by contamination, the study area encompasses the extent of the area within the project boundary for EIA scoping and extends an additional 250m from the soils and land study area outlined above.

16.2.3.5 The justification for this study area is based upon professional judgement of the following principles:

- The spatial extent to which effects of potentially contaminated land are likely to affect receptors via viable pollutant pathway linkages such as dispersion by wind or water;
- The spatial extent to which potential sources of contamination outside of the project boundary for EIA scoping are likely to cause significant effects on receptors within the project boundary for EIA scoping;
- The spatial extent to which ground gases and vapours are likely to cause significant effects to receptors within the project boundary for EIA scoping; and
- It is deemed any contamination migration beyond this distance is likely to be minimal, or that it is likely to be mitigated such as through following best practice guidance during construction. The study area is considered appropriate for capturing both historical and current land uses to which the land may be potentially affected by contamination.

16.2.3.6 The study area for land potentially affected by contamination will be referred to as the ‘land quality study area’ as shown in Figure 16-1 throughout the remainder of this chapter.

16.3 Baseline

16.3.1 Existing Baseline

16.3.1.1 Spatial distribution of superficial and bedrock geology is shown in Figures 16-2 and 16-3 in Appendix A respectively. The details of the geological strata below have been obtained from geotechnical and geo-environmental reporting as part of previous GI undertaken for the project (GBV, 2016).

Bedrock geology

16.3.1.2 The bedrock underlying the northern extent of the soils and land study area, which includes the north of the Runnymede Channel along with the three River Thames weirs, is the London Clay Formation of the Thames Group.

16.3.1.3 The London Clay Formation mainly comprises bioturbated or poorly laminated, blue-grey or grey-brown, slightly calcareous, silty to very silty clay, clayey silt and sometimes silt, with some layers of sandy clay. It contains thin courses of carbonate concretions (‘cement stone nodules’) and disseminated pyrite. The bedrock is found to be widespread across the soils and land study area.

16.3.1.4 Further south, underlying the central area of the Runnymede Channel, the downstream end of the Spelthorne Channel and the area downstream of Desborough Cut, the Claygate Member of the London Clay Formation lies above its parent unit in isolated sections.

16.3.1.5 The London Claygate Member is described as sandy clay, with local interbeds of fine sand and clay / silt but still retaining a cohesive texture.

16.3.1.6 The bedrock geology encountered in the south-western section of the soils and land study area, the south of the Runnymede Channel and most of the Spelthorne Channel is the Bagshot Formation of the Bracklesham Group overlying the Thames Group.

16.3.1.7 Most of the Bagshot Formation is composed of pale-yellow brown to pale grey, or white, partially cemented fine sand, locally fine to coarse sand, with local pebble beds. The sands indicated a degree of crossbedding. This stratum is present in the southern extent of the Runnymede Channel and widely across the Spelthorne Channel.

Superficial geology

16.3.1.8 The natural superficial geology underlying much of the soils and land study area consists of River Terrace Deposits of Shepperton Gravel Member and Alluvium. The River Terrace Deposits at the most upstream section of the Spelthorne Channel are Langley Silt Member, whilst River Terrace Deposits near the three River Thames weirs are of the Kempton Park Gravel Formation and Langley Silt Member.

16.3.1.9 The superficial Shepperton Gravel Member stratum is a multi-coloured and yellow brown, medium dense to very dense, gravel and sand to sandy gravel. It is found to be widespread across the channel route.

16.3.1.10 The Alluvium is described as soft and firm, variable, slightly sandy or sandy, locally slightly gravelly, clay and silt. Locally lenses and beds of peat were encountered as well during the RTS GI. The deposits consist of beds of sand, or laminated clay and sand and are described as Alluvial

Sand. Occasional shell fragments are noted. The gravel was angular to sub-rounded, fine and medium with flint. The alluvium stratum is found to be widespread across the channel route.

Made ground and landfill materials

16.3.1.11 Made ground and landfill materials are known to be present throughout the soils and land study area. The material is generally associated with known former landfills, which are shown on Figure 16-1 in Appendix A. Some sediment from the area downstream of Desborough Cut (identified for bed lowering) is likely to consist of a mixture of made ground and natural superficial deposits as noted above.

16.3.1.12 Made ground encountered within the historical or authorised landfill sites have been characterised as one of the following:

- Made ground – landfill – undifferentiated;
- Made ground – landfill – demolition and construction; or
- Made ground – landfill – domestic.

16.3.1.13 All other types of made ground encountered in previous GI which are not landfill material have not been subjected to further characterisation and are termed “Made Ground”. This “Made Ground” is of variable deposits with a little to some, anthropogenic material in them, such as brick and concrete. Occasional hydrocarbon odour has been noted. Reworked natural soils, such as Alluvium, Alluvial Sands, Shepperton Gravel Member and London Clay have also been tentatively identified.

Made Ground – Landfill – Undifferentiated

16.3.1.14 Undifferentiated landfill material are deposits with little to no anthropogenic material. Gravel is predominantly natural with rare brick and/or concrete fragments. Rare bricks or cobble size fragments of brick were described on trial pit logs. Occasional olfactory evidence of contamination, including hydrocarbon odours were also noted.

Made Ground – Landfill – Demolition and Construction

16.3.1.15 Demolition and construction landfill generally consist of variable deposits of granular material with low to medium cobble content, or cohesive material with medium cobble content and/or low boulder content. The logs from GI encountering this material were described as having any one, or a combination of, the following noted in them:

- Exploratory hole terminated on an obstruction;
- With occasional, locally frequent to abundant wood/timber fragments (<200mm x 1m), frequently stained black;
- With whole bricks or brick rubble;
- With concrete rubble or slab;
- With occasional or higher occurrences fragments of any of the following; asbestos, ash, brick, ceramic, concrete, glass, metal, tarmacadam, tile/pottery, plastic, rebar, rope, wire.

16.3.1.16 Gravel is angular to subrounded of flint, sandstone, brick, concrete. Cobbles are angular and subangular of sandstone, brick and concrete. Boulders are angular of concrete with occasional hydrocarbon odour noted.

Made Ground – Landfill – Domestic

16.3.1.17 Domestic waste landfill generally consists of a variable deposit with a wide range and varying abundance of cohesive or granular deposits, with any or a combination of the following;

- Varying amounts of black bin liners containing general household waste;
- Frequent household waste (paper, phonebooks, books);
- Abundant plastic sheeting (<2mm x 4m);
- Abundant timber/wood fragments, stained black;
- Frequent household waste;
- Mixed material including cardboard, ceramic, fabric, glass, metal, paper, plastic binding straps, plastic bags, plastic cables, rubber ducting material, tiles, umbrellas, vinyl floor tiles and wire;
- Strong refuse odour.

Geologically Designated Areas

16.3.1.18 No geological SSSI, Regionally Important Geological and Geomorphological Sites (RIGs) or Locally Important Geological Sites (LIGs) have been identified within the soils and land study area. At this stage, it is not possible to determine the presence of geological sites of local importance/interest, which may have a low sensitivity, within the soils and land study area. Consultation with local authorities and local groups will confirm the presence of these assets within the soils and land study area and this information will be used to inform the assessment.

16.3.1.19 The resource value of both the superficial and bedrock aquifers underlying the project is discussed in Chapter 18: Water Environment.

Soils (including ALC)

16.3.1.20 Soils within the soils and land study area are of varying permeability, the distribution of soil type is summarised in Figure 16-4 in Appendix A. There are also large sections in the soils and land study area that are recorded as unclassified due to the urban environment. Soils west of the Runnymede Channel, the north of the Spelthorne Channel and both sides of Sunbury and Molesey Weirs are considered to be freely draining, slightly acidic, loamy soils (see Figure 16-4 in Appendix A). In contrast, the majority of the Runnymede Channel, the south of the Spelthorne Channel, land to the south of Desborough Island and the area immediately surrounding Teddington Weir are considered to be loamy and clayey floodplain soils with naturally high groundwater.

16.3.1.21 Soils within other parts of the soils and land study area such as land identified as potential HCAs include freely draining slightly acid loamy soils such as Land Between Desborough Cut and Engine River HCA and; slightly acid loamy and clayey soils with impeded drainage such as Drink Water Pit HCA.

16.3.1.22 ALC is the approved system for grading agricultural land between 1 and 5 with Grade 3 subdivided into subgrades 3a and 3b (Stapleton *et al.,* 2022). The 'Best and Most Versatile' agricultural land is defined within the planning system as Grades 1, 2 and Subgrade 3a (good quality land) (Natural England, 2012).

16.3.1.23 Figure 16-5 in Appendix A illustrates the ALC in the soils and land study area. Given its urban setting much of the land is classified as urban or non-agricultural land. Whilst the total area of agricultural land within the soils and land study area is limited, the quality is generally high with the majority of agricultural land classified as good to moderate (Grade 3) or very good (Grade 2). The area within the soils and land study area contains isolated areas of agricultural land throughout. Land around

Sunbury and Molesey Weirs are classed as non-agricultural, land around Teddington Weir is dominated by urban areas.

16.3.1.24 The highest quality agricultural land within the soils and land study area is Grade 2 (very good) land confined to isolated areas near Thorpe, Laleham and Shepperton. The largest continuous swathes of agriculture grade land are between Egham and Chertsey (Grade 2 – very good and Grade 3 – good to moderate). Mead Farm lies within this agricultural land area. There are other areas of rough grazing or non-agricultural land adjacent to Thorpe Hay Meadow, and across Abbey Meads in the Runnymede Channel. Land to the South of Wraysbury Reservoir and land to the south of Desborough Island, where the Land Between Desborough Cut and Engine River HCA is proposed, is of Grade 3 agricultural land (good to moderate).

Land potentially affected by contamination

16.3.1.25 Sources of potential contamination have been identified within the land quality study area. These include authorised and historical landfilling activities, commercial and industrial land uses and farming activity, among others. Elevated concentrations of solid, leachate and water contaminants have been identified and include hydrocarbons, heavy metals, particularly lead and arsenic among others, localised elevated levels of Volatile Organic Compounds (VOCs) and asbestos within areas associated with landfill activities. These contaminants, although in much smaller quantities, were also encountered within areas of natural soils (GBV, 2016).

16.3.1.26 Locations of the historic landfill and authorised landfill areas within the land quality study area are provided in Figure 16-1 (Appendix A) and a summary of the type of landfill material that they contain and is provided in Appendix I.

16.3.1.27 Some of the soils within the land quality study area, particularly those encountered in landfill areas, may have the potential to pose a risk to human health if not managed according to relevant industry guidance (GBV, 2017). Soils with concentrations of contaminants exceeding the LQM/CIEH S4ULs for Human Health Risk Assessment in Public Open Spaces Park (Nathanail et al. 2015) were encountered at multiple sites during the RTS GI surveys. A greater proportion of the samples tested identified exceedances in landfills at, Manor Farm, Shepperton Ranges and Sheep Walk. It is also noted that asbestos was present in most of the landfill sites within the land quality study area.

16.3.1.28 Laboratory results found concentrations of contaminants in leachate and groundwater that may pose a risk to identified water resources; the location of these generally coincided with contaminant exceedances in soils (as noted above).

16.3.1.29 The previous GI surveys gathered information on land potentially affected by contamination within the flood relief channel alignment. Where landfill material was encountered, it is split into three categories; construction and demolition waste, domestic waste and undifferentiated landfill (Fugro, 2015).

Radon Gas

16.3.1.30 The radon potential for the area is low. The majority of the land quality study area (including for the largest extent) falls within the lowest band of radon potential of '*Less than 1 % of homes above the Action Level*'. A small part of the study area in the Thorpe area falls within a band of '*elevated radon potential. Maximum radon potential is 1-3 %*'. The health implications of radon gas are generally associated with its ingress and subsequent build up in enclosed spaces such as the basement or subfloor voids in dwellings (particularly new ones), protection measures are not necessary in the construction of non-domestic buildings. Therefore, due to the nature of the project, issues associated with radon gas do not need to be considered as part of the EIA.

16.3.2 Future Baseline

16.3.2.1 Ground conditions are unlikely to change between now and the start of construction and / or operation. However, if any mineral restoration, or construction works are undertaken in the area, this may impact the geology. Similarly any developments or any activities that may have or may occur prior to the project starting construction may change the soils, geology, agricultural land and other identified receptors. These changes will be considered within the ES as the EIA, design and consultation process continues.

16.3.2.2 Agricultural assets will remain at risk of flooding, and this risk will gradually increase over time as climate change becomes more significant (Ashley et al., 2005).

16.3.2.3 The likely future baseline conditions during the years of anticipated project construction and operation will be determined based upon our understanding of the changeability of existing conditions and the influence of external factors such as legislation and development.

16.3.3 Key Environmental Considerations and Opportunities

16.3.3.1 The key environmental considerations in relation to soils and land are:

- The presence of moderate and high-quality agricultural land; and
- The presence of historical and authorised landfill sites and other areas of potentially contaminated land within the study area which could pose a risk to receptors via pollutant pathway linkages; the risk of disturbing contaminants from past landfill sites and other areas of potentially contaminated land during construction, especially with regards to those contaminants identified as having a risk to human health and water resources; the requirement to protect soil structure, quality and quantity during construction.

16.3.3.2 The key opportunities in relation to soils and land are:

- A reduction in flood risk for land use assets (e.g. agricultural land within the soils and land study area);
- There are likely to be opportunities for use of excavated soils within the project, incorporated in the landscape design (subject to approval).

16.4 Likely Significant Effects Requiring Assessment

16.4.1 Construction effects

16.4.1.1 Project activities and associated likely significant effects are identified below:

- Earthworks and general construction activity have the potential to cause significant effects resulting from the permanent loss to soils as a result of land take to construct the flood channels and other project components;
- Creation of site compounds, temporary material processing sites and temporary storage of excavated material, including vehicle use to construct embankments and other structures, have potential effects

from depositing material causing damage to soil structure through compaction, erosion or bank instability;

- Use of excavated material onsite has the potential to cause significant effects, due to the migration of contaminants from the placed landfill material and material sourced from other potentially contaminative sites through the creation of new pollutant pathways. Pathways could be, for example, via surface water, groundwater and windblown dusts to onsite and offsite receptors;

- Use of excavated material onsite from placement of material on landfill areas has the potential to result in release of ground gas (including volatile vapours), landfill leachate and/or other contaminants into groundwater. This could be from the result of compaction and compression forcing ground gas and water or leachate laterally, or from direct pathways such as surface water runoff from the placed materials. This may affect identified receptors on or offsite;

- Use of excavated material onsite could have potential adverse effects of material deposition and re-profiling to soil structure / physical and chemical properties etc as a result of landscaping (potentially snaking rampart and / or raised landforms) excavation through landfill and other sources of contamination, which have the potential to cause significant effects resulting from the creation of new pollutant pathway linkages from landfill materials, ground gas (including volatile vapours) and landfill derived leachate. Mobilisation of contaminants of concern via windblown dusts, release of ground gas, migration of leachate or groundwater may migrate to and impact uncontaminated soils and land;

- Earthworks and general construction activity have the potential to create new pollutant pathways as a result of constructing flood channels/project components through landfill areas and areas of potential contamination;

- Mobilising existing contamination in soil and groundwater as a result of ground disturbance (due to the installation of foundations/retaining walls/structures along the new channel areas), stockpiles and dewatering (if required) during construction, increasing the potential for contaminants in unsaturated soils to leach to groundwater in open excavations during construction or reach saturated soils not previously considered to contain contaminants (see also Chapter 18: Water Environment); and

- Transportation of material / waste, and placement / processing of non-hazardous material at end destination have the potential adverse effects from exporting soil to other sites through deposition of dust and material placement and re-profiling on the physical and chemical properties of both the indigenous and imported soils.

16.4.2 Operational effects

16.4.2.1 Project activities and associated likely significant effects are identified below:

- Use of the flood channel, associated features and capacity improvements during times of flood will have a beneficial effect of reduced flood risk in areas of contaminated land, and subsequent reduced likelihood of mobilising contaminated soils in the floodplain during flood events;

- Use of the flood channel, associated features and capacity improvements will have a beneficial effect of reduced flood risk to agricultural land and soil quality through a reduction in leaching of contaminants during flood events. This will not only reduce the loss of farmland but will likely also result in the reduction of pesticides, herbicides and nitrates and phosphates being mobilised during flood events from agricultural land and migrating into the surface water. This is also discussed in Chapter 10: Flood Risk and Chapter 18: Water Environment. The existence of flood channels in landfill areas has the potential to cause effects from landfill leachate migrating to uncontaminated soils close to landfill sites and affecting its quality. A Source-Pathway-Receptor model will be applied to demonstrate all possible viable pathways for contamination to migrate to identified receptors have been captured as a result of the project. Consideration will be given to the construction methods likely to be undertaken to reduce or eliminate potential pathways to sensitive receptors where reasonably practicable; and

- Use of the flood channels, other project components (e.g. changes in land levels) has the potential for mobilisation of ground gas due to the changes in flooding frequency / extent and compression forces on ground gas sources within the ground.

16.5 Effects Not Requiring Assessment

16.5.1 Construction Effects

16.5.1.1 Project activities and associated effects that are deemed not likely to be significant and are therefore proposed to be scoped out of the EIA are identified below:

- General construction activities, movement of vehicles, equipment and site operatives have potential to cause effects from tracking of vehicles, establishment of compounds and GI works, causing damage to soil structure, compaction, erosion or bank instability. The potential effect is considered to be temporary and will be managed, avoided, prevented and reduced through the implementation of standard best practice measures and guidance via a CEMP including reference to a project specific Soil Resources Management Plan or similar;
- The storage of chemicals and liquids have the potential to cause effects to receptors such as soils, geology and human health through new pollutant pathways (for example through surface or groundwaters) as a result of accidental spillages. The effect will be avoided, prevented and reduced through the implementation of construction best practice measures and guidance via a CEMP, including reference to a project specific Surface Water Management Plan. Where appropriate, measures will include ensuring chemicals and liquids are stored safely, drip trays are used underneath equipment and ensuring emergency spill kits are available. Toolbox talks will be given to ensure construction staff are aware of risks and procedures; and
- Movement of hazardous material/ wastes from the major road network and placement offsite has the potential to cause effects to soils and land due to pollution from dusts arising from handling and transport. Nevertheless, licensed waste operators will be used to transport hazardous waste/ material offsite to an appropriately licensed waste facility using suitable vehicles and equipment.

16.5.2 Operational Effects

16.5.2.1 Project activities and associated effects that are deemed not likely to be significant and are therefore proposed to be scoped out of the EIA are identified below:

- General maintenance activities have the potential to cause damage to soil structure, compaction, erosion or bank instability as a result of the tracking of vehicles. Vehicle movements required for maintenance activities are likely to be infrequent and of short duration, minimising any effects. In addition, best practice measures will ensure that these effects will be minimised by including relevant post-construction clauses in the CEMP such as restricting vehicles to specific routes and keeping vehicle routes a set distance away from banks;
- Operational failures of the RTS have the potential to cause bank instability and/or erosion of soils within the flood relief channels and on the River Thames at the channel's intakes and outfalls. Embedded will reduce the risk of these potential effects, such as bank protection works and profiling the flood relief channels to be of a safe and stable angle. Where there is restricted space, and this angle cannot be achieved, the bank will be supported by sheet piling, further reducing the risk of erosion and subsequent bank instability; and
- The existence of flood channels has a potential effect on soil structure and soil quality as a result of changes to groundwater levels. This is not considered to be significant, as water level control structures have been built into the project to maintain existing groundwater levels in areas surrounding the new flood relief channel. This will prevent any substantial changes in soil structure and quality. Soil quality may improve due to reduction of groundwater level and thus leaching effects on soils.

16.6 Approach to Mitigation

16.6.1.1 This section should be read in conjunction with Chapter 5: Approach to EIA Scoping which sets out further definition for the project regarding primary (embedded) mitigation, secondary (additional) mitigation and tertiary (best practice) mitigation.

16.6.2 Construction

16.6.2.1 Secondary mitigation measures that are under consideration for the construction phase are identified below:

- Opportunities for protection and/or enhancement of soils and land including remediation of contaminated land will be considered where appropriate;
- Following the Waste Hierarchy, any site-won material from the project will be processed and recovered and reused as appropriate, reducing the need to import materials from offsite sources and minimising the volume of unsuitable made ground requiring offsite placement. This will be achieved through the implementation of a material management strategy, utilising a combination of waste recovery permits and/or via MMP or appropriate permits which will allow for the transfer of materials for processing within the project boundary for EIA scoping. Remediation strategies, implementation and appropriate tracking and verification will be required as part of those works; and
- A hydrogeological risk assessment will be undertaken in the next stage as part of detailed design to identify any required mitigation measures.

16.6.3 Operation

16.6.3.1 At this stage there are no specific secondary mitigation measures under consideration for the operation phase other than potential for additional monitoring and maintenance.

16.7 Assessment Methodology

16.7.1 Scope of Assessment

16.7.1.1 The appraisal of significance and assessment of effects will be based on general EIA assessment methodologies alongside professional judgement. In addition, best practice guidance and legislation will be used to support the assessment (see Appendix M). The scoping exercise has identified potential for significant effects relating to soils and land during the construction phase of the project and, therefore, an assessment will be undertaken in accordance with the appropriate guidance.

16.7.1.2 In the UK a risk-based approach is taken to assess the significance of contamination present within a study area. In a regulatory sense, for land to be deemed as contaminated, or for there to be a significant 'risk' of contamination, there must be clearly identifiable pollutant linkages. Land Contamination and Risk Management guidance documentation sets out the process for risk assessment as previously noted. The following pollutant linkage definitions apply for assessments:

- Contaminant source: contamination that has the potential to cause unacceptable adverse effects to a receptor. It may comprise chemical, biological or physical agents;
- Pathway: a route whereby a contaminant may come into contact with the receptor; examples include ingestion of contaminated soil and leaching of contaminants from soil and migrating into water resources; and
- Receptor: a target that may be affected by contamination; examples include human occupants or users of the site, surface or ground water bodies or structures.

16.7.1.3 A conceptual site model (CSM) will be developed for the project using the above information to identify any sources of contamination, ground gas, pathways, and receptors present within the study area. The CSM will assess the likelihood of existing contamination being encountered during the construction process, such that it could cause significant environmental harm or adverse health effects if not addressed adequately at the construction and/or operational stages. It will also be used to identify potential construction and operational effects.

16.7.1.4 The concentrations of contaminants will be tested for significance against accepted industrial threshold standards including generic assessment criteria such as LQM/CIEH S4ULs and CLEA to assess whether measured concentrations of contaminants present a potential risk to human health. This will be via combination of previously gathered GI and future data gathered from investigations.

16.7.1.5 To establish a baseline for the historical landfills where options for new green open spaces and HCAs are proposed, GI information will be used. Groundwater levels, flows and the concentration of contaminants within the groundwater at present will be determined by interpreting data from the

Environment Agency's long-term borehole monitoring (see Chapter 18: Water Environment for more details).

16.7.1.6 A scheme of ground gas monitoring is planned to be undertaken in 2022. The C665 CIRIA, 2007 Assessing Risks Posed by Hazardous Ground Gases to Buildings guidelines, BS8485:2015+A1:2019, Code of Practice for the Design of Protective Measures for Methane and Carbon Dioxide Ground Gases for New Buildings and BS 8576:2013 Guidance on Investigations for Ground Gas Permanent Gases and VOCs will be used to assess the monitoring data and provide a gas risk baseline for the EIA.

16.7.2 Significance Criteria

16.7.2.1 The assessment of significance will define magnitude of change and receptor sensitivity to determine the significance of effects as outlined below.

16.7.2.2 To determine the sensitivity of environmental receptors, topic specific criteria have been developed that categorise sensitivity of receptors into high, moderate or low.

High sensitivity

16.7.2.3 High sensitivity receptors include the following:

- Residential areas, schools, recreational within residential areas (open space residential), allotment areas;
- Nationally or internationally designated ecological sites;
- Principle aquifer, public reservoir, abstractions (surface or groundwater), inner groundwater source protection zones (GSPZ), surface waters of high quality;
- Areas of high historic value or listed buildings; and
- Major mineral resource areas.

Moderate sensitivity

16.7.2.4 Moderate sensitivity receptors include the following:

- Open space such as parkland, places of work and public retail or shopping parks with open space / landscape areas;
- Outer and total catchment GSPZ;

- Secondary Aquifers;
- Locally important mineral resource areas; and
- Locally designated ecological sites such as SNCIs.

Low sensitivity

16.7.2.5 Low sensitivity receptors include the following:

- Commercial or industrial developments;
- Areas mainly covered by hardstanding;
- Mineral consultation areas;
- Unproductive or non-aquifers; and
- Sites of no significant ecological value.

16.7.2.6 The magnitude (scale) of effects will be defined as follows and will be defined using qualitative criteria:

High magnitude

16.7.2.7 An effect will be classified as having a high magnitude of change if a sensitive receptor is exposed to harmful concentrations of contamination.

Moderate magnitude

16.7.2.8 An effect will be classified as having a moderate magnitude of change if there is a potential for concentrations of contamination to exceed statutory guidance, or legislation.

Low magnitude

16.7.2.9 An effect will be classified as having a low magnitude of change if a source-receptor-pathway linkage has been identified, but contamination deemed to be low risk.

Negligible magnitude

16.7.2.10 An effect will be classified as having a negligible magnitude of change if there is a limited, to no, source-receptor-pathway linkage identified.

16.7.2.11 The significance of an effect on contaminated land is a product of the magnitude of change and the sensitivity of the receptor and will be determined by professional judgement.

16.7.2.12 The assessment of environmental effects will use the criteria as shown in the matrix in Table 16-1. After establishing the sensitivity of the receptor and assessing the magnitude of change using the criteria above, the effect to the receptor can be determined as either significant (major or moderate effects) or not significant (minor or negligible effects) for consistency with other technical assessments in the ES.

Table 16-1: Significance of effects matrix.

	High Sensitivity	Moderate Sensitivity	Low Sensitivity
High Magnitude	Major (Significant)	Major (Significant)	Moderate (Significant)
Moderate Magnitude	Major (Significant)	Moderate (Significant)	Minor
Low Magnitude	Moderate (Significant)	Minor	Negligible
Very Low Magnitude	Minor	Negligible	Negligible
No Change	None	None	None

16.7.2.13 Definitions of the significant effects derived in the table above are discussed below.

16.7.2.14 A major (significant) significance is defined as a significant change in environmental conditions causing breaches of legislation or the exceeding of statutory objectives. It is likely to affect sites designated for national or international importance. It is also likely to affect a large-scale area, or a large number of people on frequent or permanent basis. It may be an irreversible decline and it may require remediation of large areas of contaminated land where there is a high risk of highly sensitive receptor exposure to harmful levels of contamination such as significant health effect.

16.7.2.15 A moderate (significant) significance is defined as not being likely to cause a breach of legislation, but likely to effect on a site of regional or local environmental importance. Likely to affect a small number of residents/visitors on a permanent basis. Remediation may be required of large areas of contaminated land where there is a high risk of moderate, or low sensitive receptor exposure to harmful levels of contamination such as significant health effect.

16.7.2.16 A minor significance is defined as something that is likely to affect an area, or feature of local interest, or importance. It is also likely to have a temporary effect on a small number of people or be a recoverable effect.

16.7.2.17 A negligible significance is defined as something that has a limited or no indiscernible effect predicted.

16.7.3 Construction Effects

16.7.3.1 We will determine likely significant construction effects to receptors resulting from the project using a combination of the criteria in the above tables. Assessment of effects (with primary and tertiary mitigation assumed to be in place) will be presented initially. Any further (secondary) mitigation that may be required to address any remaining significant adverse effects will be identified and residual effects assessed with such additional secondary mitigation in place as a second stage of the assessment. An appropriate hydrogeological risk assessment will be undertaken to assess the magnitude of effects of altering groundwater flow and pathways around existing landfill from the creation of the new green open spaces and HCAs and what impacts this may have on relevant identified receptors.

16.7.3.2 In order to identify and assess the effects of land contamination, the nature and extent of the sources of contamination present within the DCO application project boundary at that point in time will be determined. The concentrations of contaminants will be tested for significance against industrial threshold standards including generic assessment criteria such as, but not limited to S4Uls and Category 4 Screening Levels (C4SLs). The methodology outlined above will then be applied as part of the assessment of data to assess the magnitude of risk to identified receptors. The cross over with the Water Environment topic (Chapter 18) will ensure all receptors, not just “human” will be covered in this way.

16.7.3.3 The design of the project has embedded mitigation to avoid the creation of new soil pollution pathways. The Source-Pathway-Receptor model will identify whether the project does not create viable pathways for contamination to migrate to identified receptors. Consideration will be given to the construction methods likely to be undertaken to reduce or eliminate potential pathways to sensitive receptors where reasonably practicable.

16.7.3.4 To assess soils and land for reuse and to assess if any risk or change may occur to identified receptors, the results from all valid surveys will be analysed using the two-stage Generic Qualitative Risk Assessment. This uses standard criteria for soils with a soil organic matter content of 1 per cent and will be carried out in accordance with the methodology for assessing soil samples set out in the Environment Agency's guidance document 'Using Soil Guideline Values, SC050021/SGV Introduction' (Environment Agency, 2009d) and using the CLEA 1.06 model software (and CLEA 1.071 for nickel). Firstly, in the Risk Estimation stage, the measured contaminant concentrations will be compared to the relevant Generic Acceptance Criteria or C4SLs/S4ULs for contaminants where these have been published. The proposed end use of these sites is considered to be representative of parkland, as set out in the CL:AIRE (2014) guidance report 'SP1010 - Development of C4SLs'. At present, there are no Generic Acceptance Criteria values for Public Open Space end use however, the values generated via the C4SLs/S4UL methodologies will be used for the assessment of significant effects. In cases where C4SLs or Generic Acceptance Criteria are exceeded, a second stage of Risk Evaluation or Detailed Quantitative Risk Assessment may be required to consider if exceedance may be acceptable in the particular circumstances, or if a significant risk or change is posed by identified contamination.

16.7.3.5 To assess likely effects of material deposition compression in areas or development (new green open spaces and potentially some HCAs) within historic landfill sites, appropriate software will be used to develop a model of each area to understand the geological formations. The GI data will be used to develop models and cross sections, which will also assist the development of the CSM.

16.7.3.6 The current void space and the potential void collapse after the loading of material will then be estimated. Any changes to the groundwater levels and flows will be identified and the potential release of leachate after loading will be assessed, to determine the quantity and flow of contaminant plumes for best and worst-case scenarios, potential dilution factors, and any subsequent significance of effect on receptors.

16.7.4 Operational Effects

16.7.4.1 By the operational stage of the project, conditions may have altered the baseline as a result of the various construction work.

16.7.4.2 We will assess the potential operational effects of release of leachate resulting from material deposition and settling at the new green open spaces and potentially some HCAs if designs require placement of materials. We will assess the potential for contaminants that may come into contact with groundwater flows and subsequent leachate that may be released. We will also assess if any settlement could cause an increase in leachate generation that infiltrates groundwater flows. This will then be assessed to determine if there is an ongoing significant effect upon groundwater and further identified receptors and whether mitigation is required.

16.7.5 Cumulative Effects

16.7.5.1 As part of the ongoing assessment, the current list of consented projects to be considered for the assessment of cumulative effects will be reviewed.

16.7.5.2 Other projects in proximity to the project will be considered, to determine if they will affect land use, and thereby change or influence pathways and receptors that are also influenced by the project.

16.7.5.3 The potential for cumulative effects to arise from the identified effects of the RTS acting in-combination with other existing and/or approved projects is provided in Chapter 19: Cumulative Effects Assessment.

16.8 Assumptions and Limitations

16.8.1.1 The soil and land assessment will be undertaken based on information available at the time of the assessment. It is acknowledged that some of the information required may not be known or may change during the EIA.

16.8.1.2 The existing GI data is incomplete with some areas of historic landfill not currently investigated. Further surveys are required and will be undertaken to fully establish baseline ground conditions and inform the ES in the following areas:

- Areas proposed for landscaping including green open areas such as the central and eastern portion of Manor Farm;

- The area downstream of Desborough Island;
- The potential HCAs;
- Construction access routes and compound; and
- Some areas within the extents of the project boundary for EIA scoping including auxiliary areas adjacent to the main work areas and material processing sites.

16.8.1.3 Further investigations are being carried out to obtain samples to fully characterise the strata to the depth of potential excavations, including topsoil (where present) with care taken to differentiate it from made ground or sub-soil. Testing will be required throughout the land quality study area, but with a focus on the known areas of data gaps. The GI will include WAC analysis and full waste classification. For full details please refer to Chapter 13: Materials and Waste.

16.8.1.4 As part of the further assessments to be undertaken on the project, a hydrogeological risk assessment will be required to assess the effects of altering groundwater flow and pathways around existing landfills. Using data obtained from the 2006, 2014-2016 and 2017 RTS geotechnical investigations, the concentrations of contaminants will be re-screened against accepted end use criteria for the areas, including any recently updated screening criteria to assess whether there is a potential risk to human health. The risk assessments will consider the need for additional GI to inform the detailed design. The results will be shared with stakeholders to agree the validity of the data and if the approach to screening the data and the need for additional GI is appropriate.

16.8.1.5 This Chapter has assumed that all third-party data used to generate the baseline is fit for purpose and accurately reflects the current status of the soils and land in the study area. Consultation with local authorities and local groups will confirm the presence of other geological sites of local importance/interest.

16.8.1.6 Further, more focused, GI surveys are likely to be undertaken at the detailed design stage; this is likely to be required if structures in the current design are moved and / or new structures are added, or where it becomes apparent that more information on contaminants is needed.

16.8.1.7 The volume of excavated soils and materials may change during detailed design as the design is optimised or as minor changes to working methods are identified. Furthermore, the ongoing process of iterative design is likely to further reduce the volumes of excavated soils and materials in accordance with the principals of the waste hierarchy (prevention, reuse, recycling, other recovery and disposal). These principals, along with methods of re-using site won soils are discussed in Chapter 13: Materials and Waste.

17 Traffic and Transport

17.1 Introduction

17.1.1.1 This chapter describes the proposed scope of the assessment on traffic and transport. It outlines the baseline conditions, the likely effects of the project and the avoidance or mitigation measures proposed to alleviate these. It also outlines the methodology that will be used for the assessment of effects related to traffic and transport in the PEIR/ES.

17.1.1.2 The purpose of this chapter is to describe (and, where possible, quantify) the likely effect that the RTS will have on the surrounding transport networks.

17.1.1.3 This will consider the potential effects on traffic and transport arising from construction and operation of the project. It will include assessments of the potential effect on amenity of the road network and delays to pedestrians, cyclists and equestrians, railway and waterway transport.

17.1.1.4 Effects on off-road cycle routes, footpaths, equestrian routes and recreational navigation are covered in Chapter 11: Health (in relation to effects on health to users of these resources) and Chapter 15: Socio-economics (in relation to their use as a recreational resource). Effects on air quality and noise and vibration as a result of changes in traffic are considered in relation to Chapters 6 and 14 respectively.

17.1.1.5 The Transport Assessment (TA), that will be prepared alongside the ES, will inform the trip generation estimates and will feed into the environmental effects assessed in the ES. Several effects of the generation of trips by vehicles, particularly HGVs, will be assessed as part of the EIA Traffic and Transport Chapter.

17.1.1.6 A summary of the key legislation, policy and guidance relevant to traffic and transport is provided in Appendix M.

17.2 Baseline Methodology

17.2.1 Introduction

17.2.1.1 This Traffic and Transport chapter considers the potential effects on traffic and transport arising from construction, operation and maintenance of the project. It includes assessments of the likely significant effects on road (including pedestrians and cyclists), railway and waterway transport. Additional effects on off road cycle routes, footpaths, and recreational navigation will be covered in Chapter 11: Health and Chapter 15: Socio-Economics.

17.2.1.2 The assessment of potential project effects on traffic and transport will be defined based on where there will be a significant increase in trips associated with the construction, operation and maintenance of the project. This will cover all affected users of the public highway and public transport network. This chapter sets out the Traffic and Transport Study Area for EIA scoping (referred to hence forth as 'study area'), with further details of the study area included within Section 17.2.4.

17.2.1.3 This chapter will be prepared with reference to the Institute of Environmental Assessment document 'Guidelines for the Environmental Assessment of Road Traffic' (IEA, 1993). It will therefore include an assessment of the projects' effects on the following during construction and operation/maintenance:

- Driver Delay;
- Severance (perceived division of community by increased traffic conditions);
- Pedestrian and Cyclist Delay;
- Pedestrian and Cyclist Amenity (fear and intimidation from high levels of traffic, large vehicles and vehicle speed);
- Public Transport Amenity; and
- Accidents and Safety.

17.2.1.4 This chapter will be prepared in parallel with the TA which will assess the project's impact on the safety, capacity and network operational performance of the public highway in all phases. Much of the baseline evidence, data and assessment of the effects of the project within this chapter will be informed from the TA. Although the objectives of the assessment of this chapter and the TA differ, it will still be necessary to refer to the TA alongside this chapter.

17.2.2 Information Sources

17.2.2.1 To inform the assessment of the effects of the project on traffic and transportation the following sources of information and data will be collected and collated. The information sources will inform both the TA and assessment of environmental effects within this Chapter:

- Surrey County Council Traffic Model (note that the latest Surrey County Council traffic model data is unavailable. Once available, this will be used instead of the previous Surrey County Council Traffic Model data obtained in 2019);
- Surveys;
- Personal Injury Collision (PIC) Data;
- Public Transport information, including timetables, routing plans, and usage obtained from service operators;
- Sustrans National Cycle Network Map;
- Boat traffic through locks and weirs; and
- Open source maps, Google Maps and relevant LPA websites.

Surrey County Council Traffic Model

17.2.2.2 Traffic flow data from Surrey County Council's Traffic Model was made available by Surrey County Council in 2019 and included Car, LGVs and HGVs link flows.

17.2.2.3 It is expected that a new Surrey County Council Traffic Model will be available in summer 2022. Data from this model will be used instead of the previously provided data if available. The model data will be utilised to determine baseline and future forecasted traffic levels throughout the study area.

Surveys

17.2.2.4 Where traffic data is not available from the Surrey County Council Traffic Model, traffic surveys (extent and type to be discussed with Surrey County Council) will be used instead as a basis to inform the baseline and future forecasted traffic levels. Traffic survey data will include data recorded in 2019 by Automatic Traffic Counts and Manual Classified Turning Counts. Additional data is likely to be sought at locations of potential effect where the above model and available survey data is missing within the study area.

17.2.2.5 NMU surveys have been undertaken in 2022 at locations along the PRoW network (including the Thames Path National Trail) to determine current use by pedestrians, cyclists and equestrians.

Collision Data, Active Travel, Public Transport and River Traffic Data

17.2.2.6 PIC data will be requested from the Local Highway Authorities (LHAs) within the study area on potentially effected routes.

17.2.2.7 Information on public transport, walking and cycling routes will be collated from open source maps, Google Maps and relevant LPA websites to inform the baseline transport network of which the project's possible effects can be assessed against.

17.2.2.8 Consideration is being made to the possibility of material movement by barge for works associated with the bed lowering downstream of the Desborough Cut. As well as considering the effect of moving material, data on vessel movements through locks on the River Thames will be sought to inform a qualitative assessment of possible effects on navigation.

17.2.2.9 Consideration to the potential movement of materials by rail as part of the project will also be made.

17.2.3 Stakeholder Engagement

17.2.3.1 The RTS has been in development for some time, with early engagement with local highway authorities initially having taken place in 2016 and 2017 to inform the project development. More recently formal pre-application meetings took place in early 2019 with the three highway authorities and the five LPAs that are stakeholders of the project. These are listed below for reference:

- LHAs:
  - RBWM;
  - Surrey County Council; and
  - LBRUT.
- LPAs:

- RBWM;
- RBC;
- SBC;
- EBC; and
- LBRUT.

17.2.3.2 The chronology of meetings that took place up to 2019 with LHAs and LPAs is summarised below:

- RBWM:
  - 7th November 2017 - Discussion on the Potential Traffic Impacts of the RTS – Project Central Office, Slough; and
  - 7th February 2019 – Transport Pre-Application Scoping Meeting (RBWM) – Maidenhead Town Hall, Maidenhead.
- Surrey County Council:
  - 24th May 2016 – Traffic Count and Structural Review Meeting – Fairmount House, Leatherhead;
  - 18th July 2017 – Transport Studies Meeting – Surrey County Council Network Management and Information Centre, Leatherhead; and
  - 14th February 2019 – Transport Pre-Application Scoping Meeting (Surrey County Council) – County Hall, Kingston upon Thames.
- LBRUT:
  - 20th March 2019 – Transport Pre-Application Scoping Meeting (LBRUT) – Civic Centre, LBRUT.

17.2.3.3 Initial engagement with the LHAs on the extent of data available took place with early discussions in 2016 and 2017 on the likely area of assessment discussed. The LHAs have acknowledged that the proposals seek to maximise short journeys moving material between new green open spaces and to minimise long distance disposal, by seeking to re-use or recover material for use in the project, where needed. The numbers of construction lorry movements and worker trips associated with the construction of the project will be estimated in conjunction with information that will be calculated as part of the MMS and Materials Transport Plan currently under development. The plans look at total materials and people travelling to and from the sites, which are assigned to the period of works on the project programme and then filtered down to daily and hourly trips, per route in that timeline. Once allocated to a route, these are then overlapped as required where compounds share routes to show overall demand on those links.

17.2.3.4 The extent of the area of assessment was agreed in 2019 with the local highway authorities and LPAs listed above in paragraph 17.2.3.2 in line with agreement to the proposed construction routes and possible junctions and corridors of concern that lie mainly within their area of control.

17.2.3.5 The previous Scoping Opinions (2017 and 2018) received were comprehensive and the comments are still valid for the traffic and transport assessment chapter, despite the design iterations since they were issued. The majority of the comments related to construction routes, access requirements and other cumulative developments that would need to be considered, and these are all fully covered in the proposed scope. Specific comments on the assessment methodology have also been taken in to consideration, for example, the assessment of construction effects on recreation and PRoW through possible closures/diversions is included in the scope.

17.2.3.6 Further engagement with Surrey County Council and LBRUT has taken place in early 2022 to inform them of the design iterations since previous pre-application discussions took place, and as the project develops, ongoing engagement will help inform the agreed area of assessment.

17.2.3.7 Further engagement with LPAs will take place as proposals evolve and further information is available with regard to the likely effects of traffic and transport associated with the project, following preparation of the MMS. Additionally, National Highways and Transport for London will be consulted due to potential effects of traffic on the strategic road network.

17.2.4 Study Area

17.2.4.1 As mentioned in paragraph 17.2.1.2, the study area will be defined based on where there will be a significant increase in trips associated with the construction and operation of the project. However, as the extent of impact is unknown at this stage, the traffic and transport study area for EIA scoping has been defined as a 600m buffer zone from main roads required to reach the Strategic Road Network (main ‘A’ roads, M3, M4, M25) from main compound sites, HCAs and new green open spaces of the project. The traffic and transport study area for EIA scoping is presented in Figure 17-1.

17.3 Baseline

17.3.1.1 Overall baseline information is presented by mode to provide a baseline that the finalised traffic and transport chapter and TA will provide further detail on. This baseline information by mode has been presented specifically to the various parts of the project for ease of reference.

17.3.2 Existing Baseline

Public Transport

17.3.2.1 Datchet, Sunnymeads, Wraysbury, Staines, Chertsey, Shepperton and Hampton Court railway stations are located within the study area. These stations provide connections to key transport hubs such as London Waterloo, Weybridge, Windsor & Eton Riverside, and Reading. The railway line is operated by South Western Railway.

17.3.2.2 Information on bus services has been obtained from bus operator websites, for bus stops located within the study area. Bus services located within the study area are operated by Falcon Buses, White Bus and Transport for London (TfL) buses amongst others. These provide public transport links between the communities of Datchet, Wraysbury, Staines upon Thames, Chertsey, Shepperton, Walton on Thames, Surbiton and Kingston upon Thames.

17.3.2.3 The ES Traffic and Transport Chapter and TA will present details of public transport services located within the study area. This will include information on key destinations, operators and peak and off-peak frequency. This will allow for the potential effects of the project to be quantified in regard to Public Transport amenity.

17.3.2.4 Bus services which are identified to experience possible delays or overcrowding due to the project will be assessed further as part of the traffic and transport chapter. Appropriate thresholds for this assessment will be determined considering the expected levels of additional patronage and possible network delay effecting services, and these thresholds will be discussed with key stakeholders.

Walking, Cycling and Horse Riding

17.3.2.5 Walking and cycling are modes used for commuting and recreational travel. Throughout the study area, there are footways and pedestrian crossings to support journeys by foot, as well as several signed cycle routes and routes used by equestrians.

17.3.2.6 Baseline data will be obtained from open source maps, Google Maps and relevant LPA websites, including information for the walking and cycling network, and PRoWs.

Road

17.3.2.7 There is an extensive transport road network within the study area, including the nationally important M3, M4 and M25 motorways, and regionally significant trunk roads, including the A3, A244, A240, A244, A305, A308, A309, A310, A320, A3050.

17.3.2.8 It is anticipated that traffic associated with the construction of the project will seek to prioritise using these routes for the movement of materials as much as possible.

17.3.2.9 To reach the trunk network several significant B roads such as the B375, B376, B377 and B387 will also accommodate project related traffic flows as well as localised un-classified roads.

17.3.2.10 The ES Traffic and Transport Chapter and TA will present details of the baseline highway network for the construction and operational routes. This will include information on highway delay within the baseline highway network. Specifically for this chapter baseline two-way traffic flows along the key construction route will be provided in the form of 24h AADT and 18h Average Annual Weekday Traffic (AAWT). This will allow for the potential effects of the project to be quantified in regard to severance and Pedestrian and Cyclist Delay and Amenity.

Waterways navigation

17.3.2.11 The River Thames is the busiest inland waterway and tidal river in the UK, with a wide cross-section of users (PLA, 2015). It is a popular navigable route both commercially (e.g. freight, river taxis, fishing and tourist trips) and recreationally (e.g. private powerboats, rowing), from upstream at Lechlade, Gloucestershire, through the study area to central London, and downstream beyond Canvey Island to the North Sea. In 2014, three billion tonnes of goods were lifted on the River Thames (excluding seagoing traffic)

17.3.2.12 Data with regard to numbers of boats transiting the River Thames and passing through the staffed locks and downstream at Sunbury, Molesey and Teddington will be obtained from the Environment Agency and presented in the ES Traffic and Transport Chapter and TA. This will allow for the potential effects on navigation associated with the bed lowering downstream of Desborough Cut to be assessed.

17.3.3 Future baseline

17.3.3.1 To establish the future baseline, the new Surrey County Council Transport Model will be used, which will account for planned growth and new infrastructure including:

- New residential development;
- Employment growth; and
- Planned infrastructure, including new roads and active travel improvements.

17.3.3.2 The transport model will include an uncertainty log which will include details of projects and interventions included within the model. This will enable a full understanding of future considerations accommodated for when assessing the RTS across the various ES Chapters.

17.3.4 Key Environmental Considerations and Opportunities

17.3.4.1 Existing transport infrastructure (especially major motorways, Heathrow Airport and railway lines) which are already congested, is a major consideration.

17.3.4.2 The key consideration in relation to traffic and transport is the disruption that project-related traffic (both at construction and operational stages, including maintenance) may have on the local road network and waterways, potentially increasing journey times and lengths. A challenge will be to avoid significant disruption to the transport network (including PRoW) during construction.

17.3.4.3 The key opportunities in relation to traffic and transport during operation of the project are:

- The creation of new active travel corridors and recreation spaces that will increase accessibility for pedestrians and cyclists; and
- The prevention of, or reduction in, flooding key routes, which will prevent disruption to road, rail, airport and river traffic networks.

17.4 Likely Significant Effects Requiring Assessment

17.4.1 Construction Effects

17.4.1.1 Project activities and associated likely significant effects are identified below:

- Construction of road bridges is likely to have the temporary significant adverse effect of disruption to traffic;
- Transportation of material / waste, and placement / processing of non-hazardous material at end destination are likely to have the temporary significant adverse effects of increased traffic on local roads, as well as on regionally (A-roads) and nationally (motorways) important roads, causing an adverse effect on traffic congestion, journey times and the condition of local roads;
- Construction traffic on and off site is likely to have the temporary significant adverse effect of increased traffic on local roads, as well as on regionally (A-roads) and nationally (motorways) important roads, causing an adverse effect on traffic congestion, journey times and the condition of local roads;
- The influx of a large number of construction site personnel who will need to access the working areas in order to construct the project, is likely to have a temporary significant adverse effect on traffic congestion, journey times and the condition of local roads;
- General construction activities and movement of vehicles, equipment and site operatives are likely to have a significant adverse effect (temporary closure/diversion due to flood channel excavation) on local roads, PRoW, cycling and equestrian routes, and important roads;

- Material excavation during construction of the project is likely to have a significant adverse effect (temporary closure/diversion) on local roads, PRoW, cycling and equestrian routes, as well as on regionally and nationally important roads;
- Potential temporary adverse effect of increase in flood risk to local and regionally important roads and rail infrastructure due to construction phases / temporary changes to land levels. The FRA is a key design tool but it is not possible to fully design the required flood mitigation at this stage of the project, hence it is scoped in; and
- Movement of hazardous material/ waste offsite to the major road network could cause increased traffic on local roads which are more constrained in characteristics than regionally or nationally important roads, causing a potential adverse effect on traffic congestion, journey times and the condition of local roads. This is only likely to be of adverse effect on the local road network before joining regionally and nationally important roads as is it assumed that assessment of transportation effects from the major road network to hazardous waste sites would have been completed as part of the licensing process for these.

17.4.2 Operation Effects

17.4.2.1 Project activities and associated likely significant effects are identified below:

- Operation of flood channel (including transport movements associated with the maintenance), associated features and capacity improvements during times of flood is likely to have a significant beneficial effect of reduced disturbance to use of rail and local, national and regionally important roads and rail infrastructure;
- Changes in land use are likely to have a significant beneficial and / or adverse effect on traffic and transport movements on roads, public transport services and existing parking facilities; and
- Potential adverse effect on water quantity within the River Thames leading to changes in water levels and sediment processes and adverse effects to river navigation.

17.5 Effects Not Requiring Assessment

17.5.1 Construction Effects

17.5.1.1 Project activities and associated effects that are deemed not likely to be significant and are therefore proposed to be scoped out of the EIA are identified below:

- Movement of hazardous waste / materials from the major road network and placement offsite could cause increased traffic on regionally (A-roads) and nationally (motorways) important roads, causing a potential adverse effect on traffic congestion, journey times and the condition of local roads. Due to the road characteristic of these strategic roads it is not considered the project will have a likely adverse effect on regional or nationally important roads. Also, hazardous material/ waste will be taken by licensed carriers to permitted facilities which will have already completed assessments of effects for their operations; and
- Construction of capacity improvements at the River Thames weirs plus bed lowering and scour protection on the riverbanks could cause an adverse effect on boat traffic on the River Thames (obstructing navigation). However, the construction works to the River Thames weirs are temporary and phased i.e. only one weir per year is allowed to be worked upon and navigation of the River Thames will be maintained throughout the duration of construction. Mitigation measures will be incorporated in the project to provide fenders/buoys, signage and facilitate Notices to Mariners to advise waterway users of the works taking place. The CEMP will also stipulate that movement of materials onto the lock islands will be undertaken outside of peak periods of boat traffic which occur in summer.

17.5.2 Operation Effects

17.5.2.1 Project activities and associated effects that are deemed not likely to be significant and are therefore proposed to be scoped out of the EIA are identified below:

- The beneficial effect of enhanced connectivity through provision of new road bridges is not likely to be significant as the proposed bridges will avoid severance but not enhance traffic connections;

- The proposed new active travel infrastructure will provide beneficial facilities to encourage walking and cycling across the study area. These improvements however are not anticipated to lead to a mode shift from those travelling by car that would have a significant effect specifically on reducing traffic delay specifically. While the effect is not considered significant within the ES assessment criteria the active travel benefits from the proposals will be described within the TA to be submitted in support of the DCO. The ES will include an assessment of pedestrian and cycle delay and amenity;

- Creation of navigable sections of flood channel could have potential beneficial and / or adverse effects on boat traffic using the River Thames, as a result of the presence of additional canoes being attracted to using the new channel. While the creation of navigable sections along the new flood channel for canoes may either relieve or attract more boat traffic to the main River Thames, the effect is unlikely to be significant due to the anticipated low number of boat users on this section of the River Thames;

- Existence of the flood channel and other project components could attract additional large fowl to the area, which could cause a potential adverse effect on aeroplanes using Heathrow Airport through an increase in the risk of bird strike. However, consultation with Heathrow Airport Ltd has taken place to ensure that bird strike risk will be kept to a minimum. The general recommended avoidance measures will be accommodated and assessed as part of the ongoing design and consultation process; and

- General maintenance activities could result in increased traffic on local roads, causing a potential adverse effect on traffic congestion, journey times and the condition of local roads. However, it is anticipated that the effect will not be significant because maintenance activities are likely to be infrequent and of short duration, with few vehicle movements resulting in minimal effects to the transport network.

17.6 Approach to Mitigation

17.6.1.1 This section should be read in conjunction with Chapter 5: Approach to EIA Scoping which sets out further definition for the project regarding primary (embedded) measures, secondary (additional) mitigation and tertiary (best practice) mitigation.

17.6.2 Construction Effects

17.6.2.1 Secondary mitigation measures that are under consideration for the construction phase are identified below.

17.6.2.2 Preparation of Construction Logistic Plans (CLP) to optimise the logistics management arrangements across the project, minimise the impacts associated with the transportation of construction materials and waste to and from the construction sites on communities and the environment. Objectives of the CLP include:

- Reducing vehicle movements, especially during peak periods to reduce delay to the operation of the highway network;
- Exploring options to maximise river and rail transport opportunities and reduce trips via road;
- Seeking to minimise the number and length of construction related transport movements associated with the project.

17.6.2.3 Traffic Management Plans will be prepared to minimise any inconvenience to the public using the highway and PRoWs caused by the construction of the project. It will define how traffic, transport and travel issues affecting the highway during the works are undertaken, managed and amended. They will detail how Traffic Management Schemes will control temporary closures and diversions required to construct the project and be co-ordinated with other highway works to reduce public disturbance.

17.6.2.4 Travel Plans will be prepared to proactively manage and influence workforce travel during construction to reduce effects on traffic from site personnel. For example, promoting travel by public or active travel and providing supporting facilities (cycle parking, lockers, showers for example) or for areas of the project with suitable accessibility operatives would be prohibited from parking on-site where feasible.

17.6.3 Operation Effects

17.6.3.1 Secondary mitigation measures that are under consideration for the construction phase are identified below.

17.6.3.2 To mitigate the effects associated with changes in land use, the operational uses will be designed to integrate with the local transport network to reduce the reliance to travel to the site by private car. Travel

Plans will be prepared to influence, manage, monitor and enforce travel to the new facilities to maintain and increase travel by sustainable modes.

17.7 Assessment Methodology

17.7.1 Construction and operation assessment methodology

17.7.1.1 The assessment methodology described within this section applies to both construction and operational phases.

17.7.1.2 The IEMA Guidance (IEMA, 1993) is predominantly focussed on the effects of vehicular movement rather than taking a wider multi-modal view of potential effects. In relation to traffic and transport, it suggests that the following criteria are assessed:

- Driver delay;
- Severance;
- Pedestrian delay;
- Pedestrian amenity;
- Fear and intimidation;
- Accidents and safety; and
- Hazardous loads.

17.7.1.3 For this assessment, these assessment criteria have been combined into the following to account for the DMRB Guidance (Highways England, 2020b) with the method of assessment explained below:

- Highway network delay;
- Severance;
- Pedestrian and cyclist delay;
- Pedestrian and cyclist amenity (including fear and intimidation); and
- Accidents and safety.

17.7.1.4 In addition to the above, the assessment will also include the effect of the project on the public transport network. This is not a requirement of the above guidance.

Highway network delay

17.7.1.5 Change in journey times on the highway network will be assessed using information from highway modelling. This will provide an indication of how traffic flows and delay are likely to change on the network in the assessment years against the baseline position. IEMA Guidance (IEMA, 1993) states that computer modelling programmes can be used to assess the changes in driver delay on the network as a result of the project. Within the study area, the scope of the assessment regarding changes in flows will be limited to locations which exceed the guidance thresholds set out in the IEMA Guidance (IEMA, 1993):

- Rule 1: Include highway links where traffic flows will increase more than 30 per cent (or the number of HGVs will increase by more than 30 per cent); and
- Rule 2: Include any other specifically sensitive areas where traffic flows have increased by 10 per cent or more.

17.7.1.6 In the first instance, routes expected to experience a change to traffic flows in excess of the 10 per cent threshold will be identified. These routes will then be assessed to determine if they are located within a sensitive area. The locations deemed as being located within a sensitive area where traffic flows increase by more than 10 per cent due to the project will be assessed.

17.7.1.7 Following this a review of routes that experience more than a 30 per cent increase in traffic flow and located outside of a sensitive area will be identified and assessed. Those routes outside of a sensitive area which have less than a 30 per cent change in traffic flows along them due to the project will be considered as not experiencing a significant effect and therefore will not be considered further.

17.7.1.8 In terms of public transport the impact of construction workers and the construction operations will be dispersed across multiple routes, as such it is not anticipated that the quantum and timing of the works will have a material effect on public transport operations and delay within the study area. However, an assessment of the potential distribution of workers travelling to the project will be undertaken to define any routes likely to witness high increases, these will be discussed with Surrey County Council and TfL to determine if they may have a temporary impact of specific routes/services and if mitigation is required.

17.7.1.9 In terms of use of the waterways, it is not anticipated that the works will cause a significant effect to commercial or recreational river users, however a qualitative assessment will be carried out to validate this position.

Severance

17.7.1.10 Severance is the perceived division that can occur within a community when it becomes severed by a major traffic artery. This may result from the difficulty in crossing a heavily trafficked road or a physical barrier. Severance is difficult to measure and by its subjective nature is likely to vary between different groups within a single community. In addition to the volume, composition and speed of traffic, severance is also likely to be influenced by the geometric characteristics of a road, the demand for movement across a road and the variety of land uses and extent of community located on either side of a road. All these factors are considered when determining the likely severance effect. IEMA Guidance (IEMA, 1993) provides thresholds of community severance based on the AADT which is summarised in Table 17-1 below.

Table 17-1: IEMA Severance Criteria.

Degree of Hazard	Annual Average Daily Traffic
Significant (High)	>16,000
Moderate (Medium)	8,000-16,000
Slight (Low)	<8,000

Note: Bracketed is EIA terminology and unbracketed is IEMA terminology

17.7.1.11 The IEMA guidelines state that where changes to the AADT (as a result of the project) are 30 per cent, 60 per cent and 90 per cent or higher, then these links can be regarded in this instance as producing ‘low’, ‘medium’ and ‘high’ changes in severance respectively. However, the guidance acknowledges that the accurate measurement and prediction of severance is extremely difficult.

Pedestrian and cyclist delay

17.7.1.12 The delay to pedestrians and cyclists due to the project will be assessed based on the potential change in journey times as a result of an increase in traffic affecting the ability to cross the highway, and/or result in a change in route (highway and non-highway) due to the project leading to an increase in journey distance or time.

17.7.1.13 Locations on the highway network which are identified as being subject to increases in traffic flow will be assessed in relation to how this increase could affect pedestrians and cyclists, causing journey delay. For example, if an increased flow results in a delay to cross the road, this level of delay will be classified using Table 3.12 of DMRB Guidance (DMRB, 2020a) to define the magnitude of change experienced.

17.7.1.14 The effects on new off-road pedestrian, cycle, and equestrian routes and amendments to current PRoWs, cycling and equestrian routes will be dealt with in the Health Chapter 11.

Pedestrian, cyclist and equestrian amenity (including fear and intimidation)

17.7.1.15 Pedestrian, cyclist and equestrian amenity is broadly defined as the relative pleasantness of a journey. It is affected by traffic flow, traffic composition and pavement width / separation from traffic. It encompasses the overall relationship between pedestrians and traffic, including fear and intimidation caused from traffic which is the most emotive and difficult effect to quantify and assess.

17.7.1.16 There are no commonly agreed thresholds for quantifying the significance of changes in pedestrian amenity, although the IEMA Guidance (IEMA, 1993) provides a useful study which is commonly used to inform ES traffic and transport chapters. Therefore, a qualitative approach will be employed which will give an overall indication of the change in amenity and the number of journeys affected. Fear and intimidation will be assessed based on the change in vehicle numbers, vehicle speed and HGV composition from the IEMA Guidance (IEMA, 1993) criteria set out in Table 17-2 below.

Table 17-2: Fear and Intimidation Criteria.

Degree of Hazard	Average traffic flow over 18 hr day (vehicles/ hour two-way)	18 hour HGV flow	Average Vehicle Speed over 18 hour day (mph)
Extreme (High)	+1,800	+ 3,000	+ 20
Great (Medium)	1,200 – 1,800	2,000 – 3,000	15 – 20
Moderate (Low)	600 – 1,200	1,000 – 2,000	10 – 15

Note: Bracketed is EIA terminology and unbracketed is IEMA terminology

Accidents and safety

17.7.1.17 The potential change in PIC due to the project will be assessed based on how traffic volumes will change for different road types and considering current PIC rates statistics

17.7.1.18 The implications of accidents and safety on human health will also be considered as part of the Health Chapter.

Hazardous loads

17.7.1.19 The assessment and quantification on the number of hazardous loads associated with the construction of the RTS and the probability of the loads being involved in a collision has been included for the part of movement on the local road network only. This will be reviewed and agreed with stakeholders, upon completion of the MMS.

17.7.2 Magnitude, Sensitivity and Significance

Magnitude of change

17.7.2.1 The magnitude of change will be defined following DMRB Guidance (DMRB, 2020b) considering the location of the effect, how long it will last for and considering if it is permanent or temporary.

17.7.2.2 Table 3.4N of the DMRB Guidance (DMRB, 2020b) sets out typical descriptions of the magnitude of change. This has been used to set the following criteria for determining the magnitude of effect, considering positive and negative effects:

- Major Magnitude – Substantial change (positive or negative) to infrastructure or service provisions;

- Moderate Magnitude – Notable change (positive or negative) to infrastructure or service provisions;
- Minor Magnitude – Minor change (positive of negative) or improvement to infrastructure or service provisions;
- Negligible Magnitude – Very small change (positive or negative) which may not be noticeable in the instance of most trips; and
- No Change – No loss, gain or alteration.

Receptor Sensitivity

17.7.2.3 The sensitivity of assessed links will vary depending on the surrounding conditions and receptors. The IEMA Guidelines (IEMA, 1993) identify groups and special interests that may be more sensitive to change. It also notes that other groups could be added based on professional judgement. The below list has been prepared to provide an indication of receptors to consider when understanding the sensitivity of change to a link/route, noting that each receptor has a differing sensitivity to specific effects:

- People at home;
- People in work places;
- Sensitive groups including children, the elderly and disabled;
- Sensitive locations e.g. hospitals, churches, schools, historical buildings;
- People walking;
- People cycling;
- People horse riding;
- Open spaces, recreational sites, shopping areas;
- Sites of ecological / nature conservation value;
- Sites of tourist / visitor attraction;
- Vehicle drivers and passengers; and
- Public transport passengers.

17.7.2.4 Further to the IEMA Guidance (IEMA, 1993) that provokes thought toward the sensitivity to specific receptors, guidance within Table 3.2N of DMRB Guidance (DMRB, 2020b) defines the sensitivity to change as:

- Very High – Very high importance and rarity, international scale and very limited potential for substitution;
- High – High importance and rarity, national scale, and limited potential for substitution;
- Medium – Medium or high importance and rarity, regional scale, limited potential for substitution;
- Low – Low or medium importance and rarity, local scale; and
- Negligible – Very low importance and rarity, local scale.

17.7.2.5 Therefore when categorising the sensitivity of change, both the IEMA (IEMA, 1993) and DMRB guidance (DMRB, 2020b) will be considered by the professional judgement of the assessor, with the assessor seeking to understand the sensitivity to change of the receptor and how this fits with the definition set out within the DMRB guidance (DMRB, 2020b).

Significance

17.7.2.6 The significance of effects will be defined based on the combination of the magnitude of change and the sensitivity of the receptor using the matrix set out below in Table 17-3 below. Significance ratings of Moderate or above will be considered as ‘significant’ with those noted as Neutral or Slight being ‘not significant’. This is based on DMRB guidance (DMRB, 2020b).

17.7.2.7 The approach to assigning significance will be based upon reasoned argument, professional judgement of qualified transport planners, assessment of the extent of the traffic flow changes and consulting with appropriate stakeholders.

Table 17-3: Defining significance of environmental effects.

	Very High Sensitivity	High Sensitivity	Medium Sensitivity	Low Sensitivity	Negligible Sensitivity
Major Magnitude	Very Large (Significant)	Large or Very Large (Significant)	Moderate or Large (Significant)	Slight or Moderate (Significant)	Slight (Not significant)
Moderate Magnitude	Large or Very Large (Significant)	Moderate or Large (Significant)	Moderate (Significant)	Slight (Not significant)	Neutral or Slight (Not significant)
Minor Magnitude	Moderate or Large (Significant)	Slight or Moderate (Significant)	Slight (Not significant)	Neutral or Slight (Not significant)	Neutral or Slight (Not significant)
Negligible Magnitude	Slight (Not significant)	Slight (Not significant)	Neutral or Slight (Not significant)	Neutral or Slight (Not significant)	Neutral (Not significant)
No Change	Neutral (Not significant)	Neutral (Not significant)	Neutral (Not significant)	Neutral (Not significant)	Neutral (Not significant)

17.7.2.8 The assessment of the significance of environmental effects shall cover the following factors as set out within paragraph 3.9 of DMRB guidance (2020b):

- The receptors/resources (natural and human) which would be affected and the pathways for such effects;
- The geographic importance, sensitivity or value of receptors/resources;
- The duration (long or short-term), permanence (permanent or temporary) and changes in significance (increase or decrease);
- Reversibility - e.g. is the change reversible or irreversible, permanent or temporary;
- Environmental and health standards (e.g. local air quality standards) being threatened; and

- Feasibility and mechanisms for delivering mitigating measures, e.g. is there evidence of the ability to legally deliver the environmental assumptions which are the basis for the assessment.

17.7.3 Cumulative Effects Assessment

17.7.3.1 Future traffic growth forecasts will be assessed as part of the ES and TA from the time of the DCO submission to the estimated completion of construction and periods of peak movement. At initial start-up meetings the LPA and LHAs have highlighted other cumulative developments that could interact with the RTS subject to confirmation of their start/end dates.

17.7.3.2 Information such as traffic flow contained within other projects EIAs, Transport Assessments, Traffic Management Plans, Construction Logistic Plans etc. will be considered with the traffic flows generated by the project and assessed to enable the cumulative effect of the RTS with other schemes to be understood. Where the relevant highway authority traffic models are being utilised, the assessment of cumulative effects will check which schemes are included to understand what is included within their future forecasts to ensure consistency.

17.7.3.3 The interaction with environmental factors such as air quality, noise, health etc. on a single receptor at a single point in time will also be assessed as part of the in-combination assessment. The approach for both in-combination and cumulative assessments is detailed in Chapter 19.

17.8 Assumptions and Limitations

17.8.1.1 The following limitations with availability of baseline information were encountered:

- Latest Surrey County Council traffic model data is unavailable. Once available, this will be used instead of the previous Surrey County Council Traffic Model data obtained in 2019.

17.8.1.2 This scoping assessment is based on the best information on possible construction routes available at this stage of the project. It is possible that potential construction routes will alter as the project develops and any expansion to study area due to this will be considered as part of the ongoing EIA, design and consultation process.

17.8.1.3 A significant number of traffic surveys were undertaken before the Covid-19 pandemic to inform the project. Traffic flow is close to or approaching pre pandemic levels across the country and therefore the surveys undertaken to date are expected to still be fit for purpose. This will be checked and agreed with Surrey County Council.

18 Water Environment

18.1 Introduction

18.1.1.1 This chapter describes the proposed scope of the assessment on the water environment. It outlines the baseline conditions, the likely effects of the project and the avoidance or mitigation measures proposed to alleviate these. It also outlines the methodology that will be used for the assessment of potential effects to the water environment arising from the construction and operation of the RTS.

18.1.1.2 This chapter covers the potential effects on surface water, groundwater and WFD receptor water bodies arising from the construction and operation of the RTS. This chapter should be read in conjunction with the WFD Compliance Assessment: Re-screening Assessment (Appendix K), which identifies relevant water bodies. The purpose of the scoping study is to identify and characterise any relevant surface water and groundwater resources, identify baseline conditions and to determine the likely significant effects.

18.1.1.3 The water environment is closely linked to most other EIA topic Chapters. Potential effects on Biodiversity as a result of changes in the water environment are discussed in Chapter 7. Potential effects on Health and Socio-economics as a result of changes in the water environment are discussed in Chapters 11 and 15 respectively. Potential effects on the associated topics of Flood Risk are discussed in Chapter 10. Potential effects of land quality and contamination are discussed in Chapter 13 Materials and Waste and Chapter 16 Soils and Land.

18.1.1.4 A summary of the key legislation, policy and guidance relevant to the water environment is provided in Appendix M.

18.2 Baseline Methodology

18.2.1 Information Sources

Desk Based Assessment

18.2.1.1 Information on surface water, groundwater and WFD receptor water bodies has been collated from the Environment Agency, water companies, lake owners, land operators, and from surveys undertaken specifically for the RTS. This includes information on WFD water bodies and aquifers, licensed abstraction and discharge points, water quality and level monitoring, flows, fluvial morphology and bathymetric surveys.

18.2.1.2 As part of the RTS, a water quality monitoring plan and associated DBA was developed for surface and groundwater bodies in a proportion of the project boundary for EIA scoping, in consultation with Environment Agency technical specialists and in line with a series of monitoring principles. These principles can be summarised as:

- Principle 1: Undertake monitoring using a risk-based approach (as identified in an associated Source Pathway Receptor Model), taking account of the variation in determinands recorded in previous monitoring programmes;
- Principle 2: Follow the monitoring principle design guidelines as set out in the WFD and daughter directive on Priority Hazardous Substances (except where modified due to Principle 1 above);
- Principle 3: Continued monitoring of some water bodies within the channel section previously proposed for the RBWM;
- Principle 4: Apply monitoring consistent with HRA requirements;
- Principle 5: Review the spatial and temporal extent of the groundwater monitoring programme; and
- Principle 6: Monitoring to consider the octanol-water partition coefficient of determinands (which relates to the affinity of substances to be dissolved in the water column or to be associated with sediments).

18.2.1.3 These principles have been used to develop the water quality sampling locations, frequency and determinands being analysed for the EIA, WFD compliance assessment and HRA, along with an environmental survey data gap analysis which identified further monitoring requirements as detailed in Appendix J.

18.2.1.4 A contaminated sediment DBA has been undertaken and recommends further investigations, including sediment cores from deeper layers to identify if there are stored or buried contaminants that may be disturbed as part of the project.

18.2.1.5 A fluvial assessment to better understand sediment process baseline was undertaken in 2017 and a further hydromorphological assessment is planned, to determine the level of surveys and location required to provide certainty on sediment transport, deposition or erosion in the proposed RTS channels.

18.2.1.6 Information on sediments to inform the baseline has been obtained from historic monitoring projects where appropriate: Maidenhead, Windsor and Eton Flood Study (Hydraulics Research Limited, 1988), Lower Thames Fluvial Morphology Study (Halcrow, 2006) and Thames Tideway Tunnels: Detailed Scour Assessment Victoria Embankment Foreshore (HR Wallingford, 2013).

Monitoring

18.2.1.7 Information from the extensive RTS baseline Ecological Monitoring Project (Environment Agency, 2016b) (2012 – 2015) and subsequent ongoing monitoring informs the understanding of baseline conditions for surface water, groundwater, hydromorphology and sediments. Further information on the monitoring programme is included in Appendix J Table J1.

18.2.1.8 Surface water monitoring has included monitoring of various sections of rivers, tributaries and lakes across the study area, as follows:

- River Thames and lake water quality monitoring 2012 - 2015 (monthly to bi-annual);
- Lake water quality monitoring at 24 locations, 2016 – 2021 and ongoing (bi-annual);
- River Thames and tributary water quality monitoring at 27 locations (monthly) 2019 – 2021 and ongoing;
- Microbial monitoring of recreational areas of interest across the project (River Thames, lakes and tributaries) May-September 2019 and 2021 and ongoing to verify existing data (weekly during bathing water season);
- Lake level monitoring 2012 – 2021 and ongoing (continuous monitoring at 15-minute intervals using level loggers in situ, corrected using gaugeboard readings taken monthly to bi-annually);
- Spot flow monitoring on key tributaries 2019 - 2021 (monthly, ongoing); and

- Flow monitoring on the Jubilee River (2019). Undertaken by the Centre for Ecology and Hydrology (CEH) to assess potential losses to groundwater).

18.2.1.9 To inform the EIA, HRA and WFD compliance assessment, monitoring and data analysis will be undertaken until a minimum of one full year of data is obtained for each determinand at the specified frequency, including additional surface water quality, flow and levels monitoring at water bodies close to HCAs.

18.2.1.10 Groundwater monitoring has been undertaken from across 33 boreholes across a proportion of the area within the project boundary for EIA scoping as follows:

- Groundwater quality monitoring 2012-2021 and ongoing (monthly to bi-annual); and
- Groundwater level monitoring 2012-2021 and ongoing (continuous monitoring at 15-minute intervals using level loggers in situ, corrected using manual depth readings taken monthly to bi-annually).

18.2.1.11 Groundwater levels and quality monitoring continue at existing monitoring boreholes across the study area, with the addition of new boreholes within and around the study area to gain a complete understanding of the baseline environment. Further groundwater monitoring is proposed for a wide suite of determinands over at least one full year, similar to the surface water requirements.

18.2.1.12 To determine the hydromorphology baseline, a series of MoRPh surveys have been undertaken. In 2019, MultiMoRPh (10xMoRPh) surveys at Datchet Common Brook, Horton Brook, Wraysbury Stream, Abbey River and Burway Ditch (upstream and downstream of intersections) were completed on two occasions (a winter survey (February) and a summer survey (May/June)) (Cartographer, 2019a,b,c). MoRPH5 field surveys (a sequence of five adjacent MoRPH surveys) and River Type Surveys (desk-based surveys) were completed across all sites in October 2020 on the River Thames, rivers and tributaries intersected by the proposed flood channel, weirs, and HCAs to inform RCA surveys (Cartographer, 2020). The results from the RCAs are being used to inform the River Metric in Defra’s biodiversity net gain calculator (GBV, 2021b) Further MoRPh surveys covering additional locations are planned.

18.2.1.13 Lake bed surface sediment sampling within some lakes that would become 'online' as part of the RTS design was undertaken in 2015, including at Lake South of Norlands Lane, Littleton North, Littleton East, Sheepwalk West and Sheepwalk East Lakes. This data has been used to characterise the physical surface sediments and was combined with lake sediment depth bathymetric surveys undertaken in 2015 and 2016.

18.2.1.14 Sediment samples from dredging were analysed in 2014 (taken as part of the Lower Thames Shoal Removal). Samples were used to determine whether material could be used elsewhere.

18.2.1.15 Suspended sediment sampling has been completed on the Jubilee River (2020 - 2021) and is ongoing (subject to high flow events occurring) on the River Thames at Penton Hook adding to existing suspended sediment data from high flow events in 2016, 2019 – 2020 and 2021. Data from these surveys will be analysed to determine particle size distribution, turbidity and presence of the following: total phosphorus, soluble reactive phosphorus, ammonium, nitrate and nitrite. This will inform assessments of potential for sediment deposition (the larger sediment sizes in the River Thames load) into the flood channel and identify potential contaminants from upstream sources which will be transported into the channel and the lakes that will be connected as part of the project.

18.2.1.16 A contaminated sediment DBA has been undertaken and recommends further investigations, including sediment cores from deeper layers to identify if there are stored or buried contaminants that may be disturbed as part of the project.

Modelling

18.2.1.17 Several modelling studies have been carried out or are currently in progress and these are summarised below. The results and/or interim study findings have been used to gain insight into indicative potential effects of the RTS at this scoping stage. A conceptual modelling workshop (to be held in October 2022) will bring together the findings in a more integrated way to provide a greater understanding of the likely significant effects on surface water and groundwater quality, flows and levels. The need for any further modelling will be given consideration at the workshop and through follow-up meetings with the Environmental Modelling Steering Group. This steering group comprises technical experts including representatives from the Environment Agency, as applicant, and their consultants, plus Thames Water and Affinity Water. The group has met approximately every two months over the duration of the modelling studies to provide expert opinion and review of progress.

18.2.1.18 An integrated model (surface water, groundwater hydrodynamic, water quality and sediment transport) has been developed for the flood channel which models the effects of the RTS on sediment and water quality on the lakes, as well as effects on channel capacity, groundwater and public water supply abstractions. The model uses the MIKE software package. Due to limited sediment data available, the model assumed conservative estimates of sediment and nutrients data (i.e. worst-case-scenario). This model has been adapted to account for low conditions (ESI/DHI, 2017 and ongoing).

18.2.1.19 A QUESTOR model (essentially a river model with limited representation of lakes) has been developed for the Jubilee River (upstream on the River Thames) using an extensive dataset collected by CEH. The Jubilee River was chosen as a surrogate system to the RTS in order to model the extent to which the augmented flow could be reduced without having a potential significant effect on the water quality in the flood channel or on the River Thames. The modelling considered a range of augmented flow scenarios including short periods of very low flow. The results provided some useful insight into indicative potential effects (such as the risk of phytoplankton blooms and low Dissolved Oxygen conditions) that may arise from the project. The results were used to screen out augmented flow scenarios that would present too much pressure on water quality (such as significant dips in dissolved oxygen concentrations or excessive algal blooms) and to help design further QUESTOR and PROTECH (a lake phytoplankton model) modelling studies as described below and based on more acceptable augmented flow scenarios.

18.2.1.20 A PROTECH model is being developed to model the key online lakes that will form part of scheme (Fleet lake, Abbey lake, Abbey 2, Littleton North, Littleton East, Sheepwalk West and Ferry Lane), which will work alongside a QUESTOR model (rivers) for the channel sections to simulate the flood channel. The focus of the modelling is to simulate the augmented flows within the channels and the linked lakes and their impacts on phytoplankton growth and water quality as well as the impacts under flow conditions within the River Thames outside of flood conditions.

18.2.1.21 The findings of the QUESTOR and PROTECH modelling will feed into the conceptual model (described above), with the aim of reducing uncertainty surrounding nutrient and sediment inputs to the flood channel during operation. The outputs from the modelling discussed in this section will be used to develop operational rules for the augmented flow.

18.2.1.22 As well as integrated modelling, sediment transport modelling has been undertaken for the flood channel to understand the long-term balance of deposition and erosion within the flood channel. This information has been used to inform likely maintenance requirements, flood channel design and the impact on sediment load reaching the Thames Estuary (GBV, 2020).

18.2.2 Stakeholder Engagement

18.2.2.1 Stakeholder engagement was carried out for the 2018 EIA Scoping Report and 2019 pre-application, as well as other engagement relevant to the water environment. However, given design changes that have occurred, only stakeholder engagement relevant to the current design has been included in this report.

18.2.2.2 Stakeholder feedback received has been factored into the proposed methodology for the water environment topic and the effects proposed to be scoped in and out of the EIA.

Feedback received from consultation on EIA Scoping and draft assessment methodologies

18.2.2.3 Surrey County Council, in their capacity as a regulator, provided a Scoping Opinion on the EIA Scoping Report submitted for the project in 2017. No comments were provided by Surrey County Council or the LPAs directly relevant to the Water Environment Chapter.

18.2.2.4 Additionally, the MMO were asked to provide a Scoping Opinion. In relation to the water environment, they have requested further thought be given to the following factors:

- ‘If and how chemical testing of sediments at high risk disturbance/sediment mobilisation sites around the weir will mitigate the impact of contaminant release’;
- ‘Any mitigation proposed to prevent/reduce any reduction in water quality must be detailed, demonstrating how they will avoid deterioration in water body status and damage to protected features. Any monitoring proposed must also be detailed. This must include any mitigation proposed to reduce/avoid reduction in quality of shellfish

waters experienced from increased boat traffic. Details of dredging methodologies and volumes of silt expected to also be provided'; and that

- 'A WFD assessment is required with detailed methodology provided for each stage of the construction works at Teddington Weir'. A WFD assessment will be produced as part of the ES, along with justified mitigation measures.

18.2.2.5 The MMO do, however, agree with the previous findings of the previous EIA Scoping Report that:

- The effects of accidental spillage or runoff from stored chemicals/fuel can be scoped out of further assessment as the inherent mitigation is sufficient to avoid impacts on benthic ecology;
- Coastal processes should be scoped out due to *'minimal impact on coastal processes from works at Teddington Weir*'; and
- *'Silt curtains are an appropriate mitigation method to minimise spread of sediment from the footprint of the proposed works*'.

Feedback received from pre-application consultation under Town and Country Planning Act

18.2.2.6 Pre-application consultation was undertaken in 2019 with Surrey County Council (in their capacity as a statutory consultee), LPAs, GLA, the Environment Agency Sustainable Places team and the MMO.

18.2.2.7 The Environment Agency National Sustainable Places team provided pre-application feedback in 2019. The key issues raised in relation to the water environment, and that have been scoped into the EIA for further consideration include the following:

- The channel design should allow for shallow marginal habitat, with piling and hard engineering the exception not the rule. This design feature has been built into the project;
- Any impact on ecology of maintaining lake levels as part of the project is identified;
- It must be established through modelling if the flood channel will become a sediment sink. This will be explored by a geomorphology steering group, as discussed under 'other engagement' below;

- The proposed development and any remedial works should not cause secondary pollution or new pathways;
- More information is required to determine if leachate escape is likely into the channel. They recommended water tight channels and an assessment to show leachate levels will not increase following the re-engineering of the channels. They emphasise that the project should not go ahead until the risk to surface waters from landfill has been sufficiently mitigated against;
- WFD compliance assessments, further discussion on water quantity and low flow conditions, including the impact on abstractors, must be produced; this has been scoped into the EIA and a WFD compliance assessment is underway;
- Any risks to the Thames (Egham to Teddington) drinking water protected area from Priority Hazardous Substances from landfill sites, and evidence that these are effectively mitigated against;
- They request further information on the potential depleted reach between the Runnymede Channel outfall and the Spelthorne Channel intake, including any impacts to water quality and WFD status; and
- The effect on dissolved oxygen and temperatures in lakes and channels that were not previously connected.

18.2.2.8 The Environment Agency Sustainable Places team also highlighted a series of concerns regarding low flows, which have been scoped in for further consideration as part of this EIA. They include:

- Further assessment requested on the impact of low flows due to the increased abstraction for augmented flow and its effect on abstractors and the aquatic environment; and
- Establishing the impact of low flow conditions on the Thames, especially during drought conditions and if this will pose a risk to WFD Physico-chemical elements.

Other topic specific engagement

18.2.2.9 Consultation with the Environment Agency’s hydrology, fisheries, biodiversity, limnology, and geomorphology technical specialists (in their capacity as advisors to the project) has been undertaken over several years and is ongoing. This has included various workshops, meetings and the Environmental Modelling Steering Group.

18.2.2.10 Additionally, a geomorphology steering group is to be established which will include key representatives from academia, industry (e.g. Partrac), CEH and Environment Agency technical specialists to guide the type and nature of sediment and geomorphology work going forward. This will include the need for additional data collection and the most appropriate tools and techniques to be applied for the project (e.g. the need for fluvial audits, additional modelling, particle tracking and further sediment regime studies).

18.2.3 Study Area

18.2.3.1 The water environment study area for EIA scoping incorporates all surface and groundwater bodies that lie within the project boundary for EIA scoping plus a 500m buffer, combined with the area of the 1 in 100 year floodplain (i.e. the area with a one per cent chance of flooding in any given year) affected by the RTS (i.e. whichever was the greater area). Therefore this study area also includes surface water bodies downstream of and/or supplied by the River Thames up to 500m downstream of the project boundary for EIA scoping (including Banbury Reservoir and Lockwood Reservoir via abstraction). This is considered to be sufficient distance due to the dilution and in-channel mixing that will occur within 500m and as such would make it difficult to categorically determine the source of impacts to water features beyond this distance. It is considered that this is a sufficient study area for all water features, taking into account the nature of the development and the urbanised location of the RTS and ensures all key hydrological influences are represented.

18.3 Baseline

18.3.1 Existing Baseline

18.3.1.1 The Water Environment study area encompasses surface and groundwater receptors. As well as the River Thames, there are numerous tributaries of varying size and man-made lakes located in former gravel pits that are fed by a combination of surface water and groundwater. Approximately 14 per cent of the study area is made up of lakes or reservoirs. These water body types and specific receptors are introduced in the following sections.

Surface Water

18.3.1.2 The official tidal limit of the River Thames is located approximately 15 km downstream of the flood channel at Teddington Weir. In reality, tidal influence can be observed as far upstream as Molesey Weir under some flood conditions, some 8km downstream of the flood channel.

18.3.1.3 Rivers and lakes within the study area are listed below and are shown on Figures 18-1 and 18-2 in Appendix A. Where available, information on water quality, water levels/river flows and hydromorphology of these water bodies is provided in Appendix J Tables J2 to J7.

18.3.1.4 There are 36 WFD surface water bodies (18 rivers and 18 lakes) within the study area (see Figure 18-2 in Appendix A), including three WFD reaches of the River Thames. These water bodies are all covered by the Thames River Basin Management Plan (RBMP).

18.3.1.5 Of the 18 WFD river water bodies within the EIA study area (which include one transitional and one surface water transfer body), five lie upstream of the flood channel. The other 13 river water bodies intersect or are in proximity to the flood channel, or are located close to the Sunbury, Molesey and Teddington Weirs.

18.3.1.6 Of the 18 WFD river water bodies (15 classified as Artificial or Heavily Modified Water Bodies), 14 were at ‘Moderate’ ecological status (2019) and four were identified as ‘Poor’ ecological status under the RBMP in 2019. There are no water bodies currently meeting ‘Good’ ecological status. Phosphate is classified as ‘Good’ status in only one of these water bodies, with nine at ‘Moderate’, six at ‘Poor’, and two were not assessed under the RBMP in 2019 for this element. For biological quality elements, invertebrates are used to classify 15 of these water bodies, with six at ‘High’ status, two at ‘Good’ status and two at ‘Moderate’ under the RBMP in 2019. Four water bodies are at ‘Poor’ status for invertebrates with one at ‘Bad’ and three not assessed under the RBMP in 2019. Further information on the WFD river water bodies is provided in Appendix J Table J5. This includes information on their current status, objectives and additional information collected for the project since 2014.

18.3.1.7 Of the 18 lake WFD water bodies identified, nine lie within or in proximity of the flood channel, or abstract from the River Thames. Of those nine, two are achieving ‘Good’ WFD status, five have ‘Moderate’ status and two have ‘Poor’ overall status. Hydromorphological supporting elements are not used to classify any of these nine lake water bodies. Dissolved oxygen, transparency, thermal conditions and acidification status are also not assessed. With the exception of the Thorpe Park Lakes water body, all are at ‘Poor’ or ‘Bad’ status for Total Phosphorus. Two lakes are failing for concentration of Total Nitrogen. All are observed to be failing Chemical status, due to priority hazardous substances. Further WFD baseline information is provided within Appendix J Tables 3 and 4 for all nine WFD lake water bodies lying within or in proximity to the flood channel. This includes information on their characteristics, current status, objectives and additional information collected for the project since 2014.

18.3.1.8 The named watercourses within the study area are listed below (those marked with an * will be intersected by the flood channel, those marked with an (F) experienced flooding in 2013/14 (see Chapter 12 for further information on the relevance of 2013/14 flooding) and those marked with (WFD) are WFD water bodies with their current overall status from under the RBMP in 2019:

- Relevant watercourses upstream of the Runnymede Channel:
  - Datchet Common Brook (WFD – ‘Moderate’)* (F);
  - Midridge Green Drain*;
  - Colne Brook (WFD – ‘Moderate’) (F);
  - Wraysbury Stream * (F);
  - New Cut;
  - Horton Brook (WFD – ‘Moderate’)* (F);
  - Foot Drain (F);
  - County Ditch (F);
  - Bonehead Ditch;
  - River Thames (WFD – Thames (Cookham to Egham) – Moderate;
  - River Colne (WFD – Colne (Confluence with Chess to River Thames – ‘Moderate’) (F); and
  - Wraysbury River.

- Relevant watercourses in proximity to the Runnymede Channel:
  - Mead Lake Ditch * (F);
  - The Moat (WFD – The Moat at Egham - ‘Poor’) * (F);
  - Chertsey Bourne (WFD – Virginia Water to Chertsey – ‘Moderate’ and WFD - Chertsey to R. Thames Confluence – ‘Poor’) * (F);
  - Abbey River * (F);
  - Burway Ditch * (F);
  - Sweep’s Ditch (F); and
  - Addlestone Bourne (WFD - Mill/Hale to Chertsey Bourne – ‘Moderate’).
- Relevant watercourses in proximity to the Spelthorne Channel:
  - Pool End Ditch (F);
  - Engine River (F);
  - The Chap* (F); and
  - River Wey (WFD – Wey (Shalford to River Thames confluence at Weybridge) – ‘Moderate’) (F).
- Relevant watercourses in proximity to Sunbury, Molesey and Teddington Weirs:
  - River Thames (WFD –Thames (Egham to Teddington) – ‘Poor’ and WFD – Thames Upper – ‘Moderate’);
  - River Ash (WFD – Surrey Ash – ‘Moderate’);
  - The Mole (River Ember) (WFD – Mole (Hersham to River Thames Conf at East Molesey) – ‘Moderate’);
  - Portlane Brook (WFD – ‘Moderate’);
  - Longford River (WFD – ‘Moderate’);
  - Rythe (WFD – ‘Poor’); and
  - Hogsmill (WFD – ‘Moderate’).

18.3.1.9 Within the study area, there are numerous ordinary watercourses and land drains that feed into the watercourses listed above. Several of these watercourses have been marked on Figure 18-1 in Appendix A.

18.3.1.10 Within the study area, the majority of lakes are flooded sand and gravel workings. In addition, several are also designated as raised reservoirs. The lakes within the study area are listed below (those marked with an * will be intersected by the flood channel, those marked with an (F) experienced flooding in 2013/14 and those marked with (WFD) are WFD water bodies with their associated current overall status):

- Lake upstream of the flood channel:
  - Datchet 1, 2, 3 (N and S) (F);
  - Sunnymeads Lakes 1 – 5 (F), 5 and 6;
  - Kingsmead Island Lake (F);
  - Kingsmead 1 (S and N);
  - Horton Lakes 1 (F), 2 (F) and 4 (F);
  - Church Lake (F);
  - Crayfish Pool;
  - Douglas Lane;
  - Blenheim Lake (F);
  - Heron Lake (WFD – ‘Moderate’);
  - The Queen Mother Reservoir (WFD – ‘Moderate’);
  - Queensmead (WFD – ‘Moderate’) (F);
  - Wraysbury Lake (WFD – ‘Poor’);
  - Wraysbury 1 (F);
  - Wraysbury 2 (WFD – ‘Moderate’) (F);
  - Wraysbury Reservoir (WFD – ‘Moderate’);
  - Lower Hythe Gravel Pits 1, 2 (F), 3 (F), 4 and 5 (F);

  - Hythe End East, Central and West (F);
  - The Moor Gravel Pit (F);
  - Church Lammas Lake (F);
  - King George VI Reservoir (WFD – ‘Moderate’);
  - Staines Reservoir North (WFD – ‘Moderate’); and,
  - Staines Reservoir South (WFD – ‘Moderate’)
- Lakes in proximity to the Runnymede Channel:
  - Egham Hythe Pond (F);
  - Meadlake (F);
  - Lake South of Green Lane* (F);
  - Lake South of Norlands Lane 1* (F) and 2;
  - Lakes West of Thorpe Lea Road (N and S);
  - Thorpe Park Lakes (WFD – ‘Poor’) (F) (Fleet Lake*, Manor Lake, Abbey Lake*, St Ann’s Lake);
  - Abbey 1 and 2*(F);
  - Penton Hook Marina (F);
  - Twynersh Lakes (F); and
  - Reservoir at Chertsey Water Works.
- Lakes in proximity to the Spelthorne Channel:
  - Littleton North* (F), South (F) & East* (F);
  - Sheepwalk East (F);
  - Sheepwalk West 1* (F), 2* (F) and 3 (F);
  - Old Littleton Lane Lake (F);
  - River Croft Lake;
  - Black Ditch Pond (F);

  - Manor Farm Lake;
  - Halliford Mere;
  - Ferry Lane Lake 1(F), 2 (F) and 3* (F);
  - Ferry Lane Lake* (F);
  - Kempton Park East Reservoir (WFD – ‘Good’);
  - Queen Mary Reservoir (supplied by the Laleham Intake) (WFD – ‘Poor’);
  - Lockwood Reservoir – (supplied by the Thames Lee Tunnel) (WFD – ‘Moderate’); and,
  - Banbury Reservoir (supplied by the Thames Lee Tunnel) (WFD – ‘Moderate’);
- Lakes in proximity to Sunbury, Molesey and Teddington Weirs
  - Molesey Reservoirs;
  - Queen Elizabeth 2 Storage Reservoir (WFD – ‘Good’);
  - Knight Reservoir (WFD – ‘Moderate’);
  - Bessborough Reservoir (WFD – ‘Moderate’); and
  - Island Barn Reservoir (WFD – ‘Moderate’).

Hydromorphology

18.3.1.11 The River Thames displays many characteristics of the lower reaches of a highly regulated and modified, mature, lowland river, comprising wide meanders and several divided channels around stable, mid-channel islands.

18.3.1.12 The extensive historic modification of the lower reaches of the River Thames to accommodate human habitation, activities and usage has substantially influenced sedimentary processes. Urban development, agricultural drainage and runoff, channel modification and boat wash erosion are responsible for increased sediment supply. Bed lowering, plus weirs and bank protection can all lead to decreased sediment supply.

18.3.1.13 The depth and movement of water along the River Thames has been controlled by a series of weirs and locks for over a century. These structures present obstructions to the natural movement of sediment, causing build-up of course material immediately behind weirs and deeper pools in areas of scour immediately downstream. This has also occurred around some meander bends creating temporary sediment storage which may be activated during periods of increased flow.

18.3.1.14 Maintenance dredging has historically been undertaken within the River Thames to maintain flow conveyance and allow for suitable and safe navigation of the channel. This previously involved dredging of accumulated sediments from within the channel. Since 1998 widespread sediment removal is no longer part of the current river management practice, however, localised removal continues on an ad hoc basis, being undertaken when and where areas of significant deposition are identified. The reduction in widespread channel dredging has not affected the long-term bed elevations.

18.3.1.15 The flow regime of the River Thames and its tributaries are affected by their use for land drainage, water abstraction, flood control and navigation, all of which affect sediment supply to the River Thames.

18.3.1.16 The study area includes a series of man-made lakes created from former gravel pits. These are of varying size and morphology but are typically steep sided. Some lakes have islands while others are wide areas of open water allowing for unhindered surface water movement. Although the lakes are relatively recent and man-made, their geomorphology and habitats continue to evolve over time.

Groundwater

18.3.1.17 The hydrogeology across the study area is varied as a result of the geology in the area. Bedrock geology comprises of the London Clay Formation and the Bagshot Formation. Superficial geology consists of River Terrace Deposits of Shepperton Gravel Member, Langley Silt Member, Kempton Park Gravel Formation, and Alluvium (BGS, 2022). Further detail on the spatial distribution of the bedrock and superficial geology is set out within Chapter 16: Soils and Land.

18.3.1.18 The study area is underlain by a Lower Thames Gravel Aquifer, of mostly Shepperton Gravel Member, with Kempton Park Gravel Member and Taplow Gravel Member to the south-east (Figure 16-2 in Appendix A). This gravel layer is formed by river terrace sand/gravel deposits and acts as a single aquifer unit, termed the Lower Thames Gravels Aquifer. This is a principal aquifer which means it may support water supplies at a strategic scale, including the baseflow of the River Thames (Defra, 2022b) (Figure 18-3 in Appendix A). The layer is largely unconfined, and the thickness of the gravels vary considerably from two to 24 m, with an average thickness of around five to six m, with considerable variations over relatively short distances (ESI, 2015 in DHI/Stantec, 2022).

18.3.1.19 Those sections of the study area not directly underlain by the Shepperton Gravel Member, Kempton Park Gravel Member or Taplow Gravel Member are classed as Secondary A superficial aquifers (Desborough Cut and Sunbury Weir). Molesey and Teddington Weirs are within Secondary (undifferentiated) superficial aquifers. The Lambeth Group, London Clay Formation: Claygate Member, Bagshot Formation and alluvium are classified as Secondary A bedrock aquifers, including permeable layers capable of supporting water supply on a local not strategic scale, including the base flow of river (Defra, 2022b). Permeable Tertiary bedrock strata such as the Bagshot Formation may interact with the overlying sands and gravels, but it is unlikely to have a significant effect on groundwater levels.

18.3.1.20 DHI/Stantec (2022) reviewed the aquifers within the study area and suggest that aquifers of relevance to the RTS are the river terrace sand and gravel deposits (Lower Thames Gravels Aquifer) and any overlying or adjacent permeable materials such as alluvium and permeable made ground. Most of the study area is underlain by bedrock of the London Clay Formation. It is of low permeability and separates the principal gravel aquifer from the minor aquifer below (the Lambeth Group) (see Chapter 16: Soils and Land for more details on geology in the study area). Groundwater levels are typically 0.5m to 2.5m below the ground surface across the study area. At a regional scale, groundwater flow is generally from north-west to south-east, broadly parallel to the River Thames flow but with local variations in flow due to flow barriers such as groundwater abstractions, low permeability landfills and lined reservoirs. There is a shallow hydraulic gradient in the north western part of the study area between Datchet and Wraysbury, within the Shepperton Gravel Member aquifer, where the River Thames level is higher than groundwater levels. In the south eastern section, the hydraulic gradient is to the south east, towards the Chertsey public water supply abstractions (Abbey Meads) and the River Thames (ESI, 2015).

18.3.1.21 Overall, groundwater flow comprises only a small proportion of total surface water flow due to a generally shallow hydraulic gradients and numerous flow barriers (e.g. lined water bodies, low permeability rocks, soils and landfill areas). However, the RTS Ecological Monitoring Project (Environment Agency, 2016c) has identified seasonal responses to rainfall in groundwater levels. At many locations, groundwater flooding was recorded for short periods of time in January and February 2014 during the winter floods. This is indicative of good hydraulic connection between the superficial aquifer and the River Thames, and it is considered that the River Thames represents a discharge boundary for groundwater, responding rapidly to changes in river levels (DHI/Stantec, 2022). As such, local groundwater storage influences surface water, particularly during a flood.

18.3.1.22 Overall, the lakes in the study area are considered to be well connected to groundwater. Eleven lakes were found to have potential hydraulic connections to groundwater, details of these connections are summarised in Environment Agency (2016c):

- Manor, Fleet and Abbey Lakes;
- St Ann's;
- Abbey 1 and Abbey 2;
- Littleton North and Littleton South;
- Littleton East;
- Sheepwalk West 2 and Sheepwalk East; and
- Ferry Lane.

18.3.1.23 In addition to the natural geological influences on groundwater, various other activities affect its behaviour. This includes abstraction of large quantities of groundwater for public water supply (Affinity Water abstract at Chertsey and Walton Bridge pumping stations), the location of extensive sewage systems, gravel quarrying and associated de-watering. There are also physical interruptions to groundwater flows; it is anticipated that all non-historical landfills and the main reservoirs have impenetrable bunds preventing interaction with groundwater (ESI, 2015). In addition, the waste contained within older landfills is likely to have a low hydraulic conductivity compared to the surrounding gravel aquifers (ESI, 2015).

18.3.1.24 Sections of the flood channel are within a GSPZ (Figure 18-3 in Appendix A); all the Runnymede Channel, the upstream half of the Spelthorne Channel and Desborough Island. The Abbey Meads area of the Runnymede Channel is within a Source Protection Zone 1 (the highest level of protection).

18.3.1.25 There are two WFD groundwater bodies within the study area, Lower Thames Gravels WFD water body and Chobham Bagshot Beds WFD water body. These water bodies are covered by the Thames RBMP. Lower Thames Gravels has deteriorated from Overall Status ‘Good’ in 2016 to ‘Poor Overall Status’ in 2019 due to a deterioration in the quantitative water balance element. The Reason for Not Achieving Good (RNAG) status is due to a Trend Assessment classification element relating to continuous sewage discharge from the water industry. Chobham Bagshot Beds has also deteriorated from ‘Good Overall Status’ to ‘Poor Overall Status’ from 2016 to 2019, due to a change in the chemical status element related to poor nutrient management from agriculture and land management (Environment Agency, 2022) (Figure 18-2 in Appendix A). Further details of these groundwater bodies, their current status and objectives and are provided in Appendix J Table J6.

Water resources

18.3.1.26 Within the study area, water is abstracted from surface water and groundwater under licence. There are 22 surface water abstraction points, from the River Thames and its tributaries, one on Colne Brook, two points on the River Ash and the remainder from the River Thames. Four surface water abstractions are operated by Affinity Water and three by Thames Water. Average daily abstraction varies from approximately 0.3 m^3/s (25 Ml/day) at Chertsey to 5 m^3/s (432 Ml/day) at Datchet according to the operator records (DHI/Stantec, 2022). Abstraction is managed under the Thames Catchment Abstraction Management Strategy (CAMS) (CAMS, 2019) which implements a bespoke strategy that protects the rights of existing abstractors and facilitates future abstraction without preventing the Lower Thames reaching Good Ecological Potential under the WFD. A Q50 ‘Hands off Flow’ is applied to abstractions throughout the catchment with stricter restrictions between Q30 and Q50 flows. Flow in the River Thames is required to be maintained for navigation, to support existing abstraction licences (including strategically important abstractions for public water supply), and to support ecological requirements such as Environmental

Flow Indicators to ensure flow is sufficient to support biology (including biological elements under the WFD).

18.3.1.27 The majority of surface water abstraction within the study area is used for potable water supply, with five sites used for irrigation and three used for heat pump supply to provide a sustainable heat source.

18.3.1.28 Water is also abstracted from groundwater within the study area, predominately from the Lower Thames Gravels aquifer. There are 52 groundwater abstraction points within the study area, 18 of which are for public water supply. Affinity Water's Public Water Supply (PWS) abstraction at Chertsey and Walton Bridge represent two of the largest abstractions (> 1Ml/d) from the superficial aquifer and are licensed for an annual average abstraction of 27.4 Ml/d and 10 Ml/d respectively. Dewatering activities occur at several active mineral extraction sites within the study area and are licensed to abstract greater than 3.5 Ml/d. However, current and future operation of these abstraction points is uncertain and the exact abstraction rates are unknown (DHI/Stantec, 2022). The only gravel quarry that may have significantly affected groundwater levels is located between Littleton North and Littleton East in proximity to the flood channel. However, abstraction from this borehole has not occurred since 2016. The remaining majority of the other abstraction points within the study area for EIA scoping are used for irrigation for horticulture, golf courses or agriculture.

18.3.2 Future Baseline

18.3.2.1 The RBMPs set out measures to improve hydromorphology, water quality and ecology. These measures include managing diffuse pollution sources and restoring the impacts of legacy physical modifications to help improve and protect ecology and ecosystem functions (Environment Agency, 2021k). This may lead to improvements in the local water environment prior to construction and most likely throughout the operation of the project. Furthermore, improvements in the quality of water released from sewage treatment works (to reduce organic pollution and address excess phosphorus loads) are likely to continue as a result of requirements placed on water companies through the Water Industry National Environment Programme.

18.3.2.2 The RBMP second cycle (2015-21) only sets out measures to improve the water environment for the next six years and the RBMP third cycle (2021-

2026) is currently still in draft. It will need to be taken into consideration that a new RBMP may be in place before construction commences, with potential changes in WFD objectives and their condition classifications.

18.3.2.3 River flows and groundwater levels are anticipated to be more variable in the long term as a result of more extreme weather conditions caused by climate change. Baseline water supplies are forecast to decrease between present day and 2100 due to climate change (Thames Water, 2019). Groundwater levels and quality may be more variable in the future and will continue to be managed by the TCAMS. All future abstraction licence applications are subject to an assessment to take account of any local and downstream issues and may be subject to further restrictions in line with the bespoke strategy. Abstraction may be available for approximately 182 days per annum (assuming average conditions), with restrictions when average daily mean flow for the preceding five days is equal to or less than the Q50 (CAMS, 2019).

18.3.2.4 Ground conditions and drainage pathways are unlikely to change between now and the start of construction and / or operation. However, if any mineral restoration or construction works are undertaken in the area, this may affect the water environment. Similarly, any developments or any activities that may have or may occur prior to the project starting construction may change surface and groundwater flow pathways, water quality, water quantity and hydromorphology. These changes will be considered within the ES as the EIA, design and consultation process continues.

18.3.3 Key Environmental Considerations and Opportunities

18.3.3.1 The key environmental considerations in relation to surface water, groundwater and WFD are provided below:

- There are 25 main rivers and approximately 90 lakes of varying sizes within the study area, all of which are a valuable resource for biodiversity. Several are also important for recreation and the local economy;
- 38 WFD water bodies (18 river water bodies, 18 lake water bodies and two groundwater bodies) may potentially interact with the proposed works; there is a need to ensure compliance with WFD and the project must consider whether the works will lead to a

deterioration in WFD status or potential of any water body, or if it may prevent any WFD objectives being delivered;

- The proposed works are underlain by a series of principal aquifers within GSPZs. Water quality must be maintained to prevent derogation or reduction in quality of water abstractions; and
- There are multiple licensed abstractions from surface waters in the study area, and no capacity for additional consumptive licences without restrictions.

18.3.3.2 As part of the project there are opportunities to improve the features of some of the water bodies in the study area, including delivery of RBMP measures and WFD enhancements:

- Enhancement opportunities for the multiple surface water bodies that interact with the RTS project; and
- Fish pass installation and improvement.

18.4 Likely Significant Effects Requiring Assessment

18.4.1 Construction Effects

18.4.1.1 Project activities and associated likely significant effects are identified below:

- Construction of sheet piling along sections of the flood channel has the potential for adverse effects on groundwater flows and levels due to changes or barriers to existing flow pathways;
- Use of excavated material onsite has the potential to result in adverse effects (through contamination) on previously unimpacted watercourses or groundwater depending on design, for instance of new green open spaces, not yet confirmed. Excavated material could negatively affect drainage in a new location (due to changes in ground porosity), depending on use;
- Movement of hazardous material / waste to the major road network and movement of non-hazardous material offsite and placement at end destination have the potential to result in adverse effects on the water environment;

- Excavation through landfill and other sources of contamination has the potential to release leachates and other pollutants causing adverse effects on surface water and groundwater quality (including WFD water bodies, a surface water safeguard zone, PWS abstractions and GSPZs) (see also Chapter 16 Soils and Land);
- Aquatic INNS and pathogens management through chemical treatment, removal or lowering water levels in lakes has the potential for adverse effects on water quality, water levels, flow regime and hydromorphology (e.g. sediment processes in lakes);
- River bed and bank lowering has the potential for adverse effects by releasing or disturbing sediment, causing an increase in turbidity in the water column and causing a reduction in water quality;
- River bed and bank lowering has the potential to result in adverse effects of mobilising/re-suspending contaminants from potentially contaminated sediment, causing a reduction in water quality and risk to WFD quality elements due to resuspended sediments;
- Long-term over-pumping, due to the need to dewater water bodies has potential for hydromorphological impacts on flow and sediment processes in dewatered surface water courses and lakes, and also receiving waterbodies; and
- General construction activity and earthworks (including material stockpiling and materials dewatering) have the potential for adverse effects on groundwater levels and flow pathways from compacting natural ground. In areas of contamination, such as within landfills, these activities may also lead to drainage and run off into surface and groundwaters together with the mobilisation of contaminants in saturated soils reducing water quality.

18.4.2 Operational Effects

18.4.2.1 Project activities and associated likely significant effects are identified below:

- Existence of the flood channel and other project components including operation of the flow control structures could have adverse effects on the flow, hydromorphology, water quality and biological conditions of rivers (WFD, non-WFD and within surface water safeguard zones) intersected by the flood channel through operation of the project due to potential differences in flows, water quality and biological conditions of the flood relief channel and the downstream sections of these rivers. Primary mitigation includes appropriate structure design minimising impacts to flow conditions and hydromorphology;

- The existence of the flood channel has the potential to result in adverse effects on groundwater quality and quantity by altering groundwater flow regimes and pathways for contaminants, potentially impacting abstraction. Groundwater modelling currently being undertaken will give further information on the significance of this impact;
- Introducing an augmented flow and operational water into the flood channel and intersected waterbodies has the potential to result in adverse effects in terms of altered flow and flood frequency on the hydrological regime, sediment processes, hydromorphology and water quality of WFD and non-WFD lakes and watercourses from the introduction of River Thames water (in normal conditions and during floods) to previously unconnected waterbodies;
- Introducing an augmented flow and operational flow into the flood channel and intersected waterbodies has the potential for adverse effects on the chemical water quality of WFD and non-WFD lakes from the introduction of river water to previously unconnected lakes containing nutrient rich water and potentially contaminated sediments from sources including increased scour within the existing and new channels;
- Introducing an augmented flow and operational flow in flood channel and intersected waterbodies has the potential for adverse effects on water quantity and levels in the River Thames causing adverse effects to sediment processes and surface water available for public water supply within the River Thames reach bypassed by the flood channel during low flows;
- Introducing an augmented flow and operational flow into the flood channel and intersected waterbodies has the potential for adverse effects on sediment processes within the River Thames downstream of the new channel intake;

- Provision of new areas of open green space and other landscape works (including new walking / cycle routes) has the potential adverse effect of changes in groundwater quality, flow and infilltration from creating impermable layers or compacting existing landfills and mobilising contaminants;

- Provision of habitat improvements has the potential for positive effects of increased diversity of water dependent habitat which will have a beneficial effect on hydromorphology and biology of WFD and non WFD surface water;

- Fish pass creation and modification works have the potential for positive impacts on fishery WFD classification; and

- Dredging or other possible management activities to reinstate the design profile of the flood channel have the potential for adverse effects on water quality due to the mobilisation of sediment and pollutants.

18.5 Effects Not Requiring Assessment

18.5.1 Construction Effects

18.5.1.1 Project activities and associated effects that are deemed not likely to be significant and are therefore proposed to be scoped out of the EIA are identified below:

- Sheet piling along sections of the flood channel has the potential to negatively affect groundwater quality due to creation of a hydraulic connection within landfill whereby contaminated water could migrate. The risk of creating an additional hydraulic connection as piles are installed will be assessed as part of the piling risk assessment, and thereby construction method/piling method will mitigate this risk. A Source-Pathway-Receptor model will be applied to demonstrate all viable pathways for contamination to migrate to identified receptors. Consideration will be given to the construction methods likely to be undertaken to reduce or eliminate potential pathways to sensitive receptors where reasonably practicable as part of a Preliminary Risk Assessment, and any required mitigations integrated as part of the CEMP following best construction practises and Land Contamination and Risk Management guidance;

- Transportation of hazardous waste from the major road network and placement of hazardous material/waste will not affect the water environment as waste will be handled by a licensed waste carrier and disposed of following the necessary permits;
- Creation of site compounds, temporary materials processing sites and storage of excavated material have the potential to cause adverse effects on surface water runoff carrying contamination or sediment into nearby watercourses. Surface water run-off will be managed through the Construction Surface Water Management Plan, pursuant to a DCO requirement;
- Construction of capacity improvements at the River Thames weirs have the potential for adverse effects on flow, hydromorphology, water quality and biological conditions of the lakes and rivers (including WFD water bodies) through disturbance of sediment by works in water bodies and release of pollutants through spillages. Construction will follow coffer dam guidance and be built in line with the CEMP;
- Construction of capacity improvements at River Thames weirs has the potential for temporary adverse effects on the availability of groundwater in the aquifers, WFD groundwater bodies, PWS abstractions and GSPZs by altering flow regime due to use of coffer dams during construction. Construction will follow coffer dam guidance and be built in line with the CEMP; and
- Construction works in and around water bodies has the potential for adverse effects on flow, hydromorphology, water quality and biological conditions of lakes and rivers (including WFD water bodies) intersected by the flood channel, and tidal, estuarine and coastal waters through disturbance of sediment by works in water bodies and release of pollutants through spillages. Construction will follow best practice guidance for work in and around water, according to the CEMP and Government ‘Pollution Prevention for Businesses’ guidelines; and
- Storage of chemicals and liquids associated with construction presents a potential risk to surface and groundwater if any spills occur, however; chemicals will be stored following guidance for pollution prevention. This will include use of drip trays, which will be of

adequate capacity and regularly maintained, to reduce risk of pollution from vehicles near to waterbodies. In addition, fuels will be stored in appropriately bunded areas, with refuelling activities taking place in designated areas away from waterbodies. Construction equipment will be operated using biodegradable lubricants and materials where possible. These will further reduce the potential impact of contaminant or pollutant spills to surface water or groundwater bodies. These procedures will be included in the CEMP.

18.5.2 Operational Effects

18.5.2.1 Project activities and associated effects that are deemed not likely to be significant and are therefore proposed to be scoped out of the EIA are identified below:

- The existence of capacity improvements at the River Thames weirs has the potential of adverse effects on hydromorphological conditions downstream of the River Thames weirs (such as weir pools). However; these changes are expected to be within the scale of natural changes caused by major flow events (a review of historical bathymetric surveys reveals that slight changes in depth occur around these features). Measures have also been built-in to avoid the main weir pools. The new structures at Sunbury and Teddington Weirs are downstream of the main weir pools and the works at Molesey Weir are approximately 250m upstream of the main weir pool. In addition, embedded mitigation will address the operational flow to design the weir structures appropriately. There will be monitoring of the flow over the structures and therefore adjustments made to the operation of the structures as required;

- Operational failures of flow control structures on the channel, new weir gates or fish passes not operating as planned could cause adverse effects on erosion or water quality/quantity. However, there will be an operating procedure for augmented flow and maintenance procedure for flow control structures built into the design pursuant to a DCO requirement;

- General maintenance activities have the potential for adverse effects such as bank instability/erosion of soils adjacent to the flood relief channel, on the River Thames and in new green open spaces. Measures are built into the design to minimise risk of failure of banks, plus Maintenance activities which follow standard good practice, are likely to be infrequent, of low impact and of short duration;

- The existence of the flood channel in landfill areas has the potential for adverse effects on surface water quality, with the possibility of contaminants reaching surface water bodies (including WFD water bodies, tidal, estuarine and coastal waters and surface water safeguard zones). Mitigation measures include:
    - Reducing the risk of contaminants from landfill areas reaching surface water bodies, by implementing an impermeable layer (sheet piling) between the landfill materials and watercourses. The flood channel will be capped with concrete slab where there are landfill remains under the channel; and
    - Water quality of surface water bodies in close proximity to the landfills is likely to already be influenced by landfill contaminants, therefore any changes to local hydraulic connectivity as a result of the channel are unlikely to alter these existing conditions.

18.6 Approach to Mitigation

18.6.1.1 This section should be read in conjunction with Chapter 5: Approach to EIA Scoping which sets out further definition for the project regarding primary (embedded) mitigation, secondary (additional) mitigation and tertiary (best practice) mitigation.

18.6.2 Construction

18.6.2.1 Secondary mitigation measures that are under consideration for the construction phase are identified below:

- Install silt traps, such as silt curtains or booms, to reduce sediment dispersal during works within waterbodies;
- Use of impermeable bases, flood bunds, and temporary covering of exposed material to minimise risks of leachate from material stockpiles. Specific measures will be established as part of a MMS and SWMP (or similar) following completion of conceptual site modelling of Source-Pathway-Receptor. (See Chapter 13 Materials and Waste and Chapter 16 Soils and Land for assessment methodology). This may also include collection and treatment of run

off from stockpiles and dewatering activities. Mitigation will be included into the CEMP;

- Produce a construction stage surface water management plan (or similar) (including measures to minimise site run-off) in agreement with Environment Agency internal technical specialists to reduce the risk of pollution to the water environment from the working area, including during times of flood. This is to be included into the CEMP;

- Produce an Emergency Pollution Response Plan to reduce the risk of pollution to the water environment following a spillage or interaction with contaminated soils or land. This is to be included into the CEMP;

- Carry out pre-construction survey for non-native invasive plant species and develop and carry out appropriate response procedures as part of the Invasive Species Management Plan to prevent the spread. This is to be included into the CEMP;

- Suitably experienced Environmental Clerk of Works and fluvial geomorphologist to supervise the creation of geomorphological WFD enhancement features. This is to be included into the CEMP. This will minimise the risk of water pollution and will ensure best ecological value is obtained by guiding design of individual features as best fits site specific locations; and

- Register for flood warnings to reduce the risk of pollution to the water environment from mobilisation during flood waters. This is to be included into the CEMP.

18.6.2.2 GI and monitoring will include a hydrogeological risk assessment and land contamination risk assessment utilising a Source-Pathway-Receptor model applied to demonstrate all possible viable pathways for contamination to migrate to surface waters and groundwater (including from dewatering and site run off). Consideration will be given to the construction methods likely to be undertaken to reduce or eliminate potential pathways to sensitive receptors, where reasonably practicable.

18.6.3 Operation

18.6.3.1 Secondary mitigation measures that are under consideration for the operation phase are identified below:

- Carry out erosion control, such as but not limited to planting as per landscape plan, to minimise risk to water quality. It is expected erosion controls will be controlled pursuant to a DCO requirement;
- Post-construction monitoring and maintenance to ensure successful establishment of landscape planting and hydromorphological/ WFD enhancement proposals. It is expected that this will be controlled pursuant to a DCO requirement;
- Sediment mitigation, such as sediment basins, traps and/or a sediment maintenance regime, to reduce the risk of sediment release leading to downstream accumulations in-channel or within lakes leading to smothering of aquatic habitat or reduced conveyance. Sediment modelling being undertaken will inform the development of appropriate measures. It is expected these will be secured pursuant to condition requirements of the DCO; and
- Sediment sampling will be undertaken as part of GI and monitoring works where management activities will involve sediment removal (such a dredging to reinstate the design profile of the flood channel). A hydrogeological risk assessment and land contamination risk assessment will be undertaken which will identify effects to water quality and inform development of appropriate mitigations.

18.6.3.2 Impacts to fish, invertebrate, macrophyte and phytobenthos habitat availability and access will require replacement or enhancement of the watercourse elsewhere, to be secured as part of the project design.

- GI (and monitoring) in areas where below ground activities are anticipated will permit the effects of the project on the hydrogeology to be understood. Monitoring of groundwater levels will allow seasonal variations in levels to be understood, and the risks to the aquifer will be assessed. As with construction, a hydrogeological risk assessment and land contamination risk assessment will be undertaken including a use of a Source-Pathway-Receptor model to demonstrate all viable pathways for contamination to migrate to identified below ground receptors. Measures to reduce the effect on groundwater flows and quality may include but not be limited to:
    - Cut-off structures such as sheet piles, driven/installed to the depths of underlying strata of lower permeability, to be used as a barrier to lateral inflow or longitudinal flow, reducing the flow into or along

excavations and reducing the influence of dewatering on local water tables;

- Passive bypasses used to allow groundwater to bypass a barrier. Such bypasses could comprise a 'blanket' of permeable material (e.g. gravel) placed below cuttings allowing groundwater to bypass the structure without a groundwater level rise upstream of the underground structure; and
- Barriers / collars will discourage groundwater flowing in zones in which the hydraulic conductivity has been increased.

18.6.3.3 Secondary mitigation appropriate and specific to the potential effects specified in Section 18.4 will be further identified or refined as additional information becomes available from the surveys and modelling studies currently being undertaken or proposed to be undertaken during the next stage of the EIA.

18.7 Assessment Methodology

18.7.1 Significance Criteria

18.7.1.1 The methodology for appraising the effects of the project on the water environment has been developed based on a combination of the DMRB and Transport Analysis Guidance (TAG), with additional bespoke criteria outlined to meet the specific needs of the RTS. The main refinements relate to the inclusion of criteria for hydromorphology and access for recreation where these are not covered specifically within the guidance. This bespoke methodology has been developed in close collaboration with Environment Agency technical specialists. TAG and DMRB standards split water receptors into 'resources' and their respective 'features' (or attributes). Resources represent the individual hydrological receptors grouped into the same resource type, consisting of a surface watercourse, groundwater body or still water body, as these represent distinct and discrete volumes of water. The features represent specific attributes of each water resource where a consequence of an impact can be realised. Secondary effects to biodiversity or recreational social value and value to the economy are assessed respectively in Chapter 7: Biodiversity and Chapter 15: Socio-Economics. Effects on lake processes and ecosystem functions are assessed in Chapter 7: Biodiversity whereas effects to water quality as a result of eutrophication are assessed within this Water

Environment Chapter. Each water resource and the relevant features of these that are subject to potentially significant construction and operational effects are outlined below:

- Surface water (rivers and streams, drainage channels):
  - Hydromorphology;
  - Water quality;
  - Supply;
  - Surface water dependent biodiversity (which is supported by WQ and hydromorphology); and
  - Recreation access (which is supported by water quality and hydromorphology).
- Groundwater:
  - Water quality, levels and supply; and
  - Groundwater dependent biodiversity (which is supported by water quality, levels and supply).
- Still waters (lakes and ponds):
  - Hydromorphology, water quality and supply;
  - Water dependent biodiversity (which is supported by water quality and supply; and
  - Recreation access (which is supported by water quality and hydromorphology).

18.7.1.2 Water dependent biodiversity is separated as a unique feature, although any effects may be considered secondary and as a result of changes to hydromorphology, water quality or supply. This is to ensure any impacts to hydromorphology, water quality or supply within/to a water dependent site are set against a higher importance than may otherwise be classified to reflect the protected status these sites are afforded.

18.7.1.3 The importance (or sensitivity) of relevant water resources within the study area will be assessed by analysing their features to determine a baseline. The indicators used to make a judgement on the importance (or sensitivity) of a feature under consideration are listed below. The importance (or sensitivity) of a water receptor is a function of its quality, scale, rarity and substitutability (i.e. consideration of whether water features are replaced over a given time and their capability to absorb change). Table 18.1 provides criteria for classifying the importance (or sensitivity) of the water receptors and examples of application across relevant water features. These criteria are slightly different from most EIA assessment topics, as an additional importance (or sensitivity) level of ‘very high’ has been included in line with DMRB and TAG guidance.

18.7.1.4 Each water feature (as listed in Table 18-1) will receive a score, and therefore each water resource will have multiple and perhaps varied scores. For a feature to achieve a specified importance (or sensitivity) score, the majority of the criteria specified must be met. Where criteria are met between multiple importance scores, professional judgement will be used to determine the most appropriate score. The score for each water feature will be agreed in collaboration with the Environment Agency technical specialists as either a workshop or discussion.

18.7.1.5 To determine the magnitude of change on relevant water features, the nature of the effect (beneficial or adverse) upon relevant features of each water resource will be classified as either very high, high, moderate, low or negligible. The magnitude of a change is its severity or scale. The magnitude of a change on a feature reflects consideration of information and analysis relating to the spatial extent (localised/isolated versus widespread with potential secondary effects); and the duration (short, medium and long-term). Table 18-2 outlines the criteria and examples of application across relevant water features to assess the magnitude of change in features of each water feature relevant to the RTS. Where not explicit, further development of the criteria to determine to magnitude of change will be undertaken during the next stage of the assessment. This will be developed and agreed in collaboration with the Environment Agency. This is expected to include hydromorphology and limnology.

Table 18-1: Criteria for classifying the importance (or sensitivity) of water features.

Importance (or sensitivity)	Hydromorphology (Surface Water and Still Waters)	Surface water dependent biodiversity	Water quality (Surface Water and Still Waters)	Water supply (Surface Water and Still Waters)	water quality and hydromorphology (Surface Water and Still Waters) to support recreation	Water quality, levels and supply, and support to groundwater dependent biodiversity (Groundwater)
Very High Water environment feature with a high quality and rarity on regional or national scale and limited potential for substitution.	Watercourse or lake which is not classified as HMWB or AWB and with a High hydromorphological element classification status. Water feature displays very little or no signs of modification and not subject to morphological pressures with a natural range of morphological features including pools, riffles, sediment bars or braiding, a natural planform and naturally	Presence of water dependent biodiversity protected under UK habitat legislation including SAC, SPA, SSSI, Water Protection Zones, Ramsar site.	Watercourse having a WFD classification. Baseline RCA determined good river or good lake condition. A chalk stream.	Drinking water protected areas provides a Public drinking water supply.	Water feature widely used for recreation, directly related to its quality (e.g. swimming with a bathing water quality rating of excellent; angling in a salmon/cyprinid fishery; full/free navigational access).	SPZ1. Principal aquifer. Providing potable water to a large population. Groundwater locally supports groundwater dependent terrestrial ecosystems with a statutory designation. Waterbody having a WFD classification.

Importance (or sensitivity)	Hydromorphology (Surface Water and Still Waters)	Surface water dependent biodiversity	Water quality (Surface Water and Still Waters)	Water supply (Surface Water and Still Waters)	water quality and hydromorphology (Surface Water and Still Waters) to support recreation	Water quality, levels and supply, and support to groundwater dependent biodiversity (Groundwater)
	occurring woody debris dams. The water feature is in complete natural equilibrium as a source, transfer or sink of sediment. There is no unnatural or externally forced erosion or deposition and the sediment regime may be critical to supporting protected or rare species by provision of spawning grounds or similar in an ecosystem. A water feature with geomorphology that					Quantitative water balance element status Good.

Importance (or sensitivity)	Hydromorphology (Surface Water and Still Waters)	Surface water dependent biodiversity	Water quality (Surface Water and Still Waters)	Water supply (Surface Water and Still Waters)	water quality and hydromorphology (Surface Water and Still Waters) to support recreation	Water quality, levels and supply, and support to groundwater dependent biodiversity (Groundwater)
	produces variations in velocity and flow conditions beneficial to biodiversity and as such is highly vulnerable to changes to conditions that may reduce the quality of habitat. Baseline lake condition assessment classifies physical lake morphology element as Good.					
High Feature with a high quality and rarity, local scale and	Water feature with some signs of modification and subject to some morphological pressures. This may be heavily modified or artificial but managed as a High	Supports presence of non-statutory protected water dependent biodiversity	Watercourse having a WFD classification. Baseline RCA determined fairly good river	Drinking Water Protected Area. Provides a potable	Water feature used locally for recreation, directly related to its quality. Water body has the potential to be	SPZ2. Secondary A aquifer. Providing potable water to a small population.

Importance (or sensitivity)	Hydromorphology (Surface Water and Still Waters)	Surface water dependent biodiversity	Water quality (Surface Water and Still Waters)	Water supply (Surface Water and Still Waters)	water quality and hydromorphology (Surface Water and Still Waters) to support recreation	Water quality, levels and supply, and support to groundwater dependent biodiversity (Groundwater)
limited potential for substitution. Feature with a medium quality and rarity, regional or national scale and limited potential for substitution.	status morphological regime. Rivers may have a natural range of morphological features including pools, riffles, sediment bars or braiding. A water feature with geomorphology that produces variations in velocity and flow conditions beneficial to biodiversity and as such is highly vulnerable to changes to conditions that may reduce the quality of habitat.	(e.g. Local Wildlife Site).	or fairly good lake condition.	water supply (Private supply).	classified as 'good' for bathing water quality. Current hydromorphological regime suitable for safe recreation throughout the year.	Groundwater locally supports groundwater dependent terrestrial ecosystems with a habitat considered to be under significant decline at a national or regional scale. Waterbody having a WFD classification. Quantitative water balance element status of upward trend.

Importance (or sensitivity)	Hydromorphology (Surface Water and Still Waters)	Surface water dependent biodiversity	Water quality (Surface Water and Still Waters)	Water supply (Surface Water and Still Waters)	water quality and hydromorphology (Surface Water and Still Waters) to support recreation	Water quality, levels and supply, and support to groundwater dependent biodiversity (Groundwater)
	There is no significant unnatural or externally forced erosion or deposition and the sediment regime may be critical to supporting biodiversity such as through the provision of spawning grounds or similar. Baseline lake condition assessment classifies physical lake morphology element as Fairly Good.					
Moderate Feature with a medium quality and	Water feature that is heavily modified or shows signs of modification and subject to morphological	No species or habitats of conservation concern.	Waterbodies not having a WFD classification.	Drinking Water Safeguard Zone.	Water feature not widely used for recreation, or recreation use not	SPZ3. Secondary B aquifer – abstraction for

Importance (or sensitivity)	Hydromorphology (Surface Water and Still Waters)	Surface water dependent biodiversity	Water quality (Surface Water and Still Waters)	Water supply (Surface Water and Still Waters)	water quality and hydromorphology (Surface Water and Still Waters) to support recreation	Water quality, levels and supply, and support to groundwater dependent biodiversity (Groundwater)
rarity, local scale and limited potential for substitution. Feature with a low quality and rarity, regional or national scale and limited potential for substitution.	pressures with active restoration attempts. Erosion and / or deposition may be externally forced, and the sediment regime may be of importance to some local species or habitats. Variety of morphological features is limited but contains active features such as gravel bars. Fluvial processes are limited and heavily influenced by modifications or anthropogenic processes.		Baseline condition assessment determined moderate river or moderate lake condition.	Non potable water supply.	directly related to water quality. Has the potential to be classified as ‘sufficient’ for bathing water quality. Current hydromorphological regime is generally suitable for safe ‘in-water’ recreation however, in some conditions it is too dangerous or difficult for safe ‘in-water’ recreation to take place.	agricultural or industrial use. Groundwater locally supports groundwater dependent terrestrial ecosystems of local value or with high recoverability. Groundwater Drinking Water Safeguard Zone. Quantitative water balance element status of moderate or poor.

Importance (or sensitivity)	Hydromorphology (Surface Water and Still Waters)	Surface water dependent biodiversity	Water quality (Surface Water and Still Waters)	Water supply (Surface Water and Still Waters)	water quality and hydromorphology (Surface Water and Still Waters) to support recreation	Water quality, levels and supply, and support to groundwater dependent biodiversity (Groundwater)
	Water feature deemed to be vulnerable to changes in its vicinity. Variety of morphological features is limited. Baseline lake condition assessment classifies physical lake morphology element as Moderate.					
Low Feature with a low quality and rarity, local scale and limited potential for substitution.	Baseline RCA determined to be fairly poor to poor river or lake condition. A water feature that is heavily modified or artificially engineered and incapable of naturally	It is highly unlikely that the water feature supports sensitive species or habitats (limited	Waterbodies not having a WFD classification.	Non potable water supply or Agricultural or industrial use not directly	Rarely or not used for recreation purposes. Has the potential to be classified as 'poor' for bathing water quality.	Secondary undifferentiated aquifers. Unproductive strata. Waterbody not having a WFD classification.

Importance (or sensitivity)	Hydromorphology (Surface Water and Still Waters)	Surface water dependent biodiversity	Water quality (Surface Water and Still Waters)	Water supply (Surface Water and Still Waters)	water quality and hydromorphology (Surface Water and Still Waters) to support recreation	Water quality, levels and supply, and support to groundwater dependent biodiversity (Groundwater)
	reaching a natural equilibrium without significant active restoration attempts. The water feature exhibits a completely unnatural sediment regime, meaning zones of storage and transfer are significantly influenced by anthropogenic pressures. Morphological diversity is largely absent, flow is uniform as are the banks and anthropogenic modification is extremely likely such as localised,	biodiversity and no species or habitats of conservation concern).		related with water quality.	Current hydromorphological regime is not suitable for safe ‘in-water’ recreation to be undertaken on this water body.	No species or habitats of conservation concern.

Importance (or sensitivity)	Hydromorphology (Surface Water and Still Waters)	Surface water dependent biodiversity	Water quality (Surface Water and Still Waters)	Water supply (Surface Water and Still Waters)	water quality and hydromorphology (Surface Water and Still Waters) to support recreation	Water quality, levels and supply, and support to groundwater dependent biodiversity (Groundwater)
	bank protection or culverting. Baseline lake condition assessment classifies physical lake morphology element as fairly poor.					

Table 18-2: Criteria and examples for classifying the magnitude of change on water features.

Magnitude	Revised proposed RTS criteria	Hydromorphological feature: surface waters	Hydromorphological feature: still waters	Water quality	Groundwater	Recreation
High Adverse	Results in major deterioration to quality of feature and/or loss of most or all of feature.	Substantial shift away from baseline conditions, results in loss of or preventing attainment of self-regulating hydromorphological features and / or failure of hydromorphological elements (morphology, quantity and dynamics of flow). Significant/extensive alteration to channel planform and/or cross section. Substantial adverse change in physical habitats such as water feature bed, banks and vegetated riparian corridor. Substantial changes to sediment characteristics, transport processes,	Substantial changes in quantity and dynamics of water flow, residence time, connectivity to groundwater body. Substantial adverse change in the quantity, structure and substrate of the lake bed, the variation of the lake depth and to the structure of the lake shore. Deteriorates WFD status, prevents achievement of Good Ecological Potential or Status, or causes deterioration in a Biological Quality Element due to a	Results in deterioration or prevention of achieving good WFD WQ status or a change in a Biological Quality Element due to WQ changes. For non-WFD water bodies, where a change would result in theoretical deterioration in WFD status, if the water body was classified under the WFD.	Loss of, or extensive change to, an aquifer/groundwater supporting internationally designated water dependent habitats which deteriorates the groundwater bodies qualitative or quantitative WFD status or prevents it from achieving Good Status.	Water quality: Permanent or intermittent change in bacteria and nutrient WQ that would prohibit safe 'in-water' recreation and / or would consequently degrade any potential bathing water classification of the water body. Hydromorphology: Change in hydromorphological regime that would prohibit safe 'in-water' recreation.

Magnitude	Revised proposed RTS criteria	Hydromorphological feature: surface waters	Hydromorphological feature: still waters	Water quality	Groundwater	Recreation
		sediment load and turbidity. Deteriorates WFD status, prevents achievement of Good Ecological Potential or Status causes deterioration in a Biological Quality Element due to a change in hydromorphology. For non-WFD water bodies, where a change would result in theoretical deterioration in WFD status, if the water body was classified under the WFD.	change in hydromorphology. For non-WFD water bodies, where a change would result in theoretical deterioration in WFD status, if the water body was classified under the WFD.			
High Beneficial	Results in major improvement of feature.	Creation or large-scale improvements of self-sustaining hydromorphology features or	Creation or large-scale improvements of self-sustaining hydromorphology features or	Beneficial change in WQ WFD status.	Increase in groundwater qualitative or quantitative WFD status.	Water quality: Improves WQ to enable new or improved use of water body for ‘in-

Magnitude	Revised proposed RTS criteria	Hydromorphological feature: surface waters	Hydromorphological feature: still waters	Water quality	Groundwater	Recreation
		improvements in fluvial processes that result in a beneficial change in the WFD status of the water body.	improvement in lake processes that result in a beneficial change in the WFD status of the water body.	Removal of a major existing polluting discharge to a watercourse.		water' recreational purposes (e.g. prevention of algal blooms) that would have the potential to improve bathing WQ classification. Hydromorphology: Change in hydromorphological regime that would enable safe 'in-water' recreation within a water body that previously could not support any.
Moderate Adverse	Results in partial deterioration to / partial loss of feature.	Moderate change from baseline conditions, resulting in the loss of some self-regulating hydromorphological features. Some alteration to channel planform and / or cross section.	Moderate changes in the flow regime, lake residence time and connectivity to groundwater. Moderate effects on the quantity, structure and	Within class changes in WQ that does not result in a real or theoretical change in WFD classification (depending on whether the	Partial loss or change to an aquifer/groundwater supporting nationally designated water dependent habitats. Measurable decline or reversible change in	Water quality: Permanent or intermittent change in bacteria and nutrient water quality, but does not prohibit safe 'in-water' recreation and / or would not

Magnitude	Revised proposed RTS criteria	Hydromorphological feature: surface waters	Hydromorphological feature: still waters	Water quality	Groundwater	Recreation
		Moderate changes to physical habitats such as water feature bed, banks and vegetated riparian corridor Limited (but notable) changes to sediment characteristics, transport processes, sediment load and turbidity. Results in a reduction in the river condition class but does not result in a change in WFD status of the water body, prevent achievement of Good Ecological Potential or cause deterioration in a Biological Quality Element due to a change in hydromorphology.	substrate of the lake bed, the variation of the lake depth and to the structure of the lake shore. Impact on WFD attribute resulting in reduction in sub-classification. However, does not result in degrading overall WFD status or would not degrade the water body if it was a WFD water body or prevent it from reaching Good Ecological Potential.	water body is a WFD water body).	the yield or quality of an aquifer, affecting users, but not affecting WFD status.	consequently degrade any potential bathing water classification of the water body. Hydromorphology: Change in hydromorphological regime that would prohibit safe 'in-water' recreation in some conditions.

Magnitude	Revised proposed RTS criteria	Hydromorphological feature: surface waters	Hydromorphological feature: still waters	Water quality	Groundwater	Recreation
		For non-WFD water bodies, where a change would not result in theoretical deterioration in WFD status, if the water body was classified under the WFD.				
Moderate Beneficial	Results in moderate improvement of feature.	Large scale enhancements / improvements to existing hydromorphology features or fluvial processes, but may require ongoing management. Results in an increase in the river condition class but does not result in a change in WFD status of the water body.	Large scale enhancements / improvements to existing hydromorphology features or lake processes, but may require ongoing management. Does not result in a change in WFD status of the water body.	Temporary or within class improvements in WQ that does not result in a real or theoretical change in WFD classification (depending on whether the water body is a WFD water body).	Measurable increase in the yield or quality of the aquifer benefiting existing users but not changing any WFD status.	Water quality: Improves water quality, but would not have the potential to improve a bathing WQ classification. Hydromorphology: Change in hydromorphological regime that would enable safe 'in-water' recreation within a water body that previously could not support any, during some conditions.

Magnitude	Revised proposed RTS criteria	Hydromorphological feature: surface waters	Hydromorphological feature: still waters	Water quality	Groundwater	Recreation
Low Adverse	Results in minor adverse effect on feature.	Minimal shift away from baseline conditions with typically localised changes in self-regulating hydromorphological features. Limited adverse changes in the water feature bed, banks and vegetated riparian corridor. Localised changes to sediment characteristics, transport processes, sediment load and turbidity. A small change or modification in the channel planform and/or cross section. Results in a reduction in the river condition	Limited adverse changes on the water feature bed, banks and vegetated riparian corridor. Small changes in the hydrological regime, lake residence time and connectivity to groundwater. Minimal shift away from baseline conditions with typically localised impacts.	Temporary or within class changes in WQ that does not result in a real or theoretical change in WFD classification (depending on whether the water body is a WFD water body).	Measurable decline in yield or quality of aquifer not affecting users or affecting WFD status.	Water quality: Temporary change in bacteria and nutrient water quality, and / or does not prohibit safe ‘in-water’ recreation. Hydromorphology: Change in hydromorphological regime and would not prohibit safe ‘in-water’ recreation within the water body.

Magnitude	Revised proposed RTS criteria	Hydromorphological feature: surface waters	Hydromorphological feature: still waters	Water quality	Groundwater	Recreation
		class but does not result in a change in WFD status of the water body.				
Low Beneficial	Results in minor beneficial effect on feature or a reduced risk of adverse effect occurring.	Localised improvements in hydromorphology features or fluvial processes that may require ongoing management. Results in an increase in the river condition class but does not result in a change in WFD status of the water body.	Localised / small scale improvements in hydromorphology features or lake processes that may require ongoing management. Does not result in a change in WFD status of the water body.	Negligible within class improvements in WQ that do not result in a real or theoretical change in WFD classification (depending on whether the water body is a WFD water body).	Measurable increase in the yield or quality of the aquifer not benefiting existing users or change any WFD status.	Water quality: Negligible improvements in WQ which would not change a bathing WQ classification. Hydromorphology: Change in hydromorphological regime, but would not enable any safe ‘in-water’ recreation within the water body.
Very Low Adverse	Results in an effect on feature but of insufficient magnitude to affect use / integrity.	Minimal from baseline conditions in terms of sediment transport, channel morphology and natural fluvial processes. Any impacts are likely to be highly localized.	Minimal or no measurable change from baseline conditions in terms of morphology and natural hydrological processes. Any	Negligible within class changes in WQ that does not result in a real or theoretical change in WFD classification (depending on	Negligible change to an aquifer which lead to no effect on users or a change in WFD.	Water quality: Negligible change in bacteria and nutrient water quality, and does not affect safe ‘in-water’ recreation.

Magnitude	Revised proposed RTS criteria	Hydromorphological feature: surface waters	Hydromorphological feature: still waters	Water quality	Groundwater	Recreation
			impacts are likely to be highly localized.	whether the water body is a WFD water body).		Hydromorphology: Negligible change in hydromorphological regime and no effect on ‘in-water’ recreation.
None	No change in feature.	No predicted adverse effect on the receptor.	No predicted adverse effect on the receptor.	No predicted adverse effect on the receptor.	No predicted adverse effect on the receptor.	No predicted adverse effect on the receptor.

18.7.1.6 The appraisal of the importance (or sensitivity) of the water environment features is then combined with the appraisal of the magnitude of change, to determine the potential significant effects. An indicative matrix for the determination of significance is provided in Table 18-3 below.

18.7.1.7 For the purposes of this EIA, moderate and major effects are deemed to be significant, be they adverse or beneficial.

18.7.1.8 It should also be noted that for impacts associated with low probability major impact events, such as major spillage, the application of the above assessment methodology could suggest an artificially high significance of the effect on the water environment. Therefore, for qualitative assessments, the output of the assessment will be reviewed using professional judgement, and where considered appropriate in light of assumed tertiary measures, the assessed significance will be reduced to reflect the low probability of occurrence. This is in line with the recommendations within the DMRB.

Table 18-3: Significance of effects matrix.

	Very High Sensitivity	High Sensitivity	Moderate Sensitivity	Low Sensitivity	Negligible Sensitivity
High Magnitude	Major (significant)	Major (significant)	Major (significant)	Moderate (significant)	Minor
Moderate Magnitude	Major (significant)	Major (significant)	Moderate (significant)	Minor	Negligible
Low Magnitude	Moderate (significant)	Moderate (significant)	Minor	Negligible	Negligible
Very Low Magnitude	Minor	Minor	Negligible	Negligible	Negligible
No change	None	None	None	None	Negligible

18.7.2 Construction Effects

18.7.3 Likely significant effects to each water environment feature during the construction phase of the project will be determined using the tables outlined above. Assessment of effects (with primary and tertiary mitigation assumed to be in place) will be presented initially. Any further (secondary) mitigation that may be required to address any remaining significant adverse effects will be identified and residual effects assessed with such additional secondary mitigation in place as a second stage of the assessment.

Operational Effects.

18.7.3.1 Likely significant effects to each water environment feature during the operational phase will be assessed using the same criteria as described for the construction effects.

18.7.3.2 In addition, the assessment will draw on the considerations undertaken in the associated WFD compliance assessment.

18.7.4 Cumulative Effects

18.7.4.1 The RTS involves construction and operation in a built-up area, within and surrounding several waterbodies, with the primary intention of reducing flood risk to the area. It is therefore possible that the impacts and effects associated with the RTS, through hydraulic connections or pathways may combine with effects resulting from other projects or developments in the vicinity. These inter-project effects, which individually might not be significant, but when considered together could have a significant cumulative effect on a shared receptor. Given the interconnectedness, the assessment will also consider specific interactions with other topics which could change the effect on a receptor and require additional assessment of significance. The approach to scoping of potential cumulative effects is provided in Chapter 19: Cumulative Effects Assessment.

18.8 Assumptions and Limitations

18.8.1.1 Modelling of effects upon water quality, groundwater and sedimentation from operation of the RTS is not yet complete; therefore a precautionary approach to scoping has been adopted and potential effects have been scoped into the EIA. Once the outcomes of the modelling are available it will be possible to review the scope of the EIA.

19 Cumulative Effects Assessment

19.1 Introduction

19.1.1.1 The cumulative effects assessment (CEA) will identify and characterise the potential for in-combination (intra) and cumulative (inter) effects and then assess the significance of these effects. The data collection on other developments is ongoing and monitored as part of the EIA process.

19.1.1.2 In-combination and cumulative effects result from multiple actions on receptors and resources over time. These can be:

- Additive - caused by other past, present or reasonably foreseeable actions together with the project itself; and/or,
- Interactive/Synergistic - the reaction between effects of a development on different aspects of the environment.

19.1.1.3 While there is no standard, industry-accepted methodology for CEA, there is emerging guidance which aims to reduce differences of approach and uncertainties. The CEA will follow the approach set out in PINS Advice Notes Nine and Seventeen (see Section 19.2). Professional judgement and knowledge by qualified EIA specialists is required for the CEA at it is also necessarily qualitative, in keeping with the need to ensure the CEA is proportionate.

19.2 Approach to Cumulative (Inter) Effects Assessment

19.2.1.1 PINS Advice Note Seventeen (PINS, 2019b) provides a four-staged approach to identify and assess other developments which is to be used for the RTS.

19.2.1.2 The four stages are described below:

- Stage 1a - Establish the project’s Zone of Influence(s) (ZOIs) for each topic area. These will then be used to identify the long list of ‘other developments’;

- Stage 1b - Identify the long list of ‘other developments’ by using the tiered approach (as outlined in paragraph 19.2.3 below) and outlining any inclusion/exclusion criteria used and in consultation with the LPAs;
- Stage 2 - Develop a shortlist of ‘other developments’ which will be considered within the assessment. The shortlist will be consulted upon with statutory and non-statutory consultees during the EIA process further down the line;
- Stage 3 - A desk study will be undertaken to gather the appropriate environmental information (if available) for the identified ‘other developments’ in the shortlist; and,
- Stage 4 - An assessment of the likely cumulative effects. Mitigation measures will be identified (where appropriate) where an adverse cumulative effect is identified. The apportionment of effect between the project and ‘he 'other developments’ will be considered, e.g. the contribution to the effect demonstrably related to one development or if there is an equal contribution from either development.

19.2.1.3 The three tiers recommended to categorise the other developments in terms of their certainty are set out below:

Tier 1

- Under construction;
- Permitted application(s), whether under the PA2008 or other regimes, but not yet implemented; and
- Submitted application(s) but not yet determined.

Tier 2

- Projects on the PINS’ Programme of Projects where a Scoping Report has been submitted.

Tier 3

- Projects on the PINS’ Programme of Projects where a Scoping Report has not been submitted;
- Sites identified in the relevant Local Development Plan (and emerging Local Development Plans – with appropriate weight being given as

they move closer to adoption) recognising that there will be limited information available on the relevant proposals; and

- Other plans and programmes (as appropriate) which set the framework for future development consents/approvals, where such development is reasonably likely to come forward.

19.2.2 Stage 1a: Zones of Influence

19.2.2.1 Given the nature of the project and the stage of design, the ZOIs for this Scoping Report for each environmental topic have been defined by using the study area used for each topic. This ranges from a minimum of the project boundary for EIA scoping up to a maximum of 30km distance to account for sites where bats are the qualifying interest features of European sites (as defined in Section 7.2.3). Whilst the study areas for Materials and Waste cover England and the South East of England respectively, these were discounted from the CEA at this time as they would not result in a proportionate assessment.

19.2.2.2 These ZOIs are already defined in the relevant topic chapter preceding this chapter and have been mapped by the respective study areas shown in Appendix A. Please refer to the relevant ‘study area’ section of each topic chapter and associated drawings in Appendix A.

19.2.3 Stage 1b: Identifying the long list of ‘other developments’

19.2.3.1 The overarching criteria used in identifying the long-list of potentially relevant ‘other developments’ to date were:

- Other developments with the potential for overlap with the project in terms of impacts on sensitive receptors; or
- Other developments that introduce new sensitive receptors that could be impacted by the project, where existing receptors assessed are not adequately representative of effects.

19.2.3.2 All other developments assumed to be automatically scoped in have been included.

19.2.3.3 In addition, as part of the ongoing data collection, where possible the LPAs (planning departments and Highways Authority) were contacted directly to identify potential large developments that would need to be considered. It was requested that each LPA provide a list of developments that would be categorised as an EIA development in order to ensure a proportionate CEA at this early stage. The developments suggested by the LPAs have been included in the long list at this stage where appropriate. As stated, this is an ongoing data collection process at an early stage; all relevant bodies will be contacted as the consultation and EIA process continues.

19.2.3.4 The long list identified using the above data is presented in a table in Appendix L. Each topic Chapter will also review and assess where new developments introduce new receptors as part of their changing baseline where appropriate at regular planned and documented intervals for the DCO submission process to ensure a robust audit trail.

19.2.3.5 In order to have a meaningful and proportionate CEA, the list of other developments will be deliberately paused at key stages to enable the next stages to take place and an assessment to be undertaken. These pauses will be for the PEIR and the ES.

19.2.3.6 The next stages listed in this chapter are to be undertaken as the EIA process, project design and consultation progresses.

19.2.4 Stage 2 – Identifying the shortlist of 'other developments' to be considered

19.2.4.1 This stage will require threshold criteria to be applied to the long list.

19.2.4.2 It is considered that the following general search criteria will be used to ensure a proportionate CEA.

19.2.4.3 The temporal timescale of five years previous from August 2022 and all active NSIPs and Hybrid Bills within the maximum ZOI will be automatically screened in.

19.2.4.4 The following matrix in Table 19-1 below provides the recommended search criteria for short-listing other developments into the CEA.

Table 19-1: Matrix of search criteria for short-listing developments.

Development/ Plan	Search timescale	Search radius	Shortlisting criteria: Housing unit (n)	Shortlisting criteria: Housing land (Ha)	Shortlisting criteria: Non-residential (m^2)	Shortlisting criteria: Non-residential (Ha)
'Major applications' to LPA	5 years from August 2022 / active	Variable depending on topic ZOI	Topic specific or if an EIA is required / has been submitted			
Other applications to LPA			Case by case basis / in consultation with the LPA			
Local Development Plan Allocations			Case by case basis / in consultation with the LPA particularly with regards to emerging policies and plans			

19.2.4.5 It is acknowledged that the above criteria will also be supported by professional judgement on the nature of the developments, the receptor and the potential for cumulative pathways. This is important to CEA when considering that stand-alone, a development may not exceed a threshold, but cumulatively with other developments, a receptor could however receive significant changes.

19.2.4.6 It is proposed that further consultation with LPAs and the planned monitoring of planning applications will also provide the input on any other developments that introduce sensitive receptors hitherto not included in the assessment of effects and their likelihood to change the baseline that could lead to an incremental significant effect. In this way, developments such as Long Cross Garden Village recently submitted for planning will also be captured.

19.2.4.7 Importantly, if the CEA suggests early on that a certain short listed project could give rise to a significant effect, this project will be fast tracked to the next stages.

19.2.5 Stage 3 – Data Gathering of the Short List Developments

19.2.5.1 Data will be sought for the relevant short list of other developments using readily available sources (Planning Portal) and through consultation with relevant planning bodies. The PINS recommended matrix will be used to formalise the details.

19.2.6 Stage 4 – Assessment

19.2.6.1 The PINS guidance will be followed. The residual effects identified in each technical chapter will be used to assess a relevant receptor that also is changed by the scope of the other development in question. A qualitative approach will be taken to review how the effects interact to create a different or greater effect. This will then be used to assess if this cumulative change is a significant effect for the receptor or not.

19.3 Approach to In-Combination (Intra) effects

19.3.1.1 The approach to assessing in-combination effects will also follow a four-staged approach using the same ZOIs:

- **Stage 1** – Individual assessments undertaken for the environmental topics;
- **Stage 2** – Use the assessment of effects for each topic to highlight a receptor / resource that is changed by more than one topic / effect;
- **Stage 3** – Using the receptor / resource groups, use the topic chapter assessments to identify the potential for in-combination effects; and
- **Stage 4** – Assess the likelihood that the potential for the individual effects to interact to create a different or greater effect could alter the assessment of significance.

19.4 Mitigation

19.4.1.1 The CEA will be undertaken assuming the embedded and secondary mitigation specified in the topic assessments are in place. Currently all topics are scoped in for assessing cumulative effects. If the CEA indicates additional mitigation is required, this will be recommended and assessed.

19.5 Transboundary Effects

19.5.1.1 Regulation 32 of the EIA Regulations requires the consideration of any likely significant effects on the environment of another EEA States.

19.5.1.2 Guidance for the consideration of transboundary effects is provided in PINS Advice Note Twelve. This states that all NSIPs that are EIA development will be subject to a transboundary screening process determined by the PINS on behalf of the SoS. Where the SoS is satisfied that the likelihood of transboundary effects is extremely low, the transboundary screening decision will be included in a Scoping Opinion.

19.5.1.3 To assist the SoS as part of their Scoping Opinion, a transboundary screening exercise has been carried out following the guidance in PINS Advice Note Twelve, using the criteria set out in the proforma in Annex 1. The screening exercise can be found in Appendix C.

19.5.1.4 The screening exercise includes review of the setting and nature of the project, the likely extent of individual effects, the activities involved with construction and operation, the environmental importance of the site and surroundings, the potential for impacts to have widespread effects (the "carrier" effect) including irreversible changes and the potential for cumulative impacts with other developments with implications for transboundary changes.

19.5.1.5 The transboundary screening identifies that there are no effects beyond those associated with release of GHG to the climate that are likely to extend beyond the jurisdiction of the UK.

19.5.1.6 It has been assumed that the project will contribute to the level of GHG emissions in the UK during construction and operation. However, opportunities will be explored throughout the project development to minimise GHG emissions and where possible sequester carbon or generate renewable energy. Therefore, although at this stage of the assessment it has been assumed that the project will contribute to the level of GHG emissions based on the required operational activities, it is assumed that the reduction in flood risk as a result of the RTS will cause a reduction in emissions during operation (e.g. reduction in flood damage and repair to buildings and infrastructure). The potential effect of GHG emissions associated with the project is being fully assessed as part of the EIA and mitigation developed as required.

20 Stakeholder Engagement

20.1 Introduction

20.1.1.1 Consultation with public bodies, business and residents has been ongoing since 2009 when the LTFRMS set out recommendations for the RTS.

20.1.1.2 The scope and design of the project that will be submitted for application and assessed in the ES, will be shaped by technical, environmental and economic factors alongside feedback from engagement with stakeholders and through the statutory consultation process, further to the applicant's duties under sections 42 to 49 of the PA08.

20.1.1.3 This section provides an overview of:

- Engagement planning;
- Breadth of past engagement;
- How engagement has already informed the RTS; and
- Future consultation.

20.1.1.4 Previous stakeholder engagement relevant to individual environmental topics is covered in individual topic chapters.

20.2 Engagement Planning

20.2.1.1 Before the Section 35 Direction in December 2020, a communication strategy was implemented by the Environment Agency and Surrey County Council to 'consult regularly, welcome feedback and provide clear evidence of how this was used in our design'. The 'working with others' approach was used to ensure effective engagement on the project. This works through a series of iterative steps, being:

- WHAT do you want to achieve?
- WHY work with others?
- WHO do you need to work with?
- HOW will you involve them?
- DELIVER – let's do it!

- EVALUATE - how did it go and what did we learn?

20.2.1.2 The project has over 250 organisations identified as stakeholders, as well as thousands of affected individuals from a broad range of interests including statutory authorities, landowners and operators, environmental groups and businesses.

20.2.1.3 At this pre-application stage of the DCO process, the project will consult with communities and statutory bodies on the plans for the RTS in line with the statutory requirements in the PA08 and its associated regulations.

20.2.1.4 All the feedback received will be carefully considered by the project team.

20.2.1.5 All relevant comments and suggestions will be logged in the Consultation Report submitted with the application. The report will explain where and how changes have been made in response to feedback or why it has not been possible to make the changes suggested.

20.2.1.6 The consultation and engagement currently being undertaken has been taking account of the PA08 and the PINS Advice Notes Two, Three and Fourteen, whereby:

- Section 42 prescribed consultees have been identified with ongoing engagement and collaborations happening with them;
- Section 43 local authorities (categories A, B and C) have been identified with ongoing engagement and collaborations happening with them;
- Non-Prescribed consultees have been identified with on-going engagement and collaborations happening with them; and
- A ‘Statement of Community Consultation’ (SOCC) will be developed with host and neighbouring LPAs to inform the shape of public consultation activities alongside the statutory notice requirements.

20.3 Breadth of Past Engagement

20.3.1.1 To date, the project has engaged with over 250 stakeholders.

20.3.1.2 Past engagement has influenced distinct development phases of the RTS:

- During development of the LTFRMS, over 50 different options were considered to manage flood risk between Egham and Teddington. Engagement and consultation on this stage was held in 2009;
- Outline planning and design work has been ongoing since 2015, shaped by economic, environmental, and technical considerations and feedback from engagement with communities and landowners;
- Scoping Opinions were received from LPAs (2017) and the MMO (2018) in response to the EIA Scoping Report on an earlier design of the project (as noted in Section 3.2.1);
- Pre-application advice was sought from prescribed consultees and LPAs on the earlier design (2019) (as noted in Section 3.2.3); and
- Feedback on draft topic assessment methodologies was received from Surrey County Council's Principal Environmental Assessment Officer in 2019 (as noted in Section 3.2.3).

20.3.1.3 To date the project has used a range of engagement methods according to the characteristics of individual stakeholders and their needs. This has included:

- Group meetings with partners (e.g. Consents and Authorisations Advisory Group and an Environmental Modelling Steering Group);
- One-to-one meetings (e.g. with landowners, utility providers, interest groups and statutory authorities e.g. HE, NE, conservation groups);
- Seven workshops for three 'Discussion Groups' (Berkshire, Surrey and downstream interests) with 100+ representatives in autumn 2015 and autumn/ winter 2016;
- 20+ public drop-ins in summer 2015, spring 2016 and winter 2016 with circa 1500 attendees;
- Five Community Resilience Advisors engaging with local communities including vulnerable groups;
- Mailshots;
- Public Notices;
- Newsletters and briefing notes;

- The RTS webpage;
- Print media, TV, radio interviews;
- Social media; and
- Emails.

20.4 How Engagement is Informing the RTS

20.4.1.1 Stakeholder engagement has already led to several changes to the proposed design and operation of the RTS.

20.4.1.2 Section 4.5 (in Chapter 4) in this document gives detailed information on the design changes and how stakeholder engagement informed the design development (selection of the preferred option):

- Consensus on the preferred flood channel alignment at Thorpe Hay Meadow SSSI was reached with Discussion Groups in winter 2016 (see paragraph 4.5.3.6);
- Downstream section of the Runnymede Channel (paragraph 4.5.3.8);
- Wet or dry Channel (paragraph 4.5.3.9 and 4.5.3.10);
- Capacity Improvements at Desborough Cut (paragraph 4.5.3.11 to 4.5.3.14);
- Abbey Meads Floodway on the Runnymede Channel (paragraph 4.5.3.25 to 4.5.3.26);
- Littleton East Lake Separation Bund (paragraph 4.5.3.23); and,
- Selection of preferred weir designs at Sunbury, Molesey and Teddington including a canopy over the proposed weir at Molesey was gained through public feedback at drop-in events in spring 2016 (paragraph 4.5.3.28 to 4.5.3.33).

20.4.1.3 Public consultation was undertaken in 2016. This looked at enhancement opportunities within the RTS. The consultation aimed to identify possible enhancement opportunities, consider how these opportunities aligned with the RTS vision and then a report was created to identify responsibilities to take forward further works relating to the opportunities. This consultation work was used as guidance to inform the landscape design work for the RTS.

2.5.1.12 There is also ongoing engagement that will affect the design and operation of the RTS:

- Six additional fish passes have been included in the design (two fish/eel passes at Teddington, two at Sunbury, one at Chertsey, one on Abbey River) to be developed in consultation with all relevant stakeholders;
- The design and management of structures that cross the flood relief channel is being developed through meetings with National Highways (formerly Highways England), local highway authorities, Network Rail, and private landowners (2016 – present);
- Channel operational features have been informed by consultation with landowners, businesses, NE and Thames Water (2016 – present);
- Initial ideas for environmental mitigation such as naturalised lake, channel and water body edges, vegetation buffering of new buildings/ infrastructure, planting trees, and shallowing of lake margins to encourage macrophyte growth have been developed in consultation with environmental groups (such as Colne Valley Trust, National Trust, Surrey Wildlife Trust, Wildfowl and Wetland Trust) and NE;
- Engagement is ongoing with ecological stakeholders and landowners (such as NE, Surrey Wildlife Trust, and Thames Water) on a range of potential HCAs that could contribute to BNG; and
- Consultation with Cadent Gas, Brett Aggregates and Esso has been ongoing to ensure the RTS design integrates with proposed capital utilities projects (2019 to present).

20.5 Future Consultation

20.5.1.1 A statutory consultation, as required by the PA08, will take place in due course, but before this stage, ongoing engagement will continue with stakeholders as the design develops.

20.5.1.2 A non-statutory consultation is proposed in autumn 2022 to give stakeholders and communities further opportunity to learn about the project and provide input.

21 Scope of the EIA

21.1 Effects 'scoped in' to the EIA

21.1.1.1 The individual topic Chapters of this EIA Scoping Report (Chapters 6 to 19) identify project activities and associated likely significant effects during both the construction and operational phases of the project. All of these topics include some effects that are proposed to be scoped in and therefore included within the PEIR/ES. The cumulative effects assessment is ongoing and is also scoped in.

21.1.1.2 Consideration has been given to the vulnerability of the project to major accidents and disasters. The risks to the project associated with climate change, flooding and events resulting in human illness or injury have all been identified as requiring potential consideration within the PEIR/ES. These effects will be assessed as part of the 'Climatic Factors', 'Flood Risk' and 'Health' Chapters of the PEIR/ES respectively.

21.2 Effects 'scoped out' of the EIA

21.2.1.1 The following list summarises the effects proposed to be scoped out of the EIA for each environmental topic. The explanation for scoping out these effects is given in the individual topic Chapters of this EIA Scoping Report (Chapters 6 to 19). Further detail regarding transboundary effects is provided in Section 5.4.5 and Appendix C. Further detail regarding vulnerability to major accidents and disasters is provided in Section 5.4.6 and Appendix D. These effects are not proposed to be considered further within the PEIR/ES.

Transboundary effects

- To assist the SoS a transboundary screening exercise has been carried out that identifies that there are no effects beyond those associated with release of GHG to the climate that are likely to extend beyond the jurisdiction of the UK. The potential effect of GHG emissions associated with the project is being fully assessed as part of the EIA and mitigation developed as required. It is therefore proposed that Transboundary effects are scoped out and not considered further within the PEIR/ES;

Vulnerability to Major Accidents and Disaster

- No further potential significant adverse effects on the environment have been identified resulting from vulnerability of the project to major accidents and disasters, beyond those mentioned in paragraph 21.1.1.2;

Air Quality

- Construction effect from NRMM (plant) on and offsite on air quality and AQMAs;
- Construction effect from air quality from movement of hazardous materials / waste from the major road network and placement at licensed sites offsite; and
- Operational effect from general maintenance activities which could result in increased traffic and plant on local roads and within the project boundary, causing a potential adverse effect on air emissions.

Biodiversity

- Construction effect from transportation of hazardous material from the major road network to, and placement at, licensed sites offsite, causing the transfer of INNS or other effects upon biodiversity;
- Construction effects on designated sites, terrestrial and aquatic habitats, or protected and notable species, from accidental spillage or run-off from stored chemicals or fuel;
- Operational effect of capacity improvements at the River Thames weirs on the hydromorphological conditions downstream (such as weir pools) causing adverse effect upon aquatic habitats, protected and notable species;
- Operational failures of flow control structures on the channel, new weir gates or fish passes not operating as planned could cause adverse effects on soil erosion or water quality with subsequent effects on habitats and protected and notable species (e.g. flooding of adjacent habitat types and submerged badger setts, otter holts);
- Damage to habitats and disturbance to designated sites and protected and notable species from general maintenance activities; and

- Designated statutory or non-statutory sites beyond more than 2 km from the project boundary for EIA scoping or beyond the extent of the 1 in 100 year floodplain (i.e. the area with a one per cent chance of flooding in any given year) affected by the RTS (where greater) that are not designated for mobile species, otters, bats or hydrologically connected to the area within the project boundary for EIA scoping.

Climatic Factors

- Construction effects on carbon footprint from the creation of site compounds, processing material and vehicle use to construct embankments causing damage to soil structure, compaction, erosion or bank instability; and

- Construction effects on climatic factors from the movement of hazardous waste / materials from the major road network and placement / processing of hazardous material/waste offsite at licensed locations.

Cultural heritage, archaeology and built heritage

- Construction effects on heritage assets from the transportation of non-hazardous materials from the major road network and placement at licensed sites; and

- General maintenance activities resulting in increased traffic and plant on local roads and within the project boundary, causing a potential adverse effect on cultural heritage, archaeological or built heritage receptors.

Flood risk

- Construction effect from the transportation of hazardous material / waste from the major road network and placement at licensed sites;

- Construction effect from dewatering increasing surface water flood risk if water is released to watercourses, potentially affecting their hydrological regime;

- Construction effect from dewatering causing increased sewer flood risk, if dewatering during channel excavation and earthworks is released to the local sewer network;

- Effect from construction works has the potential to cause adverse effects of increased fluvial flood risk e.g. through the construction of coffer dams for construction works on Molesey Weir;
- Construction effect of changes in flood risk posed to and from reservoirs;
- Construction effect from the risk of flooding posed to and from canals;
- Operational effect from downstream fluvial flooding during use of the flood channels during times of flood;
- Operational effect from the accumulation of sediment within the flood channels during their times of flood, potentially affecting its ability to convey capacity;
- Operational effect from changes in drainage patterns from alterations in ground levels and increases in areas of hard standing or other unvegetated surfaces; and
- General maintenance activities are not anticipated to affect flood risk.

Health

- Construction effects on health from the transportation of hazardous waste / materials from the major road network and placement offsite;
- Operational effect from changes in land drainage on flood risk and associated health effects on local communities (e.g. increased stress);
- Operational effect from new green open spaces and other landscape works (including new walking / cycle routes) which will lead to new areas of public access and may adversely affect the security of surrounding privately owned land;
- Operational effect from the existence of the flood channel and other project components may lead to an adverse effect of risk to public health and safety through presence of project features (particularly new water bodies) and effects on flow dynamics downstream of the weirs. At Molesey Weir this could pose a health and safety risk (e.g. to houseboats downstream of Molesey Weir);
- Operational effect from the creation of the new green open spaces with the potential for activities including stadium style lighting (up to a

maximum of 12m in height) leading to light pollution and disturbance of local communities in close proximity; and

- Operational effect from the existence of the flood channel and other project components on potential decrease in access to existing Public Open Spaces or recreational facilities, and;
- General maintenance activities could result in increased traffic and plant on local roads and within the project boundary as well as noise and emissions from routine activities such as vegetation management.

Landscape and visual amenity

- Construction effects on landscape and visual amenity from the transportation of hazardous waste / materials from the major road network and placement offsite at licensed locations, and;
- General maintenance activities could result in visual disturbance from increased traffic and plant on local roads and within the project boundary as well as disturbance from routine activities such as vegetation management.

Materials and waste

- Construction effect from the demolition of buildings has the potential to cause potential adverse effects resulting from the generation of small volumes of demolition waste putting pressure on local waste management and disposal facilities;
- Construction effect from waste management at established third party waste management facilities;
- Effect from the use of materials during operational activities; and
- General maintenance activities could result in minor disturbance to materials and waste receptors.

Noise and vibration

- Construction effects from any temporary noise or vibration effects associated with the transportation of hazardous waste from the major road network and placement at licensed locations;

- Operational noise effect from activities associated with the provision of the new green open spaces and other landscape works; and
- General maintenance activities could result in noise disturbance from increased traffic and plant on local roads and within the project boundary as well as disturbance from routine activities such as vegetation management.

Socio-economics

- Construction effect from the influx of site personnel affecting community cohesion due to changes in population characteristics;
- Construction effect on socio-economic receptors from the movement of hazardous waste / materials from the major road network and placement / processing of hazardous material/waste offsite at licensed locations;
- Effects on registered Common Land directly affected by construction;
- Operational construction effects from reduction in flood risk to registered Common Land;
- Operational effect from the provision the new green open spaces and other landscape works (including new walking / cycle routes) has the potential for effects on traffic movements on roads, public transport services and existing parking facilities which could cause minor additional disturbance to local businesses;
- Operational effect from the existence of the flood channel and other project components has the potential adverse effect through the permanent loss of land from residential dwellings;
- Operational effect from the demolition of existing buildings which will result in a reduction in housing available;
- Operational effect from the provision of new road bridges has the potential to alter road access for local communities and businesses; and
- General maintenance activities could result in disturbance to socio-economic receptors from increased traffic and plant on local roads and within the project boundary as well as disturbance and emissions from routine activities such as vegetation management.

Soils and land

- Effect from general construction activities, movement of vehicles, equipment and site operatives has potential to cause effects from tracking of vehicles, establishment of compounds and GI works, causing damage to soil structure, compaction, erosion or bank instability;

- Construction effect from the storage of chemicals and liquids has the potential to cause effects to receptors such as soils, geology and human health through new pollutant pathways (for example through surface or groundwaters) as a result of accidental spillages;

- Construction effect to soils and land from the movement of hazardous waste / materials from the major road network and placement offsite at licensed locations due to pollution from dusts from handling and transport;

- Operational effect from general maintenance activities on soil structure, compaction, erosion or bank instability as a result of tracking of vehicles;

- Effect from operational failures of the RTS on bank instability and/or erosion of soils within the flood relief channels and on the River Thames at the channel's intakes and outfalls; and

- Operational effect from the existence of the flood channels on soil structure and soil quality as a result of changes to groundwater levels.

Traffic and transport

- Construction effect from the movement of hazardous waste / materials from the major road network and placement offsite could cause increased traffic on regionally (A-roads) and nationally (motorways) important roads, resulting in traffic congestion, increased journey times and deterioration of the condition of local roads;

- Construction effect from the capacity improvement works on the River Thames weirs plus bed lowering and scour protection of the riverbanks on boat traffic on the River Thames (e.g. obstruction of navigation);

- Operational effect of enhanced connectivity through provision of new road bridges;

- Operational effect from the new active travel infrastructure providing beneficial facilities to encourage walking and cycling across the study area, however, this will not cause a modal shift in transport uses and thereby will not significantly reduce traffic delays;
- Operational effect (adverse and/or beneficial) from creation of navigable sections of flood channel for canoes on boat traffic using the River Thames;
- Operational effect from the existence of the flood channel and other project components on attracting additional large fowl to the area, resulting in a danger to aviation through an increased risk of bird strike; and
- Effect from general maintenance activities causing increased traffic congestion, journey times and affecting the condition of local roads.

Water environment

- Construction effect from sheet piling along sections of the flood channel has the potential to negatively affect groundwater quality due to creation of a hydraulic connection within landfill whereby contaminated water could migrate;
- Construction effect from the transportation of hazardous materials/waste from the major road network and placement of hazardous material/waste at licensed locations;
- Construction effect from the creation of site compounds, temporary materials processing sites and storage of excavated material on surface water runoff carrying contamination or sediment into nearby watercourses;
- Effect from the construction of capacity improvements at the River Thames weirs on flow, hydromorphology, water quality and biological conditions of the lakes and rivers (including WFD water bodies) through disturbance of sediment by works in water bodies and release of pollutants through spillages;
- Construction effect of capacity improvements at River Thames weirs on the availability of groundwater in the aquifers, WFD groundwater bodies, PWS abstractions and GSPZ’s by altering flow regime due to use of coffer dams during construction;

- Effect from construction works in and around water bodies on flow, hydromorphology, water quality and biological conditions of lakes and rivers (including WFD water bodies) intersected by the flood channel, and tidal, estuarine and coastal waters through disturbance of sediment by works in water bodies and release of pollutants through spillages;
- Storage of chemicals and liquids associated with construction posing a potential risk to surface and groundwater if any spills occur;
- Operational effect from the existence of capacity improvements at the River Thames weirs on hydromorphological conditions downstream of the River Thames weirs (such as weir pools);
- Effect from potential operational failures at flow control structures on channel, new weir gates or fish passes not operating as planned, causing adverse effects on erosion or water quality/quantity;
- Effect from maintenance activities on bank instability/erosion of soils adjacent to the flood relief channel, on the River Thames and in new green open spaces; and
- Operational effect from the existence of the flood channel in landfill areas has the potential for adverse effects on surface water quality, with the possibility of contaminants reaching surface water bodies (including WFD water bodies, tidal, estuarine and coastal waters and surface water safeguard zones).

22 Next Steps

22.1 Provision of a Scoping Opinion

22.1.1.1 This EIA Scoping Report has been prepared to enable PINS on behalf of the SoS to provide its opinion as to the scope of the ES.

22.1.1.2 PINS must adopt a Scoping Opinion within 42 days of receiving a scoping request. This includes a 28 day period for PINS to consult with relevant consultation bodies.

22.2 Production of the PEIR

22.2.1.1 The next step in the EIA process after scoping will be the production of the PEIR. This is expected to be produced in 2023 and will be based on the Scoping Opinion produced by PINS.

22.2.1.2 The PEIR will provide the information reasonably required to allow consultees (both specialist and non-specialist) to develop an informed view of the likely significant effects of the project when they are commenting on the proposals at the pre-application stage.

22.3 Proposed structure of the ES

22.3.1.1 PINS Advice Note Seven advises that the Scoping Report should provide an outline structure of what the ES will contain.

22.3.1.2 The structure of the ES (and PEIR) will broadly follow the same order of Chapters that are presented within this Scoping Report, however, changes may need to be made to address the requirements of the EIA Regulations, Scoping Opinion or the evolution of the project.

22.3.1.3 The indicative outline structure of the ES is as follows:

- Non-Technical Summary;
- Details of the applicant team and statement of competence;
- Chapter 1 Introduction;
- Chapter 2: Legislation and Policy Context;
- Chapter 3: Project Description and Alternative Options Considered;

- Chapter 4: Stakeholder engagement;
- Chapter 5: EIA Assessment Methodology;
- Chapters 6 – 18: Technical topic Chapters;
- Chapter 19: Cumulative Effects Assessment;
- Chapter 20: Summary; and
- Chapter 21: Environmental Action Plan.

22.3.1.4 The indicative outline structure of the technical topic Chapters is as follows:

- Introduction;
- Legislation and Policy;
- Consultation and Engagement;
- Assessment Methodology;
- Existing and Future Baseline;
- Key Environmental Considerations and Opportunities;
- Assessment of Effects;
- Cumulative and in-combination effects;
- Summary of Significance; and
- Mitigation and Management.

22.3.1.5 Based on current programme it is anticipated that the ES will be submitted as part of the DCO application in winter 2024/25.

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24 List of Abbreviations

Abbreviation	Full text
AADT	Average Annual Daily Traffic
AAWT	Average Annual Weekday Traffic
AEP	Annual Exceedance Probability
AHAP	Area of High Archaeological Potential
ALC	Agricultural Land Classification
APIS	Air Pollution Information System
AQMA	Air Quality Management Area
AQO	Air Quality Objective
AQS	Air Quality Standards
ARN	Affected Road Network
ASR	Annual Status Report
BGS	British Geological Survey
BNG	Biodiversity Net Gain
BOA	Biodiversity Opportunity Areas
BoCC	Birds of Conservation Concern
BS	British Standard
C4SLs	Category 4 Screening Levels
CA	Conservation Area
CAMS	Catchment Abstraction Management Strategy
CCG	Clinical Commissioning Group
CEA	Cumulative Effects Assessment
CEH	Centre for Ecology and Hydrology

Abbreviation	Full text
CEMP	Construction Environmental Management Plan
CH_4	Methane
CIEEM	Chartered Institute for Ecology and Environmental Management
CIEH	Chartered Institute of Environmental Health
CIRIA	Construction Industry Research and Information Association
CL:AIRE	Contaminated Land: Applications in Real Environments
CLEA	Contaminated Land Exposure Assessment
CLP	Construction Logistics Plan
CSM	Conceptual Site Model
dB	Decibel
DBA	Desk Based Assessment
DCO	Development Consent Order
Defra	Department of Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges
DoWCoP	Deposit of Wastes Code of Practice
EBC	Elmbridge Borough Council
EcIA	Ecological Impact Assessment
EHO	Environmental Health Officer
EIA	Environmental Impact Assessment
EMS	Environmental Management System
EPUK	Environmental Protection United Kingdom

Abbreviation	Full text
EqIA	Equality Impact Assessment
ES	Environmental Statement
EU	European Union
FRA	Flood Risk Assessment
GHG	Greenhouse Gases
GI	Ground Investigation
GLA	Greater London Authority
GLVIA3	Guidelines for Landscape and Visual Impact Assessment 3
GSPZ	Groundwater Source Protection Zone
GWSI	Generic Written Scheme of Investigation
HCA	Habitat Creation Area
HE	Historic England
HER	Historic Environment Records
HGV	Heavy Goods Vehicle
HIA	Health Impact Assessment
HPI	Habitats of Principle Importance
HRA	Habitat Regulations Assessment
IAQM	Institute of Air Quality Management
ICCI	In-Combination Climate Impacts
IEMA	Institute of Environmental Management and Assessment
IMD	Index of Multiple Deprivation
INNS	Invasive Non-Native Species

Abbreviation	Full text
JSNA	Joint Strategic Needs Assessment
LBRUT	London Borough of Richmond upon Thames
LCA	Landscape Character Assessment
LGV	Light Goods Vehicle
LHA	Local Highways Authorities
LiDAR	Light Detection and Ranging
LLFA	Lead Local Flood Authority
LNR	Local Nature Reserve
LOAEL	Lowest Observed Adverse Effect Level
LPA	Local Planning Authority
LQM	Land Quality Management
LSOA	Lower Super Output Area
LTFRMS	Lower Thames Flood Risk Management Strategy
LVIA	Landscape and Visual Impact Assessment
LWS	Local Wildlife Site
mAOD	Metres Above Ordnance Datum
MMO	Marine Management Organisation
MMP	Materials Management Plan
MMS	Materials Management Strategy
MSA	Mineral Safeguarding Area
MWLP	Minerals and Waste Local Plan
MWPA	Minerals and Waste Planning Authority
NCA	National Character Area

Abbreviation	Full text
NE	Natural England
NHLE	National Heritage List for England
NHS	National Health Service
NIC	National Infrastructure Commission
NMU	Non-motorised User
NNR	National Nature Reserve
NO_2	Nitrogen Dioxide
NOEL	No Observed Effect Level
NO_X	Oxides of Nitrogen
NPPF	National Planning Policy Framework
NPS	National Policy Statement
NPSE	Noise Policy Statement for England
NRMM	Non-Road Mobile Machinery
NSIPs	Nationally Significant Infrastructure Project(s)
ONS	Office of National Statistics
OS	Ordnance Survey
P1HS	Phase 1 Habitat Survey
PA08	Planning Act 2008
PEA	Preliminary Ecological Appraisal
PEIR	Preliminary Environmental Information Report
PFRA	Preliminary Flood Risk Assessment
PHE	Public Health England
PIC	Personal Injury Collision

Abbreviation	Full text
PINS	Planning Inspectorate
PM_{10}	Fine Particulate Matter 2.5-10 micrometres in diameter
$PM_{2.5}$	Fine Particulate Matter 2.5 micrometres or smaller in diameter
PPG	Planning Practice Guidance
PPV	Peak Particle Velocity
PRA	Preliminary Roost Assessment
PRoW	Public Rights of Way
PSRA	Public Safety Risk Assessment
PWS	Public Water Supply
RBC	Runnymede Borough Council
RBKUT	Royal Borough of Kingston upon Thames
RBMP	River Basin Management Plan
RBWM	Royal Borough of Windsor and Maidenhead
RCA	River Condition Assessment
RCP	Representative Concentration Pathway
RIGS	Regionally Important Geological Site
RSPB	Royal Society for Protection of Birds
RTS	River Thames Scheme
S4UL	Suitable for Use Levels
SAC	Special Area of Conservation
SBC	Spelthorne Borough Council
SBG	Surrey Bat Group

Abbreviation	Full text
SBIC	Surrey Biodiversity Information Centre
SEA	Strategic Environmental Assessment
SHAPE	Strategic Health Asset Planning and Evaluation
SMR	Standardised Mortality Ratio
SNCI	Sites of Nature Conservation Interest
SOAEL	Significant Observed Adverse Effect Level
SoCC	Statement of Community Consultation
SoS	Secretary of State
SPA	Special Protection Area
SPG	Supplementary Planning Guidance
SPZ	Source Protection Zone
SSSI	Site of Special Scientific Interest
SUDS	Sustainable Urban Drainage Systems
SWLW	South West London Waterbodies
SWMP	Site Waste Management Plan
TAG	Transport Analysis Guidance
TE2100	Thames Estuary 2100 Plan
TfL	Transport for London
UK-AIR	UK Air Information Resource
UKCP	United Kingdom Climate Projections
UKCP18	United Kingdom Climate Projections 2018
UKHSA	UK Health Security Agency
UXO	Unexploded Ordnance

Abbreviation	Full text
VOC	Volatile Organic Compounds
WAC	Waste Acceptance Criteria
WCA	Waste Consultation Areas
WFD	Water Framework Directive
WHO	World Health Organisation
WSI	Written Scheme of Investigation
ZoI	Zone of Influence
ZTV	Zone of Theoretical Visibility

25 Glossary

Term	Definition
Active Travel	Physically active methods of travel such as walking, running, cycling, or canoeing.
Aggregate	A broad category of course to medium grained material such as sand, gravel and crushed rock, which is often used in the construction industry.
Agricultural Land Classification (ALC)	A series of six grades classifying soil in terms of its suitability for agriculture, from 1 (excellent quality) to 5 (very poor quality).
Air Quality Management Area (AQMA)	Area defined by the LPA as an area requiring management because air quality levels do not meet national air quality objectives.
Air Quality Objectives (AQO)	Non-statutory limits on the acceptable presence of contaminants in the atmosphere, established to protect human health and the environment.
Air Quality Standards (AQS)	Concentrations recorded over a given time period, which are considered to be acceptable in terms of what is scientifically known about the effects of each pollutant on health and the environment.
Ancient Woodland	Land continuously wooded since 1600 in England and Wales.
Appropriate Assessment (AA)	A stage of the Habitats Regulations Assessment (HRA) process which must be undertaken in accordance with the Conservation of Habitats and Species Regulations 2017 (as amended). An Appropriate Assessment is required to be undertaken by a competent authority when the potential for likely significant effects on a European designated nature conservation site (e.g. SPA, SAC or Ramsar site) from a plan or project cannot be excluded in view of the site’s conservation objectives.

Term	Definition
Aquifer	An underground layer of rock with water storage capability.
Area of High Archaeological Potential (AHAP)	Areas where archaeological artefacts and remains are likely to survive.
Augmented Flow	A small flow required in non-flood conditions to facilitate fish passage at flow and water control structures.
Authorised Landfill	Authorised landfill sites are sites that are currently authorised by the Environment Agency under Environmental Permitting Regulations to receive waste from local authorities.
Baseline	A description of the present state of the environment.
Bed lowering	Bed lowering is a technique which excavates the river bed in a localised area. Because it works to a greater depth than dredging, which only removes silt material from the riverbed, it is a longer term solution that requires less regular maintenance.
Benthic Invertebrates	Organisms that live on the bottom of a water body (or in the sediment) and have no backbone. They range in size from microscopic (for example microinvertebrates <10 microns) to a few tens of centimetres or more in length (for example macroinvertebrates, >50 cm).
Biodiversity	Biodiversity is the variety of all life on Earth. It includes all species of animals and plants – everything that is alive on our planet (Biodiversity 2020 strategy).
Biodiversity Net Gain (BNG)	An approach to development and/or land management, that aims to leave the natural environment in a measurably better state than it was beforehand. It delivers measurable improvements for biodiversity by creating or

Term	Definition
	enhancing habitats in association with development. It can be achieved onsite, offsite or through a combination of on/offsite measures.
Brownfield Site	A site which has been previously developed, often a disused factory site or industrial area.
Carbon Management Plan	Defines baseline carbon emissions, targets to reduce emissions and details of mitigation measures.
Catchment	A surface water catchment is the total area that drains into a river. A groundwater catchment is the total area that supplies the groundwater part of the river flow.
Climate Change	A change in the state of the global climate, which can be identified by changes in average climate characteristics that persist for extended periods - typically decades or longer.
Climate Change Adaptation	In the context of this Scoping Report, climate change adaption refers to the effect from projected future climate change on the project
Climate Change Mitigation	In the context of this Scoping Report, climate change mitigation refers to the project’s effect on climate.
Coffer dam	A temporary enclosure built within water-filled ground or a body of water to regulate the in-flow and out-flow of water. Typically used to allow works to take place below the normal water level.
Compensation	If mitigation for adverse effects upon the environment cannot be achieved, compensation should be sought. Whereas mitigation would seek to reduce or minimise damage occurring, compensation is relevant when we accept that we cannot prevent some damage. Compensation is the creation of new (or improvement of existing)

Term	Definition
	features of at least equivalent (often better) value than those lost.
Conservation Area (CA)	An area defined under the Planning Act 1990 as being of “special architectural or historic interest, the character or appearance of which it is desirable to preserve or enhance”.
Construction Effects	Both positive and negative consequences for receptors during the construction phase of the project.
Cumulative Effects	Cumulative effects arise from the proposed development together with other plans and projects proposed and consented that have not yet been constructed and are not operational (i.e. developments that are in addition to the baseline.
Department for Environment, Food and Rural Affairs (Defra)	The government department responsible for flood management policy in England.
Development Consent Order (DCO)	Application for consent to undertake a Nationally Significant Infrastructure Project (NSIP) is made to the Planning Inspectorate who will consider the application and make a recommendation to the Secretary of State, who will decide on whether development consent should be granted for the proposed scheme.
DCO Application Project Boundary	The spatial extent of the project footprint which will be used to inform the DCO application.
Diffusion Tubes	Diffusion tubes are indicative air quality samplers: they consist of small plastic tubes containing a chemical reagent to absorb the pollutant to be measured directly from the air.
Direct Effects	Effects that arise from the impact of activities that form an integral part of the project (e.g. new infrastructure).

Term	Definition
Ecological Impact Assessment (EcIA)	An assessment of the potential effects of a proposed development on species, habitats and sites that are of value to conservation or protected by national and/or international legislation.
Environment	Where environmental issues are referred to, this term is used to encompass landscape/natural beauty, biodiversity, geological or geomorphological features and buildings, sites and objects of archaeological, architectural or historical interest.
Environmental Impact Assessment (EIA)	EIA is an assessment process applied to both new development proposals and changes or extensions to existing developments that are likely to have significant effects on the environment. The EIA process ensures that potential effects on the environment are considered, including natural resources such as water, air and soil; conservation of species and habitats; and community issues such as visual effects and impacts on the population. EIA provides a mechanism by which the interaction of environmental effects resulting from development can be predicted, allowing them to be avoided or reduced through the development of mitigation measures. As such, it is a critical part of the decision-making process.
Environmental Statement (ES)	The document produced to describe the environmental impact assessment process where statutory EIA is required.
Equalities Impact Assessment	An evidence-based approach designed to help organisations ensure that their policies, practices and decision-making processes are fair and do not present barriers to participation or disadvantage any protected groups from participation.
Flooding	Refers to inundation by water whether this is caused by breaches, overtopping of banks or

Term	Definition
	defences, or by inadequate or slow drainage of rainfall or underlying ground water levels.
Flood Risk Assessment (FRA)	A document that reviews a development project proposal and assesses the risk of flooding from groundwater, river (fluvial), tidal (pluvial), estuary/coastal (tidal) or sewers.
Flow Control Structures	Flow control structures with fish passes are required at the intake of each channel section and at the crossing of Staines Road (A320), downstream of the Thorpe Park Lakes. These will be required to control the amount of water entering the flood channel.
Fluvial Flood Risk	Risk of the water level in rivers, lakes and streams overflowing and flooding the surrounding area.
Future Baseline	The likely evolution of the baseline environment without implementation of the project. Future baseline may differ from the existing baseline as a result of changes to relevant local plans or policies, new legal obligations that may drive change or wider changes to the environment, such as changes in population or climate change.
Geographical Information Systems (GIS)	A computer based system for capturing, storing, integrating, manipulating, analysing and displaying data spatially.
Geomorphology	The study of landforms, their processes, form and sediments at the surface of the Earth, includes how processes such as air and water can mould the landscape.
Green Belt	A designation for land around some cities and large built-up areas, which aim to keep this land permanently open or largely undeveloped.
Green and Blue Infrastructure	A network of features which aim to solve urban and climatic challenges by building solutions that work

Term	Definition
	with nature (in the context of the RTS this integrates a new flood channel with new public open space, environmental and active travel enhancements).
Gross Value Added	The measure of the value of goods or services produced in an area, industry or sector of an economy.
Groundwater	Water contained in the void spaces in pervious rocks and also within soil.
Habitat	A place where an organism lives; a type of environment inhabited by a particular species and/or communities; often characterised by dominant plant forms, physical characters, or a combination of these.
Habitat Creation Area (HCA)	The RTS is aiming to achieve biodiversity net gain through biodiversity improvements. To supplement these improvement measures, a series of potential HCAs are being considered. These areas will favour the enhancement of existing habitats such as neutral grassland, mixed scrub, broadleaved woodland, ponds, wet woodland and open mosaic. The HCAs will also seek to create additional high quality habitats such as reedbeds, ditches, hedgerows and lowland meadows. Some HCAs will be considered as open green spaces and therefore may have an interface between habitats and public access.
Health Impact Assessment (HIA)	A tool that helps to identify significant effects on health and wellbeing and necessary mitigation measures to make a development acceptable in planning terms
Historic Landfill	Historic landfill sites are where records exist of waste being received and buried that are now closed or covered.

Term	Definition
Hydrogeology	Branch of geology concerned with water within the earth's crust.
Hydrology	The study of water and its dynamics.
Hydromorphology	The physical characteristics of the shape, boundaries and content of a water body.
Historic England (HE)	Government statutory advisor on the historic environment, funded by the government.
In-combination Effects	Multiple effects on the same receptor caused by the proposed development together with those from all developments that have been built and are operational (i.e. the baseline). For example, a project may be resulting in the loss of a small area of woodland. This woodland may have been vast historically and, over time, developments in the area have each resulted in small losses. The project being assessed could be the tipping point whereby the remaining area of woodland habitat is no longer functional.
Indices of Multiple Deprivation	Measure of relative deprivation in England. It is based on seven distinct domains of deprivation; income, employment, health, deprivation and disability, education and skills training, crime, barriers to housing and services, and living environment. These are combined and weighted to form the overall index.
Indirect Effects	Effects that arise from the impact of activities not explicitly forming part of the project (e.g. increased road traffic at Park and Ride sites).
Intra-project Effects	Intra-project effects occur where an environmental resource or receptor is affected by more than one impact from the same development and the impacts act together. For instance, a resident living adjacent to a construction site may experience noise and vibration impacts from piling works but

Term	Definition
	also light pollution from security lighting required on the site.
Invasive Species	Part II of Schedule 9 of the Wildlife and Countryside Act lists non-native invasive plant species for which it is a criminal offence in England and Wales to plant or cause to grow in the wild due to their impact on native wildlife.
Joint Strategic Needs Assessment (JSNA)	Assesses the current and future health and care needs of local populations to inform the planning and implementation of heal, well-being and social care services within a LPA area.
Landscape Character	Distinct and recognisable pattern of elements, or characteristics in the landscape that make one landscape different to another.
Landscape Value	An attachment, emotional bond or use that people develop with places. This can include cultural ties to landscapes and appreciation of visual aesthetics of a region.
Leachate	Leachate is formed when rainwater is contaminated as it passes through landfill wastes or polluted ground. It may contain high levels of organic or inorganic pollutants such as ammonia and heavy metals.
Left / right bank	The descriptive terms 'left bank' and 'right bank' are relative to an observer looking downstream, in which the right bank is to the observer's right and the left bank is to their left.
LiDAR	Acronym for 'light detection and ranging'. Laser scanning technology to create 3D representation of an environment.
Listed Building	Identifies buildings with special architectural and historic interest and ensures they are considered

Term	Definition
	within the planning system so that they can be protected.
Local Nature Reserve (LNR)	Nature reserves designated under the National Parks and Countryside Act (1949) for locally important wildlife or geological features. They are controlled by local authorities in liaison with Natural England.
Macrophytes	Aquatic plants that grow in or near water which are either emergent, submergent or floating
Main River	A watercourse designated by Defra. The Environment Agency has permissive powers to carry out flood defence works, maintenance and operational activities on main rivers. Responsibility for maintenance rests on the riparian owner.
Major Accidents and Disasters	There is no definition within the legislation for what constitutes a major accident or disaster, but both man-made and natural hazards are considered.
Marine Management Organisation (MMO)	An executive non-departmental public body established under the Marine and Coastal Access Act 2009 with responsibilities including marine licensing and working with Natural England and others to manage a network of marine protected areas (marine conservation zones and European marine sites).
Material Management Plan (MMP)	A plan to ensure compliance with Environment Agency regulations for excavated ground material by those developing a site. It should consider protection of human health and environment, suitability for material with or without treatment, how much material is used and where the material is being used.
Mineral Safeguarding Area (MSA)	An area designated by the Minerals Planning Authorities which covers known deposits of minerals which are desired to be kept safeguarded

Term	Definition
	from unnecessary sterilisation by non-mineral development.
Mitigation Measures	Actions that are taken to minimise, prevent or compensate for adverse effects of the project.
National Highways (NH)	National Highways, formerly Highways England is a government owned company which plans, designs, builds, operates and maintains England’s motorways and major A-roads, known as the strategic road network.
Nationally Significant Infrastructure Projects (NSIP)	The project has been designated a project of national significance and will be consented by way of a Development Consent Order (DCO) under Section 35 of the Planning Act 2008. NSIPs are large scale developments (usually involving energy, transport, water or waste).
Natural England (NE)	Natural England is an Executive Non-departmental Public Body responsible to the Secretary of State for Environment, Food and Rural Affairs. Their purpose is to protect and improve England’s natural environment and encourage people to enjoy and get involved in their surroundings. Their aim is to create a better natural environment that covers all of our urban, country and coastal landscapes, along with all of the animals, plants and other organisms that live with us.
New Green Open Space	New areas of recreational value for the public.
Operational Effects	Both positive and negative consequences for receptors during the operation phase of the project when the development is fully built.
Ordinary Watercourse	A watercourse not designated as main river. The LPA or Internal Drainage Board has permissive powers to maintain them.

Term	Definition
Paleochannel	Remnant of an inactive river or stream that has been filled/buried by younger sediment.
Permanent Effects	Due to the subjectivity of human receptors to timeframes, those effects that continue for greater than 10 years following construction can be defined as permanent.
Plotland	Land used for the construction of dwellings.
Preliminary Ecological Appraisal (PEA)	Assessment of the ecological features present or potentially present within a study area, to identify ecological considerations for a development.
$PM_{2.5}$	Particulate matter of size fraction approximating to <10mm diameter.
PM_{10}	Particulate matter of size fraction approximating to <2.5mm diameter.
Primary Mitigation	Modifications to the location or design of the development made during the pre-application phase that are an inherent part of the project, and do not require additional action to be taken.
Priority Habitats	UK BAP priority habitats cover a wide range of semi-natural habitat types, and were those that were identified as being the most threatened and requiring conservation action under the UK Biodiversity Action Plan (UK BAP)
Priority Species	UK BAP priority species are those that were identified as being the most threatened and requiring conservation action under the UK Biodiversity Action Plan (UK BAP).
Project Boundary for EIA Scoping	The likely maximum spatial extent of the project footprint, which has been used to inform the assessment of Likely Significant Effects for EIA Scoping.

Term	Definition
Ramsar Site	Wetland site of international importance listed under the Convention on Wetlands of International Importance under the Conservation of Waterfowl Habitat (Ramsar) Convention 1973.
Receptor	Any component of the natural or man-made environment that is potentially affected by an impact from a development.
Residual Effect	Residual effects are those that remain following the implementation of project mitigation measures.
Riparian	Area of land or habitat adjacent to rivers and streams.
Ruderal	A plant species/habitat that is first to colonise disturbed lands (e.g. after a natural disaster or human activity such as construction or agriculture).
Runnymede Channel	The Runnymede Channel will start at Egham Hythe and end at Chertsey. The intake to the channel will be on the right bank of the River Thames. It will pass through agricultural fields before heading south across Green Lane and joining the existing course of the Mead Lake Ditch. Passing through five existing lakes, including the Thorpe Park lakes, it will pass under Chertsey Lane (A320) towards Abbey Meads and through the existing Burway Ditch M3 flood culverts, returning to the River Thames just south of the M3 motorway and downstream of Chertsey Weir.
Scheduled Monument (SM)	Nationally important historic sites, buildings or monuments identified by Historic England and designated by the Secretary of State for Culture, Media and Sport. Any work affecting a Scheduled Monument must gain consent from Historic England under the Ancient Monuments and Archaeological Areas Act (1979).

Term	Definition
Scoping	The process of deciding the scope or level of detail of an EIA and reported in a Scoping Report. During this stage the key environmental issues (likely significant effects) of a project are identified so that the rest of the process can focus on these issues. Issues may result from the proposal itself or from sensitivities of the site.
Screening	The process of deciding which developments require an EIA to be carried out.
Scoping Opinion	Statutory opinion from the competent authority as to the effects that should be reported in the Environmental Statement.
Secondary Effects	Effects that arise as a result of an initial effect of the scheme (e.g. reduced amenity of a community facility as a result of construction noise).
Secondary Mitigation	Actions that will require further activity in order to achieve the anticipated outcome. These may be imposed as part of the planning consent, or through inclusion in the ES.
Section 35 Direction	Direction from the Secretary of State under Section 35(1) of the Planning Act as to whether a project sits within one for the qualifying infrastructure fields listed in Section 35(2)(a)(i) – water – of the Planning Act
Site of Special Scientific Interest (SSSI)	Nationally important sites designated for their flora, fauna, geological or physiographical features under the Wildlife and Countryside Act (1981) (as amended) and the Countryside Rights of Way (CRoW) Act (2000).
Source Pathway Receptor Model	A model used to identify the sources of environmental pollution, pathways into the environment and the potential receptors affected.

Term	Definition
Special Area for Conservation (SAC)	Sites of European importance for habitats and non-bird species. Above mean low water mark they are also SSSIs.
Special Protection Area (SPA)	An area designated for rare or vulnerable birds, or migratory birds and their habitats, classified under Article 4 of the EC Directive on the Conservation of Wild Birds (79/409/EEC).
Spelthorne Channel	The Spelthorne Channel flood channel will leave the left bank of the River Thames at Laleham, approximately 0.4km upstream of the outlet of the Runnymede Channel, and north of the M3 motorway. The flood channel will follow an easterly route through three existing lakes and pass under two local roads before turning south underneath the M3 motorway. The flood channel route continues through areas of grassland and scrub at Sheep Walk and Manor Farm and will pass under a further three local roads and through a lake before re-joining the River Thames opposite D’Oyly Carte Island, just upstream of Desborough Island, and downstream of Shepperton Weir.
Study Area	Each environment topic Chapter within this Scoping Report (Chapters 6 to 18) have defined a specific ‘study area’ that has been considered in the assessment of likely significant effects. The extent of these study areas differ primarily as a result of the manner and extent to which effects are likely to be propagated for individual topics topic. Where relevant these include wider areas such as the areas that will experience a change in flood risk as a result of the project or, for example, areas being considered as part of the materials management feasibility study.
Sustainable Development	A concept defined by the Brundtland Report (1987) as “Development that meets the needs of the

Term	Definition
	present without compromising the ability of future generations to meet their own needs”.
Temporary Effects	Temporary effects can be defined as follows: - Short-term: Effect continues during construction and up to one year following construction. - Medium-term: Effect continues for one to five years following construction. - Long-term: Effect continues five to ten years following construction.
Tertiary Mitigation	Actions that would occur with or without input from the EIA feeding into the design process. These include actions that will be undertaken to meet other existing legislative requirements, or actions that are considered to be standard or best practices used to manage commonly occurring environmental effects.
Topsoil	The uppermost layer in the soil profile, with a high content of organic matter and is a product of biological processes.
Trackout	The transport of dust and dirt from the construction/demolition site onto the public road network, where it may be deposited and then re-suspended by vehicles using the network. This arises when heavy duty vehicles (HDVs) leave the construction/demolition site with dusty materials, which may then spill onto the road, and/or when HDVs transfer dust and dirt onto the road having travelled over muddy ground on site.
Transboundary effects	Any significant effect on the environment resulting from human activity, the physical origin of which is situated wholly or in part within an area under the jurisdiction of another country.
UK Habitat Survey	UK Habitat Survey is a relatively new method for classifying habitats which was produced by the UK

Term	Definition
	Habitat Classification Working Group in 2018. This has now replaced the JNCC Phase 1 Survey method. UK Hab provides detailed interpretation of habitat types with a greater number of ‘codes’ which can be distinguished unambiguously in the field.

The River Thames Scheme, delivered in a partnership led by the Environment Agency and Surrey County Council, will reduce flood risk for residents and businesses and improve the surrounding area.