River Thames Scheme

Protecting our communities
Securing our economy
Enhancing our Thames

Preliminary Environmental Information Report

Volume 2

Chapter 18: Water Environment

18 Water Environment

18.1 Introduction

18.1.1.1 This chapter of our Preliminary Environmental Information Report (PEIR) considers the effects from construction and operation of the River Thames Scheme (RTS) ('the project') in relation to surface water and groundwater quality and resources. This chapter should be read in conjunction with the Water Framework Directive (WFD) Compliance Assessment: Preliminary Assessment (Appendix 18.1).

18.1.1.2 Within this chapter we have included topic specific sections on:

- Legislation, policy and guidance (noting any changes since Environmental Impact Assessment (EIA) scoping);
- Engagement with consultees, including response to comments received on the RTS EIA Scoping Report;
- The assessment methodology for this topic (again noting any changes or updates since EIA scoping);
- Key environmental considerations and opportunities,
- Primary and tertiary mitigation;
- Our preliminary assessment of effects;
- Secondary mitigation; and
- Future work for this topic of the EIA.

18.1.1.3 For a summary of the key baseline elements associated with the water environment see Section 5.14.

18.1.1.4 The water environment is closely linked to most of the other 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 topic of Flood Risk are discussed in Chapter 10. Potential effects on land quality and contamination are discussed in Chapter 13: Materials and Waste and Chapter 16: Soils and Land.

18.1.1.5 This chapter is supported by the following figures:

- Figure 5.34: Surface Waterbodies

- Figure 5.35: Water Framework Directive Waterbodies
- Figure 5.36: Groundwater Waterbodies

18.1.1.6 An explanation of the topic study area can be found in Section 18.2 of our RTS EIA Scoping Report (Environment Agency and Surrey County Council, October 2022) ('the EIA Scoping Report'). The study area incorporates all surface and groundwater bodies that lie within the project boundary for EIA PEIR, plus a 500 metre buffer or the area within the 1:100 year floodplain that benefits from the RTS (i.e. the area with a one per cent chance of flooding in any given year), whichever is the greater. The study area is therefore slightly different to that presented in our EIA Scoping Report due to minor changes in the design parameters and project boundary for EIA PEIR.

18.2 Legislation, Policy and Guidance

18.2.1.1 A summary of the key legislation, policy and guidance relevant to the water environment is provided in Appendix M of our EIA Scoping Report. Since publication of our EIA Scoping Report in October 2022, the National Policy Statement (NPS) for Water Resources Infrastructure (Defra, 2023a) has been finalised and was designated in September 2023. Furthermore, there have been updates to the Environmental Permitting (England and Wales) (Amendment) (England) Regulations and the Environmental Targets (Water) (England) Regulations 2022, plus the release of the Environmental Improvement Plan 2023 and the Defra Plan for Our Water 'Our integrated plan for delivering clean and plentiful water' 2023. These revisions to legislation are discussed below.

18.2.1.2 Changes to the NPS since the draft version was released in 2018 that are relevant to the water environment are:

- The inclusion of direct reference of the need to assess measures to protect the water environment for protecting eels and improving fish passage.
- The addition of further details regarding acceptance or refusal of a project, such as “refusal where a project is likely to cause deterioration of a water body or its failure to achieve good status or good potential, unless the conditions to apply the exemption of Overriding Public Interest, as outlined under Regulation 19 of the WFD Regulations, are met. A project may be approved in the

absence of a qualifying Overriding Public Interest test only if there is sufficient certainty that it will not cause deterioration or compromise the achievement of good status or good potential."

18.2.1.3 Updates to the Environmental Permitting (England and Wales) (Amendment) (England) Regulations relevant to the water environment are:

- The addition of further detail to require improved management and protection of groundwater.

18.2.1.4 Updates to the Environmental Targets (Water) (England) Regulations are:

- The regulations added new legally binding targets for water to reduce nitrogen, phosphorus and sediment pollution from agricultural land by 40 per cent; to reduce phosphorus from treated wastewater by 80 per cent; reduce the length of rivers polluted by abandoned metal mines; and reduce water demand on rivers by 20 per cent.

18.2.1.5 The Environmental Improvement Plan 2023 is relevant to the water environment, including:

- Addressing nutrient pollution of rivers from wastewater treatment and agriculture by increasing advice and incentives;
- Restoring rivers and woodlands through Landscape Recovery Projects;
- Introducing water efficiency labelling and reducing leakages; and
- Introducing environmental "Goal 3: Clean and plentiful water".

18.2.1.6 Plan for Our Water 2023:

- Sets out the first steps to reform the programme for the water system which builds on and outlines additional actions to be taken to meet water targets and transform the water system.

18.3 Engagement

18.3.1 Responses to EIA Scoping

18.3.1.1 Table 18-1 below summarises the comments and responses received on our EIA Scoping Report following formal submission to the Planning Inspectorate (PINS) including the PINS EIA Scoping Opinion (date 15 November 2022) ('the PINS Scoping Opinion') and any key comments received from statutory consultees. Full consultee comments on our EIA Scoping Report and our responses to these comments are provided in Appendix 4.1.

Table 18-1: Responses to comments received on the EIA Scoping Report

Consultee or Organisation	Summary of Comment	Project Response
PINS	Operation – capacity improvement impacts resulting in downstream hydromorphological changes: The EIA Scoping Report identifies that such changes are anticipated to be within the scale of natural changes from major flow events based on historic bathymetric surveys and that measures are embedded to avoid main weir pools and maintain operational flow so that weir structures are appropriately designed. These measures are currently not described therefore the Inspectorate does not agree to scope this matter out. The Environmental Statement (ES) should describe the measures to be employed and secured to reduce the potential effects from weir upgrades on downstream hydromorphological change and assess significant effects where they are likely to occur or explain how measures reduce/avoid such effects.	The existing operational regime of the weir structures maintains a standard head water level for navigation; therefore, this dictates normal flow conditions through the weirs. The increased capacity will only come into effect in larger flood events. The new gates at each weir will not be operated until all the existing weir gates have already been fully opened as per the current operational requirements. When they need to be opened, the flood in the River Thames will be well developed and the tailwater level downstream of each weir will be much higher than the normal level in non-flood conditions so the additional water added from opening the new gates will have no impact on non-flood condition levels. The modification of the direction of water flow by the new weir gates when in operation with the new gates, is likely to lead to only subtle changes in the pattern of scour and deposition immediately downstream. These changes are therefore localised and within the scale of changes that already occur during a particularly large flow event. As such, any changes to

Consultee or Organisation	Summary of Comment	Project Response
		hydromorphology are expected to be within the normal range of baseline variance of existing flood flow conditions. Furthermore, the main weir pools at Sunbury and Teddington are upstream of the proposed new structures; therefore, no downstream hydromorphological changes can affect these. Whereas the Molesey main weir pool is approximately 250m downstream of the weir. Effects to hydromorphology at weirs within the section bypassed by the flood channel remain scoped in and will be assessed. In addition, effects from the augmented flow and the depleted water level to flow dependent habitats such as weir pools will be assessed. It should be noted that additional operational effects on aquatic habitat and notable and protected species from the RTS are to be assessed in the EcIA, see Chapter 7: Biodiversity.
PINS	Construction – sediment disturbance and spills affecting waterbodies intersected by the flood channel: Not enough evidence has been provided to demonstrate there are no pathways for sediment and contaminants to enter the water column during construction. The ES should identify the construction activities that have potential to lead to sediment disturbance and spill contamination and explain what mitigation measures will be employed to reduce/avoid effects. These measures should be secured through the Development Consent Order (DCO).	At scoping, there was a lack of known information of the specific activities which may lead to the disturbance of sediment or contaminants. The Materials Management Strategy will contain identification of some of these sources and mitigation. In addition, a land contamination conceptual site model (CSM) will be developed for the project 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 negative health effects if not addressed adequately at the construction and/or operational stages.

Consultee or Organisation	Summary of Comment	Project Response
		Furthermore, any works involving waste will be subject to the requirement for an environmental permit. As part of the permitting process, a range of risk assessments will be undertaken which will be subject to scrutiny by the Environment Agency's National Permitting Service.
PINS and Environment Agency Sustainable Places	Construction – capacity works on weirs: The ES should assess impacts/effects on hydrology from mitigation used during construction e.g. changes in flow from use of coffer dams where significant effects are likely to occur.	The effects of mitigation measures will also be considered for their impacts to hydrology during construction. These will be addressed within the ES. Pertaining to coffer dams, it is noted that PINS comment ID 3.13.4 accepts our proposal to scope out cofferdams where their use is in line with cofferdam guidance and the CEMP.
PINS	Construction and operation – changes in water quality due to bringing lakes 'online' into new river channels: Impacts on water quality and subsequently other receptors (such as ecology) from linking lakes into the riverine system are not proposed to be assessed although this has potential to alter dissolved oxygen and result in pollution transfer into the new channels. The ES should assess significant effects from bringing lakes 'online' during construction and operation where significant effects are likely to occur. This should cross refer to other assessments where they overlap e.g. biodiversity.	This will be included within the ES. This potential effect is included within our EIA Scoping Report under 18.2.4.1 "Introducing an augmented flow and operational water into the flood channel and intersected waterbodies has the potential to result in negative effects in terms of .... 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". This potential effect is considered within this PEIR.
PINS and Environment Agency Sustainable Places	Augmented flow: The ES should demonstrate that augmented flow can be maintained at all times, even in extreme weather conditions e.g. at times of drought and explain	The ES will assess the expected effects of using an augmented flow under extreme weather (flood and drought). The effects of the augmented flow on the lakes and channels is being modelled further under a range of scenarios. It is currently being determined whether augmented flow needs to be maintained

Consultee or Organisation	Summary of Comment	Project Response
	how this may impact on groundwater flows. Significant effects should be assessed in the relevant Chapters where they are likely to occur. Please see the Environment Agency's scoping consultation response for further detail on this matter.	at all times and this will be considered further in the ES.
PINS, Local Planning Authority (LPA) Project Group and Environment Agency Sustainable Places	Sediment: As the augmentation mechanism is currently unknown, the potential for changes in sedimentation is also unknown. The ES must quantify the sediment/silt baseline in lakes and describe how this would change during construction and operation. This must include identification of potential additional inputs/outputs. Where mitigation is required, this should be described in the ES and secured via the DCO.	The ES will include a sediment baseline; modelling has recently been completed to determine sediment movements through the lakes and new channels during operation. Fluvial audits/geomorphological reconnaissance are being undertaken and will also input towards the sediment baseline through identifying potential sources and sinks of sediment and locations for potential mitigations.
LPA Project Group	Can the bed substrate be site-won material?	It is currently not expected that there will be any suitable river bed materials won onsite. Screening of materials is required as it is anticipated there may be contamination and unsuitably sized (for riverbed substrate) materials excavated due to excavations within historic land fill sites. Re-using site won materials for the new river bed will be a future consideration as part of the material management plan and any details included as part of the ES.
LPA Project Group	Modelling has been undertaken / is being carried out, but neither the model or outputs have been provided at this stage.	Modelling will be available for the ES, including integrated groundwater and surface water modelling, adaptive augmented surface water flow modelling, sediment modelling, drought/low flow modelling. Findings will be included within the ES.
LPA Project Group	Modelling of the Jubilee River, a surrogate system, has been	Yes and further monitoring and modelling has been carried out by

Consultee or Organisation	Summary of Comment	Project Response
	undertaken to establish the minimum flow with no detrimental impact on water quality.	UKCEH, building on this study to replicate the RTS and further refine the understanding of the impacts of augmented flows on water quality within the RTS and within the River Thames.
LPA Project Group	Movement of hazardous material has been highlighted to have an adverse impact on the watercourses, however, it is not clear how. Further explanation is required. The assessment should consider impacts to water quality and sediment processes.	The PEIR identifies hydraulic connections with the RTS in place. Further explanation will be provided in the ES.
Natural England	It would be useful for consideration to be given to turbidity in the lakes, their water levels and the general water quality among the other items to be assessed as part of the “Water Environment’ section.	Monitoring is on-going for turbidity, lake levels and water quality, and is a consideration of this PEIR and WFD Assessment. Results will refine the baseline and assessment of likely significant effects and will be reported within the ES.
Environment Agency Sustainable Places	There should be an assessment of the derogated reach as this stretch of waterbody contains 0.4 kilometres where the Spelthorne Channel offtakes before the Runnymede Channel returns, which would leave it without the flows of both channels.	The WFD assessment will include consideration and assessment of effects to the derogated reach.
Environment Agency Sustainable Places	We understand from the report that modelling is ongoing, however; there should be an assessment for the augmentation flow change after the completion of the WFD assessment or evidence as to why this isn’t required. As part of the groundwater modelling process, modelling potential climate change impacts and extreme flood and drought scenarios will be required to support the feasibility of the augmented flow aims. For example, how will groundwater flows be modified in the project area and how will augmented flow balances be delivered under prolonged dry	We have completed integrated groundwater and surface water modelling that has considered groundwater flow paths (this will be reported on in the ES). The effects of the augmented flow on the water environment of lakes and watercourses on the flood channel alignment and on the Thames itself is being modelled and assessed further under a range of scenarios to understand its sustainability. An operating procedure will be developed for the augmented flow, to balance demands.

Consultee or Organisation	Summary of Comment	Project Response
	weather and drought scenarios? Are the augmented flow volumes sustainable, and are they potentially at the cost of baseflow that is needed elsewhere?	
Environment Agency Sustainable Places	Section 4.2.3.2 identifies that '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'. In terms of water resources, the groundwater flows in the (shallow) groundwater units are likely to be the most disturbed by the project construction works at a range of flow scales. We welcome that site-specific ground investigations and modelling have been discussed and further assessments will be carried out to improve the geo-environmental understanding of the conditions in the vicinity of the RTS channel and the landfills. During any construction works that disturb, or have the potential to disturb landfills/contaminated land, carefully designed monitoring will be essential to detect any impacts to receptors, in real-time, especially to vulnerable and sensitive controlled waters which border the site works.	Ground Investigations are ongoing; A land contamination conceptual site model (CSM) and risk assessments will be developed for the project using the monitoring data to identify any sources of contamination, ground gas, pathways, and receptors present within the study area. The risk assessment will determine the likelihood of existing contamination being encountered during the construction process, such that it could cause significant environmental harm or negative health effects if not addressed adequately at the construction and/or operational stages. Measures, including the scope of required monitoring, would be identified within the CSM assessment, and secured within the DCO process.
Environment Agency Sustainable Places	With regards to Section 4.1.2.14: Channel Through Existing Lakes, there needs to be an assessment of the quantities of silt in the lakes currently, and the potential for all other sediment inputs. The report does identify potential for increased sediment load from urban development (and construction), agricultural runoff, channel modification and boat wash however, it does not identify burrowing activities of non-native	Silt mitigation is included within the project (channel maintenance to restore the design profile is primary mitigation and siltation management during construction is tertiary mitigation). In addition, modelling is being undertaken to understand sediment processes and effects to the lakes from augmented and flood flows. Results will refine any necessary silt mitigation at operational stage. Findings and assessment of the

Consultee or Organisation	Summary of Comment	Project Response
	crayfish or mitten crabs as a potential fine sediment input. This should inform both a construction silt mitigation plan and an operational silt mitigation plan. As the augmentation mechanism is not clear within the report, it is also unknown if there will be an additional source of sediment entering the system. The report states: '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'. However, there is currently no suggestion of mitigation.	sources, pathways and sinks will be available within the ES.
Marine Management Organisation (MMO)	If any bespoke sediment sampling is required/undertaken for sediment quality, these should adhere to the MMO guidelines, especially with regard to the selection of a validated laboratory.	We have used accredited laboratories.

18.3.2 Other Engagement since EIA Scoping

18.3.2.1 Section 18.2.2 of our EIA Scoping Report summarises the stakeholder engagement relevant to the Water Environment topic that was undertaken prior to submission of our EIA Scoping Report.

18.3.2.2 We have established an Environmental Modelling Steering Group which includes industry (e.g. water companies). This group has identified the need for and scope of further modelling studies.

18.3.2.3 We held a meeting with the Environment Agency National Infrastructure Team in October 2023 to discuss the phased approach the RTS is taking to the WFD compliance assessment, the outcomes of the Preliminary WFD Compliance Assessment, and the extensive ongoing environmental modelling.

18.4 Methodology

18.4.1 Introduction

18.4.1.1 This section should be read in conjunction with Chapter 4 'Approach to the Environmental Assessment' which sets out relevant information on the design parameters and information that have informed our PEIR assessment, and how we have approached various aspects of the assessment including:

- The scope of the assessment;
- The methodology (including the approach to defining the baseline environment, topic study areas, and assessment methodology and criteria);
- The approach to mitigation; and
- The approach to cumulative effects.

18.4.1.2 The assessment methodology we have used for the Water Environment topic in this PEIR, and to be used in the Environmental Statement (ES), is presented in Section 18.7 of our EIA Scoping Report and is expanded and updated by the information in Section 18.4.2.

18.4.2 EIA Methodology

18.4.2.1 To aid the preliminary assessment of likely significant effects, we have assigned sensitivity to the features of each waterbody (i.e. the receptors) as per the assessment methodology (this is provided in Appendix 18.2).

18.4.2.2 Our assessment is based on the design for the project as described in Chapter 2: Project Description. The sensitivity of water environment receptors has been defined using published data sources, data obtained from stakeholders, data collected from site surveys and computer modelling.

18.4.2.3 The information we have gathered to date (including the environmental baseline surveys we have completed so far, summarised in Appendix 5.1) is considered sufficient to provide the basis for the preliminary assessment set out in this chapter.

18.4.2.4 At this stage, surveys and modelling are still on-going and the data from these will be used to inform our more detailed assessment of effects on the water environment within the ES. The ES assessment will also draw on the outcomes of our WFD compliance assessment, the methodology for which is summarised in section 18.4.3.

18.4.2.5 For the purposes of our PEIR assessment of effects on the water environment, we have assumed that environmental permits for waste management (and the mitigation measures that they would secure) will be in place as tertiary mitigation. However, where a baseline element associated with the water environment is in its lowest class, this level may not be acceptable under the WFD Regulations and therefore a precautionary approach has been taken in determining the likely significant effect upon these particular elements.

18.4.3 WFD Compliance Assessment

18.4.3.1 We are undertaking a WFD Compliance Assessment in accordance with guidance from PINS, the Environment Agency, UK Technical Advisory Group (UKTAG) and the European Commission. This guidance is referenced in the accompanying WFD Compliance Assessment: Preliminary Assessment (Appendix 18.1).

18.4.3.2 The WFD was transposed into national law in the UK by means of the Water Environment Regulations 2003 (England and Wales). The Water Environment Regulations 2017 (England and Wales) updated the previous regulations of 2003. The 2017 Regulations are currently in force in England following the departure of the UK from the European Union under the provisions of the European Union (Withdrawal Agreement Act 2020) but as amended by the Flood and Water (Amendment etc.) (EU Exit) Regulations 2019 (hereafter referred to as the WFD Regulations).

18.4.3.3 The methodology for WFD Compliance Assessments follows a standard three staged process:

- Stage 1 – WFD Screening: to determine if there are any activities associated with the RTS that don't require further consideration. For the RTS, we completed this alongside our EIA Scoping Report in 2022 (Appendix K to that report and also appended to our WFD Compliance Assessment: Preliminary Assessment in Appendix 18.1 of this PEIR).
- Stage 2 – WFD Scoping (Preliminary Assessment): to identify risks of the RTS's activities to receptors based on the relevant waterbodies and their water quality elements (including information on status, objectives, and the parameters for each water body). For the RTS we have completed this during the PEIR stage based on the design parameters and project boundary we set for this (as set out in Chapter 2). As design development is ongoing, and is being informed by consultation, technical surveys and assessments, an understanding of the potential likely significant effects of the RTS upon the water environment is still underway and the information provided within the WFD scoping assessment is preliminary only. At the ES stage, this preliminary WFD compliance assessment will be reviewed and potentially refined to take account of any developments in the project.
- Stage 3 – WFD Impact Assessment (Compliance Assessment): a detailed assessment of waterbodies and their quality elements that are considered likely to be affected by the RTS, identification of any areas of noncompliance; consideration of mitigation measures, enhancements, and contributions to the River Basin Management Plan (RBMP) objectives which is to be carried out at ES Stage.

18.4.3.4 We screened a total of 36 WFD waterbodies (34 surface and two ground) to identify which could be affected by the RTS. Of this, a total of 22 waterbodies (20 surface and two ground) were screened into the preliminary assessment. This screening assessment (i.e. Stage 1) was completed in September 2022 and at the time of writing did not include several design components that are now part of the PEIR parameters. These changes include River Thames bridges, and temporary wharves. These design changes are not considered to affect the screening conclusion, and in addition are assessed within the preliminary assessment (i.e. Stage 2). The preliminary assessment identified 14 waterbodies (12 surface and two ground) as requiring further detailed assessment (i.e. Stage 3), which is currently ongoing. Following this, we

will review the need for the development of Regulation 19 documentation if the RTS cannot meet the environmental objectives of the WFD Directive and Regulations (if required, this would be Stage 4 of the WFD Compliance Assessment).

18.5 Key Environmental Considerations and Opportunities

18.5.1.1 The key considerations with respect to the water environment are:

- There are 22 main rivers and approximately 73 lakes or (lake groups) and reservoirs of varying sizes within the study area. These comprise 36 WFD waterbodies (19 river waterbodies, 15 lake waterbodies and two groundwater bodies); the project must comply with the WFD and consider whether the works will lead to a deterioration of individual elements or overall WFD status or potential, or, if it may prevent any WFD objectives being delivered;
- Many of these lakes in the study area are man-made, created from former gravel pits and are a valuable resource for biodiversity. These lakes are stable lentic environments and therefore sensitive to nutrient influx from the River Thames, which could decrease water quality and lead to potential algal blooms and eutrophication;
- Several lakes and sections of rivers in the study area are important for recreation and the local economy. Influx of poor-quality water and changes to water level and flow will affect their usability;
- 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. The pools are an important habitat, and therefore sensitive to changes in flow characteristics at the weir structures;
- The proposed works are underlain by a series of principal aquifers within Groundwater Source Protection Zones (SPZs). Water quality needs to be maintained to prevent deterioration or reduction in quality such as at ground water abstractions;
- There are numerous landfill and contaminated sites within the study area which are a risk to sensitive groundwater aquifers as the aquifers may be affected by leachate; and

- There are multiple licensed abstractions from surface waters and groundwater in the study area, 52 abstraction points in total, 18 of which are of public water supply. Currently, there is no capacity for additional consumptive licences without restrictions (Environment Agency, 2019a). These water supplies face significant pressures during drought conditions where water level is low and turbidity is high; operation of the RTS may exacerbate these issues.

18.5.1.2 The key opportunities with respect to the water environment are:

- Improvements to features of some of the waterbodies in the study area, including delivery of RBMP measures and WFD enhancements;
- Enhancement opportunities for the multiple surface waterbodies that interact with the RTS project such as aquatic habitat and riparian habitat installations, regrading lake margins and diversifying bed and bank morphology;
- Treatment and removal of Invasive Non-Native Species (INNS); and
- Fish pass installation and improvement: The weir and lock structures within the River Thames present a barrier to fish migration, and the RTS offers greater freedom of movement beyond these barriers.

18.6 Primary and Tertiary Mitigation

18.6.1 Primary Mitigation

18.6.1.1 We have included primary mitigation in relation to the water environment within the project design. As part of the design and EIA process this is being further refined; it includes:

- The provision of fish passes on flow control structures along the new flood channel to prevent trapping of fish;
- Channel morphology and structure improvements to existing rivers and lakes and within the Spelthorne and Runnymede channels to mitigate for changes to hydromorphology;
- Flow devices will control ground and surface water within the new channels to maintain a minimum water level and flow. This will prevent over-conveyance of groundwater and prevent drawdown of water from aquifers into the new channel;

- The provision and management of augmented flow along the flood channel when not in operation during flooding, to prevent water stagnation in the flood channel (including lakes), provide continued sediment and nutrient transport, reduce the risk of algal blooms and eutrophication and assist in the movement of fish through the system;
- Application of the mitigation hierarchy for habitats and species to reduce impacts from water quality decline at surface and groundwater dependent terrestrial ecosystems;
- Habitat creation, enhancement or mitigation for other effects on habitats or species;
- 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) to address potential effects on habitats as a result of changes in water quantity. There will be a watching brief and implementation of any enhancements will be subject to the EIA confirming effects on these habitats from diverting water along the flood channel;
- Undertake ongoing silt monitoring and maintenance of the flood channel to restore the design profile and therefore ensure it can continue to function effectively and reduce effects upon hydromorphology; and
- 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. These measures will mitigate for effects upon water quality of these lakes and hydraulically connected waterbodies.

18.6.2 Tertiary Mitigation

18.6.2.1 We are proposing the following tertiary mitigation in relation to water environment effects:

- A construction surface water management plan will include measures to limit water quality and hydromorphology effects associated with

site drainage and run off, manage existing flow paths and storm water;

- Standard construction practices for handling of soils will include a site specific soil resource plan containing mitigation measures in accordance with standard practice guidance documents as detailed in Chapter 13: Materials and Waste. These measures will reduce indirect effects on the water environment, such as from runoff of sediment into waterbodies;
- Application of the waste hierarchy. This will include the consideration to minimise the generation of waste such as from within channels or lakes, ensure reuse of arising and treatment of waste to make it suitable for reuse such as for within channels where practicably possible. These measures will reduce indirect effects on the water environment, such as from contamination;
- A Site Waste Management Plan (SWMP) will set out the amount and type of waste and how it will be reused, recycled or disposed (see Chapter 13: Materials and Waste). Likely measures in the plan relating to the water environment include for example keeping materials a safe distance from waterbodies, covering materials to avoid spillages or wind blown sediments entering waterbodies, and ensuring reused materials are suitable for use in or near waterbodies;
- An Emergency Response Plan will be prepared and be location specific to deal with contamination, spillages to the water environment or onset of flooding through deployment of suitable measures to contain, avoid or otherwise minimise effects;
- Standard construction practices for waste and materials management will be adhered to. This would include mitigation measures and associated monitoring (such as for groundwater) in accordance with good practice guidance documents and legislation as detailed in Chapter 13: Materials and Waste. Any works within or affecting landfills or involving waste will be subject to the requirement for an environmental permit under the Environmental Permitting (England and Wales) Regulations 2016. As part of the permitting process, a range of risk assessments will be required, which will be subject to scrutiny by the Environment Agency's National Permitting Service to ensure that they are robust. Suitable measures to mitigate effects on the environment to an acceptable level will be proposed and put in place, which the Environment Agency's National Permitting Service

will review and scrutinise in terms of their adequacy and appropriateness for mitigating the risks and impacts identified. An environmental permit will only be granted if the Environment Agency's National Permitting Service is satisfied that effects on the environment (and human health) are acceptable. The environmental permits will include appropriate permit conditions to limit effects on the environment (and human health) and ensure that the activities are subject to suitable controls;

- Hydro(geo)logical Risk Assessment will evaluate the environmental risk of pollution of groundwater from contaminated soils, in accordance with the Water Resources Act 1991. This will be submitted with the DCO application;
- Results of geotechnical and geoenvironmental investigations will inform development of primary, tertiary, and secondary mitigation for effects upon the water environment that will influence the design;
- A terrestrial INNS management plan would include measures to avoid, limit or eradicate INNS spread within the water environment (see Chapter 7: Biodiversity for details);
- Standard Construction Practices for Water - this would include mitigation measures to reduce effects on the water environment in accordance with Construction Industry Research and Information Association (CIRIA) C762 Environmental good practice on site. This is likely to include measures such as (this is not an exhaustive list):
  - Site drainage to include cut-off ditches and settlement ponds as required;
  - All wastewater produced on site is disposed of appropriately and cannot enter watercourses before treatment (in compliance with water quality standards);
  - All liquids are appropriately stored to prevent spillage; and
  - Geomorphological supervision.
- A Materials Management Strategy - the Strategy is being developed in parallel to the Development Consent Order (DCO) process. See Chapter 13: Materials and Waste. The strategy will include measures to reduce indirect effects on the water environment, such as from contamination; and
- Risk assessment / modelling of landfill leachate migration. This will include desk based assessments using ground investigation data to model/estimate the potential effects of contamination upon water

quality. This will inform further development of primary, tertiary, and secondary mitigation as required.

18.7 Preliminary Assessment of Likely Significant Effects

18.7.1 Introduction

18.7.1.1 Our PEIR adopts a precautionary approach. Assessments reported within this chapter are a preliminary assessment of potential likely significant environmental effects based on the design parameters set out in Chapter 2. This precautionary approach has been taken for the PEIR as there is some information on the project that is currently incomplete and the parameters within Chapter 2 are high level and account for a range of uses and allowance for design development within a boundary that could possibly be refined once this work has been completed. For example, some designs, construction and mitigation details (and therefore also land requirements) or baseline information is still required from further surveys, assessments and/or consultation feedback.

18.7.1.2 In making a determination of likely significant effects, we have considered the sensitivity of receptors (a receptor being a feature of the environment that responds to change) and the potential magnitude (i.e. size) of change caused by the RTS. The methodology for defining sensitivity and magnitude varies by topic and are defined in the topic sections of our Scoping Report.

18.7.1.3 We are committed to including mitigation measures as necessary to address likely significant negative environmental effects as far as reasonably practicable. Both primary and tertiary mitigation are considered to form part of the RTS; those applicable to this topic are set out in Section 18.6. Several of these mitigation measures are still being developed, and therefore as a precaution, the preliminary assessment of effects for the PEIR does not assume full achievement of these in considering if a project effect is likely to be significant (Appendix 4.2 identifies the implementation status of primary and tertiary mitigation for the PEIR assessment). Furthermore, the potential likely significant effects reported within this PEIR have been assessed prior to the implementation of secondary mitigation measures, those applicable to this topic are set out in Section 18.7.5. These secondary mitigation measures are the

subject of further development; and given they are still being developed, are not able to be applied to develop a ‘residual’ effects assessment.

18.7.1.4 The PEIR is based on the latest design and construction parameters and baseline information. As such the findings of the preliminary environmental appraisal presented within this PEIR may be subject to change as the design progresses, as mitigation is further developed or information from further studies becomes available, such as our ongoing work to refine the augmented flow through scenario testing in different flow conditions. The final assessment of effects undertaken as part of the EIA and reported within the ES will be based on the latest information available at that time.

18.7.2 Potential Likely Significant Effects

18.7.2.1 Our preliminary assessment of likely significant environmental effects has identified the potential for the following temporary negative effects from construction on the water environment:

- Potential negative effects to some main rivers and ordinary watercourses and lakes including:
  - Water quality (physico-chemical, biological and chemical) effects - from movement and use of contaminated materials, aquatic INNS and pathogen management (such as biocide treatments), contaminated or sediment laden run off from stockpiles or temporary wharfs, excavation or bed and bank lowering particularly within areas of landfill or contamination.
  - Hydromorphology effects - from bed and bank lowering, dewatering or long term over pumping, aquatic INNS and pathogen management (such as dewatering or drawdown treatments).
  - Water supply effects - resulting in loss of water quality or quantity (i.e. deployable output) from movement and use of contaminated materials, aquatic INNS and pathogen management (such as biocide treatments or dewatering), contaminated or sediment laden run off from stockpiles or temporary wharfs, excavation or bed and bank lowering particularly within areas of landfill or contamination.
  - Recreation effects - from reuse of excavated materials, excavation and movement of contaminated materials, use of

temporary wharfs resulting in water quality or hydromorphological changes affecting use of the water body.
    - Effects on surface water dependent habitats - from movement and use of contaminated materials, aquatic INNS and pathogen management (such as biocide treatments), contaminated or sediment laden run off from stockpiles or temporary wharfs, excavation or bed and bank lowering particularly within areas of landfill or contamination.
- Potential negative effects to two groundwater bodies (the Lower Thames Gravel Aquifer and Chobham and Bagshot Aquifer) including:
    - Changes in aquifer quality or quantity - from excavation within landfill or areas of contamination, sheet piling installation or means of creating or altering pathways for migration of water into and out of the aquifer.
    - Effects on groundwater dependent habitats - from excavation within landfill or areas of contamination, sheet piling or means of creating or altering pathways for migration of water into and out of the aquifer resulting in quality or quantity changes within connected groundwater dependent habitats.

18.7.2.2 Our preliminary assessment of likely significant environmental effects has identified the potential for the following permanent positive and negative effects from operation on the water environment:

- Potential positive effects to:
    - Water quality - consisting of WFD biological quality and physico-chemical quality elements from installing fish passes and improving habitats within existing channels, lakes and within priority areas for habitat creation, enhancement or mitigation.
    - Surface water dependent habitat – including certain watercourses and lakes (including certain SPA waterbodies and supporting waterbodies) from improving habitats within existing channels, lakes and within priority areas for habitat creation, enhancement or mitigation that are hydraulically connected.
- Potential negative effects to some main rivers, ordinary watercourses and lakes including:

  - Water quality (physico-chemical, biological and chemical) - from mixing of river and lake waters containing nutrients and pollutants and alteration to residence times.
  - Hydromorphology - from augmented flow altering flow dynamics, sediment transport and water levels altering physical characteristics and hydraulic connectivity across their catchments.
  - Water supply - resulting in loss of quality or water quantity (i.e. deployable output) from augmented flow creating a depleted reach and mixing of river and lake water altering water quality and turbidity in areas of abstraction.
  - Recreation effects - from existence of the new channels and introduction of augmented flow resulting in water quality or hydromorphological changes affecting use of the water body.
  - Surface water dependent habitats (such as SPAs) - reliant on flow regime and water quality to maintain the habitat from augmented flow and mixing of river and lake waters.
- Potential negative effects to two groundwater bodies (Lower Thames Gravel Aquifer and Chobham and Bagshot Aquifer) including:
  - Changes in quality or quantity of aquifer for supply – through changes in groundwater movement and levels caused by the presence of the flood channel and other project components, altering or creating new pathways for contaminant migration.
  - Effects on groundwater dependant biodiversity - as a result of contamination and changes in groundwater movement and levels through the presence of the flood channel and other project components altering or creating new pathways for migration of water into and out of the aquifer, resulting in quality or quantity changes within connected groundwater dependent habitats.

18.7.2.3 This preliminary assessment has identified that, in total, 26 surface water receptors have potential to experience temporary likely significant environmental effects from construction to one or more of their features, of which 12 receptors will experience negative effects and 14 receptors experience both positive and negative effects. In total 17 receptors have potential to experience permanent likely significant environmental effects from operation to one or more of their features, of which 15 will experience negative effects and two will experience both positive and

negative effects. A summary of this information is provided below in Table 18-2 for surface water receptors.

18.7.2.4 We have prepared a map (Figure 18.1) to demonstrate the potential changes in hydraulic connections between waterbodies once the flood channel is in place. Waterbodies have been grouped into the following categories:

- Lake within flood channel (new connection or enhanced direct permanent connection);
- Offline lake with continued flooding in <1:20 flood (i.e. five per cent chance of flooding in any given year);
- Offline lake with indirect connection to flood channel;
- Lake with a removed connection to other previously linked waterbodies (e.g. Manor Lake will no longer be connected to the other Thorpe Park lakes). No flooding in <1:20 flood (i.e. five per cent chance of flooding in any given year);
- Online watercourse (new connection or enhanced direct permanent connection); and
- Other watercourses.

18.7.2.5 Further details of the potential likely significant effects from construction and operation with respect to receptors, project components and project activities, in relation to the water environment can be found in Table 1 and 2 in Appendix 18.3.

18.7.3 Potential Likely Non-Significant Effects

18.7.3.1 Further details of the effects from construction and operation that are considered to be non-significant with respect to receptors, project components and project activities, in relation to the water environment can be found in Table 3 and 4 in Appendix 18.3.

18.7.3.2 Some examples of non-significant effects on the water environment include (this is not an exhaustive list):

- Positive effects of habitat enhancement works on water quality and hydromorphlogy in watercourses with moderate hydromorphology sensitivity such as the River Thames – Egham to Teddington, Mead Lake Ditch and Abbey River during operation of the RTS; and

- Positive effects on flows in the Burway Ditch in terms of recreation – the augmented flow would provide additional water quantity into Burway Ditch which is normally dry. This additional water quantity would allow for more recreation/wet use of the water body permanently.

18.7.4 In-Combination Climate Impact

18.7.4.1 Consideration of 'In-Combination Climate Impact' (ICCI) has been undertaken. The preliminary environmental assessment has considered a future climate scenario and has identified certain potential likely significant environmental effects for this topic which may be exacerbated further by predicted climate change. For example, the RTS impact to water levels and availability for public water supply during the future climate scenario of more frequent droughts and low flow conditions. Further consideration of ICCI will be included in the ES.

Table 18-2: Summary of surface water receptors with potential to experience likely significant effects (blank cell means no potential likely significant effect, positive or negative)

Receptor	Receptor	Hydromorphology - Construction	Hydromorphology - Operation	Surface water dependent biodiversity - Construction	Surface water dependent biodiversity - Operation	Water Quality - Construction	Water Quality - Operation	Water Supply - Construction	Water Supply - Operation	Recreation - Construction	Recreation - Operation
Datchet Common Brook	Surface water										
Colne Brook	Surface water			Negative		Negative					
New Cut	Surface water										
County Ditch	Surface water							Negative		Negative	
Bonehead Ditch	Surface water			Negative							
River Thames - Cookham to Egham	Surface water					Negative		Negative		Negative	
River Colne	Surface water			Negative		Negative					
Wraysbury River	Surface water			Negative		Negative					
Mead Lake Ditch	Surface water	Negative			Negative	Negative	Negative				Positive
The Moat	Surface water			Negative		Negative					
Chertsey Bourne	Surface water			Negative		Negative				Negative	
Abbey River	Surface water		Negative		Negative		Negative/ Positive	Negative	Negative	Negative	Negative
Burway Ditch	Surface water		Negative					Negative	Negative		
Pool End Ditch	Surface water				Negative		Negative/ Positive				
Engine River	Surface water							Negative			
The Chap	Surface water							Negative		Negative	
River Thames - Egham to Teddington	Surface water	Negative	Negative	Negative	Negative/ Positive	Negative	Negative/ Positive	Negative	Negative	Negative	Negative/ Positive
River Ash	Surface water			Negative		Negative				Negative	
River Mole	Surface water	Negative				Negative				Negative	

Receptor	Receptor	Hydromorphology - Construction	Hydromorphology - Operation	Surface water dependent biodiversity - Construction	Surface water dependent biodiversity - Operation	Water Quality - Construction	Water Quality - Operation	Water Supply - Construction	Water Supply - Operation	Recreation - Construction	Recreation - Operation
(unnamed) ordinary watercourses and land drains	Surface water										
Transitional Thames Upper and Thames Middle	Surface water				Negative		Negative				
Blenheim Lake	Still Water										
Heron Lake	Still Water										
Hythe End East	Still Water										
The Moor Gravel Pit	Still Water										
Egham Hythe Pond	Still Water										
Meadlake	Still Water										
Lake South of Green Lane	Still Water	Negative	Negative/ Positive	Negative	Negative/ positive	Negative	Negative/ positive	Negative	Negative	Negative	Negative
Lake South of Norlands Lane 1	Still Water		Negative/ Positive		Negative/ positive		Negative/ positive		Negative		Negative
Thorpe Park Lakes: Fleet Lake, Manor Lake, Abbey Lake, St Ann's Lake	Still Water		Negative/ Positive		Negative/ Positive		Negative/ Positive				Negative/ Positive
Abbey 1	Still Water		Negative		Negative						
Abbey 2	Still Water		Negative/ Positive		Negative/ Positive		Negative/ Positive		Negative		Positive
Penton Hook Marina	Still Water		Negative						Negative		Negative
Littleton North	Still Water		Negative/ Positive		Negative/ Positive		Negative/ Positive		Negative		Negative/ Positive
Littleton South	Still Water		Negative		Negative				Negative		Negative
Littleton East	Still Water		Negative/ Positive		Negative/ Positive		Negative/ Positive		Negative		Negative/ Positive
Sheepwalk East (F)	Still Water		Negative		Negative		Negative		Negative		Negative

Receptor	Receptor	Hydromorphology - Construction	Hydromorphology - Operation	Surface water dependent biodiversity - Construction	Surface water dependent biodiversity - Operation	Water Quality - Construction	Water Quality - Operation	Water Supply - Construction	Water Supply - Operation	Recreation - Construction	Recreation - Operation
Sheepwalk West 1	Still Water		Negative		Negative		Negative		Negative		Negative
Sheepwalk West 2	Still Water		Negative		Negative		Negative/ Positive		Negative		Negative/ Positive
Sheepwalk West 3	Still Water		Negative		Negative		Negative		Negative		Negative
Black Ditch Pond	Still Water										
Manor Farm Lake	Still Water										
Ferry Lane Lake 1	Still Water										
Ferry Lane Lake 2	Still Water		Negative								
Ferry Lane Lake 3	Still Water		Negative								
Ferry Lane Lake	Still Water		Negative		Negative		Negative/ Positive		Negative		Negative/ Positive
Queen Mary Reservoir	Still Water		Negative				Negative		Negative		
Lockwood Reservoir	Still Water										
Banbury Reservoir	Still Water										
Queen Elizabeth 2 Storage Reservoir	Still Water						Negative				
Knight Reservoir	Still Water						Negative				
Bessborough Reservoir	Still Water						Negative				
Island Barn Reservoir	Still Water						Negative				

18.7.5 Secondary Mitigation

18.7.5.1 As noted in paragraph 18.7.1.3, primary and tertiary mitigation are still being developed, and therefore as a precaution, the preliminary assessment of effects for our PEIR does not assume full achievement of these in considering if a project effect is likely to be significant. Furthermore, the potential likely significant effects reported within our PEIR have been assessed prior to the implementation of secondary mitigation measures. For the majority of the identified likely significant environmental effects it is considered likely that the primary and tertiary mitigation will be sufficient at ES stage such that no secondary mitigation will be required. Where secondary mitigation is already under consideration for potential significant environmental effects, this is detailed below.

18.7.5.2 In order to reduce the magnitude of significant effects, the following secondary mitigation is currently under consideration in relation to the water environment:

- Water quality monitoring during construction and operation and subsequent remedial activities where these are required that will aid with development of bespoke mitigation measures, which may include for example deployment of proprietary equipment to filter any detected pollutants.
- An Aquatic INNS Management Plan will be prepared that may include measures such as eradication of INNS before commencement of construction and monitoring for spread and implementation of treatment measures to avoid colonisation that would lead to effects upon surface water dependent habitats.
- An Aquatic Pathogen Management Plan will be prepared that may include measures to reduce transfer of fish parasites in either direction between the River Thames and surrounding fisheries. In addition, there will be monitoring for pathogen spread and implementation of treatment measures where required to avoid colonisation that would lead to effects upon surface water dependent habitats.
- Further design will need to be undertaken to mitigate effects on the water environment following results of further studies and on-going monitoring (outlined in Section 18.7). For example, water quality

impacts on lake recreation will need to be analysed in order to determine effects on water chemistry and effect on bathing water use. On-going water quality monitoring and subsequent analysis will investigate potential effects and identify potential areas for mitigation. Mitigation will also be developed following focused study of modelling outputs.

- Further operational design will also be undertaken following additional environmental modelling to mitigate effects upon the water environment during drought / low flows.
- Further environmental mitigation may be required as a result of the WFD compliance assessment and the EIA, such as in relation to water quality, for physico-chemical elements or chemicals, and is yet to be developed.

18.8 Further Work for the EIA

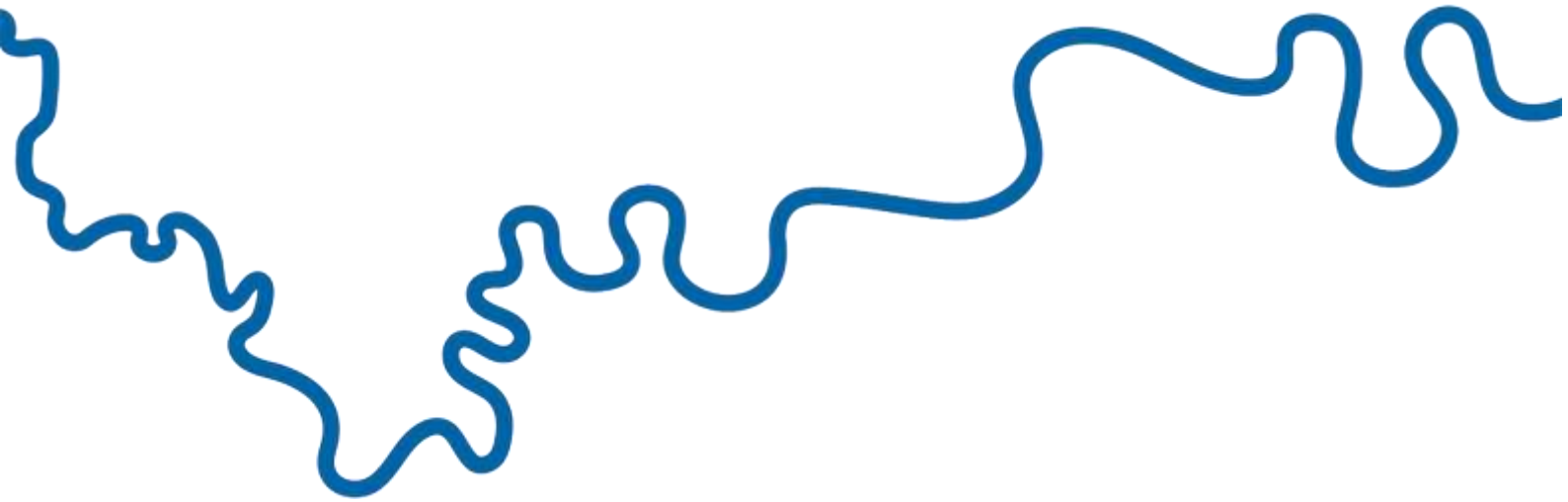
18.8.1.1 We will undertake a detailed assessment of the effects from construction and operation on the water environment of the project for the ES in accordance with the methodology set out Section 18.3 above. The assessment will be completed alongside the WFD Compliance Assessment for the project.

18.8.1.2 Our assessment for the ES will be based on the effects scoped into the assessment. It will take into account:

- The comments received in our EIA Scoping Opinion, as explained in Appendix 4.1, including identifying the construction activities that have potential to lead to sediment disturbance and spill contamination, and explain what mitigation measures will be employed to reduce/avoid effects, as requested by PINS.
- Further development of the design of the project and its accompanying secondary mitigation measures.
- Any additional baseline information that will become available from on-going surface and groundwater quality and level monitoring, ecological surveys, sediment sampling, geomorphological (fluvial) reconnaissance, integrated groundwater and surface water modelling, adaptive augmented surface water flow modelling, drought/low flow modelling, hydro(geo)logical assessment and a detailed WFD assessment.

- On-going engagement with Thames Water and Affinity Water, in addition to the Environmental Modelling Steering Group, which will inform the scope of the modelling, assessment work and potential mitigation.
- In addition, the assessment will also be informed by any further information received during the statutory consultation process.

18.8.1.3 Our assessment for the ES will state the predicted significance of effects, provide further detail of relevant mitigation and document the subsequent residual effects. We consider that the further development of the project design and mitigation measures which will be reflected in the ES and DCO application, will enable a reduction in the scale of identified negative likely significant effects set out in this chapter.



SURREY COUNTY COUNCIL

Environment Agency

The River Thames Scheme represents a new landscape-based approach to creating healthier, more resilient and more sustainable communities by reducing the risk of flooding and creating high quality natural environments.

River Thames
Scheme