River Thames Scheme

PROTECTING our communities
SECURING our economy
ENHANCING our Thames

View of Bell weir on the River Thames at Hythe End, from downstream of the Channel Section 1 outlet.

River Thames Scheme - Capacity Improvements and Flood Channel Project

Draft Environmental Impact Assessment Scoping Report for Consultation

June 2017

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Checking and Approvals

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Summary

Purpose of this document

This document is the Environmental Impact Assessment (EIA) Scoping Report for construction and operation of the River Thames Scheme (RTS) Capacity Improvements and Flood Channel (CI&FC) Project. The proposed project is being promoted by a partnership of organisations including the Environment Agency, Royal Borough of Windsor & Maidenhead, Surrey County Council, Elmbridge Borough Council, Runnymede Borough Council, Spelthorne Borough Council, London Borough of Richmond upon Thames, Royal Borough of Kingston upon Thames, Thames Water, the Department of Environment, Food and Rural Affairs (Defra), and Thames Regional Flood and Coastal Committee (RFCC).

The purpose of this report is to provide details of the preferred option for the RTS CI&FC Project, and to present the findings of the scoping stage undertaken as part of the EIA process. The EIA is being completed under the Town and Country Planning (EIA) Regulations 2017 (SI 2017/ 571).

The Project sits within a wider framework of activities being delivered under the RTS. The vision for the RTS is broad ranging and goes far beyond solely delivering flood protection. The vision for the RTS is: 'PROTECTING our communities, SECURING our economy, ENHANCING our Thames'.

Background

The RTS CI&FC Project will provide flood relief to people, property and existing infrastructure within the River Thames catchment between Datchet and Teddington to the south west of Greater London. The sites of the Project are within the vicinity of the River Thames between Datchet and Desborough Island, at the existing Sunbury, Molesey and Teddington weirs and at Ham Lands (see Figure 0-1).

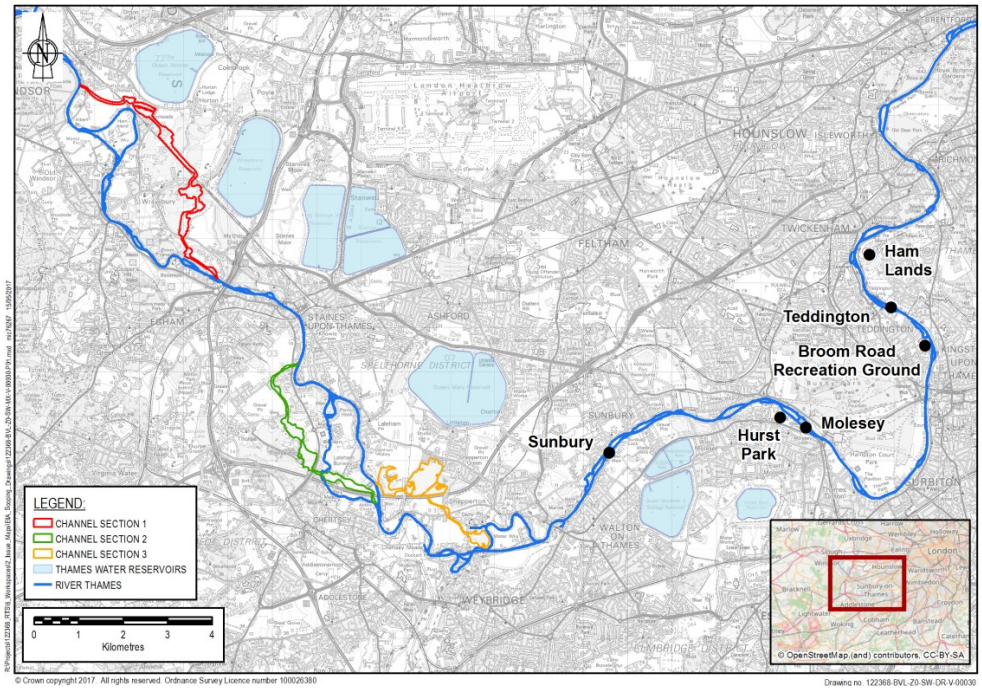

Figure 0-1: Location of the RTS CI&FC project.

The River Thames between Datchet and Teddington is one of the largest and most at risk developed but undefended floodplains in England. A major flood (a 1 in 100 flood (one per cent chance of happening in any given year)) would cause risk to life, put approximately 15,000 residential and commercial properties at risk,

cause severe disturbance to local communities and disruption on both nationally and locally significant roads (with motorway traffic affected on the M3, M4 and M25) (see Figure 0-5). Flooding would also disrupt key rail routes and block access to internationally important infrastructure such as Heathrow Airport. Several major drinking water abstractions supplying south-east England, and up to 20 local electricity sub-stations would also be affected with a risk of flooding to the public sewage network, resulting in disruption to homes.

Option development

The Lower Thames Flood Risk Management Strategy (LTFRMS) considered a number of 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 (Environment Agency, 2009). The LTFRMS concluded that the preferred approach to flood risk management is to improve conveyance and reduce flood risk through construction of a flood relief channel and capacity improvements in the River Thames downstream of the new flood relief channel.

The project partners have worked together to identify how the preferred strategic option could be implemented, and to develop the outline designs for the preferred option.

Preferred option

The main components of the Project (see Figure 0-1) include:

- A 14.6km flood relief channel, split into three sections (Channel Sections 1 (Figure 0-2), 2 and 3);
- Capacity improvement works at Desborough Cut, Sunbury, Molesey and Teddington weirs (see Figure 0-4);
- A flood storage area at Ham Lands;
- Modifying the Thames Water abstraction regime from the River Thames to reduce the peak flows during floods; and
- Associated features including: flow and water level control structures, flood embankments, site compounds, materials reprocessing sites, landscape enhancement areas and areas of habitat creation.

Extensive consultation has been carried out as part of developing the outline designs for the preferred option with the following key stakeholders:

- Project partners and internal stakeholders;
- Statutory authorities and consenting bodies;
- Landowners and operators;
- Businesses;
- Community groups and homeowners; and
- Representative groups (e.g. recreation, wildlife and conservation groups).

Existing environmental conditions

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

- Settlements, including: Datchet; Wraysbury; Staines; Chertsey; Sunbury; East Molesey; and Teddington;

- Transport links such as the M25, M4 and M3 motorways, and railways; and
- Land uses including Heathrow Airport, Thorpe Park, lakes left from past mineral workings, raised landfills and vast raised reservoirs.

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

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 a result the area contains a wealth of heritage features, such as ancient monuments, important buildings and buried archaeological remains.

The area is very important for biodiversity. Several of the large lakes at Wraysbury are internationally designated for overwintering birds, a hay meadow at Thorpe (see Figure 0-3) is nationally designated for rare plants and insects, and the area contains many other protected species (both land and water based).

As well as the River Thames, in the study area there are over 20 rivers and streams and over 40 man-made lakes and reservoirs. Also, the groundwater in the area is an important source of drinking water.

Project activities and potential effects

The Project will involve many activities during its construction and operation which have the potential to cause beneficial or adverse environmental effects. Major activities during construction such as digging the flood relief channel, upgrades to Thames weirs and building flood banks could cause temporary disturbance to local residents, businesses and users, biodiversity and archaeological remains. In operation, the flood relief channel may cause adverse effects to the water quality of lakes it goes through, with knock on effects on biodiversity and users. Nevertheless, the Project also has the potential for beneficial effects through improved flood protection, greater public access, and creation of habitats and landscape features.

Scope of the EIA

A preliminary assessment of environmental effects as a result of implementing the RTS CI&FC Project has been carried out. The assessment took into consideration mitigation measures to avoid or reduce effects, which have been incorporated into the outline design as part of an iterative design process. Where the potential for significant effects is uncertain, for example due to uncertainties about the final design, working methods, or the findings of ongoing surveys, as a precaution the relevant environmental topics and receptors are included in the scope of the EIA.

The assessment identified that the topics scoped into the EIA are: Air quality and climatic factors; Biodiversity; Cultural heritage, archaeology and built heritage; Landscape and visual amenity; Population (including noise, vibration and land use); Soils and geology (including contaminated land); Surface water, groundwater and Water Framework Directive; and Traffic and transport. It is proposed to scope out of the EIA the Natural Resources and Waste topic and the vulnerability of the project to the risks of major accidents and/or disasters. The potential for cumulative effects with other projects was also considered within the preliminary assessment, and will be considered further in the EIA.

Next steps

This document has been prepared to support the request for a formal EIA Scoping Opinion from statutory consultees, as well as to support the submission of a business case to the Environment Agency, Defra and HM Treasury to secure funding. The information within this EIA Scoping Report will form the basis of the Environmental Statement for the RTS CI&FC Project, which will be submitted with the planning application to the local authorities in summer 2018.

Photographs of environmental features in the Project study area

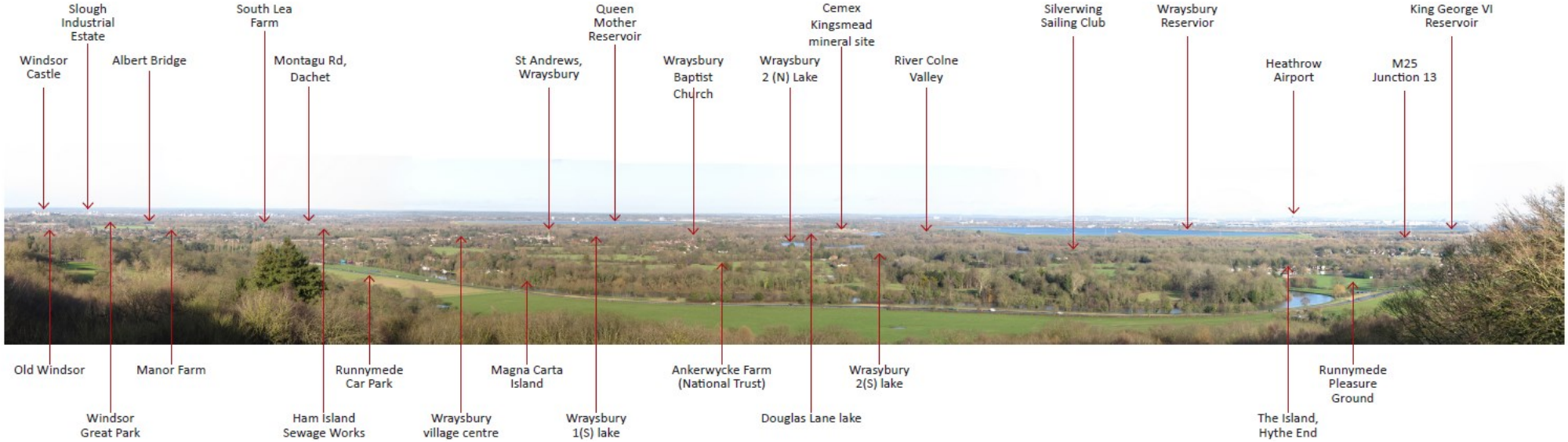

Figure 0-2: Area in proximity of Channel Section 1 of the flood relief channel, looking north from Cooper's Hill.

Figure 0-3: Thorpe Hay Meadow - an area of public access and nationally protected for rare plants and insects.

Figure 0-4: Molesey weir - where new gates will be built with a canopy similar to the existing.

Figure 0-5: 2014 flooding at Runnymede (at M25 junction 13). Runnymede Hotel is in foreground on right.

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1 Introduction

1.1.1.1 This Scoping Report has been prepared as part of an Environmental Impact Assessment (EIA) for construction and operation of the proposed River Thames Scheme (RTS) Capacity Improvements and Flood Channel (CI&FC) Project (hereafter referred to as 'the Project'). The Project is being led by a partnership of organisations including the Environment Agency, Royal Borough of Windsor & Maidenhead (RBWM), Surrey County Council (SCC), Elmbridge Borough Council (EBC), Runnymede Borough Council (RBC), Spelthorne Borough Council (SBC), London Borough of Richmond upon Thames (LBRUT), Royal Borough of Kingston upon Thames (RBKUT), Thames Water, Defra, and Thames Regional Flood and Coastal Committee (RFCC).

1.1.1.2 This Scoping Report describes:

- The characteristics of the Project;
- The process of determining the scope of the EIA, including the basis on which environmental topics have been 'scoped in' or 'scoped out'; and
- The proposed approach for the assessment of those topics scoped in to the EIA.

1.1.1.3 The Project sites are within the vicinity of the River Thames between Datchet and Desborough Island, at the existing Sunbury, Molesey and Teddington weirs and at Ham Lands. The Project location is shown in Figure 1-1.

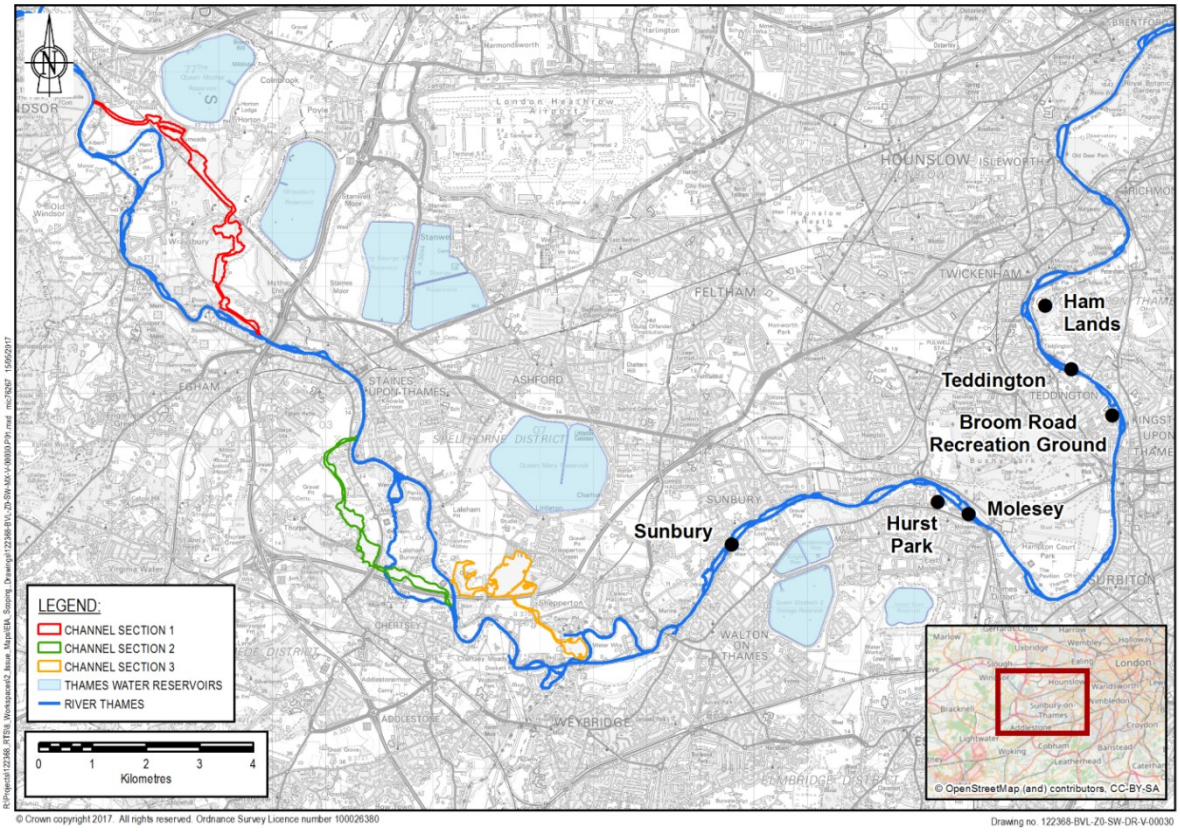

Figure 1-1: Location of the Project

1.1.1.4 The Project is being developed to provide flood relief to people, property and existing infrastructure within the River Thames catchment between Datchet and Teddington. The main components of the Project include:

- A 14.6km flood relief channel, split into three sections;
- Capacity improvement works at Desborough Cut, Sunbury, Molesey and Teddington weirs;

- A flood storage area at Ham Lands;
- Modifying the Thames Water abstraction regime from the River Thames to reduce the peak flows during floods; and
- Associated features including: flow and water level control structures, flood embankments, site compounds, materials reprocessing sites, Landscape Enhancement Areas (LEAs) and areas of habitat creation.

1.1.1.5 Section 3 of this Report provides a more detailed description of the key components of the Project.

1.2 RTS Vision

1.2.1.1 The Project sits within a wider framework of activities being delivered under the RTS. The vision for the RTS is broad ranging and goes far beyond solely delivering flood protection.

1.2.1.2 The vision for the RTS is: 'PROTECTING our communities, SECURING our economy, ENHANCING our Thames'.

1.2.1.3 By 'PROTECTING our communities' the RTS partners mean:

- Reducing flood risk and insurance costs;
- Making people and their homes safer; and
- Protecting water, electricity and telecoms supply.

1.2.1.4 'SECURING our economy' means:

- Keeping businesses running;
- Keeping motorways and airports running;
- Communities thriving; and
- Encouraging investment.

1.2.1.5 'ENHANCING our Thames' means:

- New opportunities for tourism, recreation and sport;
- Improving access to the River Thames; and
- Improving landscape and habitats.

2 Purpose of Scoping

2.1 EIA Regulations

2.1.1.1 The Town and Country Planning (Environmental Impact Assessment) Regulations 2017 (SI 2017/ 571) (referred to as 'the EIA Regulations') identify types of development where the need for EIA must be considered. Development that is listed in Schedule 1 always needs an EIA. For Schedule 2 Development, an EIA is required only if the project is judged likely to give rise to significant environmental effects by virtue of factors such as the size, nature and location of the proposal (as detailed in Schedule 3).

2.1.1.2 The proposed development falls under Schedule 2 of the EIA Regulations and therefore the scope of the potential environmental effects must be considered. There are three paragraphs of the EIA Regulations which are relevant to the Project. These are:

- Paragraph 10(h) - covering 'projects for inland waterway construction, canalisation and flood relief works';
- Paragraph 2(a) - covering 'projects for quarries, open cast mining and peat extraction (unless included in Schedule 1)'; and,
- Paragraph 13(b) - which covers 'any change to or extension of development of a description listed in paragraphs 1 to 12 of column 1 of this table [Schedule 2], where that development is already authorised, executed or in the process of being executed'. This is relevant to changes to authorised areas of landfill (which are covered under paragraph 11 (b) 'installations for the disposal of waste (unless included in Schedule 1)').

2.1.1.3 Given the sensitivity of the receiving environment and the large-scale of the Project works, it is the view of the RTS project partners that the Project, taken as a whole, is likely to give rise to significant environmental effects (as per screening criteria in Schedule 3 of the EIA Regulations).

2.1.1.4 Consequently, a statutory EIA will be undertaken in accordance with the EIA Regulations and documented within an Environmental Statement (ES), which will be submitted for consideration and approval along with an application for planning permission under the Town and Country Planning Act 1990 (as amended).

2.2 Purpose of this report

2.2.1.1 EIA is a staged process that starts by defining the proposal and extends to the monitoring of any identified significant adverse effects (IEMA, 2004) (see Figure 2-1).

2.2.1.2 The aim of EIA Scoping is to take a collaborative approach with statutory consultees and key stakeholders in order to commence early engagement, to gain feedback and to reach agreement on the scope of the EIA quickly and efficiently. As such, this Scoping Report is the first formal phase of consultation in this EIA process.

2.2.1.3 To comply with the EIA Regulations, and to facilitate statutory consultees in giving their opinions on the scope of information to be included in the EIA , this Scoping Report includes the following:

- A plan sufficient to identify the land (see Figures SW-DR-V-00058, WS-DR-V-00012, WM-DR-V-00012, WT-DR-V-00010, SW-DR-V-00054 and SW-DR-V-00053);
- A brief description of the nature and purpose of the proposed development and its possible effects on the environment (Section 3 and Sections 7 to 15); and

- Such other information or representations as the person making the request may wish to provide or make - in this Scoping Report, this information includes, amongst other things, the methodology proposed for the EIA (Section 17 and Sections 7 to 15).

Figure 2-1: Stages of the EIA.

3 Need for the Project

3.1.1.1 The River Thames between Datchet and Teddington is one of the largest and most at risk developed but undefended floodplains in England. A large flood occurred in the area in 1947 (being approximately a 1 in 50 flood (i.e. two per cent chance of happening in any given year)); other notable floods occurred in 1968, 2003 and 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 (Environment Agency & RTS Partners, 2016a).

3.1.1.2 A major flood (a 1 in 100 flood (one per cent chance of happening in any given year)) would put approximately 15,000 residential and commercial properties at risk, with 11,000 employed people potentially affected (Environment Agency & RTS Partners, 2016a). A flood of moderate frequency (a 1 in 20 flood (five per cent chance of happening in any given year) would put 4,700 properties at risk.

3.1.1.3 Major flooding in the area would cause risk to life and severe disturbance to local communities plus disruption on both nationally and locally significant roads, with motorway traffic affected on the M3, M4 and M25. Flooding would also disrupt key rail routes and block access to internationally important infrastructure such as Heathrow Airport, for employees as well as passengers (Environment Agency & RTS Partners, 2016a). Several major drinking water abstractions supplying south-east England, and up to 20 local electricity sub-stations would also be affected, with a risk of flooding to the public sewage network; all resulting in disruption to homes and businesses (Environment Agency & RTS Partners, 2016a).

3.1.1.4 Figure 3-1 illustrates how the Project reduces the risk of flooding to homes. For example, there are approximately 8000 homes currently at significant risk of flooding (represented by eight houses in the orange box on the left of the graphic). Depending on the location of the residence and the performance of the Project locally, the risk for each of the 8000 homes is either reduced to moderate or low risk as shown by the arrows. A similar trend can be seen for residences at moderate or very significant risk. About 1000 homes will remain at very significant risk of flooding after the Project has been completed (a 1 in 20 flood (five per cent chance of happening in any given year) - red bottom right box).

3.1.1.5 The following are required to mitigate a small increase in downstream flood risk (between Walton Bridge and Richmond upon Thames) that has been identified as possible once the proposed flood relief channel is operational:

- Capacity improvements to the Desborough Cut and the three River Thames weirs;
- Flood storage at Ham Lands; and
- Additional abstraction of water from the River Thames to be stored in Thames Water's existing reservoirs during times of flood.

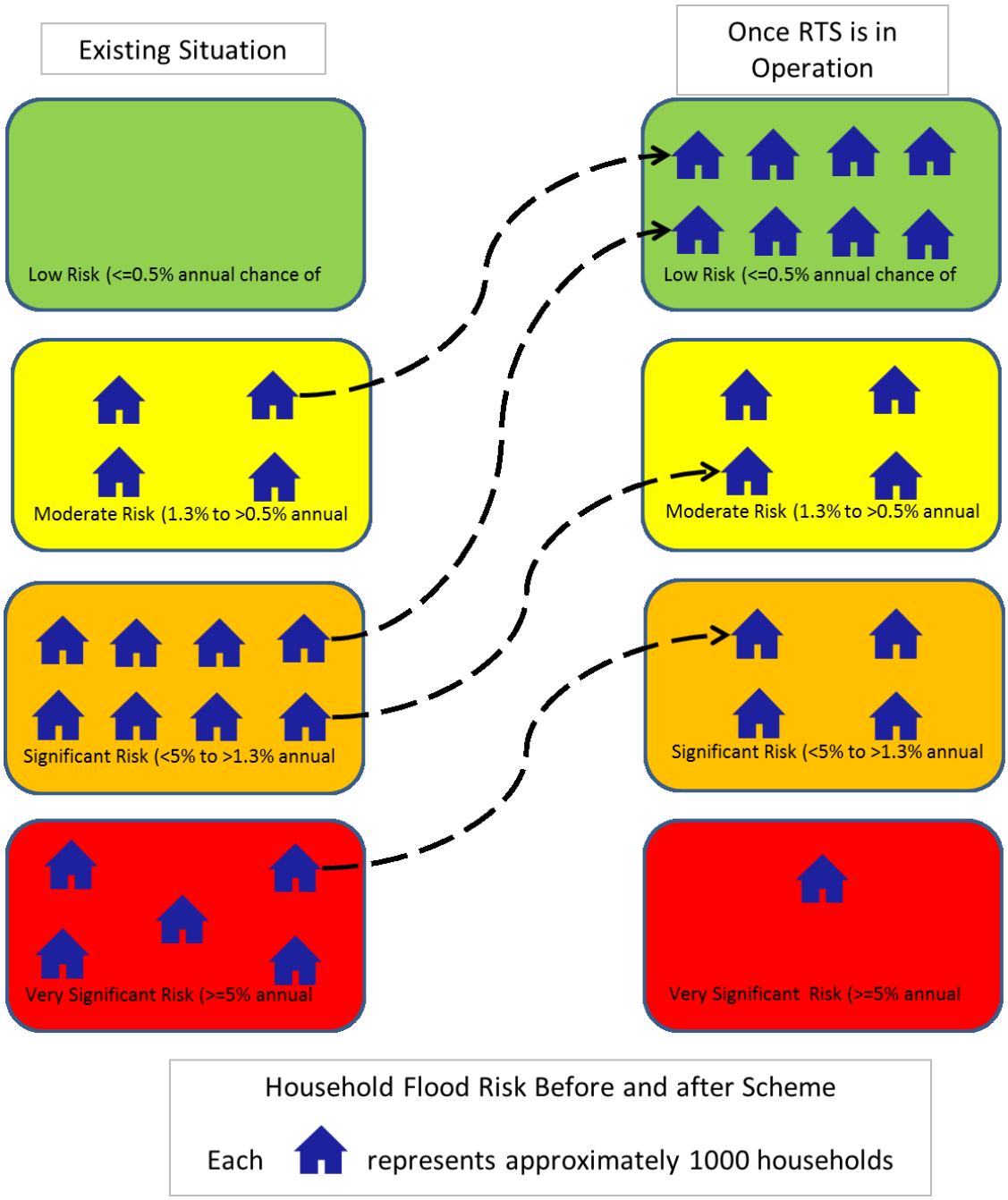

Figure 3-1: Representation of the flood risk benefit provided by the Project.

4 Project Description

4.1 The proposed development

4.1.1.1 The Project will comprise of the following elements:

- A 14.6km flood relief channel, split into three sections; Channel Sections 1, 2 and 3 are 6.6, 4.8 and 3.7km long respectively. The channel sections will generally be 20m to 50m wide (and up to 100m wide at the water level control structures). It will be between 3 to 4m deep and will convey in-bank approximately 150m^3/s of water;
- Capacity improvement works at Desborough Cut, Sunbury, Molesey and Teddington weirs;
- A flood storage area at Ham Lands;
- Modifying the Thames Water abstraction regime from the River Thames to reduce the peak flows during floods; and
- Associated features including: flow and water level control structures, flood embankments, site compounds, materials reprocessing sites, LEAs and areas of habitat creation (Figure SW-DR-V-00058).

4.1.1.2 The location of the flood relief channel and capacity improvements are shown in Figure 1-1, and described in further detail below.

4.1.2 Flood relief channel

4.1.2.1 The flood relief channel is split into three sections (Figure SW-DR-V-00058).

4.1.2.2 Channel Section 1 will be entirely within the RBWM Unitary Authority in Berkshire. This section of the flood relief channel will leave the left bank (when looking downstream) of the River Thames at Datchet, crossing arable land before passing through nine lakes and former gravel pits in the Sunnymeads, Horton and Wraysbury area. This section of the flood relief channel will cross the railway line twice and five local roads. It will re-enter the River Thames at Hythe End, immediately downstream of Bell weir.

4.1.2.3 Channel Section 2 will be entirely within the Borough of Runnymede, in Surrey. This section of the flood relief channel will leave the right bank (when looking downstream) of the River Thames at Egham Hythe, approximately 3km downstream of the outlet of Channel Section 1. It will pass through agricultural fields before heading south across Green Lane and joining the existing course of the Meadlake Ditch. Passing through six lakes, including the Thorpe Park lakes, it will cross Chertsey Lane (A320) towards Abbey Meads and return to the River Thames through the existing Burway Ditch M3 flood culverts, just south of the M3 and downstream of Chertsey weir.

4.1.2.4 Channel Section 3 will be entirely within the Borough of Spelthorne, in Surrey. This section of the flood relief channel will leave the right bank of the River Thames at Laleham, approximately 0.4km upstream of the outlet of Channel Section 2 and north of the M3. The flood relief channel will head east across three existing lakes and crosses two local roads before heading south underneath the M3. The flood relief channel will pass through areas of grassland and scrub at Sheepwalk and Manor Farm and will cross a further three local roads and a 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 Each flood relief channel section 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 relief channel will vary according to the type of land use or lake that it passes through.

Channels through natural and made ground

4.1.2.7 In general this type of channel will be engineered with a 'natural' looking trapezoidal cross-section, approximately 45m wide and 3m deep (although this will vary depending on the location). Figure 4-1 shows a typical cross-section of this type of channel. 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 relief channel lying anywhere between 1 and 2m below existing groundwater levels. Within Channel Sections 1, 2 and 3 there will be trapezoidal sections, through natural and made ground of approximately 1.5, 1 and 0.5km in length respectively.

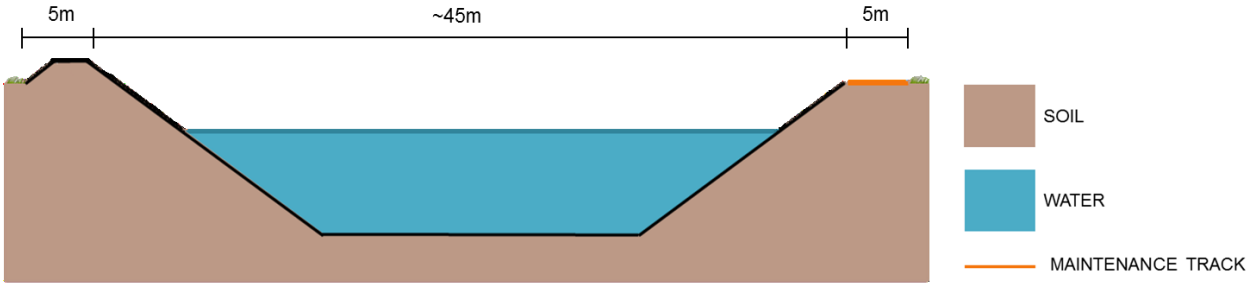

Figure 4-1: Typical cross-section of the flood relief channel through natural and made ground.

Channels crossing properties

4.1.2.8 Some sections of the flood relief channel will pass through existing properties; this will require four properties and a few other uninhabited buildings to be demolished.

Channels through landfill sites

4.1.2.9 Sections of the flood relief channel that pass through existing and historic landfill sites will be heavily engineered with steel sheet piled sides, approximately 20m wide and 4m deep. Figure 4-2 shows a typical cross-section of this type of channel. If required there will be an impermeable layer between the channel and the landfill to isolate the channel from contamination by landfill materials and leachates. Within Channel Sections 1, 2 and 3 there will be sheet piled sections of approximately 2km, 1.5km and 1.5km in length respectively.

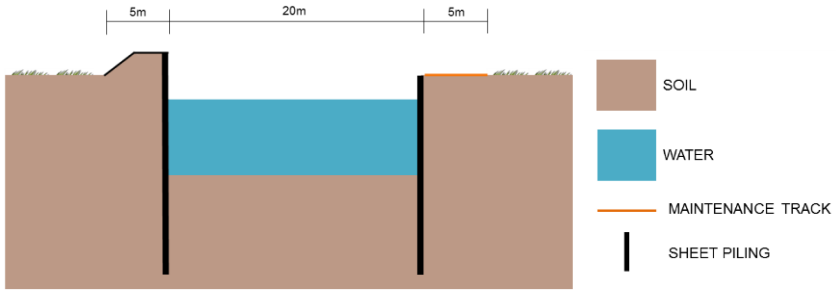

Figure 4-2: Typical cross-section of the flood relief channel through landfill sites.

Channels through existing lakes

4.1.2.10 Utilising the network of existing lakes as a flood flow route is an integral part of the project. The lakes are currently used for a variety of uses; primarily fishing and water sports such as sailing, waterskiing and swimming with some internationally protected for nature conservation as they are part of the Southwest London Water bodies Special Protection Area (SPA). The flood relief channel will enter each

lake; the flood water will flow through the lake and exit the other side. It is not intended to deepen the lake unless the existing depth is insufficient to pass the flow efficiently. Existing silt layers will remain in place, though operation of the flood relief channel may be expected to add to and redistribute the silt.

4.1.2.11 Separation embankments, to keep the River Thames water separate from the rest of the existing lake, are proposed in the following lakes:

- Kingsmead Island lake;
- Wraysbury 2 (N); and
- Wraysbury 2 (S).

4.1.2.12 At this stage in the development of the Project it has not yet been concluded as to whether separation embankments are required in the Wraysbury 2 lakes; this will be decided following the outcomes of groundwater and water quality modelling. Consequently, the effects of both scenarios are assessed within this Scoping Report.

4.1.2.13 The separation embankments will be constructed with either sheet piled vertical sides or have sloped sides and be constructed from inert, granular material. Figure 4-3 shows typical cross-sections of these types of structures. The heights of these embankments will vary according to location and ground level, however they are likely to be approximately 1.5m above normal water levels and similar to surrounding ground levels.

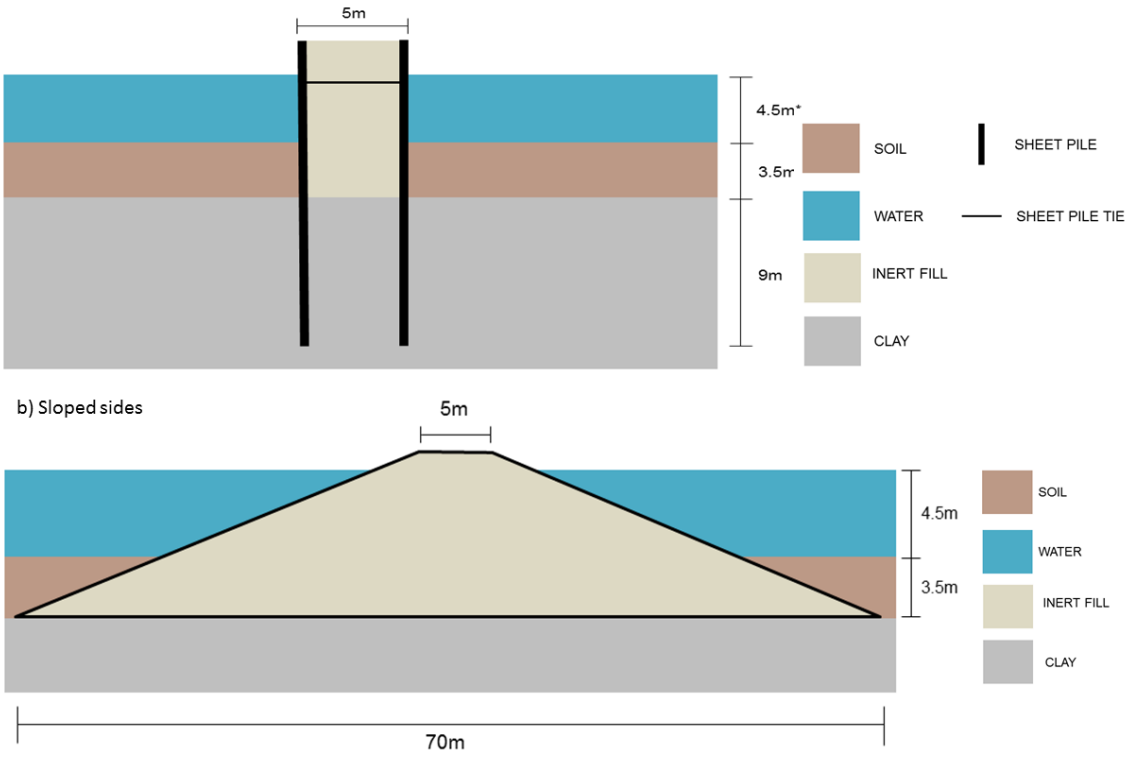

Figure 4-3: Typical cross-sections of the separation embankments in the lakes.

Structures

4.1.2.14 The following existing features will be crossed by the flood relief channel, requiring a wide range of structures, including:

- Major and minor roads and railway lines; this will require culverts (Figure 4-4) or bridges;
- Natural drainage lines; this will require cross-drainage structures;
- Footpaths and bridleways; this will require bridges; and
- Services including gas, water, electricity etc.; these will require re-location.

Figure 4-4: An example of a typical culvert.

4.1.2.15 Flow control structures (Figure 4-5) are required at the intake of each channel section and at the crossing of Chertsey Lane (A320), downstream of the Thorpe Park Lakes. These will be required to control the amount of water entering the flood relief channel.

Figure 4-5: An example of a typical flow control structure.

4.1.2.16 Water level control structures (Figure 4-6), with fish passes, will be required along each of the flood relief channel sections. Their function will be to control water levels during low flow conditions, to ensure that the flood relief channel does not act as a drain leading to the surrounding groundwater levels being drawn down by the flood relief channel during normal conditions.

Figure 4-6: An example of a typical water level control structure.

4.1.2.17 Flood embankments between approximately 0.3m and 2m high are to be constructed in proximity to housing estates, commercial developments, important utilities and other rivers as shown in Figure SW-DR-V-00058.

4.1.2.18 Protection embankments will be constructed along existing railway and motorway embankments and the margins of existing lakes and rivers to provide a buffer between the flood relief channel and existing critical transport infrastructure as shown in Figure SW-DR-V-00058.

4.1.2.19 Some river bank protection works will be required, to prevent erosion of the River Thames around the outlet of each flood relief channel section. Some areas may also require some embankment raising. The protection works are likely to be sheet piling, rock armour or concrete revetments.

4.1.3 Capacity improvements

4.1.3.1 There are four locations in which capacity improvement works are required as part of the project, all are located downstream of the flood relief channel.

4.1.3.2 Desborough Cut, within the Borough of Elmbridge, in Surrey, is a man-made channel bypassing the Desborough Loop section of the River Thames. The Cut will be widened by approximately 3m on the left bank (Figure 4-7) and deepened by approximately 1.5m underneath the two bridges at either end of the Cut.

Figure 4-7: Photograph of Desborough Cut, looking downstream from the upstream bridge on Walton Lane.

4.1.3.3 Sunbury weir is within the Borough of Elmbridge, in Surrey. The boundary between Elmbridge and the Borough of Spelthorne is on the left bank of the River Thames. The capacity improvements at this weir will be achieved by constructing a new weir complex with three dipping radial weir gates (Figure 4-8) through Sunbury Lock Ait (Figure WS-DR-V-00012). An approximately 12m wide, 75m long and 5m deep channel 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.

Figure 4-8: Example of a fixed weir radial gate.

4.1.3.4 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 (Figure 4-9) with two

dipping radial weir gates and a multi species fish pass (with a combined width of approximately 13m) (Figure WM-DR-V-00012).

Figure 4-9: Photograph of the existing overfall weir (far left) on weir C at Molesey.

4.1.3.5 Teddington weir is entirely within the LBRUT, 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 (Figure WT-DR-V-00010). An approximately 20m wide, 20m long and 5m deep channel will be cut through the island, approximately 10m upstream of the existing boat rollers and 70m downstream of the footbridge.

4.1.4 Flood storage area at Ham Lands

4.1.4.1 Ham Lands is entirely within the LBRUT, within the tidal section of the River Thames. Additional capacity for flood water will be achieved by creating a natural flood storage area within North Ham Lands (Figure 1-1, in Section 1). An area of woodland approximately 4.5ha large, which is currently above the floodplain level, will be excavated, lowering the ground level by approximately 2m to allow water from the River Thames to sit in the area during periods of high flows. The excavated material will be reused locally, within North Ham Lands to form a landscape feature.

4.1.5 Water storage and Thames Water reservoirs

4.1.5.1 In times when large floods are forecast, Thames Water will increase their abstractions prior to the peak of the flood and the water abstracted will be stored in their reservoirs (Table 4-1), this will be undertaken in accordance with an agreed protocol between the Environment Agency and Thames Water. This will help to reduce the peak water levels downstream of the abstraction points and downstream of the flood relief channel during the flood.

Table 4-1: Thames Water reservoirs to provide water storage.

Reservoirs	
Queen Mother Reservoir, Datchet	Wraysbury Reservoir, Wraysbury
King George VI, near Staines	Staines North & South, Staines
Queen Mary, near Shepperton	Bessborough, Walton
Knight, Walton	Queen Elizabeth II, Walton
Island Barn, Walton	

4.1.6 Associated features

4.1.6.1 In addition to the flood relief channel, several associated features are proposed as part of the Project. The flow and water level control structures and flood embankments have already been explained in Section 4.1.2, whilst details of the site compounds are provided Section 4.2, below.

4.1.6.2 Due to the amount of material that will be excavated during construction, areas adjacent to the flood relief channel will be used for materials reprocessing during construction (Figure SW-DR-V-00058 and Table 4-4). Post-construction these areas will be enhanced using some of the excavated material to create LEAs.

4.1.6.3 The enhancement opportunities proposed for inclusion in the project design, including those at the material reprocessing sites, have been identified through iterative design and stakeholder engagement processes, which culminated in the production of maps showing the location of these features (see Figures C1-DR-L-000030, C2-DR-L-00021 and C3-DR-L-00020). These opportunities include for example:

- A combination of visitors' facilities, habitat creation areas and Public Open Space within the LEAs, with raised landforms ('beacons') creating viewing points at:
    - Sunnymeads, off Welley Road, Wraysbury;
    - Hythe End and Fowles Recycling Depot;
    - Royal Hythe Farm, off Chertsey Lane;
    - Norlands Lane; and
    - Manor Farm, off Renfree Way.
- Footpaths and cycleways on the maintenance access tracks along the flood relief channel, connecting them with existing public rights of way (PRoW) to create circular routes and to improve access networks within the wider area. This includes routes around Channel Section 1, connecting it with both the Ankerwycke Farm and Runnymede National Trust sites. There is also potential to connect the existing PRoW's around Thorpe Park and Abbey Meads by creating footpaths along some areas of Channel Section 2;
- Car parks along all sections of the route to encourage the use of the new areas of Public Open Space and the flood relief channel for recreation purposes;
- Fishing platforms; specifically at Hythe End, Sunnymeads, Norlands Lane, at the outlet of Channel Section 2, on Littleton East Lake and near Chertsey Road (in Shepperton);
- Canoe navigation on: Channel Section 1, between Sunnymeads and Horton; and on Channel Section 2 between the River Thames and Norlands Lane, as well as downstream of the M3. Slipways will be included in the design to enable this; and
- At Molesey weir, installation of a canopy to soften the structure into the setting, and replacement of the existing salmonid fish pass with a multi species fish pass.

4.1.6.4 As part of statutory obligations on the enhancement of biodiversity (including requirements under National Planning Policy Framework (NPPF) Policy 11 (DCLG, 2012), Natural Environment and Rural Communities (NERC) Act, the Environment Act 1995), and to meet the RTS Vision, the Project is seeking to achieve the goal of net gain in biodiversity and to create additional habitat at a Project wide level. Some potential areas for habitat creation have been identified along and adjacent to the flood relief channel. This includes (Figure SW-DR-V-00053):

- Creating new habitat in the proposed materials processing sites and LEAs at Sunnymeads, Hythe End, Royal Hythe, Norlands Lane, Manor Farm and Sheepwalk;
- The modifications of the flood relief channel design at Abbey 1 will include new habitat between Channel Section 2 and the M3;

- The inclusion of Sunnymeads 5 and 6 lakes and realignment of the flood relief channel through Kingsmead Island Lake will create additional open water and areas of channel diversity;
- Shallowing of lake edges within SPA supporting lakes;
- The modification of the flood relief channel design at Abbey Meads to a two staged, braided channel and inclusion of the wider area (Abbey 1 & 2 and potentially Laleham Golf Course) for the creation of new habitat;
- Improvement to the existing habitat at Desborough Island; and
- The creation of floodplain storage within Ham Lands has the potential to create improved habitats.

4.2 Construction

4.2.1.1 The Project is scheduled to be delivered over a ten year period (see Table 4-2).

4.2.1.2 Enabling works, such as demolition of buildings, services diversions, works to some existing structures, bank protection works, and construction of compound areas, are proposed to start from January 2018. These enabling works include the capacity improvements at Desborough Cut and flood storage at Ham Lands, which will be undertaken in 2020.

4.2.1.3 The capacity improvements at the three River Thames weirs will each be undertaken in a single summer season, over three consecutive years. Works will start at Sunbury weir in April 2021, Molesey weir in April 2022 and Teddington weir in April 2023. Any landscaping, required as part of the works, will be completed during this period.

4.2.1.4 The construction of the flood relief channel will start in June 2021 and be completed by the end of 2024. This will be followed by a three year period of landscaping works until 2027 (Table 4-2).

Table 4-2: The Project construction programme.

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Enabling works										
Desborough Cut										
Ham Lands										
Sunbury Weir										
Molesey Weir										
Teddington Weir										
Flood relief channel										

Construction
Ready for use
Landscaping works

4.2.1.5 Construction of the capacity improvement works at the River Thames weirs will typically take place within a coffer dam (Figure 4-10). 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. The coffer dam will be formed of steel sheet piles which will be driven into the ground and the weir structure will be formed of cast-in-place reinforced concrete. The steel sheet piles will be cut down to bed level when the structure is finished to allow flow to pass through.

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

Figure 4-10: An example of a cofferdam, used to construct new weir gates.

4.2.1.7 The flood relief channel will pass through two types of ground: natural material which has not been previously disturbed; and landfill (see paragraph 4.1.2.5). Through the natural material, the flood relief channel will have a trapezoidal shape and will typically be dug 'wet' (i.e. groundwater will not be excluded from the excavation).

4.2.1.8 Through landfill, the edges of the flood relief channel will be formed of steel sheet piles. The steel sheet piles will first be driven into the ground to form each side of the channel. Groundwater in the landfill areas could potentially be contaminated so any water in the ground between the piles will be pumped out and treated prior to discharge to a public sewer or taken off site in a tanker. Once dewatered, the ground will be excavated from between the sheet piles to the bed of the channel. The bed will comprise either natural ground (if the excavation removes all the landfill material) or remnant landfill if testing proves it is suitable to be left exposed in the bed of the channel. If the remnant landfill material is not suitable to be left, it will be removed and replaced with inert natural material (gravels or clays), or will be capped with a slab of unreinforced concrete.

4.2.1.9 Road bridges will typically be constructed using a 'top down' method. In this method the bridge supports are formed using concrete piles bored close together. The bridge deck is cast on top of the piles at the ground surface, before the ground is dug out from underneath the deck and between the piles to form the bridge openings.

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

4.2.1.11 The main elements of the construction process will be the earthworks associated with excavation of the flood relief channel, processing the material that comes from this excavation, piling and formation of structures from either cast-in place reinforced concrete or precast concrete elements. 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 relief channel as well as compounds sufficiently large to store the plant when it is not in use.

4.2.1.12 By using haul roads along the flood relief channel route, some material 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, use of the public road network for delivery of materials and plant, and movements of material which cannot be reused on site, will be unavoidable. Heavy Goods Vehicles (HGVs) such as eight-wheeled or articulated tipper trucks as well as concrete wagons are historically very typical in the area due to extensive quarrying and material processing over the last century. Construction of the Project will see an increase in this type of vehicle on local roads.

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 and this will be more relevant to the capacity improvement works i.e. the Desborough Cut and three River Thames weirs. Use of the railway for transport has been explored with Network Rail, but there is concern regarding structural strength of bridges on the railway line. There is therefore thought to be little possibility of using rail for transport of construction materials.

4.2.1.13 Initial estimates of the number of HGV movements required to remove excavated material from site (including material processing sites) are in the range of 190 to 210 traffic movements per day. This does not include traffic movements associated with delivery of materials and plant and site operatives travelling to and from sites.

4.2.1.14 Potential locations of site compounds are shown on Figure SW-DR-V-00054 and listed in Table 4-3 below. Temporary site compounds will be located along the flood relief channel alignment during construction to store plant, materials and welfare facilities. Excavated material will predominantly be stored at the material processing sites (Table 4-4), but it is also possible that temporary stockpiles will be created elsewhere, within the working area, to allow for water to drain from the excavated material before transportation. Permanent compound facilities will be required at the four flow control structures; these will include kiosks to house the operational equipment.

Table 4-3: Potential site compound locations.

Project Element	Compound Location	Permanent or temporary
Channel Section 1	Southlea Farm, Datchet.	Permanent.
	Adjacent to the railway line at Southlea Farm – for rail bridge works.	Temporary.
	Welley Road, Wraysbury – former gravel processing site and Kingsmead Quarry landfill.	Temporary.
	Adjacent to the railway line at Station Road, Wraysbury – for rail bridge works.	Temporary.
	Fowles Recycling Depot, Hythe End.	Temporary.
Channel Section 2	A320 Chertsey Lane – at the intake of Channel Section 2.	Permanent.
	Former landfill site on Norlands Lane.	Temporary.
	A320 Chertsey Lane – downstream of the Thorpe Park Lakes.	Permanent.
	Open land adjacent J B Ski car park at St Ann's Lake, Thorpe – for construction of side spill weir structure on Chertsey Bourne.	Temporary.
Channel Section 3	Thames Side Road, Laleham.	Permanent.
	Littleton Lane, Shepperton.	Temporary.
	Sheepwalk Landfill, off Sheepwalk, Shepperton – for M3 bridge construction.	Temporary.
	Manor Farm Landfill, off Sheepwalk, Shepperton.	Temporary.
Desborough Cut	On Desborough Island - west of the property called 'The Engine House'.	Temporary.
Sunbury/Molesey weir	Hurst Park and deliveries will also be made by road via the lock access road.	Temporary.
Teddington weir	Broom Road Recreation Ground and deliveries will also be made to site via the existing access track to the lock through South Ham Lands.	Temporary.
Ham Lands	Section of grassland within North Ham Lands, off Riverside Drive.	Temporary.

4.2.1.15 Potential locations of materials reprocessing and LEAs are shown on Figure SW-DR-V-00058 and listed in Table 4-4 below.

Table 4-4: Materials reprocessing and LEAs.

Project Element	Materials Reprocessing and LEAs
Channel Section 1	Sunnymeads, Welley Road, Wraysbury – former gravel processing site and Kingsmead Quarry landfill.
	Hythe End 1 landfill, Wraysbury.
	Fowles Recycling Depot, Hythe End.
Channel Section 2	Royal Hythe Farm – landfill site off Chertsey Road (A320).
	Norlands Lane – landfill site.
Channel Section 3	Littleton Lane, Shepperton – an existing recycling site. (This site will be used for materials reprocessing only.).
	Manor Farm Landfill, off Sheepwalk, Shepperton.

4.3 Operation and maintenance

4.3.1.1 The capacity improvements at each weir, Desborough Cut and flood storage at Ham Lands will be ready for use once construction has been completed at each site. The flood relief channel and associated features will be in operation by the end of 2024 (Table 4-2).

4.3.1.2 The flood relief 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 200m^3/s. Once operational, the flow down the flood relief channel will be regulated by flow control structures at the intakes (one flow control structure for each section of the flood relief channel and one at the crossing of Chertsey Lane (A320), downstream of the Thorpe Park Lakes). These gates will be opened incrementally so that more and more flow is conveyed by the flood relief channel (up to a maximum of 150m^3/s) whilst flow in the River Thames remains at approximately the threshold value (~200m^3/s). If flow down the River Thames is such that the capacity of the flood relief channel would be exceeded, 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 relief channel will always contain groundwater due to the presence of water level control structures. For the most part, the water level control structures on the flood relief channel route will be fixed weirs (see Figure 4-8, above). This is necessary to ensure that the existing lakes (which the flood relief channel flows through) and the adjacent land (where the groundwater is typically only 1m below ground level) are not drained below their existing levels. A small augmentation flow (0.5-1 m^3/s) will be allowed to pass down the flood relief channel in non-flood conditions to facilitate fish passage at the flow and water level control structures.

4.3.1.4 The flood relief 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 (this formalises a situation that already occurs). A series of gate movements of the flow control structures in these lakes will be completed in conjunction with the overspill. In this way, Chertsey Bourne flows are directed towards, and conveyed through, the downstream end of Channel Section 2 to the River Thames to alleviate flooding in Chertsey.

4.3.1.5 The capacity improvement works will involve widening the Desborough Cut to allow more flow to pass through it. The additional gates on the River Thames will add flow capacity at the existing weirs by opening them incrementally once all the existing weir gates have been opened fully. The net effect of

this will mean that there is no increase in flood levels in the River Thames downstream of Shepperton weir during operation of the flood relief channel.

4.3.1.6 Restoration of the floodplain in North Ham Lands, will provide additional floodplain capacity, mitigating the small increase in river levels under some flow conditions downstream of Teddington weir, during the operation of the flood relief channel.

4.3.1.7 Increasing Thames Water abstraction pumping from the River Thames into the existing reservoirs in the period shortly prior to the peak of large floods can assist in reducing the peak flood levels downstream of the abstraction points, potentially from Datchet (depending on the decided operating regime).

4.3.1.8 Maintenance requirements for the flood relief 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. Bathymetric surveys will be undertaken periodically to detect any problems changes in with siltation and erosion over time. Work to reinstate the design profile may be needed to maintain the design capacity of the flood relief channel.

4.3.1.9 A permanent site compound will be sited at the start of each channel section and will primarily serve as an area to operate and maintain the gates of the flow control structures at the intakes (as listed in Table 4-3 and shown on Figure SW-DR-V-00054). 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 SW-DR-V-00058) on Channel Section 2 just downstream of Thorpe Park lakes. Other small permanent compounds may be required along some or all of the channel sections.

4.3.1.10 Access tracks along the flood relief channel will facilitate access to the various flow and water level control structures as well as the flood relief channel itself for maintenance purposes. During completion of the Public Safety Risk Assessment (PSRA), consideration will be given to emergency egress points for anyone who might fall into the channel (e.g. a formalised exit point and/or grab chains) and also access for emergency vehicles to deal with such situations. The PSRA will also consider the installation of hand rails 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 with climate change and therefore it is unlikely that a point in time will be reached when the Project is no longer required. It is highly likely that in order to maintain operation of the Project beyond 100 years, changes to its capacity or operation may be required to maintain the required level of flood risk reduction. However, changes such as these would need to be properly designed, assessed and implemented and would therefore likely form the basis of another project. Any such project may be subject to an EIA as this Project has been.

4.4.1.2 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 relief channel would be left in-situ and its operational regime modified as needed. Again, 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 EIA. It is not possible to consider these potential effects at this stage due to the high level of uncertainty associated with what any ongoing operation would involve.

4.5 Option development and 'built-in' mitigation

4.5.1.1 As part of the Project development, the design has followed an iterative design process to identify ways to improve it and to resolve five specific areas of uncertainty identified by the Lower Thames Flood Risk Management Strategy (LTFRMS) including:

- The flood relief channel alignment at Thorpe Hay Meadow Site of Special Scientific Interest (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;
- The outlet of Channel Section 3; and
- Whether the flood relief channel should have an augmentation flow.

4.5.1.2 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 Water Framework Directive (WFD) and Habitats Regulations (see Section 5.2 for further details).

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

4.5.1.4 This iterative design process has allowed mitigation of potential environmental effects to be built-in to the project; this has enabled the application of the first two stages of the mitigation hierarchy (Figure 4-11). An example of this is that the capacity improvements at the River Thames weirs are built-in mitigation to avoid increasing flood risk to downstream communities that might occur if the flood relief channel were constructed on its own.

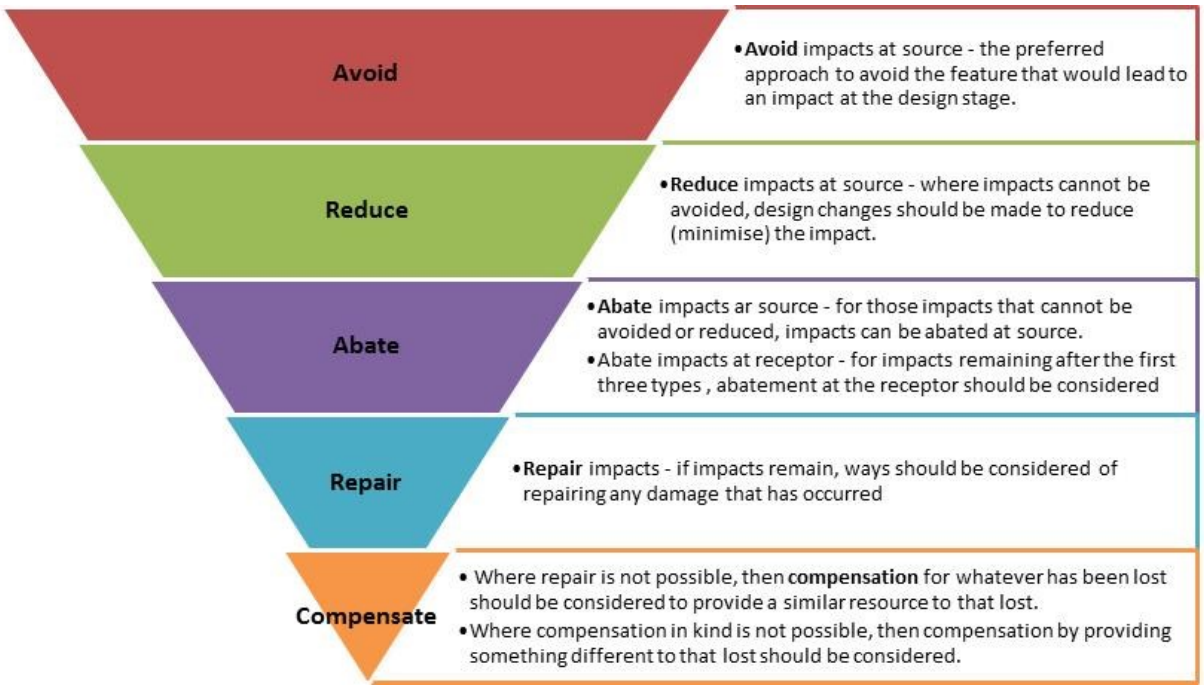

Figure 4-11: Mitigation hierarchy (as outlined in Environment Agency, 2002).

4.5.1.5 As detailed in Section 4.1.6, above, potential areas for habitat creation have been identified along and adjacent to the flood relief channel (Figure SW-DR-V-00053). Further assessment is being undertaken to identify the quantity and type of habitat which needs to be created to ensure not only mitigation of effects but also enhancement of biodiversity.

4.5.1.6 The process of iterative design has resulted in lesser effects on the environment and stakeholders, whilst increasing economic feasibility. The key changes from the LTFRMS design include reducing the length of the proposed channel by 2.7km, realigning sections to avoid certain sensitive sites, modifications to the locations and designs of capacity improvements on the River Thames weirs, and inclusion of additional measures (water storage in reservoirs and at Ham Lands) to ensure no increased flood risk downstream. See Appendix B for further details of all the key changes.

4.6 Mitigation and enhancements

4.6.1.1 This Scoping Report includes a preliminary assessment of potential environmental effects and will be used to inform the scope of the subsequent EIA. As part of this process, potential mitigation measures to avoid, reduce or compensate (Figure 4-11) for potentially significant environmental effects have been identified.

4.7 Next steps

4.7.1.1 This report sets out the scope of the studies proposed to inform the ES that will accompany the planning application for the Project. It enables the local planning authorities and other consultees the opportunity to provide comment on the scope of the ES.

4.7.1.2 Key dates in the project programme are listed below in Table 4-5 (these may be subject to alteration).

Table 4-5: Indicative project programme.

Date	Task
June 2017	Submission of Request for Scoping Opinion to local planning authorities.
June 2018	Submit Outline Business Case to the Environment Agency, Defra and HM Treasury.
July 2017 – April 2018	Undertake EIA and prepare ES.
Summer 2018 – Spring 2020	Submit planning application, undertake public inquiry and gain approvals.
Early 2020	Submit Full Business Case to the Environment Agency, Defra and HM Treasury.
Summer 2020 – Summer 2021	Undertake detailed design.
2021 to 2023	Construction of the capacity improvement works at the River Thames weirs.
2021 to 2024	Construction of the flood relief channel.
2025 to 2027	Landscaping works.

5 Policy Context

5.1.1.1 This section outlines important legislation and policy documents of relevance to the Project. These set the legislation and policy which the Project must comply with. Relevant plans and policies may be subject to change, and will be reviewed as the project and EIA progresses.

5.2 International and national legislation

EU Floods Directive

5.2.1.1 The European Union (EU) Floods Directive (2007/60/EC) requires Member States to assess if all water courses and coast lines are at risk from flooding, to map the flood extent and assets and humans at risk in these areas and to take measures to reduce this flood risk. The directive links with the WFD in the production of flood risk management plans which coordinate with River Basin Management Plans (RBMPs). This requires the Environment Agency and Local Authorities to complete Flood Risk Management Plans, and identify risk of flooding from a variety of sources.

Water Framework Directive

5.2.1.2 The WFD is an EU Directive (2000/60/EC) transposed in to domestic legislation by the Water Environment (Water Framework Directive) (England and Wales) Regulations 2003 (SI 2003/ 2342). The WFD broadly aims to deliver long-term protection of rivers, estuaries, coastal areas, groundwater and wetlands, to achieve the best possible environment for people and wildlife. The objectives and targets required by the WFD are set out in statutory RBMPs which were updated by the Environment Agency in 2016 ('cycle 2 RBMPs'). The Environment Agency is the competent authority for implementing the WFD. A WFD Compliance Assessment is being undertaken to fulfil this requirement.

Habitats Directive and Birds Directive

5.2.1.3 EU Directive 92/43/EEC on the Conservation of Habitats and Wild Flora and Fauna (known as the 'Habitats Directive') protects habitats and species of European nature conservation importance. Together with Directive 2009/147/EC on the Conservation of Wild Birds (the 'Birds Directive'), the Habitats Directive establishes a network of nationally important sites designated for their ecological status. These include Special Areas of Conservation (SACs) and SPAs. Internationally important wetlands designated under the 1971 Ramsar Convention are also afforded the same protection as SPAs and SACs.

5.2.1.4 The Conservation of Habitats and Species Regulations 2010 (as amended) transpose the Habitats and Birds Directives in to UK law. These regulations impose a duty on operating authorities to maintain the integrity of sites designated for nature conservation importance. Projects can only be permitted within these areas having ascertained no adverse effect on the integrity of the site. Projects may still be permitted if there are no alternatives, and there are imperative reasons of overriding public interest. A Habitats Regulations Assessment (HRA) is being undertaken to fulfill this requirement.

Wildlife and Countryside Act

5.2.1.5 The Wildlife and Countryside Act (WCA) 1981 (as amended) consolidates and amends several pieces of national legislation and is the principle mechanism for the legislative protection of wildlife in the UK. The Act implements the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention) and implements the species protection requirements of the Birds Directive. Its reach covers the protection of certain birds, wild animals and plants, the countryside, national parks and the designation of protected areas, including the protection and management of SSSIs. Measures to prevent the establishment of non-native species are also included in this legislation. The WCA also makes it an offence to disturb, injure or kill listed species of flora and fauna, and requires consideration

of effects of the proposed works on flora and fauna as part of the Project. A thorough Ecological Impact Assessment will be undertaken to fulfil the obligations of this Act.

5.2.1.6 The WCA has been subject to a number of amendments, the most important of which are through the Countryside and Rights of Way (CRoW) Act 2000.

Countryside and Rights of Way Act

5.2.1.7 The CRoW Act (2000) covers four main areas; access to open countryside, PRoW, nature conservation/wildlife protection and Areas of Outstanding Natural Beauty (AONB). The Act offers protection to PRoWs, increases the protection for SSSIs and strengthens wildlife enforcement legislation. As part of the legislation Natural England are required to review consent applications for works within a SSSI and may refuse consent for damaging operations. A thorough Ecological Impact Assessment will be undertaken to fulfil the obligations of this Act. Effects on Public Rights of Way have been considered during design development and mitigated where possible, remaining effects will be considered as part of the EIA.

The Natural Environment and Rural Communities (NERC) Act

5.2.1.8 Section 40 of the NERC Act (2006) imposes a duty on public authorities to conserve biodiversity. This is in addition to the statutory protection given to specified sites and species and extends to supporting actions that may also restore and enhance biodiversity.

5.2.1.9 Under Section 41 of the Act, the Secretary of State, in consultation with Natural England, has published a list of habitats and species of principal importance for the conservation of biodiversity, which must be afforded a degree of protection.

5.2.1.10 This Act mirrors the obligation to enhance biodiversity stated in the NPPF and Environment Act. Work is ongoing to consider effects on habitats and species, how to mitigate for these, and also how the Project can provide enhancements to biodiversity.

Thames Conservancy Act

5.2.1.11 The Thames Conservancy Act (1932) relates specifically to the River Thames; the Environment Agency is under statutory obligation to adhere to it. It aims to preserve the River Thames for recreational uses, and set out methods for regulating pleasure traffic. The Act makes provision for a public right of navigation on any channel through which River Thames water flows, and sets out a statutory obligation for the maintenance of locks and weirs. It also allows for dredging of the River Thames for maintenance of navigation. The Project is obliged to maintain navigation of the River Thames, and this will be done throughout construction and operation.

Salmon and Freshwater Fisheries Act 1975 (as amended)

5.2.1.12 The Salmon and Freshwater Fisheries Act 1975 provides for protection of salmonid and freshwater species, and their migration routes. The Project has been designed to mitigate effects on fish where possible, and any remaining effects will be considered in the EIA.

Eels (England and Wales) Regulations 2009

5.2.1.13 These regulations afford powers to the Environment Agency to implement measures for the recovery of eel stocks, and have implications for operators of abstractions and discharges such that they must provide and maintain safe passage (e.g. screening of intakes, eel passes). The Project has been designed to mitigate effects on eels where possible, and any remaining effects will be considered in the EIA.

Environmental Permitting Regulations

5.2.1.14 The Environmental Permitting Regulations 2010 SI2010/675 (as amended) require operators to obtain permits for some facilities, to register others as exempt and provides for ongoing supervision by

regulators. The project will require Environmental Permits (and exemptions) for various aspects of its construction and operation, for example excavations through landfill and storage of materials.

Safeguarding aerodrome, technical sites and military explosive storage areas

5.2.1.15 This Direction (2002, updated in December 2016) aims to guard against new or increased hazards caused by development. Developments especially relevant to the Project include the creation or modification of areas of water, which have the potential to attract gulls and wildfowl. The Project falls within the 13km buffer radius of Heathrow airport and therefore needs to avoid increasing the risk of bird strike. Heathrow Airport Limited is a statutory consultee for this project.

National Planning Policy Framework

5.2.1.16 The NPPF (DCLG, 2012) sets out UK government planning policies for England and how these are expected to be applied. The NPPF must be taken into account in the preparation of local and neighborhood plans, and is a material consideration in planning decisions. 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:

- Building a strong, competitive economy;
- Ensuring the vitality of town centres;
- Supporting a prosperous rural economy;
- Promoting sustainable transport;
- Supporting a high quality communications infrastructure;
- Delivering a wide choice of high quality homes;
- Requiring good design;
- Promoting healthy communities;
- 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 materials.

5.2.1.17 The National Planning Practice Guidance is a full set of legislation, policy and guidance that underpins the NPPF. Relevant guidance topics include: Climate change, Flood risk and coastal change, and natural environment.

5.2.1.18 The planning application for the Project will be considered against the NPPF and associated guidance by the Local Planning Authorities.

5.3 Local and regional policy

Thames River Basin Management Plan

5.3.1.1 The Thames RBMP has been prepared under ‘cycle 2’ (2015-2021) of the WFD. It describes the existing status of water bodies in the region, and sets out targets and deadlines for each to reach Good Ecological Status (for natural water bodies) or Good Ecological Potential (for Heavily Modified or Artificial water bodies). The RBMP provides a summary of measures which are envisaged to help achieve the environmental objectives. These objectives are being considered a part of the WFD Compliance Assessment for the Project.

Thames Catchment Abstraction Licensing Strategy

5.3.1.2 This licensing strategy (2014) sets out how water resources are managed in the Thames Catchment Abstraction Management Strategy (TCAMS) area. It provides information on how much water is available for abstraction within the River Thames catchment after consideration of the needs of the environment and existing abstractors. The Project has been designed to mitigate effects on existing abstractions, and any remaining effects will be considered in the EIA.

Thames Catchment Flood Management Plan

5.3.1.3 Catchment Flood Management Plans (CFMP) are used by the Environment Agency and partners to plan and manage future flood risk. They consider all types of inland flooding and take into account likely impacts of climate change, the effects of how land is used and managed and how to achieve sustainable development within the catchments. The Thames CFMP is split up into 43 sub-areas. Six policy options for the management of flood risk are applied to different sub-areas. The sub-area associated with the project, the Lower Thames area, is classified as a 'Heavily populated floodplain'. The preferred policy for the area is: 'Area of moderate to high flood risk where we can generally take further action to reduce flood risk'. The Project will need to align with the strategic flood risk management priorities of the Thames CFMP.

5.3.1.4 Each CFMP includes a 'post adoption statement' outlining how the environment has been taken into consideration during the development of the plan and how consultations have influenced the final plans. Project

Thames Estuary (TE2100)

5.3.1.5 The TE2100 Plan sets out how the Environment Agency is planning to manage tidal flood risk in the Thames Estuary until the year 2100. TE2100 covers the area of the River Thames estuary floodplain downstream of Teddington weir and sets out a series of flood risk management policies for different parts of the Thames Estuary. Discussion is therefore ongoing with the neighbouring TE2100 project team as part of the Project design development.

Local plans

5.3.1.6 The Project study area falls within six Local Planning Authority districts.

5.3.1.7 The London Plan (2016) incorporates the boroughs of LBRUT and RBKUT. This spatial development strategy sets a standard which the borough's individual local plans have to be in general conformity with, until its formal end date in 2036. On the topic of flood risk management the plan states that the Mayor will work with all relevant agencies to address current and future flood issues and minimise risk in a sustainable and cost effective way.

5.3.1.8 Local plans set out the priorities for development and are used for making decisions on planning applications. Generally local plans consist of local area specific policies and wider borough or district scale policies covering topics such as: Biodiversity, Green Infrastructure, Community Health and Well-being, Waste Reduction and Management, and Flooding. Supplementary Planning Documents give more detail to the policies in the Local Plans. The relevant local plans are listed below. These plans contain numerous planning policies which will require material consideration by each local authority when assessing the planning application for the Project:

- RBWM Local Plan 2003 saved policies. The draft Borough Local Plan up to 2033 underwent statutory consultation in December 2016;
- RBC Local Plan 2001 saved policies. The emerging RBC 2035 Local plan will replace the current 2001 Local Plan;
- SBC Core Strategy and Policies Development Plan document adopted 2009. A new Local Plan is currently being prepared by the authority;
- EBC Core Strategy 2011 and the EBC Development Management Plan;

- LBRUT Core Strategy (2009). The emerging Local Plan underwent statutory consultation at the beginning of 2017 and is scheduled for adoption in 2018; and
- The RBKUT Core Strategy (2012). The emerging RBKUT Local Plan is anticipated to cover the time period 2019-2041.

The planning application for the Project will be considered against the policies set out in the above local plans.

6 Approach to Scoping the Proposed Development

6.1.1.1 This Scoping Report describes the information that will be supplied in the ES. Scoping involves identifying the likely effects of the development that need to be considered in depth as part of the EIA. It also identifies the work and methodologies required to take forward the assessment of these effects.

6.1.1.2 The scoping process identified the key receptors that could be affected by the Project for each environmental topic. The source-pathway-receptor model was used to identify which receptors could be affected by identifying sources of environmental change; the receptors that may be sensitive to that change; and, pathways between sources and receptors.

6.1.1.3 The spatial, or geographical extent of the scoping assessment took into account the following aspects of the Project:

- The physical extent of the proposed works, as defined by the Project design;
- The nature of the baseline environment; and
- The manner in which the effects are likely to be propagated.

6.1.1.4 Based on the above, a 'standard study area' was defined by applying a 500m buffer around the flood relief channel, capacity improvement works, flood storage area and associated features. This was combined with the area that will experience a change in flood risk as a result of the Project (the 1 in 100 (one per cent), floodplain).

6.1.1.5 However, it was acknowledged that the standard study area was not applicable to all of the environmental topics, and more appropriate study areas were therefore defined for topics as needed. The study areas used to scope effects for each environmental topic are defined in the 'Approach to identifying potential environmental effects' at the beginning of Sections 7 to 15.

6.1.1.6 There is no statutory definition of what constitutes a significant effect. For the purposes of the proposed development, 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 taken into account in the EIA. This definition is consistent with other EIA projects.

6.1.1.7 In this Scoping Report, 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 expected magnitude of change upon each receptor (including consideration of their nature and duration, including: site specific and wider effects; positive and negative effects; temporary and permanent effects; direct, indirect and secondary effects; and cumulative effects (including interaction of project effects acting in-combination upon a receptor)); and
- The potential to avoid or reduce any potential effects such that they are unlikely to be significant.

6.1.1.8 Where sufficient information existed to inform expert judgement that there will not be a significant effect, the environmental receptor was identified as being able to be 'scoped out' of further assessment. These effects are not taken forward for more detailed consideration in the EIA process.

6.1.1.9 Where sufficient uncertainty remained such that an environmental receptor could not be 'scoped out' in relation to the potential for significant effects, then that receptor has been 'scoped in' for consideration in the EIA.

6.1.1.10 As per Schedule 4 of the EIA Regulations, the potential for cumulative effects to arise from the identified effects of the Project acting in-combination with "*other existing and/or approved projects*" has been considered as part of the Scoping process. Details of the other projects considered in the cumulative effects assessment are included in Appendix C. The potential for effects of the Project to overlap temporally or spatially with those of the other planned developments was considered. The source-pathway-receptor model was used to identify whether pathways existed such that the projects could act in-combination to result in a cumulative effect.

6.1.1.11 For effects that are likely to be significant, this Scoping Report sets out the work that is needed to take forward the assessment.

7 Air Quality & Climatic Factors

7.1 Approach to identifying potential environmental effects

7.1.1.1 This section considers the potential effects on air quality, climate and climate change arising from construction and operation of the proposed Project. Short term air quality changes are likely to occur during construction and operation, primarily as a result of changes in traffic movements due to reasons such as an influx of HGVs transporting construction materials, and an increase in cars and public transport due to tourism and recreation at a later stage once the proposed flood relief channel and associated features are in operation (see Section 12 and Section 15).

7.1.1.2 Effects on air quality have been assessed in relation to the standard study area (detailed in the Project Description). Conversely, when considering climate change, the study area will take the wider region (i.e. the South East of England) into account as its 'area of influence'.

7.1.1.3 A desk-based assessment of the air quality and climate baseline for the study area has been undertaken using data on Air Quality Management Area (AQMA) obtained from Defra, and climate data obtained from the Environment Agency and the Met Office.

7.2 Baseline information

7.2.1 Climatic factors

7.2.1.1 Average UK temperatures, sea level, and sea surface temperatures around the UK coast have risen since the mid-twentieth century; however, over the same time period, trends in precipitation and storminess are difficult to identify (UKCIP, 2014).

7.2.1.2 Over the past 45 years, all regions of the UK have experienced an increase in winter rainfall from heavy precipitation (UKCIP, 2014), which poses a greater risk of 'flash floods' than less intensive events, especially in lowland and urban areas.

7.2.1.3 Global average temperatures have increased by approximately 0.8°C since the late nineteenth century and about 0.2°C per decade over the last 25 years (Jenkins *et al.*, 2009). This warming is often attributed to human release of greenhouse gas emissions. A report issued by UKCIP describes how the UK climate has changed over the last 100 years, with key trends for the study area presented in Table 7-1. Regionally, between 1914 and 2006 there has been a rise in average annual temperature of 0.89°C in the South East and 1.18°C in London. Furthermore, the number of days of air frost has significantly decreased between 1961 and 2006. There has been a decrease in average annual rainfall; however seasonal variation in rainfall has changed dramatically over this period, with higher spring and summer precipitation but lower rainfall in autumn and winter.

Table 7-1: Recent climate change trends in London and the South East from 1914 to 2006 (unless otherwise stated) Jenkins *et al.* (2009).

Criteria	London	South East
Change in average annual temperature.	↑1.18°C	↑0.89°C
Change in daily maximum temperature.	↑1.11°C	↑0.81°C
Percentage change in spring precipitation.	↑3.0%	↑4.7%
Percentage change in summer precipitation.	↓18.4%	↓15.3%
Percentage change in autumn precipitation.	↑10.1%	↑9.3%
Percentage change in winter precipitation.	↓7.0%	↓6.2%
Change in days of rainfall of 1mm or above (1961-2006).	↑1.3	↓0.9
Change in days of air frost (1961-2006).	↓18.7	↓23.4

7.2.2 Air quality

7.2.2.1 With regards to air quality, local authorities are required by legislation to periodically monitor and assess the air quality as part of the Government's National Air Quality Strategy which aims to improve air quality in the UK. The main pollutants of concern are nitrogen dioxide (NO_2) and fine particulate matter (PM_{10}). AQMAs are put in place if these pollutants have exceeded or are likely to exceed their national Air Quality Objectives (AQOs). The objectives include targets to reduce the mean annual concentrations of pollutants and the number of exceedances of higher concentrations over shorter time periods (Table 7-2).

Table 7-2: National Air Quality Objectives (Defra, 2007).

Pollutant	Objective	Concentration measured as
Particles (PM_{10}).	50µg/m^3 not to be exceeded more than 35 times a year.	24 hour mean.
	40µg/m^3.	Annual mean.
Particles ($PM_{2.5}$).	25µg/m^3.	Annual mean.
	12µg/m^3.	Annual mean.
Nitrogen dioxide.	200µg/m^3 not to be exceeded more than 18 times a year.	1 hour mean.
	40µg/m^3.	Annual mean.

Fine particulate matter

7.2.2.2 PM_{10} is monitored in SBC, the LBRUT and the RBKUT; however not within the study area (SBC, 2015). PM_{10} concentrations in the RBC are considered to meet the objectives at all sites across the borough ('annualised' mean result of 22.6µg/m^3), therefore there may be a revocation of the existing M25 AQMA for PM_{10} in the future and this is currently under review (Figure SW-DR-V-00033) (RBC, 2013). PM_{10} levels are not currently monitored within the RBWM (RBWM, 2015) or in EBC (EBC, 2016). In addition to PM_{10}, previous air quality assessments have concluded that concentrations of carbon monoxide (CO), lead, sulphur dioxide (SO_2), 1,3-butadiene, and benzene are compliant with UK objectives in SBC (SBC, 2015).

Nitrogen dioxide

7.2.2.3 Due to NO_2 levels being high in the study area, a total of seven AQMAs have been put in place in or near the study area by the Local Authorities. A number of monitoring stations with NO_2 diffusion tubes have been set up and the locations of these are marked on Figure SW-DR-V-00033.

Channel Section 1

7.2.2.4 Air quality across RBWM is generally good; however there are localised hotspot areas of pollution where the annual mean level of NO_2 exceeds the AQO of 40 µg/m^3, mainly due to emissions from traffic using motorways (e.g. M25, M3, M4) and trunk roads (e.g. A30, A308, B376) which pass through the borough (RBWM, 2016 and UKCP, 2014).

7.2.2.5 RBWM has developed an Air Quality Action plan to work towards improving air quality. One component of the Action Plan was to create AQMAs, one of which is located within the study area ('Wraysbury Road/M25'; see Figure SW-DR-V-00033). Additionally, there is an AQMA in SBC ('SP3', see Figure SW-DR-V-00033) which covers Wraysbury Road and the M25 (SBC, 2015).

7.2.2.6 NO_2 concentrations have been continuously monitored within the two AQMAs mentioned above and the annual mean concentrations from the monitoring stations close to Channel Section 1 (between 2010 and 2014) are displayed in Figure 7-1. Concentrations within the RBWM Wraysbury Road/M25 AQMA ranged from 36.5 to 49.7µg/m^3, with 79 per cent of the values being over the accepted NO_2 Air AQO value of 40µg/m^3. The monitoring results in SBC ranged between 33.5µg/m^3 to 38.9µg/m^3 and consistently stayed below the AQO.

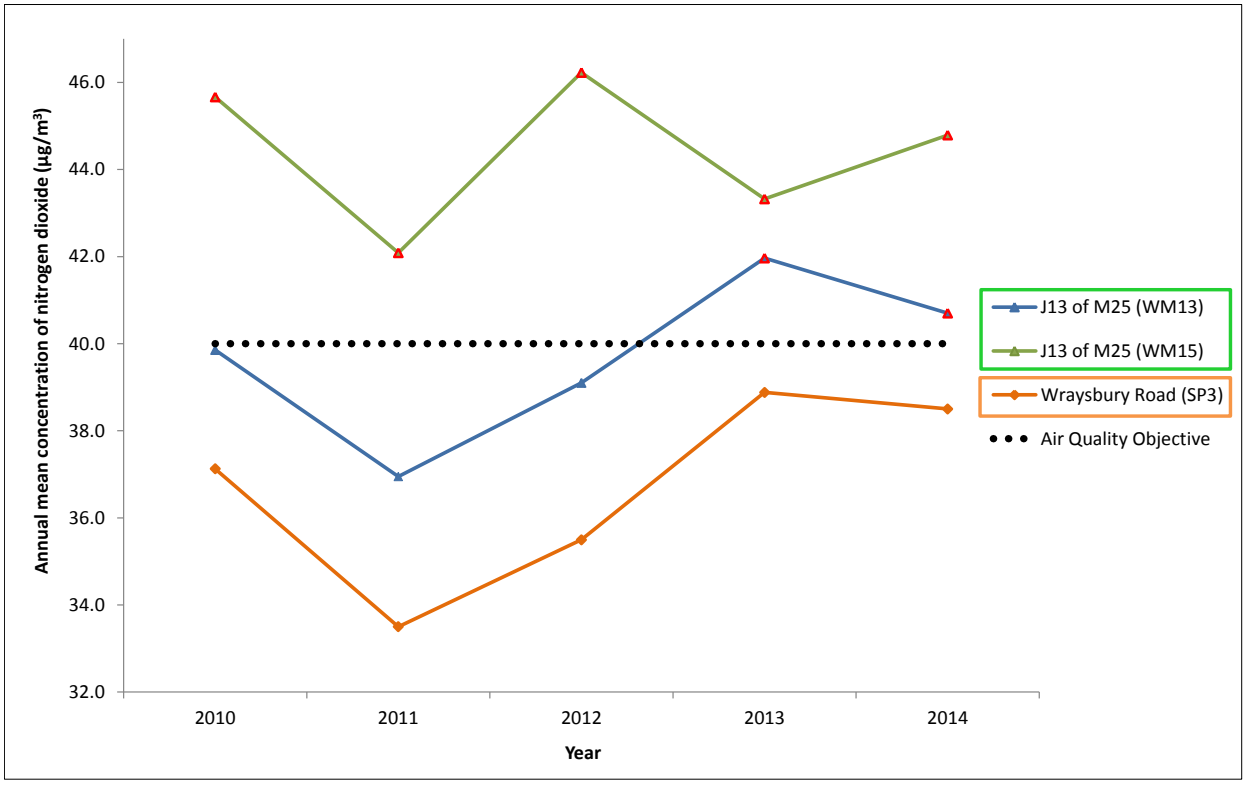

Figure 7-1: Annual mean concentration of nitrogen dioxide (µg/m^3) from monitoring stations in the M25/Wraysbury Road area within RBWM[1] (green box) and SBC (orange box) between 2010 and 2014. (Codes in brackets correspond with the respective borough's air quality report and are marked on the baseline maps; data points outlined in red signify a concentration above the AQO).

Channel Sections 2 and 3

7.2.2.7 RBC has defined an AQMA that runs along the M25 motorway just outside the study area (see inset on Figure SW-DR-V-00033). Road transport is the major source of air pollutant emissions within the RBC, and contributed 66 per cent of the total NO_2 and 67 per cent of the total particulates in 2010 (Defra, 2010).

[1] Please note RBWM stations have been averaged, as readings were duplicates/triplicates from the same site.

7.2.2.8 SBC has defined an AQMA, which covers the entire borough, including a large section of the study area around Channel Sections 2 and 3, including Wraysbury Reservoir, Staines, Laleham, Shepperton and a large section of the M3 motorway. SBC's AQMA also covers Stanwell which is in very close proximity to Heathrow Airport (see Figure SW-DR-V-00033).

7.2.2.9 The annual mean NO_2 concentrations from the above monitoring stations are displayed in Figure 7-2 below. Concentrations ranged from 24.2µg/m^3 (Station SP39, Knowle Green, Staines in 2012) to 61.4µg/m^3 (Station SP10, Walton Bridge Road, in 2013), with 28 per cent of the values being over the AQO of 40µg/m^3. However, it is important to note that NO_2 levels drop off significantly in a short distance from a road (SBC, 2015). The data shows that overall there was a decrease in average NO_2 values between 2014 and 2015 at the monitoring stations within SBC.

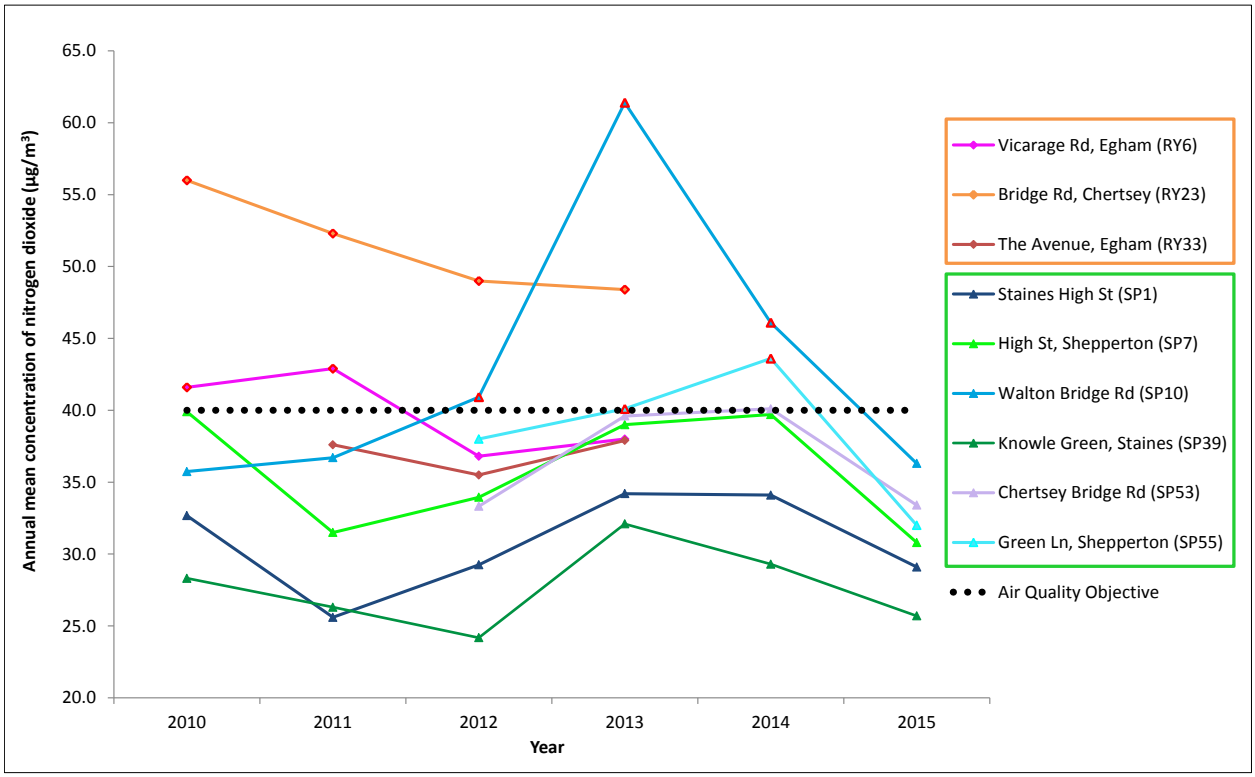

Figure 7-2: Annual mean concentration of nitrogen dioxide (µg/m^3) from monitoring stations in RBC (orange box), and SBC (green box) AQMAs (Codes in brackets correspond with the respective borough's air quality report and are marked on the baseline maps; data points outlined in red signify a concentration above the AQO).

Sunbury, Molesey and Teddington weirs

7.2.2.10 The SBC AQMA covers the whole borough, and reaches the area adjacent to Sunbury weir (see Figure SW-DR-V-00033). It has been declared due to elevated levels of NO_2 associated with traffic.

7.2.2.11 EBC, LBRUT and RBKUT AQMA's cover the study area around the Molesey and Teddington (see Figure SW-DR-V-00033). However, RBKUT has no monitoring stations within the study area boundary.

7.2.2.12 The annual mean NO_2 concentrations from the SBC and EBC monitoring stations are displayed in Figure 7-3 below. Concentrations ranged from 30.6µg/m^3 (at Station EL_HC5, Hampton Court, Molesey, in 2015) to 54.0µg/m^3 (at Station 14, Cross Deep, in 2009) with 64 per cent of the values being higher than the accepted NO_2 level of 40µg/m^3. The data shows that overall there was a decrease in average NO_2 values between 2014 and 2015 within all three boroughs.

Figure 7-3: Annual mean concentration of NO_2 (µg/m^3) from monitoring stations within SBC (green box), EBC (orange box), and RBRUT (purple box) AQMAs. (Codes in brackets correspond with the respective borough's air quality report and are marked on the baseline maps; data points outlined in red signify a concentration above the AQO).

Landfill gases

7.2.2.13 There are a number of authorised and historic landfill sites within the study area (locations of these are provided in Figure SW-DR-V-00044. Information on the type of landfill material is provided in Appendix D Table 1, and further details of which areas exceeded chemical thresholds are provided in Section 13.2).

7.2.2.14 Landfill gas contains many different gases and is produced when bacteria break down organic waste. Methane (CH_4) and carbon dioxide (CO_2) make up 90 to 98 per cent of it; the remaining 2 to 10 per cent includes nitrogen (N_2), oxygen (O_2), ammonia (NH_3), hydrogen sulphide (H_2S), and various other gases (State of New York Department of Health, 2010). Although rare, in an O_2 deprived environment, CO can also form (Haarstad, Bergerson & Sørheim, 2006). The amount of these gases depends on the type of waste present in the landfill, the age of the landfill, the O_2 content, the amount of moisture, and the temperature (i.e. gas production will have a positive correlation with an increase in temperature or moisture content). Though production of these gases generally reaches a peak in five to seven years, a landfill can continue to produce gases for over 50 years (State of New York Department of Health, 2010).

7.2.2.15 CH_4 is a major component of landfill gas; it is highly flammable and can cause explosive mixtures with air if it concentrates in an enclosed space with poor ventilation. CH_4 levels only have to be in the range of five to fifteen per cent of the total air volume to be considered an explosion hazard, however landfill gas explosions are rare occurrences (State of New York Department of Health, 2010).

7.2.2.16 CH_4 and CO_2 are colourless, odourless gases that can displace O_2 in enclosed spaces. Health effects associated with these gases are caused by asphyxiation due to reduced O_2 intake rather than a direct exposure; however, these effects have been directly reported from landfills (State of New York Department of Health, 2010).

7.2.2.17 Odours from landfill gas are caused primarily by H_2S and NH_3, which are produced during the breakdown of waste material (for example if construction or demolition debris contains drywall/gypsum board, H_2S can be formed). H_2S has the foul smell of rotten eggs, while NH_3 has a strong, pungent odour.

7.2.3 Future baseline

7.2.3.1 Climate change is likely to result in warmer temperatures, wetter winters and drier summers.

7.2.3.2 UK Climate Projections 2009 (UKCIP09) medium emissions scenario predicts that, for South East England and London summer and winter temperatures, and winter precipitation, will increase over the next 65 years. There is less certainty about changes in summer precipitation, although it is expected to decrease (UKCP, 2014).

7.2.3.3 Increased rainfall affects river levels, land and urban drainage systems, therefore the Environment Agency has made predictions of the anticipated change in both rainfall intensity, and peak river flow as a result of climate change (using 1961 to 1990 baseline data):

- Peak rainfall intensity is predicted to increase by five to ten per cent between 2015 and 2039, by ten to twenty per cent between 2040 and 2069, and by 20 to 40 per cent between 2070 and 2115 (Environment Agency, 2017a); and
- Peak river flow in the River Thames Basin is predicted to increase by 10 to 25 per cent between 2015 and 2039, by 15 to 35 per cent between 2040 and 2069, and by 25 to 70 per cent between 2070 and 2115 (Environment Agency, 2017a).

7.2.3.4 Overall, the long term trend for air quality in the UK is of improvement and has generally continued to improve since 1997 when the first Air Quality Strategy was adopted, involving the tightening controls on emissions of pollutants from industry, transport and domestic sources (Defra, 1997 and 2007 and SBC, 2016).

7.2.3.5 Road transport emissions of NO_X and PM_{10} are forecast to fall substantially between 2010 and 2040 by 62 per cent and 93 per cent, respectively. The National Transport Model (NTM) forecasts a continuing downward trend until 2025, in line with historical precedent and deployment of new vehicle standards. After 2025, NO_X and PM_{10} emissions are projected to plateau, but at significantly lower levels than those observed in 2010 (SBC, 2016 and DfT, 2013).

7.2.4 Key environmental constraints and opportunities

7.2.4.1 The key constraint in relation to climate is that the increase in peak rainfall and peak flows will gradually reduce the effectiveness of any flood risk management over time, as the flooding will occur more often and to a greater extent, and the flood relief channel will reach capacity more regularly.

7.2.4.2 The key constraint in relation to air quality is the changes in traffic movements resulting from construction (e.g. HGVs moving materials to and from site) and operation (e.g. areas of amenity will increase visitors and associated traffic movements) of the proposed Project. The study area is within or adjacent to a total of seven AQMAs; highlighting the importance of managing traffic movements and associated emissions.

7.3 Predicted changes to the environment and scope of assessment

7.3.1.1 Potential effects on air quality and climatic factors during construction and operation of the Project are discussed in Table 7-3.

Table 7-3: Potential effects relating during construction and operation.

Project activity	Potential effects and receptors	Could the effect be significant – yes/no?	Reason	Potential mitigation measures
Construction				
Project construction (including flood relief channel, flow control structures, associated features and weirs etc.) and general construction activities.	Potential adverse effects on air quality and AQMAs from dust.	Yes.	Generation of dust during earthworks and general construction activities has the potential to reduce air quality within the study area (including within AQMAs) during construction. Also see Table 8-2 (Section 8.3) and Table 12-2 (Section 12.3) for effects of dust on human health and biodiversity.	Dust mitigation is likely to include: Keeping the compounds, areas of hard standing, and roads clean; Washing vehicles to avoid the build-up of excess material; Damping down of stockpiles with water or covering them; and Use of dust screens as wind breaks. An Air Quality Impact Assessment will be undertaken prior to construction which may identify further mitigation measures (such as those included in 'The Control of Dust and Emissions During Construction and Demolition' Supplementary Planning Guidance (GLA, 2014)), and may include a management plan if necessary.
Excavation of flood relief channel and storage area through landfill.	Potential adverse effect on air quality and AQMAs through the release of landfill gases.	No.	Landfill gas presents a hazard through explosion or asphyxiation (European Commission, 2017). Emissions of landfill gases such as CH_4, CO_2, carbon monoxide (CO), NH_3, and hydrogen sulphide (H_2S) may be released into the air during excavation, which could be potentially toxic and/or volatile; however landfill gas explosions and asphyxiation from landfill gas are not common occurrences. The following mitigation measures will still be followed. Continued air quality monitoring of boreholes in landfill areas during construction, to monitor gaseous emissions. Areas of exposed landfill waste will be minimised. Also see Table 12-2 in Population (Section 12.3) for effects of potentially contaminated landfill gases on human health.	
	Potential adverse effects on local residents and businesses through the	Yes.	Emissions of landfill gases such as NH_3 and H_2S may be released into the air	Areas of exposed landfill waste will be

Project activity	Potential effects and receptors	Could the effect be significant – yes/no?	Reason	Potential mitigation measures
	release of odours from excavated landfill.		during excavation, which could potentially cause odour nuisance and harm to human health. Also see Table 12-2 in Population (Section 12.3) for effects of odour from excavated landfill on human health.	minimised. An Odour Impact Assessment will be undertaken prior to construction which may identify further mitigation measures, and may include a Management Plan if necessary.
	Potential adverse effect on climate contributing to climate change.	No.	In order to construct the proposed Project, a large amount of natural resources (i.e. materials and energy) will be required, which contribute towards greenhouse gas emissions and therefore climate change. As a result of the proposed mitigation measures to reduce use of natural resources, effects on climate change are not expected to be significant. These measures are stated in Table 11-1 of Section 11.3 on Natural Resources and Waste. These include: Materials Usage Plan and Energy Management Plan, as well as using the carbon calculator tool to minimise carbon emissions.	
On and off-site plant and vehicle and machinery movements.	Potential adverse effect on air quality and AQMAs due to emissions from an increase in traffic.	Yes.	A substantial number of vehicle movements will be required during construction to, bring plant, equipment and materials to site and to move them between different working areas and site compounds (see Section 4.2.1.13 in Project Description). HGVs will be needed to move excavated materials to the reprocessing sites. This has the potential to reduce air quality within the study area (including within AQMAs). Mitigation has been built into the design to reduce vehicle movements: • Use of barges on the River Thames for transporting plant, equipment and materials between the working areas at	Standard best practice construction site measures will be put in place to ensure emissions are limited (e.g. minimise plant idling time, all construction vehicles to have Diesel Oxidation Catalysts installed to reduce NOx and PM emissions etc.). An Air Quality Impact Assessment will be undertaken prior to construction which may identify further mitigation measures (such as those included in 'The Control of Dust and Emissions During Construction and Demolition' Supplementary Planning Guidance (GLA, 2014)), and may include a Management Plan.

Project activity	Potential effects and receptors	Could the effect be significant – yes/no?	Reason	Potential mitigation measures
			the River Thames weirs and the site compounds; and • Re-using most excavated materials on-site for landscaping and creation of the LEAs rather than removing off site.	
Operation				
Existence of LEAs and areas of habitat creation.	Potential adverse effect on air quality and AQMAs due to permanent increase in road traffic accessing the new LEAs.	Yes.	Creation of new Public Open Spaces and areas of habitat creation may attract more visitors to the area potentially causing increased traffic on local roads, which has the potential to increase emissions from vehicles resulting in an adverse effect on air quality (including within AQMAs). The provision of new walking/cycling routes and better connections between existing routes may limit the increase in road traffic associated with the LEAs.	Master planning and Urban Design Assessment will also be undertaken to consider the effects upon the public realm of creating areas of public access in terms of connectivity with existing transport links etc. An Air Quality Impact Assessment will be undertaken prior to construction which will identify mitigation measures (such as those included in 'The Control of Dust and Emissions During Construction and Demolition' Supplementary Planning Guidance (GLA, 2014)), which may include a management plan if necessary.
	Potential adverse effect on climate, contributing to climate change in the South East, due to long-term increase in traffic exhaust emissions.	No.	Additional vehicle movements and emissions in the local area associated with the LEAs would be a very small percentage of total vehicle numbers and therefore emissions in the South East, thus will have a negligible effect on regional climate change. It is also possible that there may be a reduction in vehicle movements during operation as people make use of the new walking/cycling routes, and improved connections with existing walking/cycling routes.	

7.4 Assessment methodology

7.4.1.1 Data on existing air quality and atmospheric pollutants will be assessed as part of the EIA to determine what the potential effect of the landfill and traffic emissions during construction (as well as traffic emissions during operation) will be, and how this may affect sensitive receptors.

7.4.1.2 Early engagement with the local planning authorities and environmental health departments will be important to establish the scope and detail of the Air Quality Assessment.

7.4.1.3 As Part of Air Quality Assessment, existing conditions will be determined by carrying out a review of all available data. Data sources will include the local authorities' air quality monitoring data and Air Quality Review and Assessment studies, as well as data collected by the Environment Agency's Site Investigations and ongoing monitoring of gas emissions from landfills within the study area. These will be compared against relevant British Standards (BS).

7.4.1.4 Following this the future baseline air quality will be determined, and whether this will be likely to approach or exceed the values set by relevant AQOs. The presence of AQMAs will be used an indicator of local hotspots where AQOs may be exceeded.

7.4.1.5 During construction, effects on air quality are likely to be limited to dust and landfill gas emissions (CH_4, CO_2 , hydrogen sulphide and carbon monoxide) from construction and excavation activities, and emissions from construction traffic (carbon monoxide, nitrogen dioxide and particulate matter). During operation affects are likely to be limited to emissions from traffic.

7.4.1.6 Effects from dust will be assessed qualitatively through a risk evaluation matrix. The effect of emissions from the exhausts of traffic during construction and operation along roadsides in the study area will be addressed (most likely using the Design Manual for Roads and Bridges (DMRB) screening methodology for the assessment of the effect on air quality of road traffic) and will include local traffic data, predictions of traffic during construction and operation, and background air quality data. This method provides a robust estimate of ground level concentrations for direct comparison and evaluation with respect to the standards included in the Air Quality Standards Regulations 2010.

7.4.1.7 The levels of contaminants will be tested for significance against accepted industrial threshold standards including generic assessment criteria such as Environment Quality Standards (EQS), Land Quality Management / Chartered Institute of Environmental Health 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 human health.

7.4.1.8 It is likely that an air emissions risk assessment will be required in order to obtain the Environmental Permit for excavation, recovery and re-use of landfill materials. This risk assessment will be completed in accordance with the Environment Agency's guidance on *Air emissions risk assessment for your environmental permit* (Environment Agency, 2016b), and will involve comparing the effect of the Project's emissions to air from constructing through landfill to the relevant environmental standards.

7.4.1.9 The air emissions risk assessment will screen out any substances (not previously identified in this document) which have an insignificant environmental effect, and identify the substances of concern and/or any emissions that could have a significant environmental effect, and thereby determine whether further detailed air quality modelling is required. If detailed air quality modelling is required, it will be carried out in accordance with the Environment Agency's guidance on *Environmental permitting: air dispersion modelling reports* (Environment Agency, 2014a).

7.4.1.10 The assessment of the effects of odour (in this instance, that result from the excavation of landfill) on surrounding receptors will describe the existing baseline odour conditions, along with the location of receptors and their relative sensitivities to odour effects. Details of the potential odour sources have been provided in the baseline section, along with a description of the control/mitigation measures incorporated into the Project. In line with best practice guidance (Bull et al, 2014), the predicted or observed odour effect of the Project, and the resulting effects on relevant sensitive receptors will take into account:

- The likely magnitude of odour emissions (after control measures);
- The meteorological characteristics of the site;
- The dispersion and dilution afforded by the pathway to the receptors and the resulting magnitude of odour that could result;
- The sensitivity of the receptors; and
- The potential for cumulative odour affects.

7.4.1.11 In order to predict or observe odour effects, an appropriate odour assessment tool will need to be identified and used; this may include atmospheric dispersion modelling.

7.4.1.12 There is no specific methodology for determining the significance of effects on air quality. The appraisal of significance will therefore be based on the general EIA assessment methodology as detailed in Section 17 and professional judgement.

7.5 Limitations and assumptions

7.5.1.1 There are very few stations for monitoring PM_{10} within the AQMAs and none within the study area, making it impossible to establish an accurate baseline for this aspect of air quality without collecting additional data.

7.5.1.2 Specific limitations associated with the availability and coverage of baseline information are:

- There is incomplete information on air quality within the study area as pollutant monitoring locations have only been placed within the AQMAs, which cover little of Channel Sections 1 and 2. Areas outside AQMAs are not monitored as the local authorities have concluded that the AQOs are unlikely to be breached; and
- Information is only available on the annual mean concentration of NO_2; therefore it will not be possible to assess the Project's effect on NO_2 against the existing minimum and maximum concentrations.

8 Biodiversity

8.1 Approach to identifying potential environmental effects

8.1.1.1 This section of the EIA Scoping Report considers the potential effects on biodiversity arising from the construction and operation of the Project. In determining the study areas for biodiversity, the Phase 1 Habitat Survey (P1HS) areas have generally been used as the study area for flora and fauna species (Figure SW-DR-V-00052), for designated nature conservation sites study areas of 2.5km from the proposed flood relief channel and Ham Lands, and 1km from the River Thames weirs[2] have been adopted(Figure SW-DR-V-00036).

8.1.1.2 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 (TVERC), Greenspace Information for Greater London (GiGL), Environment Agency fish and macrophyte surveys and results from a three-year (2012-2015) RTS Ecological Monitoring Project (Environment Agency, 2016c). Site specific ecological information has been gathered through an extended P1HS. With regards to fish species, records within 1km of the P1HS area have been collated, although this distance has been extended where there is potential for protected species located elsewhere to move into the study area. Desk study and observations during surveys have been used to inform a baseline of invasive non-native species (INNS) and published guidance used to assess the risk to biodiversity.

8.1.1.3 The results of the desk-based research and surveys are documented in full in the Preliminary Ecology Appraisal (PEA) Report for the Proposed Flood Channel (GBV, 2016) and the PEA for the Capacity Improvement Works on the River Thames weirs (GBV, 2015) (both in Appendix E). The baseline information in the PEA is also summarised in the following sections. Scientific (Latin) names for species are provided in Appendix F Table 8.

8.1.1.4 Consultation has been ongoing with Environment Agency fisheries and biodiversity specialists and Natural England which has inform the data-collection and PEA reporting process. In addition, other ecological organisations have attended individual meetings, stakeholder workshops and are part of project advisory groups, this includes; the Wildfowl and Wetlands Trust, Royal Society for Protection of Birds and local wildlife trusts. Furthermore, a specialist 'Fisheries and Biodiversity' advisory group has been created to guide the project design on these aspects.

8.2 Baseline information

8.2.1 Designated sites

8.2.1.1 The study area is crossed by a matrix of gravel pits restored to open water habitats following the end of extraction works. A number of these water bodies have been designated as part of the South West London Water bodies (SWLW) SPA and Ramsar site, which supports internationally important numbers of overwintering gadwall and shoveler. These species also overwinter on other lakes across the study area that are not formally part of the SPA, but are recognised as being supporting sites. Figure SW-DR-V-00036 and Table 8-1 provides details of the designated sites within 2.5km of the flood relief channel sections and the three River Thames weirs. Further details of the designated sites, including the reasons for their notification and ecological value, are provided in Appendix F Tables 1 to 5 and Figure SW-DR-V-00036.

[2] Given the relatively localised and small-scale nature of the proposed works at the three weirs, it is considered unlikely that any ecological effects would extend beyond 1km of the working areas (GBV, 2015). Therefore discussion is only provided on nature conservation sites within the 1km of the individual weirs

Table 8-1: Summary of the designated sites for nature conservation within 2.5km of the Project.

Designated sites	Number of sites within 2.5km	Those adjacent or intersected by the project
Channel Section 1		
Special Protection Area (SPA) and Ramsar Site.	6 lakes are part of the SWLW SPA and Ramsar site.	Wraysbury 2 North and South are part of the SWLW SPA and Ramsar site.
	3 additional lakes are considered to be supporting sites[3] for the SWLW SPA.	Datchet 3 Lake; Sunnymeads Lake; and Kingsmead Island Lake.
Site of Special Scientific Interest (SSSI).	7	Wraysbury & Hythe End Gravel Pits SSSI (which is also part of the SWLW SPA).
Special Area of Conservation (SAC).	1	None.
Local Nature Reserve (LNR).	1	None.
Site of Nature Conservation Interest (SNCI) (non-statutory).	19	Datchet Common and Gravel Pits SNCI; Horton & Kingsmead Lakes SNCI; Wraysbury 1 Gravel Pits SNCI; and Wraysbury 2 Gravel Pits SNCI.
Channel Section 2		
SPA and Ramsar Site.	1 lake is part of the SWLW SPA and Ramsar site.	St Ann's is part of the SWLW SPA and Ramsar site.
	4 additional lakes are considered to be supporting sites for the SWLW SPA.	Two of the four lakes are intersected by the Project: Fleet Lake; and Abbey Lake.
SSSI.	3	Thorpe Park No. 1 Gravel Pit SSSI (which is also part of the SWLW SPA); and Thorpe Hay Meadow SSSI.
LNR.	1	None.
SNCI (non-statutory).	26	The River Thames – Runnymede SNCI; Chertsey Bourne at Abbey Lake Complex SNCI; Abbey Lake Complex SNCI; and Laleham Burway Golf Course SNCI.
Channel Section 3 (and Desborough Cut)		
SPA and Ramsar Site.	1 lake is part of the SWLW SPA and Ramsar site.	None.

[3] Those water bodies outside of the current SWLW SPA and Ramsar site boundary but can be identified as important supporting sites using a threshold for the identification of such water bodes where the three year mean peak count exceeds 1 per cent of the cited SPA population for gadwall or shoveler.

Designated sites	Number of sites within 2.5km	Those adjacent or intersected by the project
	5 additional lakes are considered to be supporting sites for the SWLW SPA.	Three of the five lakes are intersected by the Project: Littleton North; Littleton East; and Ferry Lane Lake.
SSSI.	3	None.
LNR.	1	None.
SNCI (non-statutory).	30	The River Thames (and towpath) – Spelthorne SNCI; Shepperton Quarry SNCI; Sheepwalk Lake SNCI; Littleton Lake SNCI; Ferris Meadow SNCI; and Charlton Quarry SNCI.
Sunbury, Molesey and Teddington weirs		
SPA and Ramsar Site.	3 within 2.5km of Sunbury weir.	None.
SAC.	1	None.
SSSI.	4	None.
Nationnal Nature Reserve (NNR).	1	None.
LNR.	4	None.
SNCI (non-statutory).	25	River Thames and Tidal Tributaries SNCI; and River Thames – Elmbridge SNCI.
Ham Lands		
LNR.	4	Ham Lands
SNCI (non-statutory).	26	None.

8.2.2 Habitats and flora

8.2.2.1 The study area for the three channels can be characterised by the dominant habitat types (Figure SW-DR-V-00052):

- Channel Sections 1 and 3 (and Desborough Cut) both have three dominant habitat types: standing water, broad-leaved semi-natural woodland and cultivated / disturbed land – arable; and
- Channel Section 2 has four dominant habitat types: standing water, broad-leaved semi natural woodland, neutral grasslands and improved and amenity grasslands.

8.2.2.2 A key characteristic of the flood relief channel study areas, in particular in Channel Section 3, is that this landscape 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 lakes. River and lake water bodies contribute to much of the biodiversity of the area.

8.2.2.3 Sunbury weir site is situated in a semi-rural environment in outer London, and is dominated by a multi-functional green corridor created by the tree-lined section of the River Thames. The predominant habitat types at Sunbury weir are rough semi-improved grassland with scattered scrub and ruderals,

broadleaved woodland, dense scrub habitats and the tree lined running water and aquatic habitats of the River Thames (Figure SW-DR-V-00052).

8.2.2.4 The Molesey weir site is situated in an urban environment on the edge of London, adjacent to substantial areas of open space in Bushy Park and Hampton Court Park. The predominant habitat types are semi-improved grassland, semi-natural broadleaved woodland and the running water and aquatic habitats of the River Thames. Much of the area also comprises amenity grassland and hard standing of negligible ecological value (Figure SW-DR-V-00052). Private well-maintained gardens line the left bank of the River Thames, with some mature trees.

8.2.2.5 The Teddington weir site is situated in an urban environment on the edge of London. The predominant habitat types present are semi-improved grassland with tall ruderals and scattered scrub, broad-leaved semi-natural woodland, scattered trees and running water and intertidal habitats of the River Thames (Figure SW-DR-V-00052). Amenity grassland and hard standing dominate much of the area to the south and east of the study area. The mix of habitats, situated along the River Thames corridor, at all the weir sites contribute to the local biodiversity.

8.2.2.6 All habitat types and their associated species / populations have been described and attributed an ecological value reflecting their geographic significance in the PEA reports (Appendix E). The predominant habitats found across the study areas are described below plus any habitats assessed within the PEA as having more than negligible value. Appendix F Table 6 provides a summary of value for each study area. P1HS maps are included in Figure SW-DR-V-00052.

Standing water

8.2.2.7 Standing water accounts for approximately 40, 33 and 22 per cent of the habitat cover within the study areas of Channel Section 1, 2 and 3, respectively. The majority of these water bodies are the result of restored gravel and sand extraction pits. All of the water bodies are likely to support fish populations of varying sizes and assemblages (see the section on Fish below).

8.2.2.8 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.

8.2.2.9 Due to the large coverage of open water (estimated to be 4.9km^2 within the study area for the three channel sections), it is unsurprising that the area is an important habitat for overwintering waterfowl, resulting in the inclusion of five lakes (see Designated Sites Section above) within the SWLW SPA. It is likely that most of the water bodies of any significant size and open structure are used by overwintering and breeding wildfowl, although the level of use varies substantially on a lake by lake and yearly basis. Other species likely to utilise this habitat are described below.

Broadleaved semi-natural woodland and parkland

8.2.2.10 Woodland has colonised the narrow margins around and between many of the lakes, forming a thin lattice across the landscape within the Channel Section 1 study area. Woodland in Channel Section 2 and 3 does not form the same interconnected matrix. Despite this, there is still a broad distribution across the area, but it is limited to strips that partially run along the edges of other habitats or landscape features such as streams, lakes and roads.

8.2.2.11 Willow species dominate large proportions of the woodland habitats present, particularly those in close proximity to water, within the flood relief channel sections. In places there are clusters of mature to veteran pedunculate and sessile oak and 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. Species likely to utilise this habitat are described below.

8.2.2.12 There are areas of woodland within the River Thames weirs study areas; on the islands and within Ham Lands Local Nature Reserve (LNR), north of Teddington weir. The woodland areas on the islands tend to be dominated by immature sycamore and ash, whilst area of Ham Lands within the Teddington weir study area is dominated by willow, ash, hawthorn, elder, apple, and some planted oak.

Cultivated / disturbed land - arable

8.2.2.13 Arable land is dominant within the northern quarter of the Channel Section 1 study area and north of Littleton Lake, at Laleham Farm, within the Channel Section 3 study area. The majority of the fields are surrounded by defunct species poor hedgerows in combination with fencing, although some are flanked by lines of trees. This habitat type is generally of low habitat value for wildlife but can support a range of nesting birds including ground nesting.

Amenity and improved grassland

8.2.2.14 Present within Channel Section 2 and the River Thames weirs, these species poor grassland types are indicative of the intense human usage of the area, usually found in close proximity to urban areas, facilities and recreational areas. Although generally species poor botanically, these grasslands can still provide potential habitat for protected species within marginal habitats and landscape features such as rank grassland for reptiles and individual mature tree specimens for bats.

Neutral grassland; semi-improved and unimproved

8.2.2.15 The areas of both semi-improved and unimproved neutral grassland in Channel Section 2 provide supporting value for invertebrates, birds, reptiles and a high biodiversity value compared to many other habitats within the study area. Thorpe Hay Meadow is designated as a SSSI (Figure SW-DR-V-00036) as one of the last remaining unimproved hay meadows in Surrey; and the field immediately south is also currently considered as semi-improved neutral grassland but requires further survey to confirm its value.

Other habitats of ecological value

8.2.2.16 Other habitats of note within the flood relief channel sections include ephemeral / short perennial habitat, especially adjacent to the Sunnymeads lakes, in the Channel Section 1 study area. Such areas can potentially be of value to species including some ground nesting birds and reptile species where succession within this habitat has resulted in the correct vegetation structure.

8.2.2.17 There is one section of species rich, intact hedge, within Ankerwkye, in Channel Section 1, which may be an important hedgerow under the Hedgerow Regulations 1997 and may support birds and reptiles.

8.2.2.18 Scattered and dense scrub is also present throughout, along the margins of roads, railways, water bodies and some of the old landfill sites, especially Manor Farm, within the Channel Section 3 study area.

8.2.2.19 The scattered trees within the semi-improved grassland to the northeast of Teddington weir are mature; many of these have the potential to support roosting and foraging bats.

8.2.3 Protected and notable species

8.2.3.1 Only species assigned local or higher value within the PEAs are summarised below (refer to Appendix E for full details). A summary of their ecological value, within each channel section and the River Thames weirs is detailed in Appendix F Table 7.

Bats

8.2.3.2 The riparian habitat, woodland edges and green corridors connected to the wider river valley of the River Thames have a high suitability for commuting and foraging bats, and much of the study area is likely to be regularly used by bats for these purposes. Expected species for these types of habitats include: Noctule, Daubenton's, Leisler's, soprano pipistrelle, common pipistrelle and Natterer's.

8.2.3.3 Woodland, tree lined watercourses and parkland habitats present a wide range of potential roosting opportunities for bat species that utilise trees for roosting. In addition, the urban areas in close proximity to the proposed flood relief channel and River Thames weirs provide a wide range of both modern and historical buildings with features suitable for bat species with preferences for these roost

sites. This culmination of both urban and woodland roosting opportunities has the potential to support most UK bat species within their ranges.

8.2.3.4 Despite the good supporting habitat features for bats, there are very few existing bat records; only very low numbers of pipistrelle and Daubenton's in the flood relief channel study areas and seven species of bat foraging within the study area of the three River Thames weirs. It is highly likely that the presence of bat species is under recorded.

8.2.3.5 Approximately 100, 80 and 40 trees were provisionally identified as having some degree of bat roost potential within the Channel Section 1, 2 and 3 study areas, respectively during the P1HS. A number of trees, buildings, dilapidated structures and the existing weir canopies within the Teddington, Molesey and Sunbury weir study areas also provide potentially suitable roost sites for bats. However, this provisional identification does not represent a systematic search; hence it is likely that additional trees and other structures with favourable roost features are present in the area.

Great crested newts (GCN)

8.2.3.6 No biological records of GCN are present within any of the study areas; however, 61 water bodies of suitable size (under 2,000m^2) for GCN exist within 500m of the proposed flood relief channel. It is likely that many of the water bodies identified contain fish, a strong (but not absolute) excluding factor for GCN breeding. At this stage no formal Habitat Suitability Index assessment has been undertaken. It is also likely that on a wider landscape scale, large scale habitat fragmentation from disturbance and development in the area will have had a detrimental effect upon historic GCN populations. However, it is possible that isolated GCN populations may still remain within the area.

8.2.3.7 GCN are considered very unlikely to be present within the River Thames weirs study areas considering the location, general lack of ponds and no desk study records.

Reptiles

8.2.3.8 The semi-improved grassland, scattered scrub, poor semi-improved grassland and some areas of disturbed ephemeral vegetation throughout the study areas provide suitable habitat for widespread reptile species. Edge habitats, where interfaces between habitat boundaries create varied vegetative structures, are also likely to provide suitable habitat. There are biological records of grass snakes and they are likely to be the most frequently encountered reptile species within the area, due to their strong affinity with freshwater habitats. Slow worms and common lizards are also likely to be present.

Badgers

8.2.3.9 Two active outlier badger setts were recorded during the P1HS, one in the vicinity of Wraysbury 1 (S) Lake and another within Ankerwycke (both within the Channel Section 1 study area); these are thought to be two territories due to distance.

8.2.3.10 No further definitive field signs of badgers were recorded during the P1HS for the flood relief channel study areas and no biological records for badgers exist. As there is adequate suitable supporting habitat for badgers within the area, it is highly likely that the lack of records is due to badgers being under reported.

8.2.3.11 Within the Teddington weir study area badger foraging signs were recorded in semi-improved grassland in Ham Lands LNR. Many of the habitats, in the wider area, provide a potentially suitable foraging resource for the local badger population. Habitat suitable for badgers has not been identified within either the Sunbury or Molesey weir study areas.

Birds

8.2.3.12 As described within the Designated Sites section above and Appendix F Table 1, the study area for the flood relief channel contains designated and supporting habitats of international importance for overwintering gadwall and shoveler. Due to the spread and size of open water habitats the study area support a wide range of water fowl.

8.2.3.13 Biological records data and breeding bird surveys for the RTS Ecological Monitoring Project for the Channel Section 1 study area includes 18 species of protected birds as listed under Schedule 1 of the WCA (see GBV (2016) and Environment Agency (2016c) for details of those listed). Only four of these species (Cetti's warbler, merlin, barn owl and kingfisher) may potentially breed within this geographical region (RSPB, 2017).

8.2.3.14 Biological records data and breeding bird surveys for the RTS Ecological Monitoring Project for the Channel Section 2 study area includes two Schedule 1 species; black-necked grebe and kingfisher. Kingfisher could breed here however black-necked grebe usually breeds within the midlands and further north, using the south to overwinter.

8.2.3.15 Biological records data for the Channel Section 3 study area[4] include nine Schedule 1 species; scaup, kingfisher, Slavonian grebe, fieldfare, green sandpiper, greenshank, hobby, little ringed plover and redwing. The kingfisher, hobby and little ringed plover may breed within habitats found in the study area. Biological records for the flood relief channel study areas include a range of birds additionally listed as NERC priority species; grasshopper warbler, yellow wagtail, dunnock, brent goose, common starling, kestrel, reed bunting, yellow hammer, house sparrow and tree pipit. All of these NERC bird species may breed within habitats found in the study area except for brent goose.

8.2.3.16 Within the Sunbury weir and Teddington weir study areas, the complex of habitats results in structural diversity, and is well connected to the surrounding landscape and has a high potential value for birds.

8.2.3.17 The habitats present within the Molesey weir study area are not considered high value for birds in the context of the surrounding landscape, with the exception of the species-rich grassland within Hurst Park which may provide an important foraging resource.

8.2.3.18 Considering the wide range of habitats that different bird species will utilise for nesting, most habitats within the study area are likely to support further Schedule 1 birds, NERC birds species and/or unlisted bird species generally protected under the WCA.

Otters

8.2.3.19 No evidence of otters was found during the extended P1HS and no records of otters exist within the study area for the flood relief channel or River Thames weirs; however, there are recent biological records of otters along much of the River Thames corridor (published in local press, 2002-2010) and biological records include two otter sightings in the vicinity of Ferry Lane Lake (within the Channel Section 3 study area).

8.2.3.20 As many of the lakes are within close proximity to the River Thames and are stocked with fish (albeit site specific hydro-acoustic surveys for fish indicate low numbers of fish), it is possible that otters will visit to feed. Human activity in these areas is likely to be a limiting factor on the location of holts and couches, although there are some limited, secluded areas for this to still occur.

8.2.3.21 No field signs or evidence of otters were recorded in the study areas of the three River Thames weirs during P1HS, but some suitable habitat along the soft banks of the River Thames for holts and lying-up sites were identified near Teddington and Sunbury weirs.

Water voles

8.2.3.22 The water bodies within the flood relief channel study area are of mixed habitat quality for water voles. Most water bodies have slow flows and sufficiently deep water; however, poor bank profiles and over shading from woodland, and the resulting decrease in riparian cover, is likely to be an excluding factor. Two records for water voles exist for Pool End Ditch in the Channel Section 3 study area, hence it is possible that patchy populations may occur across the lakes and ditches in this area where conditions are suitable.

[4] No breeding bird surveys were undertaken in Channel Section 3 as part of the RTS Ecological Monitoring Project.

8.2.3.23 Suitable habitat for water voles has not been identified within the study area of the River Thames weirs.

Terrestrial invertebrates

8.2.3.24 No records of protected or notable terrestrial invertebrates exist within the Channel Section 1 study area. There are two records of notable terrestrial invertebrates within the Channel Section 2 study area; the NERC butterfly species (small heath and wall). Channel Section 3 study area has five records of protected or notable terrestrial invertebrates; stag beetle, one NERC butterfly species (small heath) and three NERC moth species (shaded broad-bar, cinnabar and grey dagger).

8.2.3.25 Records exist for stag beetles within the Teddington and Molesey weirs study areas, and there are some dead-wood and/or veteran trees with potential to support stag beetles and other invertebrates at all three River Thames weir study areas.

8.2.3.26 Given the size and range of habitats present within the study areas, it is likely that some notable species will be present. Habitats likely to be of particular importance are lake and river margins, semi-improved grassland, veteran trees and dead wood habitats.

Fish

Flood relief channel lakes

8.2.3.27 The flood relief channel study area encompasses 76 lakes, with at least 41 known to provide an important recreational fishing resource (Figure SW-DR-V-00038). Species information is available for many of the lakes, with the protected European eel recorded and some individual Atlantic salmon records (GBV, 2016); although salmon presence is likely to be very rare and an outcome of flooding events in the past (Environment Agency, 2016, pers. comm.).

8.2.3.28 Other notable species include bullhead and brook lamprey, although historical records only show a few individual records for brook lamprey within two lakes. The remaining fish assemblage includes species such as common bream, silver bream, chub, crucian carp, common carp, mirror carp, perch, pike, rudd, roach (and hybrids), bleak, gudgeon, goldfish, brown trout, rainbow trout, tench, dace, ruffe, three-spined stickleback and nine-spined stickleback. However, eDNA sampling undertaken in 2016, did not detect crucian carp and rudd in the lakes.

8.2.3.29 Seine netting surveys undertaken in 2016 (Hull International Fisheries Institute, 2016, 2016a, 2016b, 2016c, 2016d, 2016e, 2016f) at Datchet 2, Lower Hythe 3, Manor, St Ann's Lake and Sunnymeads 3, indicate fish assemblages typical of lowland still waters in southern England, dominated by eurytopic (generalist) species. The size structure of the populations indicates successful breeding of some species. Low fish densities were recorded which could potentially indicate the communities are in moderate/poor condition, however due to survey constraints it is possible that the densities of some fish, especially benthic species were underestimated.

8.2.3.30 Hydro-acoustic surveys across a number of lakes in May 2016, generally indicated low numbers of fish, with biomass ranging from 0.27kg/ha (Sheepwalk East 2) to 142.27kg/ha (Littleton North) and an average across all lakes surveyed of approximately 30kg/ha (Environment Agency, 2016d). By way of comparison, recommended stock densities for a recently created lake/gravel pit is 150kg/ha; for a mature gravel pit is 250kg/ha, and for a mature lowland estate lake is 350kg/ha (Environment Agency, 2000). The low biomass results for the lakes were unexpected and it is worth noting there are known populations of large carp in some of the lakes, however, their behaviour tends to make them difficult to detect with the survey equipment deployed (Environment Agency, 2017, pers. comm.).

River Thames and tributaries in the flood relief channel study areas

8.2.3.31 On the River Thames, 16-20 species have been recorded during adult surveys on each of the flood relief channel sections between 2004-2014) (Environment Agency, 2016e); including the protected European eel (including elvers), Atlantic salmon, barbel and brown/sea trout. Sea trout, which are present in greater numbers than salmon in the River Thames, are considered likely to spawn in the lower tributaries (Environment Agency, 2017, pers. comm.).

8.2.3.32 Adult population surveys of the River Thames by electric fishing from boats between 2004-2014 (Environment Agency, 2016e) have shown that the most abundant species were; roach and bleak in Channel Section 1 study area; roach in Channel Section 2 study area in most years, with gudgeon and dace in other years; and roach in Channel Section 3.

8.2.3.33 Juvenile monitoring surveys of the River Thames recorded a range of fish species, many of which are the same as those recorded during the adult surveys. Top characterising species has varied between year and location but includes chub, gudgeon, roach, dace and minnow. Spawning habitat was also identified for rheophilic and limnophilic species (Cascade, 2013), (Nunn, A.D. and Cowx, I.G., 2014).

8.2.3.34 Surveys (1986, 2002-2015) of the Colne Brook between 1986 and 2014 have identified at least 17 species (Environment Agency 2016f), with many of those already listed for the River Thames, including barbel, bullhead and European eel. The River Colne has also been identified as an important spawning site for barbel. There is limited Environment Agency survey data for the Chertsey Bourne although European eel has been recorded.

Sunbury, Molesey and Teddington weirs

8.2.3.35 Adult fish population surveys of the River Thames have been undertaken for Sunbury and Molesey weirs pools and downstream of Kingston Bridge (2.5km upstream of Teddington weir) between 2010-2014 (Environment Agency, 2016e). The protected European eel, Atlantic salmon, barbel and brown/sea trout were all found. Survey data found that roach was the most abundant species caught in each survey area, followed by gudgeon and dace at Sunbury, and bleak and dace at Molesey.

8.2.3.36 At Teddington weir, electric fishing and fyke surveys undertaken in 2016 (Hull International Fisheries Institute, 2016e) recorded poor downstream catches, with just small numbers of bleak, perch, roach and eel captured. Although, the low fish species richness and numbers recorded could potentially indicate that the community is in a poor/moderate condition, it is considered that fish numbers are more likely to have been underestimated due to survey limitations.

8.2.3.37 Environment Agency Fisheries and Biodiversity Technical Specialists (2015a and 2017, pers. comm.) have advised that river lamprey are known to occur in the River Thames.

8.2.3.38 Juvenile seine netting carried out in 2016 at Sunbury, Molesey and Teddington weirs on the River Thames (Hull International Fisheries Institute, 2016e, 2016f and 2016g), recorded fish assemblages typical of moderately impacted lowland rivers and similar to other sites surveyed on the River Thames between Marlow and Teddington in the same week and previous years. The surveys indicated self-sustaining populations of a number of eurytopic (generalist) and rheophilic (river specialist) species, dominated by varying numbers of roach, chub, dace, bleak and gudgeon. Teddington also included a small number of estuarine species and there was also a comparatively higher abundance of barbel at Sunbury. From the numerical dominance of particular species and the presence of larvae, it was suggested that spawning occurs in the vicinity of the River Thames weirs.

Zooplankton

8.2.3.39 Within the flood relief channel study areas, all of the surveyed lakes comprise zooplankton fauna that is diverse and shows no impact of specific stressors (Environment Agency, 2016c). Two *Cladocera* species of interest have been recorded. The crustacean *Ceriodaphnia setosa,* a rare species, belonging to the Daphniidae family has previously been recorded only from East Anglia, and recently South Wales, but is present in all lakes surveyed apart from Wraysbury 2 North. *Paralona pigra* (*Chydoridae*), a species with a single previous recorded location in south east England, was found at Datchet 2, Wraysbury 1 South and Abbey lakes.

Macroinvertebrates

8.2.3.40 All of the lakes surveyed (Environment Agency, 2016c) have a macroinvertebrate community that is diverse and shows no impact of specific stressors. No macroinvertebrate species of statutory conservation status have been recorded, but several nationally rare species have been found.

Channel Section 1

8.2.3.41 Eight lakes were surveyed in the Channel Section 1 study area, of these only Datchet 3 and Wraysbury 2 North did not include records of nationally rare invertebrate species. The invertebrate fauna of Wraysbury 1 South is particularly rich relative to other lakes surveyed, with an average taxon count per sample of 66. Wraysbury 2 North was also considered to be relatively rich comprising average taxon count of 52 (Environment Agency, 2016c).

8.2.3.42 On the River Thames, within the Channel Section 1 study area, the WFD water body (Cookham to Egham) has a macroinvertebrate status of High for the 2015 RBMP. See Section 14.2 for more information on WFD water bodies and Figure SW-DR-V-00047.

8.2.3.43 Assessments for macroinvertebrates, on the River Thames, at Datchet and Sunnymeads identified a high diversity and several notable species. The fauna at Sunnymeads is diverse, with a WFD classification of High, and includes records of small numbers of depressed river mussel (a NERC priority species). Surveys undertaken at Ham Island assessed macroinvertebrates as Moderate/Good for kick sampling and High for airlift sampling (Environment Agency, 2016c).

Channel Section 2

8.2.3.44 Within the Channel Section 2 study area, several nationally rare species were recorded in all of the six lakes surveyed. The invertebrate fauna of Abbey Lake is the richest of the lakes surveyed with a mean of 48 taxa, and includes 4 nationally rare species.

8.2.3.45 The WFD status for macroinvertebrates for the River Thames (Egham to Teddington) and the two WFD stretches on the Chertsey Bourne are Good or High for the 2015 RBMP. The Moat at Egham has a Poor status.

8.2.3.46 On the River Thames, there is an Environment Agency monitoring point at Laleham, which shows the river supports a diverse fauna, including some nationally rare species. There are no records of the depressed river mussel from this monitoring point but it has been historically recorded in 2006 between the M25 Bridge and Penton Hook (Aldridge, 2006).

Channel Section 3 (including Desborough Cut)

8.2.3.47 Within the Channel Section 3 study area, several nationally rare species were recorded in all of the six lakes surveyed. The invertebrate fauna of Littleton North includes four nationally rare species.

8.2.3.48 On the River Thames, within the Channel Section 3 study area, the WFD water body (Egham to Teddington) has a macroinvertebrate status of Good for the 2015 RBMP. There are no Environment Agency monitoring points within the Channel Section 3 study area; the closest is at Sunbury, downstream of the survey area (see paragraph 8.2.3.49 for further information).

Sunbury, Molesey and Teddington weirs

8.2.3.49 The Environment Agency monitoring points at Sunbury, Molesey and Teddington weirs show the areas all support diverse macroinvertebrate fauna, including some nationally rare species. Surveys at these sites indicate a benthic invertebrate community of High, Good and Moderate status in 2014 at Sunbury, Molesey and Teddington, respectively (Environment Agency, 2016c).

Macrophytes

8.2.3.50 Surveys during the Ecological Monitoring Project (Environment Agency, 2016c) of macrophyte assemblages indicate a WFD classification of Moderate to Poor for all the lakes surveyed across the flood relief channel study area. The Ecological Monitoring Project and RTS Lake Surveys for Macrophytes (Goodrich, S. and Goldsmith B., 2016) found a number of species of conservation interest to be present. The starry stonewort, assigned a Red Data List status of Vulnerable and a species of principal importance for nature conservation in England, was recorded in Wraysbury 1, Fleet, Manor, St Ann's and Abbey lakes, and surveys undertaken in 2016 also recorded at Datchet 3 South and within Littleton East. Other notable survey records include the Nationally Scarce round-fruited rush in

Wraysbury 1; frogbit *(*Red Data List status of Vulnerable) in Old Littleton Lane Lake; *Nitella mucronata var. gracillima* in Datchet 3 South (Nationally Scarce), and; great tassel stonewort (Red Data List status of Endangered and a species of principle importance for England) at Manor, Abbey, Fleet and Sheepwalk East Lakes.

8.2.3.51 Lake surveys from 2014-2016 (Environment Agency, 2016c), show a LEAFPACS WFD classification varying mostly between Poor or Moderate. There is the odd exception whereby a Bad status has been recorded, most recently at St Ann's lake in 2016, with a slightly higher Lake Macrophyte Nutrient Index, suggesting the taxa are more typical of enriched conditions. However, there were survey limitations associated with this site, including limited access resulting in only shore based surveys.

8.2.3.52 A number of designated WFD water bodies across the study area have combined macrophyte and phytobenthos statuses; Datchet Common Brook, the Thorpe Park Lake, the River Thames (Cookham to Egham) and (Egham to Teddington) and the Moat at Egham. These water bodies all have combined statuses of Moderate or Poor, with the exception of the River Thames (Cookham to Egham) which is classified as High.

8.2.3.53 There were two macrophyte survey locations on the River Thames, at Penton Hook (within the Channel Section 2 study area) and Raven's Ait (between Molesey and Teddington weirs); both sites were classified as Good using the LEAFPACS WFD classification methodology.

8.2.4 INNS

8.2.4.1 Plant and animal invasive non-native species INNS are found throughout all the study areas, within the lake water bodies, the River Thames, the tributary rivers of the River Thames and those rivers that feed into the lakes. INNS are introduced species that may spread to an extent where they cause damage to the environment, human economy or human health.

8.2.4.2 A systematic survey of INNS has not been undertaken to date. Records have been obtained from desk study sources and from incidental records from the P1HS and RTS Ecological Monitoring (Environment Agency, 2016c), RTS Lake Surveys for Macrophytes (Goodrich, S. and Goldsmith B., 2016) and advice from Environment Agency staff. Risk has been based first on the Great Britain Non-Native Species Secretariat (GBNNSS) Risk Assessments (GBNNSS, 2017) then UK WFD Technical Advisory Group (TAG) (June 2015). Risk is assessed in general terms to the UK rather than specific to the Project study area.

8.2.4.3 The most commonly recorded INNS within the lake water bodies are Nutall's pondweed and the zebra mussel, but other high risk species recorded in the lakes and water bodies include water fern, signal crayfish and Australian swamp stonecrop. eDNA surveys detected silver carp within seven lakes, albeit at very low readings below the threshold, therefore it cannot be confirmed with certainty whether this species is actually present and as such it remains a risk to be considered in future assessments. Terrestrial INNS include widespread Japanese knotweed and Himalayan balsam plus giant hogweed.

8.2.4.4 There is a high degree of interconnectivity between the lakes in the flood relief channel study area; either due to direct channel connections or flooding from the River Thames or tributaries. This means that certain aquatic species are likely to be much more widespread than existing records indicate. In particular it is possible that some of the species currently only recorded in the River Thames and other watercourses could be more widespread e.g. the high risk species bloody-red mysid (crustacean), floating pennywort, Asiatic clam, and demon shrimp. The nature of the site (heavily disturbed, urban-rural environment, with fishing and water sports), also adds to the risk of INNS (both terrestrial and aquatic) being more widespread than currently recorded or additional unrecorded species being found.

8.2.4.5 INNS recorded at Teddington and Sunbury weirs include Himalayan balsam and floating pennywort. However the River Thames which runs through all River Thames weir sites is known to also support a wide range of INNS including local records of; invasive non-native freshwater mussel species (including Zebra mussel), Chinese mitten crab, *Cheliocorophium curvispinum*, Northern river crangonyctid, sideswimmer, Asiatic clam, pikeperch / zander*, Dikerogammarus haemobaphes, Physella acuta* (Environment Agency 2015b and 2015c). The INNS red-eared terrapin is also known to be present in the River Thames at Teddington (Environment Agency, 2013) and there are records of signal crayfish.

8.2.4.6 In late September 2014 the quagga mussel (High Impact, currently on waiting list) was confirmed as being present in the River Thames including at Chertsey. This was the first UK record of this species, which was recently identified as the INNS of most concern to UK ecosystems (Environment Agency, 2016c). Since this initial confirmation, quagga mussel has also been confirmed as present at Molesey weir (Environment Agency, 2017a, pers. comm.). Due to its rapid ability to colonise, there is considered to be a high risk of it being present elsewhere within the study area or it spreading further by the time of the Project's construction and/ or operation.

8.2.4.7 Further details of all records of INNS are provided in the PEAs for the Flood Channel (GBV, 2016) and the capacity improvements to Teddington weir, Molesey weir and Teddington weir (GBV, 2015) and RTS Lake Surveys for Macrophytes (Goodrich, S. and Goldsmith B., 2016).

8.2.5 Future baseline

8.2.5.1 Although the structure of the habitats across the study areas is unlikely to change substantially from the existing conditions, there is potential that the distribution and size of populations of some species may change, especially with regards to INNS.

8.3 Predicted changes to the environment and scope of assessment

8.3.1.1 Potential effects on biodiversity during construction and operation are discussed in Table 8-2.

Table 8-2: Potential effects during construction and operation.

Project activity	Potential effects and receptors	Could the effect be significant – yes / no?	Reason	Potential mitigation measures
Construction				
Designated Sites				
General construction activities and movement of vehicles, equipment and site operatives.	Adverse disturbance to designated site interest features (birds) from noise, vibration, lighting and visual disturbance.	Yes.	General construction activities in close proximity to, or within designated sites or supporting lakes could result in disturbance of designated overwintering birds (gadwall and shoveler, plus tufted duck, goosander and an important assemblage of breeding birds nationally protected by the Wraysbury & Hythe End Gravel Pits SSSI). A detailed list of designated sites that are bisected or in close proximity to the flood relief channel works can be found in Table 8-1 in Section 8.2.	The HRA proposes that no works that are likely to give rise to disturbance are undertaken during the overwintering period (October – March) within 100m of the shore of any SPA or SPA-supporting lake. Assent will be sought from Natural England for the works. Built-in mitigation includes avoiding SPA supporting lakes (Abbey 1, Sheepwalk East and Littleton South).
	Adverse damage to terrestrial habitats in designated sites through soil compaction.	No.	Sites such as Wraysbury & Hythe End Gravel Pits SSSI, Ham Lands LNR and multiple Sites of Nature Conservation Interest SNCI sites within the project area are cited for their terrestrial habitats. Mechanical damage to habitats from repeated tracking or long term spoil storage could harm site biodiversity (with the exception of Thorpe Hay Meadow SSSI which will be avoided during construction). A detailed list of designated sites that are bisected or in close proximity to the flood relief channel works can be found in Table 8-1 in Section 8.2. Haul routes will be planned across the site to minimise affects; avoiding access through designated sites wherever possible. It may be possible to use the new channel as a haul road in certain locations. Good construction practices, in accordance with a Construction Environmental Management Plan (CEMP) and BS guidance on handling soils (BS3882), will ensure that these effects will be minimised. See Table 13-1in Section 13.3 for details. A restoration plan will be produced and agreed with the landowner/ manager, Natural England and/or local authorities (depending upon the level of site designation).	
	Potential negative effect on habitats of SNCIs from restricted access during construction.	No.	Access for management activities of the terrestrial SNCI sites (such as mowing) will be discussed with landowners/ managers and Natural England prior to works commencing to allow these activities to continue. Access requirements for management will be built-in into traffic management plans on a site by site basis.	

Project activity	Potential effects and receptors	Could the effect be significant – yes / no?	Reason	Potential mitigation measures
	Potential adverse effect on designated sites (SWLW SPA and Thorpe Hay Meadow) from construction dust.	Yes – Thorpe Hay Meadow.	Due to the close proximity of the new flood relief channel to Thorpe Hay Meadow there is a risk that dust accumulation could produce eutrophication (via nutrient input) of the nutrient poor grassland for which the SSSI is designated.	Dust mitigation during construction is discussed in Table 7-3 in Air Quality and Climate Change (Section 7.3). In addition, an Air Quality Impact Assessment will be undertaken prior to construction which may identify further mitigation.
		No – SWLW SPA.	Materials storage and processing sites, and site compounds will be located over 100m from the SPA or SPA-supporting lakes so dust effects on the SPA are scoped out.	
	Potential adverse effect on designated sites from spread of INNS.	Yes.	The movement of people and vehicles can be a pathway for INNS dispersal. INNS negatively affect a wide range of native species and habitats both terrestrial and aquatic by out-competing and excluding native species. A detailed list of designated and non-designated sites that are bisected or in close proximity to the flood relief channel works can be found in Table 8-1 in Section 8.2.	Terrestrial INNS surveys to confirm distribution of INNS will take place in 2017 to inform the EIA and identify suitable mitigation. Targeted aquatic INNS surveys may also be carried out as required if there is considered to be a risk of spread and a significant effect as a result. A biosecurity action plan for both aquatic and terrestrial INNS will be produced, detailing mitigation measures for each site, including consideration of equipment and materials entering site. A 'Japanese Knotweed Management Plan' technical memo has been produced, outlining the strategy of Japanese knotweed control for the Project. This will be refined following INNS surveys.
	Adverse effect on designated sites from accidental spillage or run-off from stored chemicals or fuel.	No.	Site compounds will not be sited within or close to designated sites. Mitigation is built-in to construction methodologies, making a significant pollution event unlikely. This will include: good construction practices in accordance with a CEMP and Government 'Pollution Prevention for Businesses' guidelines. These include ensuring chemicals and liquids are stored safely, drip trays are used underneath equipment and ensuring emergency spill kits are available.	
	Potential adverse increase in noise disturbance to interest features of the SWLW	No.	This effect is not likely to be significant. The SWLW SPA experiences a considerable level of existing noise disturbance from its proximity to the motorway and position under the flight path for Heathrow airport. It is therefore unlikely that a change in noise from baseline as a result of increased construction traffic would be detectable. The SPA interest features have habituated their use of the site to reflect existing levels of disturbance:	

Project activity	Potential effects and receptors	Could the effect be significant – yes / no?	Reason	Potential mitigation measures
	SPA from increased traffic on local roads.		shoveler use the River Thames reservoirs which are less disturbed, and gadwall have become habituated to noise disturbance from the motorways/roads and aircraft from Heathrow airport.	
Works in and around water bodies.	Potential for adverse effect on designated sites from pollution incidents.	No.	See Table 14-4in Surface Water, Groundwater and WFD (Section 14.3) for mitigation to address pollution incidents.	
Non-designated habitats, plus protected and notable species				
General construction activities and movement of vehicles, equipment and site operatives.	Potential adverse disturbance to aquatic and terrestrial protected and notable species via noise, vibration, lighting and visual disturbance.	Yes.	Noise and vibration can negatively affect European and nationally important species. Species considered potentially at risk and scoped in due to ecological value are badgers, bats, birds (Schedule 1 only), GCN, reptiles and water voles. Most of these are currently scoped in as a precaution and may be scoped out following further surveys. All fish species, including Atlantic salmon, European eel, brown and sea trout and barbel are potentially at risk. Some fish species may also be vulnerable during important periods of migration or spawning. Vehicle movements could cause disturbance to reptiles in particular. Strong lighting can negatively affect the emergence, commuting and foraging ability of nocturnal species. This leads to a decrease in their ability to freely move and find sustenance and the duration of foraging. Otter and bat species are particularly at risk of disturbance.	Protected species and further fish surveys of the affected lakes and tributaries will be conducted in 2017 to inform the EIA and to identify suitable mitigation. Haul routes will be planned to minimise disturbance to habitat supporting sensitive species in accordance with ecological best practice. Piling methods with minimal vibration and noise i.e. non-percussive methods will be used wherever practical. Lighting will be kept to a minimum and will be directed away from habitat and foraging routes to control light spill.
	Spread of INNS could adversely affect aquatic/terrestrial habitats, protected and notable species.	Yes.	The movement of people and vehicles can be a pathway for INNS dispersal. INNS negatively affect a wide range of native species and habitats both terrestrial and aquatic by out-competing and excluding native species.	For details of the potential mitigation measures in relation to INNS refer to the section above, in this table, on the effect of spreading INNS to designated sites during construction.

Project activity	Potential effects and receptors	Could the effect be significant – yes / no?	Reason	Potential mitigation measures
	Adverse damage to terrestrial habitats and terrestrial protected and notable species through soil compaction.	No.	Mechanical damage to habitats from repeated tracking or long term spoil storage could harm site biodiversity. Haul routes will be planned across the site to minimise affects. It may be possible to use the new channel as a haul road in certain locations. Good construction practices, in accordance with a CEMP, and BS guidance on handling soils (BS3882), will ensure that these effects will be minimised. See Table 13-1 in Soils and Geology (Section 13.3) for details. A restoration plan will be prepared and agreed with landowner/manager and relevant stakeholders. Tree and hedge protection measures are in Table 10-1 in Landscape and Visual Amenity (Section 10.3).	
	Adverse effect of erecting screens and fences creating barriers to movement of terrestrial protected and notable species.	No.	Unlikely to cause a significant barrier to wildlife movement as most animals will be able to move or dig under. All linear features can provide some kind of flight lines for bats. Pre-construction badger surveys will inform whether screens and fencing will need to be badger proof to prevent access of badgers to the construction areas (see below).	
	Adverse effect of clearance of vegetation on terrestrial protected and notable species.	Yes.	Vegetation and deadwood provide habitat which supports protected and notable species through: foraging resources, navigational features or transit corridors, and as places of shelter. Temporary loss of vegetation could inhibit some species' abilities to commute, forage and seek shelter. Fauna potentially effected and scoped in are bats, birds, badgers, reptiles, GCN and certain beetles and invertebrates.	Clearance will be conducted outside of the bird nesting season of March to September wherever possible, or under ecological supervision if within the season. Deadwood habitat creation/retention will be undertaken for stag beetles.
	Adverse effect of harming protected and notable species and habitats through accidental spillage or run-off from stored chemicals or fuel.	No.	Mitigation is built-in to construction methodologies, making a significant pollution event unlikely. This will include: good construction practices in accordance with a CEMP and Government 'Pollution Prevention for Businesses' guidelines. These include ensuring chemicals and liquids are stored safely, drip trays are used underneath equipment and ensuring emergency spill kits are available.	
Construction works	Potential for release / disturbance of sediment	Yes.	Construction of separation embankments in lakes, coffer dams at the River Thames weirs, widening of the	Measures will be undertaken to reduce the area of disturbance, including the use of silt curtains around the

Project activity	Potential effects and receptors	Could the effect be significant – yes / no?	Reason	Potential mitigation measures
within water bodies.	which may have an adverse effect on aquatic habitats, protected and notable species.		Desborough Cut, bank protection works to River Thames and intake structures at intersected tributaries have the potential to generate significant amounts of silt. This can lead to suffocation or smothering of aquatic organisms. Sediments may also contain historical pollution layers that may become mobilised again. All fish species, such as Atlantic salmon, European eel, brown and sea trout and barbel are potentially at risk.	working area to minimise the spread of sediment. Chemical testing of sediments will be undertaken in those locations most at risk of disturbance and mobilisation such as around the River Thames weirs, lakes and banks of the River Thames.
Demolition of buildings.	Potential adverse effect of loss of bat roosts and bird nesting locations.	Yes (for bats only).	The demolition of approximately four buildings could have a negative effect upon bats. Loss of the buildings could lead to the loss of important bat roost locations (which are protected from damage and disturbance) and /or direct harm to bats. The buildings could be utilised by nesting birds, however, the effect of demolition on local bird populations is not considered to be significant.	The buildings will be assessed for bat roosts in 2017, and if required, surveyed in line with the latest guidance from Natural England and the Bat Conservation Trust (BCT). The information gathered will inform the EIA and help to identify suitable mitigation. Mitigation specific to bats and or mitigation licence (if necessary) will be as that recommended by Natural England and BCT. Demolition will occur outside the nesting period, or pre-demolition bird surveys will be conducted.
Works in and around water bodies.	Potential for adverse effect on aquatic habitats and protected and notable species in water bodies through pollution incidents.	No.	See Table 14-4 in Surface Water, Groundwater and WFD (Section 14.3) for mitigation to address pollution incidents.	
Operation				
Designated Sites				
Reduction in flood risk.	Positive effect Thorpe Hay Meadow SSSI from a reduction in nutrient input and improved groundwater drainage.	No.	The Project will tend to lower the groundwater level under Thorpe Hay Meadow which will improve drainage in Spring, and reduce the incidence of flooding from the Meadlake Ditch and significantly from the River Thames. These indirect effects of the Project will reduce existing negative abiotic factors currently degrading Thorpe Hay Meadow but the biggest effect on the site is currently thought to be management; therefore the resulting effect on flood reduction/improved drainage is unlikely to be significant.	

Project activity	Potential effects and receptors	Could the effect be significant – yes / no?	Reason	Potential mitigation measures
Introducing an augmentation flow and flood water to lakes without separation embankments.	Potential for changes in water quality to negatively affect interest features of designated sites.	Yes.	See Table 14-4 in Surface Water, Groundwater and WFD (Section 14.3) for effects on water quality. Mixing of water bodies may lead to changes in water quality (e.g. from increase in suspended sediment, nutrient levels etc.) with subsequent effects on habitats. Effects on aquatic habitats within designated sites (SPA and SSSI) may in turn affect the interest features (gadwall and shoveler, plus tufted duck, goosander and an important assemblage of breeding birds nationally protected by Wraysbury & Hythe End Gravel Pits SSSI).	Water quality modelling is being carried out to assess the effect and to inform possible mitigation. Built-in mitigation in the project design includes avoiding SPA supporting lakes (Abbey 1, Sheepwalk East and Littleton South), and the flood relief channel at Kingsmead / Sunnymeads has been designed to be wide (~300-400m) and open and have expansive shallow water with convoluted shores to maximise the potential increase in suitable habitat and abundance of submerged macrophytes to benefit gadwall and shoveler.
	Adverse effect on aquatic habitats in designated sites from spread of INNS.	Yes.	Potential for infestation of lakes or marginal habitats by new invasive species present in surrounding water bodies and River Thames brought in by the augmentation or flood flows. Effect currently uncertain.	For details of the potential mitigation measures in relation to INNS refer to the section above, in this table, on the effect of spreading INNS to designated sites during construction.
Public access to LEAs, habitat creation areas, new footpaths / cycleways and navigable stretches of channel.	Potential negative disturbance of habitats within designated sites, and site interest features through increased public access.	No.	The Project could open up access to areas of habitat within designated sites which had previously had no / minimal human access. There is potential for disturbance to site interest features (gadwall and shoveler, plus tufted duck, goosander and an important assemblage of breeding birds nationally protected by the Wraysbury & Hythe End Gravel Pits SSSI) through navigation, noise, presence of dogs etc. Navigable stretches of the new flood relief channel have been identified to avoid the SPA/SSSI, and the location of footpaths and cycleways have been chosen to avoid being in close proximity. Further measures under consideration include signage, screening using bunds, planting and fencing, as well as public exclusion from certain areas.	
Existence of new flood relief channel.	Potential adverse effect from loss of open water habitat within SWLW SPA as a result of presence of separation embankments.	Yes.	Existence of separation embankments within SPA lakes will reduce the area of open water, with potential adverse effects on habitat availability for interest features of the SPA (gadwall and shoveler, plus tufted duck, goosander and an important assemblage of breeding birds nationally protected by the Wraysbury & Hythe End Gravel Pits SSSI).	Built-in mitigation has removed separation embankments from Littleton East (SPA supporting lake) thereby minimising loss of open water habitat. Footprint where separation embankments are required will be minimised by linking existing islands, where possible, and minimising the width of the separation embankment footprint. The Project provides new open water whilst sections of the flood relief channel design has been widened to

Project activity	Potential effects and receptors	Could the effect be significant – yes / no?	Reason	Potential mitigation measures
				create new areas of open water in proximity to existing SPA/SPA supporting lakes, and through lake edge shallowing in SPA supporting lakes.
Habitat creation along the new channel, in habitat creation areas, LEAs and the flood storage area at Ham Lands.	Potential positive effect on designated sites via provision of enhanced or new habitats (and new habitat corridor).	Yes.	Various opportunities for habitat creation or enhancement have been identified. Habitat creation (or enhancement) can improve a site by: Increased robustness to change, protecting a site's interest features; Provide new habitat for protected species; Stabilise vulnerable populations of flora and fauna by improving the carrying capacity; Increase overall aquatic or terrestrial biodiversity; and Mitigate and offset negative effects the project may have elsewhere.	N/A.
Non-designated habitats, plus protected and notable species				
Existence of new flood relief channel.	Land take for channel sections could negatively affect terrestrial habitats, protected and notable species.	No.	The flood relief channel will result in loss of terrestrial habitat (and thereby biodiversity), replaced by aquatic or riparian habitat. Through built-in mitigation, the flood relief channel has been routed through existing lakes which minimises the amount of terrestrial habitat loss that occurs. Mitigation through habitat creation and site enhancements will prevent long-term habitat loss (and associated loss of biodiversity) and effects on protected and notable species.	
	Habitat severance caused by existence of the flood relief channel might lead to negative effects on movement of terrestrial protected and notable species.	Yes.	The flood relief channel could be a significant barrier to the movement of terrestrial protected and notable species that cannot cross water (viviparous lizard, slow worm and hedgehog). However the banks of the new channel will also create new pathways or linear features for animals to follow. Movements of non-protected and notable terrestrial	Whether severance is likely to be a significant effect will depend on results of the fauna species found to be present in the 2017 surveys. If a population is deemed to be at risk of isolation that will cause it to become vulnerable, then suitable mitigation such as enhancing the site on which it is found or translocation will be implemented.

Project activity	Potential effects and receptors	Could the effect be significant – yes / no?	Reason	Potential mitigation measures
			animals may also be impeded but this is considered to not be significant.	
	Adverse effect on aquatic habitats, protected and notable species from spread of INNS.	Yes.	Potential for infestation of lakes or marginal habitats by new invasive species present in surrounding water bodies and River Thames which are brought in by the augmentation or flood flows. Impact currently uncertain. However, many could be already present and not recorded.	Separation embankments have been built-in to the design and will keep portions of lakes off-line. For details of the potential mitigation measures in relation to INNS refer to the section above, in this table, on the effect of spreading INNS to designated sites during construction.
Introducing an augmentation flow and flood water to lakes without separation embankments.	Potential changes in water quality may negatively affect aquatic habitats, protected and notable species.	Yes.	See Table 14-4 in Surface Water, Groundwater and WFD (Section 14.3) for effects on water quality. Mixing of water bodies may lead to changes in water quality (e.g. from increase in suspended sediment and nutrient levels) with subsequent effects on the community composition of aquatic habitats and protected and notable aquatic species.	None identified at this stage. Water quality modelling is being carried out to assess the effect and to inform possible mitigation.
Public access to LEAs, habitat creation areas, new footpaths / cycleways and navigable stretches of the flood relief channel.	Potential negative disturbance of terrestrial habitats, protected and notable species through increased public access.	Yes.	The Project could open up access to areas of habitat which had previously had no / minimal human access. There is potential for direct effects to terrestrial habitats through trampling and indirect disturbance to protected and notable species through noise, presence of dogs etc.	Mitigation will be carefully planned to minimise disturbance. Measures to be considered include screening, fencing and public exclusion from certain areas.
Existence of capacity improvements at the River Thames weirs.	Adverse risk of changing the hydromorphological conditions downstream of the weir (such as weir pools) causing potential adverse effect upon aquatic habitats, protected and notable species.	No.	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 are approximately 250m upstream of the main weir pool.	

Project activity	Potential effects and receptors	Could the effect be significant – yes / no?	Reason	Potential mitigation measures
	Positive effect on protected and notable aquatic species of improved fish passage at Molesey weir C.	No.	Built structures can prevent fish from travelling further upstream. Built-in mitigation of replacing an existing salmonid fish pass with a new multi-species fish pass at Molesey weir C will allow improved access for fish to travel along the course of the River Thames, improving fish populations upstream via migration and access to spawning ground.	
Existence of flood relief channel and LEAs.	Potential beneficial effect of net gain in biodiversity during operation.	Yes.	The new flood relief channel and provision of enhancements at the LEAs are expected to result in a net gain in biodiversity and will also provide greater habitat connectivity.	N/A.

8.4 Assessment methodology

8.4.1.1 A detailed ecological impact assessment (EcIA) will be undertaken as part of the EIA. The Chartered Institute for Ecology and Environmental Management (CIEEM) have published guidance on methods of assessing effects on ecological receptors under *Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal* (CIEEM, 2016). All ecological effects will be assessed against this guidance.

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

- A risk rating of species specific to the Project area 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 water bodies they may be spread to will be assessed; and
- Mitigation and monitoring identified.

8.4.1.3 Further ecological surveys are planned for 2017 to inform the EcIA are detailed in Table 8-3.

Table 8-3: Further ecological surveys planned for 2017.

Survey	Timing of survey
Water Vole	April- June & August – September 2017.
Breeding Bird	April – June 2017.
Terrestrial INNS	April – August 2017.
Reptile	April – September 2017.
GCN	April – June 2017.
Bat Roost Potential	April 2017.
Botany	May – August 2017.
Bat Emergence / Activity	May – September 2017.
Hedgerow	June/July 2017.
Tree / Arboricultural	June/July 2017.
Badger	October – November 2017.
Wintering Bird	October 2017 – March 2018.
Otter	April – October 2017.
Fish (tributaries)	November/December 2017.
Fish (hydro-acoustic)	April 2017.

8.4.1.4 Mitigation will follow standard best practice guidelines in discussion with Natural England. License applications will be sought as required and mitigation such as exclusion and translocation of species, habitat manipulation, creation and enhancement will be undertaken.

8.4.1.5 A HRA is being undertaken due to the Project's potential effects on the SWLW SPA and its interest features (populations of wintering gadwall and shoveler). The HRA will consider the water bodies within the boundary of the SPA and supporting water bodies (adjacent, but outside the site boundary) in close

consultation with Natural England. An initial screening assessment has been completed and further assessment and modelling is being completed to inform the final HRA.

8.5 Limitations and assumptions

8.5.1.1 Where there is insufficient information on a habitat or species then a precautionary approach has been applied to the significance of effect upon the receptor, which is in-line with CIEEM guidance on EcIA. As information is gained from planned surveys (listed in paragraph 8.4.1.3) this will potentially scope out some of the receptors from the EcIA.

8.5.1.2 All surveys will be 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.

9 Cultural Heritage, Archaeology & Built Heritage

9.1 Approach to identifying potential environmental effects

9.1.1.1 This section considers the key features of the cultural heritage resource and the changes that are predicted to occur as a result of the Project. Following this, the suggested scope of the EIA assessment is provided along with an explanation of the methodology that will be used for the assessment. Enhancements that have been identified during the EIA scoping period are then outlined; and, finally, any limitations and assumptions that apply to the Scoping assessment are clarified.

9.1.1.2 The cultural heritage resource can be 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, an 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, Section 3, Part 2).

9.1.1.3 The information presented is based upon research carried out to inform a Cultural Heritage and Archaeological Desk Based Assessment (DBA) for the Project (Appendix G). The DBA report follows best practice procedures produced by Historic England and the Chartered Institute for Archaeologists. Numerous data sources and investigation techniques were used, including: site walkovers; setting assessments; historic map regression; local authority Historic Environment Records (HER); the National Record of the Historic Environment database (including National Heritage List for England, National Mapping Programme and Heritage Gateway); aerial photography data; Light Detection and Ranging (Lidar) data; geoarchaeological data; and, published and unpublished archaeological reports from archaeological 'events' (investigations) previously undertaken in the area.

9.1.1.4 The study area for this topic comprises individual study areas around the flood relief channel, Desborough Cut, the three River Thames weirs and Ham Lands (see Figure SW-DR-V-0034). The study areas around each flood relief channel section are 1km across (a 500m buffer around each section of the flood relief channel), altogether comprising some 17.5km^2 within the valley of the River Thames. The centre of the downstream capacity improvements at the Desborough Cut, Sunbury weir, Molesey weir and Teddington weir are also subject to a 500m buffer study area.

9.1.1.5 Consultation is ongoing with cultural heritage and archaeology specialists within Historic England, the Environment Agency, local authorities and their archaeological advisors. Feedback received has been taken into account in the DBA and within the proposed archaeological evaluation strategy. The heritage stakeholders will continue to be engaged throughout all relevant stages of the project.

9.2 Baseline information

9.2.1.1 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 monuments, previous finds and Roman roads) and areas of archaeological interest (for example palaeochannels) are known to exist or are likely to exist within the study area (Figure SW-DR-V-00034). However, the area is also a densely occupied and developed modern landscape; which must be taken into account when considering potential changes that may result from the Project.

9.2.1.2 Recently in this reach of the River Thames there have been a number of 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), 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 Section 4 of the DBA and briefly summarised below).

9.2.1.3 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.

9.2.1.4 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.

9.2.1.5 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).

9.2.1.6 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.

9.2.1.7 At the western end of the study area, 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.

9.2.1.8 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.

9.2.1.9 Several areas have been identified which contain evidence from multiple periods on the same site. These key heritage assets in the study area include the multi-period prehistoric site at Southlea Farm with finds including prehistoric pottery and flint and a Bronze Age series of ring ditches. Datchet contains evidence of activity from a range of time periods dating back to the Mesolithic Periods. 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.

9.2.2 Heritage assets, their setting and the archaeological potential in Channel Section 1

9.2.2.1 The majority of Channel Section 1 is located within the RBWM, the only Royal Borough to sit outside of Greater London. It inherits its royal status from Windsor Castle and, as such contains an unusually high level of Listed Buildings and general heritage assets dating from the High to Post-Medieval periods.

9.2.2.2 Records from the RBWM and Surrey HER within the Channel Section 1 study area include designated entries, including the Scheduled Monuments of part of the Early Medieval and Medieval palace and associated monuments at Old Windsor, as well as a Scheduled Bronze Age site located immediately west of Runnymede Bridge. There are also 14 Listed Buildings (all Grade II) and a Registered Park and Garden, Windsor Home Park (medieval in origin), located within this channel study area.

9.2.2.3 There are a total of 101 non-designated heritage assets, including some from the SHINE register (Selected Heritage Inventory for Natural England). The majority of these relate to prehistoric sites, including finds of pottery, flint and metal artefacts, and features including pits, ring ditches and barrow cemeteries. Roman activity within the Channel Section 1 study area is represented in the form of a Roman Road at the very southern end of the reach, and a Saxon coin hoard. Post-medieval assets with the Channel Section 1 study area include sections of the London and South Western Railway.

9.2.2.4 Numbers of designated and non-designated assets are shown in Table 9-1 and individual heritage assets are discussed in detail within Section 5.2 of the DBA (see Appendix G).

Table 9-1: Quantity of Historic Environment Records in Channel Section 1 study area.

Channel Section 1 Historic Environment Records	
Scheduled Monuments	2
Registered Park and Gardens	1
Listed Buildings	14
TOTAL DESIGNATED	**17**
NON-DESIGNATED (incl. SHINE)	**101**

9.2.2.5 Assessment has been undertaken to identify the designated assets likely to be affected and assess the contribution of their setting[5]. This assessment is summarised in Section 8 of the DBA and provided in detail in DBA Appendix 6 (within Appendix G). Baseline information about the setting of key designated assets within Channel Section 1 is provided in the paragraphs below.

9.2.2.6 Where the route of Channel Section 1 crosses Station Road, Wraysbury it passes between two Listed Buildings Greenwood and Tithe Farm Cottage (Figure SW-DR-V-00034, sheet 1). The tree-fringed Station Road provides a positive setting. Views towards existing quarry lagoons are shielded by trees and/ or surrounding buildings.

9.2.2.7 There is a Bronze Age settlement, west of Runnymede Bridge, within the study area which is designated as a Scheduled Monument (Figure SW-DR-V-00034, sheet 1). This site is now a scrubby and overgrown patch of grassland on the right bank of the River Thames, sandwiched between A30/ M25 river crossing and modern hotel buildings. The outlet of Channel Section 1 lies 160m upstream adjacent to the lock and weir and may intrude into views north from the River Thames frontage. However, although the riverside location contributes to context, the setting does little to enhance the site's significance.

[5] The '**setting**' of heritage assets is the surroundings in which a heritage asset is experienced (Historic England, 2015). Elements of a setting may make a positive or negative contribution to the significance of an asset, may affect the ability to appreciate that significance or may be neutral. Its extent is not fixed and may change as the asset and its surroundings evolve. Setting is the context of a heritage asset and can include noise, physical links and land use as well as views.

9.2.2.8 A period synthesis discussing in detail the evidence of human activity within Channel Section 1 and the potential for archaeological remains is provided within Section 9.1 of the DBA.

9.2.2.9 Studies of aerial photography and Lidar evidence carried out as part of the DBA have demonstrated crop marks and land features indicating a complex and multi-period buried landscape (discussed in further detail within Section 5 and Appendices 3 and 4 of the DBA).

9.2.3 Heritage assets, their setting and the archaeological potential in Channel Section 2

9.2.3.1 Channel Section 2 is within the county of Surrey and as such is covered by the Surrey HER. Records show designated entries within this channel section including the Scheduled Monuments of Chertsey Abbey and Chertsey Bridge and 24 Listed Buildings, which cluster, with few exceptions, around the historic core of Chertsey. There are no Registered Parks and Gardens within this channel section.

9.2.3.2 There are 63 recorded non-designated heritage assets within this channel section. 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.

9.2.3.3 Numbers of designated and non-designated assets are shown in Table 9-2 and the individual heritage assets are discussed in detail within Section 5.3 of the DBA and shown on Figure SW-DR-V-00034, sheet 2.

Table 9-2: Quantity of Historic Environment Records in Channel Section 2 study area.

Channel Section 2 Historic Environment Records[6]	
Scheduled Monuments	2
Listed Buildings	24
TOTAL DESIGNATED	**26**
NON-DESIGNATED	**63**

9.2.3.4 Assessment has been undertaken to identify the designated assets likely to be affected and assess the contribution of their setting. This assessment is summarised in Section 8 of the DBA and provided in detail in DBA Appendix 6. Baseline information about the setting of key designated assets within Channel Section 2 is provided in the paragraphs below.

9.2.3.5 There is a cluster of listed structures at Eastley End, a few hundred metres to the west of the Channel Section 2 crossing of Norlands Lane (Figure SW-DR-V-00034, sheet 2). None are in the immediate vicinity of the flood relief channel and all appear well screened by trees. West again is the Grade II* listed 286 Cemex House, built as a corporate headquarters in 1988-89 sitting alongside the worked out quarry lagoons and their now tree-fringed margins.

9.2.3.6 The site of the Chertsey Abbey Scheduled Monument (Figure SW-DR-V-00034, sheet 2) enjoys a positive setting within the Chertsey Conservation Area (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 already significantly impacts 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. The route of Channel Section 2 lies north of the motorway. The Scheduled Area encompasses an earthwork on the

[6] It should be noted that seven heritage assets fall within both the Channel Section 2 and Channel Section 3 study Areas: 179, 180, 181, 182, 251, 393 and 394.

floodplain (the former Abbey Meads) but there is no inter-visibility between this and the far side of the motorway.

9.2.3.7 The Scheduled Monument of Chertsey Bridge (Figure SW-DR-V-00034, sheet 2) 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. The outlet of Channel Section 2 might intrude into northward vistas (depending on scale of structure, extent of vegetation clearance).

9.2.3.8 A period synthesis discussing in detail the evidence of human activity within Channel Section 2 and the potential for archaeological remains is provided within Section 9.2 of the DBA.

9.2.3.9 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 the Abbey Meads and ridge and furrow remnants at Laleham Burway and Laleham Park). These features are discussed further in Section 5 and Appendices 3 and 4 of the DBA.

9.2.4 Heritage assets, their setting and the archaeological potential in Channel Section 3

9.2.4.1 Channel Section 3 is within Surrey. 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 SW-DR-V-00034, sheet 2). This Scheduled Monument is located adjacent to a water-filled gravel pit and its densely vegetated margins on the northern limits of Channel Section 3. The setting of the monument detracts slightly from its significance, as the immediate hinterland is vastly different to its original landscape, now comprising a school playing field, residential area and water-filled gravel pit.

9.2.4.2 Aside from the Listed Buildings which span both the Channel Section 2 and Channel Section 3 study areas, all of the Listed Buildings within the Channel Section 3 study area are clustered at the eastern end and are mostly 18th and 19th century in date. Of note is the 15th century rectory at Shepperton (244) and the Church of St Nicolas in Shepperton (249), built around 1600. There are no Registered Parks and Gardens within this section.

9.2.4.3 The majority of the Listed Buildings in the old core of Shepperton (Figure SW-DR-V-00034, sheet 2) are concentrated around Church Street, Church Square and the Church of St Nicholas. This provides a positive setting defined by their grouping around the church and on these streets. There is no intervisibility with proposed Channel Section 3, with the potential exception of 'Manor House' and 'The Old Ferry House' on Church Road and Church Square respectively, which have southward vistas which might be impacted by changes to the vegetated margins of the former quarry lagoon or riverside.

9.2.4.4 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 (much like the Listed Buildings).

9.2.4.5 Numbers of designated and non-designated assets are shown in Table 9-3 and the individual heritage assets are discussed in detail within Section 5.4 of the DBA and shown on Figure SW-DR-V-00034.

Table 9-3: Quantity of Historic Environment Records within Channel Section 3 study area.

Channel Section 3 Historic Environment Records[7]	
Scheduled Monuments	1
Listed Buildings	24
TOTAL DESIGNATED	**25**
NON-DESIGNATED	**76**

9.2.4.6 Assessment has been undertaken to identify the designated assets likely to be affected and assess the contribution of their setting. This assessment is summarised in Section 8 of the DBA and provided in detail in DBA Appendix 6.

9.2.4.7 Eyot House (Figure SW-DR-V-00034, sheet 2) lies opposite the outlet of Channel Section 3. Its setting on a wooded island in the River Thames contributes to its significance. Although facing south and connected by a bridge to the right bank of the River Thames (away from the proposed channel outlet) the wooded river banks to the north form part of the setting.

9.2.4.8 A period synthesis discussing in detail the evidence of human activity within Channel Section 3 and the potential for archaeological remains is provided within Section 9.3 of the DBA.

9.2.4.9 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 5 and Appendices 3 and 4 of the DBA.

9.2.5 Heritage assets, their setting and the archaeological potential at Desborough Cut

9.2.5.1 Desborough Cut runs through EBC, within the county of Surrey. Surrey HER shows a small number of designated and non-designated heritage assets recorded in the vicinity of this short stretch of channel. There is one Registered Park and Garden within this area: Oatlands Palace and five Listed Buildings (Figure SW-DR-V-00034, sheet 2). There are no Scheduled Monuments within this area.

9.2.5.2 There are 32 recorded non-designated heritage assets within the Desborough Cut study area (see Section 5.5 of the DBA). The records are spread fairly evenly throughout the area, although they are slightly more common at the eastern end. The sites range in date from Mesolithic to 20th century.

9.2.5.3 Numbers of designated and non-designated assets are shown in Table 9-4 and the individual heritage assets are discussed in detail within Section 5.5 of the DBA.

Table 9-4: Quantity of Historic Environment Records in the Desborough Cut study area.

Desborough Cut Historic Environment Records[8]	
Listed Buildings	5
Registered Park and Garden	1
TOTAL DESIGNATED	**6**
NON-DESIGNATED	**32**

[7] Five heritage assets fall within both the Channel Section 2 and Channel Section 3 study Areas: 179-181 and, 251. There are 11 assets which fall within both the Channel Section 3 and Desborough Cut Study Areas: 252-262.

[8] It should be noted that there are 11 assets which fall within both the Channel Section 3 and Desborough Cut studies areas: 252-262.

9.2.5.4 Assessment has been undertaken to identify the designated assets likely to be affected and assess the contribution of their setting. This assessment is summarised in Section 8 of the DBA and provided in detail in DBA Appendix 6.

9.2.5.5 The information on the setting of Eyot House provided under Channel Section 3 is also relevant to the Desborough Cut study area. No other heritage assets with potential for setting issues associated with the proposed Desborough Cut works were identified.

9.2.5.6 A period synthesis discussing in detail the evidence of human activity within the Desborough Cut and the potential for archaeological remains is provided within Section 9.4 of the DBA.

9.2.5.7 Possible cropmarks at Oatlands Park were identified by studies of aerial photography and Lidar evidence carried out as part of the DBA these features and this work is discussed further in Section 5 and Appendices 3 and 4 of the DBA.

9.2.6 Heritage assets, their setting and the archaeological potential at the three River Thames weirs

9.2.6.1 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.

9.2.6.2 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 (327)) and three Registered Parks and Gardens (gardens at Hampton Court (429), gardens at Hampton Court House (351) and Bushy Park (350)) within the Molesey weir study area. The other designated sites at the three River Thames weirs are all Listed Buildings.

9.2.6.3 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.

9.2.6.4 Numbers of designated and non-designated assets at each weir are shown in Table 9-5 and the individual heritage assets are discussed in detail within Sections 5.6 - 5.8 of the DBA.

Table 9-5: Quantity of Historic Environment Records (HER) in the three River Thames weirs study area.

	Sunbury weir HER	Molesey weir HER	Teddington weir HER
Scheduled Monuments	0	1	0
Registered Parks and Gardens	0	3	0
Listed Buildings	19	27	8
TOTAL DESIGNATED	**19**	**31**	**8**
NON-DESIGNATED	**26**	**41**	**15**

9.2.6.5 Assessment has been undertaken to identify the designated assets likely to be affected and assess the contribution of their setting. This assessment is summarised in Section 8 of the DBA and provided in detail in DBA Appendix 6. Baseline information about the setting of key designated assets within the study areas of the three River Thames weirs is provided in the paragraphs below.

9.2.6.6 Sunbury weir: the cluster of Listed Buildings within the Sunbury weir study area, and the Lower Sunbury Conservation Area (Figure SW-DR-V-00034, sheet 3), are largely shielded from view of the weir. The sound of the weir could not be perceived from the Listed Buildings or the closest edge of the Conservation Area. Views of the weir from the southern bank are less restricted by existing buildings, although a line of mature trees along the river bank does provide a screen. There are no known heritage assets on the southern river bank within any proximity to the weir.

9.2.6.7 Molesey weir: there are 27 Listed Buildings located within the Molesey weir study area (Figure SW-DR-V-00034, sheet 3); 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.

9.2.6.8 The proposed works on Molesey weir will be visible from certain points on the extreme northern edge of the East Molesey Kent Town Conservation Area (Figure SW-DR-V-00034, sheet 2) and, to a lesser extent, from the listed Hampton Court Bridge (Figure SW-DR-V-00034, sheet 3). The proposed works will also be visible from some of the private residences which front onto the A308 Hampton Court Road within the Hampton Village Conservation Area (Figure SW-DR-V-00034, sheet 3). The weir is largely shielded from view and the proposed works will have little impact on the setting of either of the Conservation Areas in which the weir is located, or any of the Listed structures within the study area. From areas where it can be viewed, the impact of the proposed works will be minimal; and once the works are complete, the setting of these assets should remain unaffected.

9.2.6.9 Teddington weir: the proposed capacity improvement works are situated within the Teddington Lock Conservation Area (Figure SW-DR-V-00034, sheet 3). The nearest Listed Structure (Figure SW-DR-V-00034, sheet 3) 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 Conservation Area have no view of the weir.

9.2.6.10 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 9.5 – 9.7 of the DBA.

9.2.6.11 Studies of aerial photography and Lidar evidence have been carried out as part of the DBA (as discussed in Section 5 and Appendices 3 and 4 of the DBA). No features of note have been identified within the study areas of the three River Thames weirs.

9.2.7 Heritage assets, their setting and the archaeological potential at Ham Lands

9.2.7.1 There are no Scheduled Monuments within the Ham Lands study area. Three Registered Parks and Gardens partially lie within the study area; the Grade II Listed York House, the Grade II* Listed Ham House, and the Grade II Listed Pope's Grotto. There are 73 Listed Buildings within the Ham Lands study area (Figure SW-DR-V-00034, sheet 3). Only one of these is Grade I Listed, being Orleans House, located to the north-east of the site, on the northern bank of the River Thames. A total of 17 of the buildings are Grade II* Listed, most of which are located on the northern bank of the river. The remaining 49 buildings are Grade II Listed, clustered along the northern bank of the river. A small cluster of Listed Buildings to the east of the study area belongs to Ham House. Ham House itself, a Grade I Listed Building, is located just outside of the 500m study area. There are six Listed Buildings for which there is no Grade information.

9.2.7.2 Numbers of designated and non-designated assets are shown in Table 9-6 and individual heritage assets are discussed in detail within Section 5.2 of the Ham Lands Cultural Heritage Assessment (see Appendix 7 of the DBA).

Table 9-6: Quantity of Historic Environment Records in the Ham Lands study area.

Ham Lands Historic Environment Records	
Listed Buildings	73
Registered Park and Garden	3
TOTAL DESIGNATED	**76**
NON-DESIGNATED	**118**

9.2.7.3 Assessment has been undertaken to identify the designated assets likely to be affected and assess the contribution of their setting. This assessment is summarised in Section 6.3 of the Ham Lands Cultural Heritage Assessment and provided in detail in Appendix 7 of the DBA.

9.2.7.4 The heritage assets that have views of the site are part of Ham House, and the Grade II Listed Ham House Stables, although the views are largely restricted by trees within the parkland and further trees between the parkland and the site. The site is only visible on the horizon from these assets and in its current state has a neutral impact on the setting of these assets (i.e. it currently does not have either a positive or a negative impact on the setting of the assets). The four Grade II Listed structures associated with Ham House, and the Grade I Listed Ham House (which lies just outside the development area), do not have ground level views of the site, although the site may be visible from the upper storeys of Ham House. The site is not visible to or from the remainder of the assets within the study area, all of which are located on the opposite bank of the River Thames, although it is possible that there may be restricted and distant views of the site from the upper storey of some of the buildings.

9.2.7.5 A period synthesis discussing in detail the evidence of human activity within Ham Lands and the potential for archaeological remains is appended to the DBA. Given the gravel extraction activity that occurred on the site during the first half of the 20th century, the potential for buried archaeological remains on the site is considered to be low.

9.2.8 Summary of archaeological potential

9.2.8.1 Table 9-7 below summarises the key heritage assets / areas of archaeological potential within the study area; these areas are also mapped on Figure SW-DR-V-00051. 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.

9.2.8.2 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.

Table 9-7: Summary of areas of archaeological potential.

Project Element	Key heritage assets / areas of archaeological potential	Grade
Channel Section 1	Multi-period site at Southlea Farm, Datchet.	High
	Palaeochannel on southern margins of Bronze Age settlement and field systems at Horton, which are all on the line of the Channel Section 1 corridor on Land Near Kingsmead quarry.	High
	Possible Bronze Age burial in gravel quarry, land adjacent to Datchet 3 (s).	Moderate
	Multi-period findspots in Wraysbury gravel pits in previously undisturbed areas.	Low-Moderate
	Multi-period findspots from the River Thames at Wraysbury in areas of undisturbed ground / riverbed.	Low
Channel Section 2	Multi period findspots from the River Thames at Staines in areas of undisturbed ground / riverbed.	Low
	Land at or near Thorpe Hay Meadow: undisturbed ground (also a SSSI) with potential early deposits noted in trial pits.	Moderate-High

Project Element	Key heritage assets / areas of archaeological potential	Grade
	Multi-period findspots and settlement evidence from gravel pits potentially in previously undisturbed areas.	Low-Moderate
	Presumed site of former earthwork enclosure on Abbey Mead (there is confusion in the record between different antiquarian sources, so location remains uncertain).	Moderate
	Abbey Meads - intact area of gravels/channels.	High
Channel Section 3	Medieval burh (defended site) suggested from documentary evidence; no physical remains, possibly entirely quarried away.	Low
	Multi-period findspots in gravel pits across the study area, in previously undisturbed areas.	Low-Moderate
	Anglo-Saxon cemetery (Saxon School) immediately adjacent to the Channel Section 3 study area (areas inside proposed route have been quarried away).	Low
	A cluster of Roman-medieval fish-weir/timber structures on riverside at Shepperton.	High
Desborough Cut	Aside from the area impacted by the water treatment works in the north-eastern corner, the Desborough Cut study area is undisturbed river terrace with correspondingly high potential for survival of archaeological remains.	High
	Multi-period findspots from the River Thames in areas of undisturbed ground/ riverbed.	Low-Moderate
	Uncertain cropmarks overlaying gravel terraces at Oatlands Park.	Low
Sunbury weir	Multi-period findspots (Bronze Age to Post Medieval) from the River Thames.	Low-Moderate
	Setting of Listed Buildings and Lower Sunbury Conservation Area.	Moderate
Molesey weir	Multi-period findspots (Lower Paleolithic to Post-Medieval) from the River Thames in areas of undisturbed ground/ riverbed.	Low-Moderate
	Setting of designated heritage assets.	Moderate
Teddington weir	Multi-period findspots (Mesolithic to Post-Medieval) from the River Thames in areas of undisturbed ground/ riverbed.	Low-Moderate
	Setting of Listed Buildings and Conservation Area.	Low-Moderate

9.2.9 Future baseline

9.2.9.1 The future baseline for cultural heritage, archaeology and built heritage is likely to be very similar to the current baseline, with the exception that without the Project, heritage assets will continue to be at risk of flooding, and that new remains are likely to continue to be found as a result of new developments and any new mineral excavation within the study area.

9.2.10 Key environmental constraints and opportunities

9.2.10.1 The key constraints with respect to cultural heritage, archaeology and built heritage are:

- Potential for indirect effects or effects on setting of: Scheduled Monuments, Registered Parks and Gardens, or Listed Buildings; and
- Potential direct or indirect effects on unknown, buried archaeology.

9.2.10.2 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; and

- Potential outreach and wider dissemination associated with the uncovering of new archaeological finds during construction of the project, thereby expanding the archaeological record of the River Thames floodplain.

9.3 Predicted changes to the environment and scope of assessment

9.3.1.1 Potential effects on cultural heritage, archaeology and built heritage during construction and operation of the project are discussed in Table 9-8.

Table 9-8: Potential effects during construction and operation.

Project activity	Potential effects and receptors	Could the effect be significant – yes / no?	Reason	Potential mitigation measures
Construction				
Ground disturbance as part of construction works (such as flood relief channel excavation, tracking of construction vehicles, piling and creation of flood storage areas).	Damage to or disturbance of unknown buried archaeology.	Yes.	Potential for disturbance to unknown buried archaeology through excavation, compression from vehicle tracking or other construction activities.	Various archeological investigations (field surveys, geophysical surveys, geoarchaeological assessments and trial trenching) will identify areas with high archeological risk. Mitigation strategies for areas of archaeological risk could include: preservation in-situ by redesign; strip, map, and sample excavation on identified archaeological sites i.e. Southlea Farm; Archaeological watching briefs of excavations and topsoil stripping. Development of methodology to reduce compaction/compression. Post-excavation activities will be required. These will involve archiving and long term storage of excavated remains and appropriate dissemination of the results.
Existence of construction site including: machinery and vehicles, site compounds, materials, and operatives as well as erection of screens and fences.	Temporary adverse effect on setting (both visual and conceptual) of designated features: including Scheduled Monuments, Conservation Areas and Listed Buildings.	No.	The presence of machinery, site compounds, materials and operatives as well as the erection of screens around the working area could create a temporary interruption to the setting of key heritage assets. However this effect will be temporary during construction and is not anticipated to be significant.	
Operation				
Reduced risk of flooding.	Beneficial reduction in flood risk to designated heritage	Yes.	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	N/A.

Project activity	Potential effects and receptors	Could the effect be significant – yes / no?	Reason	Potential mitigation measures
	features.		also allow for better access to, and fuller appreciation of these heritage assets.	
	The reduction in flood risk may have beneficial effect on the preservation of unknown buried archaeology.	Yes.	The reduction in flood risk both in terms of flood extent and frequency will reduce disturbance to unknown buried archaeology resulting from water inundation from fluvial flooding.	N/A.
Existence of flood relief channel.	Change of ground water levels due to the flood relief channel may have an adverse effect on the preservation of unknown buried archaeology.	No.	Water level control structures have been designed into the project to maintain existing ground water levels in areas surrounding the new flood relief channel. Therefore, preventing any substantial changes to surrounding ground water levels.	
Existence of flood relief channel, flood embankments, LEAs and areas of habitat creation.	Adverse effect on the setting (both visual and conceptual) of key designated heritage assets: including Scheduled Monuments, Conservation Areas and Listed Buildings.	Yes.	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.	A full assessment of effects upon the setting of designated heritage assets will be completed. Measures to mitigate effects and / or enhance the significance of assets will be considered, such as enhancing or creating new views, restoring historic views, masking detrimental features, improving public access, understating and awareness of heritage assets.

9.4 Assessment methodology

9.4.1.1 Following discussion with heritage consultees (those listed in Section 9.1.1.5), an Evaluation Strategy and General Written Scheme of Investigation has been agreed, setting out the proposed methodology for assessing potential effects on heritage assets resulting from the project. The evaluation strategy proposes a variety of assessment methodologies for each specific area of archaeological potential, based upon the grade assigned to heritage assets / areas of archaeological risk (i.e. high, medium or low, as listed in Figure SW-DR-V-00051):

- Areas of high potential: If they are to be directly affected, these areas will be subject to an appropriate level of Stage 1 archaeological evaluation (being one or more of the following: topographic /earthwork survey, field walking, geophysical survey, metal-detector survey, and geo-archaeological evaluation), followed potentially by trial trench evaluation (Stage 2 archaeological evaluation) in order to fully inform the EIA and ascertain if further mitigation (e.g. targeted archaeological excavation) is required prior to the start of any invasive ground works;
- Areas of moderate potential: As with high risk areas, if they are to be directly affected then these areas should be subject to an appropriate level of Stage 1 archaeological evaluation (as defined above) and/or Stage 2 archaeological evaluation; and
- Areas of low potential: These areas have typically been previously disturbed; with any archaeological deposits having been removed. No archaeological evaluation is required in these areas; however, depending on evaluation results from adjoining areas of high and moderate risk further mitigation (e.g. archaeological monitoring) might feasibly be required during the construction phase.

9.4.1.2 Several designated heritage assets have been identified by Historic England adjacent to the study area, including Ankerwyke Priory, Laleham Burway, Kingsbury Medieval Palace and those further away but in a prominent topographic position, for example St Ann's Hill Iron Age hillfort, and Windsor Castle. These assets, it is suggested, all have the potential to be harmed by the Project, in particular through development within their setting. As a result, an assessment of setting is proposed, in accordance with '*The Setting of Heritage Assets*' Guidance Note (Historic England, 2015). This will include considerations of the contribution of setting to the significance of a heritage asset in reference to views and a visual impression of an asset or place.

9.4.1.3 There is no single accepted guidance for assessing the significance of significant effects on heritage assets. The approach set out in the DMRB guidance (Highways Agency, 2012) be applied for this project. The value of archaeological features will be assessed using the DMRB guidance which advises on separate consideration of the value of archeological remains and above ground heritage assets separately, using separate criteria on a six point scale. This is informed by the Secretary of State's non-statutory criteria for the selection of monuments for scheduling; and the inclusion of buildings on the statutory list: The assessment will rank the magnitude of the effect using the definitions laid out in the DMRB. The significance of an effect upon any heritage asset will be considered as a product of the value of the heritage asset and the magnitude of the effect upon it according to the matrix in DMRB 11.3.2.

9.5 Limitations and Assumptions

9.5.1.1 Mapping archaeological potential is only as complete as our present knowledge of the key datasets that are relevant to each map (Historic Environment and Scheduling records, aerial photographs and Lidar datasets, and specialist geoarchaeological interpretations in relation to underlying topography and geology). Additionally, within each dataset, interpretative decisions have had to be made on the extent of the polygonised 'sites' categorised as high, moderate and low potential. Sometimes this is easily interpreted by the nature of the site (e.g. a Scheduled Monument with existing identified boundaries, or a field that has distinct cropmarks within it). For most areas however, different levels of inference have been required to differentiate between levels of high, moderate and low potential. Despite the above

caveats detailing the uncertainties concerning the ability to accurately plot distribution of contrasting archaeological potential, it is felt that real patterns are visible in the maps. Overall, the distribution of areas of high potential should be considered 'real', but caution should be exercised on the immediate peripheries of these areas, including areas of 'low' potential.

9.5.1.2 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. If, unexpectedly, works are required that would affect the deep undisturbed deposits (most likely through piling), there is a possibility that these could potentially contain prehistoric archaeology.

10 Landscape & Visual Amenity

10.1 Approach to identifying potential environmental effects

10.1.1.1 This section of the EIA Scoping Report considers the potential effects on landscape and visual amenity arising from the construction and operation of the proposed Project. The study areas for landscape character and visual effects respectively are shown in Figures SW-DR-L-00026 to SW-DR-L-00028. The extent of the study area for landscape character effects has been based upon the landscape character assessment work undertaken for the project to date. This has studied the character of a broad 'corridor' of up to around 1km of the centerline of the proposed channel; beyond which significant landscape character effects would not be anticipated. The study area for the assessment of visual effects is based upon defining the 'Zone of Theoretical Visibility' (ZTV) from which it may be theoretically possible to view a part of the Project during construction or operation. The ZTV for this is a preliminary assessment based on a 'bare earth' scenario, i.e. with no allowance for vegetation, buildings etc. It is considered that receptors beyond these study areas would not be significantly affected.

10.1.1.2 Baseline conditions have been established from documentary reviews (published landscape character assessments, design guidance and relevant planning policy data), desk top and fieldwork surveys as well as landscape character assessment work to determine appropriate landscape character areas, the key characteristics of each, the condition of elements and a high level assessment of landscape sensitivity. The landscape character assessment work is set out in the landscape section appendix (Appendix H). This comprises a discussion as to the methodology used ('Landscape Character Assessment Report'), the assessment sheets for each character area ('Landscape Character Sheets'), and maps showing their distribution across the study area (drawings SW-DR-L-00001, 00002, 00003; C1-DR-L-00006, SW-DR-L-00014, 00038 and 00039).

10.1.1.3 This LVIA (Landscape and Visual Impact Assessment) Scoping Study is undertaken in accordance with the principles defined in '*Guidelines for Landscape and Visual Impact Assessment*', 3rd Edition, published by the Landscape Institute and Institute of Environmental Management & Assessment (2013) (GLVIA3). 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 landscape character areas likely to be significantly affected and/or the extent of the area from which the construction and operation of the Project may be potentially visible (i.e. the ZTV).

10.1.1.4 The following landscape character assessments, studies and guidance have been used to define the landscape baseline for the study areas:

- Natural England: National Character Area (NCA): NCA 115 'Thames Valley';
- Surrey County Council (2015) Landscape Character Assessment.
- Environment Agency (2000c) Lower Thames Landscape Assessment & Strategy;
- Environment Agency (1995) Thames Environmental Design Handbook;
- Natural England (2011) The London Landscape Framework;
- Mayor of London, Environment Agency, Natural England and various Local Authorities (2011) The All London Green Grid;
- The Thames Strategy Steering Group (updated 2012) The Thames Landscape Strategy; and
- Various Conservation Area Appraisals as background for the LVIA: For Lower Sunbury Conservation Area (SBC), Hampton Court Green Conservation Area 11 (LBRUT), East Molesey Kent Town Conservation Area (EBC), Teddington Lock Conservation Area, Hampton Wick Conservation

Area and Normansfield Teddington (all LBRUT). Refer to Section 9.3 on Cultural Heritage for the assessment of predicted changes.

10.1.1.5 The LVIA Scoping Study, specifically the study areas, the outline methodology for the LVIA and the range of representative visual receptors appropriate for the visual impact assessment are included in Appendix H, in order to provide an opportunity for the local authority officers and landscape architects where relevant, to review and agree this.

10.2 Baseline information

10.2.1 Landscape character

10.2.1.1 The study areas extend from Datchet in the west, to Ham Lands (see Figures SW-DR-L-00026 to SW-DR-L-00028). The broad landscape context of the project is that of the Thames Valley (NCA 115), a wedge-shaped area widening from Reading to include Bracknell, Slough and Windsor areas, the southern part of the Colne Valley and the south-west London fringes.

10.2.1.2 The underlying landscape character of the Thames Valley is an open floodplain of flat grazing lands with scattered historic parklands on the higher ground. However, 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, as well as several significant settlements, including Datchet, Wraysbury, Staines, Chertsey, Sunbury, East Molesey and Teddington. The overall impression is of a lack of cohesiveness and consistency, with the underlying landscape character heavily fragmented by the infrastructure developments and in-part physically removed through the extensive mineral workings and 'masked' by the spread of settlements. Some former character remains where older villages survive in some seclusion and as remnants of the former agricultural landscape found at isolated farms, especially in the west of the study areas.

10.2.1.3 The channel sections begin at Datchet to the east of Windsor, and pass by Egham, Staines upon Thames, Chertsey and Shepperton, before ending near Weybridge and Walton on Thames. In between these lie many villages such as Wraysbury, Hythe End, Laleham, and Thorpe. Windsor Castle and the town surrounding it, at the western edge of the study areas, are sited on locally elevated ground. The centre of many of these settlements retain their individual and historic identities but at their edges narrow ribbons of development are strung out along connecting roads, appearing to link settlements together. Other linear settlement exists along the banks of the River Thames. The bankside areas of Thames Meadow, Penton Hook, Hythe End and Wraysbury are 'plotland' development. By their nature these were unplanned but originally at a very low density. Gradually this density has intensified as many of the plots have been re-developed, some several times over.

10.2.1.4 The landform of the floodplain of the River Thames is typically flat with only minor changes in the elevation of the natural topography. However, at some of the boundaries of the study areas there are more significant natural landforms, such as the slopes of Coopers Hill south west of Runnymede Meadows, and St Ann's Hill to the west of Chertsey, both of which have public access which allow long views out across the floodplain. Man-made changes in level that rise above the floodplain include the prominent raised reservoirs and the motorway embankments, especially where these rise up to bridge over other roads, railways and the River Thames.

10.2.1.5 The M25, M4 and M3 motorways together with the Staines to Windsor and Reading railways dissect the area. In part these create distinct visual barriers and physical constraints to movement through this landscape. The motorways along with the presence of the Heathrow Airport flight path, contribute to continued impression of movement, noise, lighting and activity.

10.2.1.6 The landscape in this part of the River Thames Valley has also been heavily influenced by the gravel extraction industry. Those extractions that remain active contain conspicuous pieces of large scale quarrying equipment (towers, conveyor belts and silos) material stockpiles and security fencing. Those

gravel pits that have been worked-out have either been left as water bodies, with many used for leisure activities, or have become sites for landfilling. Thorpe Park has been developed on the site of former gravel workings.

10.2.1.7 Most sites whether active or worked-out are enclosed by wooded tree belts, which have either regenerated naturally or have been planted to mitigate the landscape and visual impact of quarrying. These create a strong sense of visual enclosure and prevent long views that one would otherwise gain across the floodplain. Consequently from many of the PRoW, several of which are retained between areas of quarrying (e.g. the Sheepwalk through Littleton East Lake), there are few opportunities to view the wider landscape although conversely unsightly activities are generally well screened.

10.2.1.8 Many of the gravel pits that have been left as water bodies have now become sites for water sports and fishing. The margins of some of these have softened over time (e.g. Wraysbury 1 Lakes), now appear more 'natural' and many have become designated or contribute to the SWLW SPA (see Section 8.2). The built elements of these sites (e.g. access roads, gates and fencing) often retain the character of the original quarrying industry. Some of the older sites have been more sensitively restored (notably Halliford Mere) and a semi-natural character created. The vegetated edges of sites such as Ferry Lane Lake have been significantly thinned and this allows views through to the lake from the adjacent Thames Path National Trail and Desborough Island Public Open Space.

10.2.1.9 In gravel pits where backfilling with waste has occurred, these areas also exhibit some of the features of the former extraction use. The artificial mounding that has occurred (such as at Hythe End – north of the B376) is out of character with the level floodplain. The grassland habitats that have developed on the landfills often appear patchy in quality, threatened by encroaching scrub and these areas lack typical features of the local landscape character such as hedged field boundaries. Some of these are grazed by sheep and cattle, whilst others are used as horse paddocks.

10.2.1.10 Relatively few areas of original agricultural land unaffected by landfill remain within the study areas (see Section 12.2.2). Notable examples include Southlea Farm (Channel Section 1), Thorpe Hay Meadow SSSI and Abbey Meads (Channel Section 2). These and the areas around them are mainly pasture, with occasional arable farming. The low-lying landscape means that the field boundaries of such farmland are often formed of ditches with hedgerows. The frequency by which this landscape is crisscrossed by transport infrastructure together with the presence of large utility structures (such as the reservoirs and quarries) means that existing farm holdings are often fragmented.

10.2.1.11 There are several substantial areas of parkland and common or rough pasture, notably at The Home Park, Windsor, and part of Windsor Great Park, 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 local authorities). Most of these permit public access and appear to have become places valued by the local community.

10.2.1.12 The study areas also contain considerable outdoor recreation resources for formal sports (see Section 12.2.4). As well as the existence of many water sport and fishing clubs, there are two golf course (at Laleham and Datchet), sports grounds (e.g. at Desborough Island), campsites (e.g. Laleham Camping Club) and recreation grounds. Thorpe Park Resort is a major visitor attraction with a wide range of themed rides and other attractions. It occupies a large 'island' surrounded by several large water bodies created by former gravel extraction.

10.2.1.13 Despite the busy context of the study areas there are a few areas of relative tranquility. These include the environs of the River Thames (including sections of the Thames Path National Trail) where the river is wide, meandering and semi-natural, for example at Ham Island, Runnymede, Chertsey Mead and Laleham. However, for the majority of its course, the River Thames is often hard-edged and dominated by plotland development and river moorings, with areas of intense activity at the weirs, locks and marinas.

10.2.1.14 Ham Lands is an area of semi-rural character of cut grassland meadows, mature woods and trees with large areas of developing woodland currently semi-mature adjoining the River Thames. It is a well-used Public Open Space and forms part of a protected View/Vista from the Star & Garter, at Richmond Hill, to

the River Thames at Radnor Gardens. It is not part of a Conservation Area or Historic Park and Garden but lies within the context of several and close or adjacent to Twickenham Riverside and Ham House Conservation Areas, the latter of which is also a Historic Park and Garden.

10.2.1.15 The landscape/townscape setting of the three River Thames weirs is predominantly suburban, each being located within the built-up area of north Surrey/south-west London. This character is, however, broken-up by areas of well-vegetated private and Public Open Space that exist along the River Thames. Such areas include the river islands (or aits), the towpaths, particularly at Sunbury and Teddington where these are especially wide, adjoining areas of Public Open Space and by the many of the generous gardens that front the river.

10.2.2 Landscape and related designations

10.2.2.1 There are no statutory landscape designations (i.e. National Parks or Areas of Outstanding Natural Beauty) within the study areas; however, there is one non-statutory landscape designation (RBC's 'Areas of Landscape Importance' or ALI (see Figure SW-DR-L-00006). The landscape context of the channel sections lie entirely within the Green Belt (see Figure SW-DR-L-00006) and include part of the Colne Valley Regional Park, as well as various Conservation Areas (statutory designation), and several Parks & Gardens of Special Historic Interest (non-statutory), areas of Open Access Land (CROW Act 2000) and land designated as Public Open Space in Local Plans, all as detailed below.

10.2.2.2 There are four Areas of Landscape Importance in the RBC Local Plan 2001 (Policy NE8) these are Cooper's Hill, Egham Hill. Callow Hill & Runnymede Meadows, Thames Riverside, St Ann's Hill and Woburn Hill & Chertsey Meads (see Figure SW-DR-L-00006). Policy NE8 recognises these areas as being of particular landscape importance and they have been selected for their prominence, setting and, in the case of the first three, their extensive tree cover. This designation is considered to confer the value at a District/Borough level. Policy NE10 identifies a Landscape Problem Area (see Figure SW-DR-L-00006) covering Channel Section 2 within the study areas. In this area the Council will seek to improve the appearance of the landscape through development control, implantation of other powers and by negotiation.

10.2.2.3 The Colne Valley Regional Park represents one of a number of existing green infrastructure initiatives across the study areas (see Figure SW-DR-L-00005). The park stretches from Rickmansworth in the north to Staines and the River Thames in the south, Uxbridge and Heathrow in the east and to Slough and Chalfont in the west, and encompasses some 11,000 hectares. Channel section 1 would be aligned through the southern end of the park at Datchet and Wraysbury.

10.2.2.4 The study areas include all or parts of the following Parks & Gardens of Special Historic Interest (see Figure SW-DR-L-00007 and to Section 9.2 for further details). Public access to these sites varies from being fully accessible as designated Public Open Space to more restricted levels of access through the use of the PRoW network or permissive rights. This designation is considered to confer value at a national level to the following:

- Windsor Castle and Home Park (Grade I);
- Windsor Great Park (Grade I);
- St Ann's Hill and the Dingle (Grade II);
- Bushy Park (Grade I); and
- Garrick's Lawn (Grade II).

10.2.2.5 Various Conservation Areas lie within or partly within the study areas (refer to Figure SW-DR-L-00007 and to Section 9.2for further details). This designation is considered to confer value at a District/Borough level to the following:

- Windsor Town Centre (specifically Windsor Castle);
- Thorpe;

- Laleham;
- Chertsey;
- Old Shepperton;
- Lower Sunbury;
- Hampton Court Green;
- East Molesey Kent Town;
- Hampton Wick; and
- Teddington Lock.

10.2.2.6 The study areas include Open Access Land and/or designated Public Open Space (in addition to those referred to in the groups above) at Ankerwycke Estate, Runnymede and Coopers Hill, Laleham Park, Dumsey Meadows, Chertsey Meads and Desborough Island.

10.2.2.7 Promoted PROWs within the study areas include the Thames Path (National Trail) which very largely follows the route of the River Thames, the Three Castles Path which runs south from Windsor Castle, and the Colne Valley Way (both regional trails), which runs north from near the River Thames at Staines (refer to Figure SW-DR-L-00010 and to Section 12.2 on Population). Promoted cycle routes include National Cycle Route 4 which follows the route of the Thames Path through much of the study areas but also has other connected routes to the south of the River Thames. The Three Castles Walk passes through the westernmost part of the study areas. The study areas are crossed by a number of other PRoW.

10.2.3 Visual Baseline

10.2.3.1 The principal visual receptors include residents at home, users of the Thames path (National Trail), National Cycling Routes, other Public Rights of Way, Parks, Open Access Land and Public Open Spaces, users of outdoor recreation resources, as well as users of the various highways and railways; all as described in the landscape baseline section above.

10.2.3.2 The various visual receptors have been grouped together in the assessment table below (Table 10-1), depending on the nature of the activity being undertaken at these locations which determines the receptor susceptibility and sensitivity.

10.2.3.3 It is anticipated that generally most or possibly all significant visual effects would be capable of being mitigated, however this needs to be confirmed by the visual impact assessment as part of the EIA, and therefore visual effects cannot be scoped out at this stage (Table 10-1).

10.2.4 Future baseline

10.2.4.1 The landscape and visual baseline may alter between the time of the assessment and the intended date for the start of operation of the Project (i.e. 2025) although predicting any changes requires the application of various assumptions. As much of the study areas are within the Green Belt, major changes to landscape through the implementation of built development would seem to be unlikely. In addition, to the extent that there are a number of current landscape planning policies to protect and enhance landscape, as well as other landscape strategies and landscape restoration schemes (e.g. restoration of Horton gravel pits to farmland by Cemex and of Littleton gravel pit by Bretts) currently in hand across the study areas that are also seeking landscape improvement (Figures SW-DR-L-00006 and SW-DR-L-00007), the condition and appearance of the landscape resource is more likely to improve than degrade. However, significant beneficial change is also unlikely and it is anticipated that the future baseline, at 2025, would be similar to but slightly enhanced over the current position.

10.2.5 Key landscape opportunities and constraints

10.2.5.1 The principal landscape opportunities that may be realised by the Project include:

- Public access enhancements (pedestrian, cyclist and equestrian) throughout the Project with wider benefits for the whole rights of way network;
- The creation of new areas of open space accessible by the public with the additional provision of appropriate ancillary facilities;
- The permanent land use change and landscape improvement to current unsightly uses (such as some of the former landfill areas);
- The potential for new pedestrian crossings of the River Thames at locations where access is currently not available; and
- An overall landscape enhancement through the provision and long term management of landscaping, including tree, woodland and hedgerow planting, wildflower meadows and marginal planting of water bodies adjoining the Project.

10.2.5.2 The main landscape constraints to the Project include:

- Some of the Development Control planning policies, including Green Belt, which may restrict the provision/extent of some built features;
- Difficult ground conditions (i.e. the landfill sites) which may restrict the scope of landscape improvements;
- The extent of landfill generally which may limit the construction approach and engineering design to options which are less sympathetic to the local landscape context than if the conditions were undisturbed green field;
- Existing vegetation within the land take of the Project which may be lost or affected, although the Project will include for the mitigation of and enhancement of this change; and
- The presence of various existing engineered infrastructure and utilities including the motorways, railways and pipelines which could restrict access and landscaping opportunities.

10.3 Predicted changes to the environment and scope of assessment

10.3.1.1 Potential effects on landscape and visual amenity during construction and operation are discussed in Table 10-1.

Table 10-1: Potential effects during construction and operation.

Project activity	Potential effects and receptors	Could the effect be significant – yes / no?	Reason	Potential mitigation measures
Construction				
General construction: e.g. construction plant, compounds, vegetation clearance, and earthworks, for 2 to 5 years depending on the construction programme.	Adverse visual effects on residents at home.	Yes.	In some locations (e.g. at Southlea Farm, Hythe End, Ferry Avenue, Old Shepperton and at the three weir sites) existing residential properties are located close to construction working areas. At these locations construction activities would be visible from within residential properties although visual effects would be temporary.	Use of screen hoardings at longer term construction areas. Early seeding and landscape treatment of earthworks areas and engineering structures.
	Adverse visual effects on users of the Thames Path (National Trail), National Cycling Routes, other PRoW and Public Open Space.	Yes.	The channel construction working areas would only be visible from the Thames Path and National Cycle Route 4 from a few isolated locations. The Thames Path follows the River Thames across Ham Lands and this and National Cycle Route 4 are aligned along the river towpath at each of the three River Thames weirs. The construction working areas would be visible from several other PRoW (e.g. at Datchet Lake, Horton Lake, Thorpe Hay Meadow and Littleton East Lake), Public Open Space at Runnymede Recreation Ground, Laleham Park and Desborough Island, Registered Common Land at Runnymede and Open Access Land at the National Trust's Anckerwycke Estate and Runnymede. The construction site compounds at Hurst Park and Broom Road Recreation Ground would be located within Public Open Space sites. Ham Lands is an area of Public Open Space and lies close to other open spaces e.g. Radnor Gardens. At these locations construction activities would be visible although these effects would be specific to these locations, not widespread along the route, and would be temporary.	Use of screen hoardings at longer term construction areas. Early seeding and landscape treatment of earthworks areas and engineering structures.
	Adverse visual effects on leisure users of recreational facilities (such as moorings, fishing lakes, sailing lakes, watersports lakes, Thorpe Park and golf courses).	Yes.	The channel would be visible from several recreational sites including Datchet Lakes, Kingsmead Island Lake, Wraysbury Lakes 2 (N&S), Lower Hythe Gravel Pits, Thorpe Park, Laleham Golf Course, Littleton East Lake and Ferry Lane Lake, whilst Ham Lands has within it the Thames Young Mariners Base. The three River Thames weir sites all have associated moorings.	Use of screen hoardings at longer term construction areas. Early seeding and landscape treatment of earthworks areas and engineering structures.

Project activity	Potential effects and receptors	Could the effect be significant – yes / no?	Reason	Potential mitigation measures
			At these specific locations construction activities would be visible from recreational facilities. These receptors are considered to be of medium to low sensitivity, the effects would be temporary and consequently may not be significant.	
	Adverse visual effects on users of public highways, (i.e. motorways, roads and railways) and on people at their places of work.	Yes.	The construction working areas all lie close to or are crossed by other public highways and railways, the users of which are generally transitory. The working areas also lie close to people's places of work. Such receptors are not focused on views and are, therefore, normally considered to be low sensitivity receptors. However, construction activities would be visible from some locations and mitigation may be considered necessary.	None identified at this stage.
	Adverse effects on the character and quality of national and local landscape designations.	Yes.	Construction activities at the intake for Channel Section 1 and the earthworks at Ham Lands will be visible from Registered Historic Parks & Gardens and the intake for Channel Section 2 and the section across Abbey Meads would fall within the Thames Riverside Area of Landscape Importance. Effects would be limited to these locations and would be temporary.	Use of screen hoardings at longer term construction areas. Early seeding and landscape treatment of earthworks areas and engineering structures.
	Adverse effects on the character and quality of undesignated local landscape character areas.	Yes.	At a national level the Project lies within NCA 115 Thames Valley; at this broad landscape character level temporary construction is not expected to have a significant effect. The channel falls within many local landscape character areas. The key characteristics of these character areas are varied but those aspects of the local landscape most sensitive to construction effects are the relatively few areas of undisturbed and green field, typically agricultural areas, including Southlea Farm and Abbey Meads. At these locations construction activities would have an effect on landscape character although effects would be temporary. At Ham Lands, whilst a disturbed site, the existing character is rural and construction activities would have an effect on landscape character, although effects would be temporary. The three weir sites are located in relatively busy urban areas where construction is less likely to be out of character; therefore effects are not	Use of screen hoardings at longer term construction areas. Early seeding and landscape treatment of earthworks areas and engineering structures.

Project activity	Potential effects and receptors	Could the effect be significant – yes / no?	Reason	Potential mitigation measures
			expected to be significant.	
Operation				
The existence of flood relief channel and associated features e.g. flood embankments, LEAs, upgraded River Thames weirs.	Adverse visual effects on residents at home.	Yes.	At Datchet, Hythe End, Ferry Avenue, Old Shepperton and at the three River Thames weirs existing residential properties are located close to Project elements. At these locations a change in the scene would be perceived with the removal of existing landscape and built features and introduction of the Project features, including some elements of the beacons. These effects would be specific to these locations and may be capable of being mitigated through design and landscaping to ensure the effects would not be significant.	Design will ensure that new features are appropriate to the existing surroundings. Landscape treatments and new planting to soften the appearance of the new structures and marry the new features into the surroundings.
	Adverse visual effects on users of the Thames Path (National Trail), National Cycling Routes, other PRoW and Public Open Space.	Yes.	The flood relief channel and associated features would only be visible from the Thames Path and National Cycle Route 4 from a few isolated locations. The Thames Path follows the River Thames across Ham Lands and this and National Cycle Route 4 are aligned along the River Thames towpath at the three River Thames weirs. The flood relief channel and associated features would be visible from several other PRoW (e.g. at Datchet Lake, Horton Lake, Thorpe Hay Meadow and Littleton East Lake), Public Open Space at Runnymede Recreation Ground, Laleham Park and Desborough Island, Registered Common Land at Runnymede and Open Access Land at the National Trust's Anckerwycke Estate and Runnymede. Ham Lands is a Public Open Space and lies close to other open spaces such as Radnor Gardens. At these locations a change in the scene would be perceived with the removal of existing landscape and built features (as relevant) and introduction of the flood relief channel and associated features. These effects would be specific to these locations and may be capable of being mitigated through design and landscaping.	Design will ensure that new features are appropriate to the existing surroundings. Landscape treatments and new planting to soften the appearance of the new structures and marry the new features into the surroundings.
	Adverse visual effects on leisure users of recreational facilities (such as moorings,	Yes.	The channel would be visible from several recreational sites including Datchet Lakes, Kingsmead Island Lake, Wraysbury 2 Lakes, Lower Hythe Gravel Pits, Thorpe Park, Laleham Golf Course, Littleton East Lake and Ferry	Design will ensure that new features are appropriate to the existing surroundings.

Project activity	Potential effects and receptors	Could the effect be significant – yes / no?	Reason	Potential mitigation measures
	fishing lakes, sailing lakes, watersports lakes, Thorpe Park and golf courses).		Lane Lake, whilst Ham Lands has within it the Thames Young Mariners Base. The three River Thames weir sites all have associated moorings. At these locations a change in the scene would be perceived with the removal of existing landscape and built features (as relevant) and introduction of the flood relief channel and associated features. These effects would be specific to these locations where these receptors are considered to be of medium to low sensitivity. These may be capable of being mitigated through design and landscaping to ensure the effects would not be significant.	Landscape treatments and new planting to soften the appearance of the new structures and marry the new features into the surroundings.
	Adverse visual effects on users of public highways, (i.e. motorways, roads and railways) and on people at their places of work.	Yes.	The flood relief channel and associated features all lie close to or are crossed by other public highways and railways, the users of which are generally transitory. The working areas also lie close to people's places of work. Such receptors are not focused on views and are, therefore, considered to be low sensitivity receptors. However, at specific locations a change in the scene would be perceived with the removal of existing landscape and built features (as relevant) and introduction of the Project features.	None identified at this stage.
	Adverse effects on the character and quality of national landscape designations.	No.	The intake for Channel Section 1 and the earthworks at Ham Lands will be visible from Registered Historic Parks & Gardens. At these specific locations a change in the scene would be perceived with the removal of existing landscape and built features (as relevant) and introduction of the Project features. Through design and landscaping to ensure the effects would not be significant.	Design measures to ensure that the new engineering structures and other features are appropriate to the existing surroundings. Landscape treatments and new planting to soften the appearance of the new structures, to ameliorate these and to assist in marrying-in the new features into the surroundings. The effectiveness of such mitigation is likely to increase over time.

Project activity	Potential effects and receptors	Could the effect be significant – yes / no?	Reason	Potential mitigation measures
	Adverse or beneficial effects on the character and quality of local landscape designations (i.e. Areas of Local Landscape Importance).	Yes.	There would be no close range views of Channel Section 1, Ham Lands or the three River Thames weir sites from locally designated landscapes, such as RBC's Areas of Local Landscape Importance (ALLI). However, the intake for Channel Section 2 and the section across Abbey Meads would fall within the Thames Riverside ALLI. There would be a perceptible change in landscape character at Abbey Meads, although this has the potential to be a significant beneficial effect overall.	Design measures to ensure that the new engineering structures and other features are appropriate to the existing surroundings. Landscape treatments and new planting to soften the appearance of the new structures, to ameliorate these and to assist in marrying-in the new features into the surroundings. The effectiveness of such mitigation is likely to increase over time.
	Adverse or beneficial effects on the character and quality of undesignated landscape character areas.	Yes.	At a national level the Project lies within NCA 115 Thames Valley, the key characteristics of which include flat and low lying topography rising to low hills, numerous hydrological features including the River Thames, evidence of considerable past disturbance, infrastructure and large settlements. At this broad landscape character level operational effects, even of a scheme of the scale of this Project, are not considered likely to have a significant landscape character effect. At a regional level Channel Section 1 falls within the River Colne and Crane Area Framework, as defined by the All London Green Grid, and Ham Lands and the three River Thames weir sites within the Arcadian Thames Area Framework. The key characteristics of the former include extensive urban uses and infrastructure within which is a loosely connected series of lakes, reservoirs and other waterways. The latter area is characterised by the floodplain, meandering River Thames, the elevated Richmond Hill and the designed landscapes of parks, gardens and open commons. There is no similar regional level assessment for the SCC sections of Project. The channel sections fall within many local landscape character areas (as defined in the Landscape & Green Infrastructure Study). The key	Design will ensure that new features are appropriate to the existing surroundings. Landscape treatments and new planting to soften the appearance of the new structures and marry the new features into the surroundings.

Project activity	Potential effects and receptors	Could the effect be significant – yes / no?	Reason	Potential mitigation measures
			characteristics of these character areas are varied but those aspects of the local landscape most sensitive to the effects of the creation of new channels, water and infrastructure related structures, habitat creation and earthworks are the relatively few areas of undisturbed and green field, typically the agricultural land use areas, including Southlea Farm and Abbey Meads. The aspect of the Project for the greatest potential to have a long term effect on local landscape character is the creation of the landscape earthworks associated with the beacons for the LEAs. Whilst such landforms would be strictly out of character with the low lying and generally flat topography, their form would provide new amenity features of a nature and scale that they would provide new opportunities for long distance views across the River Thames floodplain and would assist in mitigating the scale and effect of other existing earthworks in the study area (e.g. at motorway and reservoir embankments). The consideration of overlook from the Beacons of private residential property is considered in Table 12-2 the Population section (see Section 12.3). The three weir sites are located in relatively busy urban or suburban areas where the introduction of similar water based structures would not be out of keeping with the existing character and is therefore not expected to have a significant effect on landscape character. A canopy would be included for the new weir at Molesey in order to replicate the appearance of similar local structures.	
The existence of a range of new publicly accessible footpaths, cycleways and open spaces, including the beacons.	Beneficial effects to public access and the public realm.	Yes.	The creation of the new open spaces of the beacons at Sunnymeads, Hythe End, Royal Hythe and Manor Farm would be a significant benefit to public realm. The new pedestrian and cycle linkages along parts of the channel sections and between these and other parts of the green infrastructure network would also be a significant benefit in an area where there is general under-provision of such access.	Design will ensure that new features are appropriate to the existing surroundings. Landscape treatments and new planting to marry the new features into the surroundings.

10.4 Assessment methodology

10.4.1.1 The LVIA will be prepared in accordance with the principles defined in GLVIA3. This guidance concentrates on principles while steering approaches where there is general professional consensus on methods and techniques. It is not intended to be prescriptive and requires the landscape professional carrying out the assessment to ensure that the approach and methodology are appropriate to the circumstances of the Project, its status and its context.

10.4.1.2 GLVIA3 requires the process of the assessment of significance to be clearly defined for each EIA project and to be expressed as transparently as possible. It provides guidance for the assessment of significant landscape and visual effects (at paragraphs 5.38 to 5.52 and 6.30 to 6.41 respectively) which involves the methodical consideration of the assessments of sensitivity of the receptor and the magnitude of effect.

10.4.1.3 In order to draw final conclusions about significance, it is necessary to combine the sensitivity of the receptor and the magnitude of the effect to make a final judgement about whether the effect is significant or not. By way of example GLVIA3 defines a sliding scale of significance for landscape effects. The gradation invites the decision-maker to consider the amount of weight that should be applied based on the degree of significance as part of the planning balance. However, it is also necessary to distinguish those effects which are considered to be significant in the terms expressed in the EIA Regulations, as distinct from those which are not. As encouraged by GLVIA3 the reasoning for these significant effects and their nature will need to be defined and set out within the narrative of the LVIA.

10.4.1.4 It is good practice under GLVIA 3 to carry out a visual assessment of all of the representative viewpoints, and it is intended that this will be done as part of the EIA. A provisional list of 83 representative viewpoints has been identified for review by the local authority officers and landscape architects. These are listed in Appendix H ('Schedule of Provisional LVIA Viewpoints') and shown on drawings CS1-DR-L-00040; SW-DR-L-00035, 00036 and 00037.

10.5 Limitations and assumptions

10.5.1.1 There is a complex existing suite of fully or partially overlapping published landscape character assessments and landscape management strategies for the study area, some of which are relatively dated, as noted above. It will be important for the landscape and visual baseline of the full LVIA that a consistent position is established. In respect of the landscape character baseline the landscape character assessment work (Appendix H) associated with this LVIA scoping has sought to provide such an approach in order to support the final LVIA baseline work.

10.5.1.2 People's attitudes towards the visual and landscape effects of the LEAs, and the beacons within these may range from very positive to very negative. Therefore, for the purposes of this LVIA scoping study, the visual and landscape effects have been considered to be potentially adverse or beneficial in nature.

11 Natural Resources & Waste

11.1 Approach to identifying potential environmental effects

11.1.1.1 This section of the EIA Scoping Report considers the potential effects on natural resources, and the generation of waste during construction and operation of the proposed Project. For the purposes of this topic, the study area extends up to 250 metres from the proposed flood relief channel, River Thames weirs and associated features. It is considered that receptors beyond this area would not be affected.

11.1.1.2 Baseline conditions have been determined from a number of sources, including data on geology from the British Geological Survey (BGS); historical and existing landfill site data from the Environment Agency and information on mineral and waste resources (minerals safeguarding areas, existing mineral and waste extraction sites, waste consultation areas and future preferred areas for extraction) which were obtained from the RBWM, SCC and the Mayor of London's office.

11.1.1.3 Consultation has taken place with all of the relevant landowners of mineral extraction, waste processing and landfill sites in the study area as well as other relevant bodies and stakeholders. Members of the project team have met with representatives of major operators in the area including: Charles Morris, CEMEX, Jayflex Group, Brett Aggregates, Viridor and Fowles Crushed Concrete. Representatives from CEMEX, Brett Aggregates and Charles Morris were invited to represent their interest groups at the Discussion Group Workshops. Additionally Environment Agency technical waste specialists have been consulted and a 'Contamination and Waste' advisory group formed to guide the Project design on these aspects.

11.2 Baseline information

11.2.1.1 Mineral extraction is one of the primary industries within the study area, as a result of the valuable reserves of sharp sand and gravel that are present within the River Thames floodplain. Minerals Safeguarding Areas (MSAs) are areas which contain specific mineral resources of local and national importance, and are in place in numerous locations across the study area to ensure sustainable husbanding of aggregate minerals; the conservation of mineral resources; and the prevention of sterilisation by other forms of development. Mineral sites are designated by the Mineral Planning Authorities and are therefore identified as locally important receptors. There are no Waste Consultation Areas within the study area[9].

11.2.1.2 Gravel extraction is recognised as a water compatible development and therefore is appropriate within a floodplain; however flooding can cause significant disruption to these activities, causing lost time and potential damage to equipment and machinery. During quarrying, the voids created may provide additional flood storage; however once mineral extraction has finished, many of the voids are either permanently filled with water, or used as landfill sites and are clay lined which can increase the severity of flooding in localised areas.

11.2.1.3 Due to the fact that mineral extraction has been a predominant industry in the study area, use of the voids this industry has created has resulted in the presence of a large number of landfill sites (both historic and authorised) within the study area (further detail on landfill sites is included in Section 13.2.3.2).

[9] Waste Consultation Areas are used by SCC to ensure existing and allocated sites for strategic waste management facilities are protected from development.

11.2.1.4 Mineral and waste planning policy in RBWM is the responsibility of Berkshire County Council.

11.2.1.5 The aggregate minerals widely found in South East England are sand and gravel. Berkshire has been a significant producer of minerals for many years (Berkshire Joint Strategic Planning Unit, 2001). Resources of sand and gravel underlie approximately 30 per cent of Berkshire, and the county currently produces ten per cent of the sand and gravel won in South East England (Berkshire Joint Strategic Planning Unit, 2001). Combined sales of sharp sand and gravel and soft sand from quarries in Berkshire between 2005 and 2015 (collected from South East England Aggregates Working Party (SEEAWP)) and 2015 Operator Survey) are shown in Figure 11-1. In all cases, data shown are the combined sales of sharp sand and gravel, and soft sand.

11.2.1.6 Total combined sales of sand and gravel and soft sand steadily increased from 645,000 tonnes in 2006 to 1,127,000 tonnes in 2011. Sales fell to 792,000 tonnes in 2013, the lowest figure since 2008, followed by a sudden increase to 1,080,000 tonnes in 2014, which then decreased again to 902,000 tonnes in 2015 (Berkshire Unitary Authorities, 2016).

11.2.1.7 Data from AMRI (Annual Mineral Raised Inquiry) indicates sales levels between 2005 and 2009 as being higher and more erratic than those collected for SEEAWP, but showing a steady decline since then to the 2014 figure (with the exception of 2013 where sales increased). According to AMRI, sales in 2011 and 2014 were considerably less than those recorded for SEEAWP and the Joint Berkshire LAA (Local Aggregates Assessment), respectively.

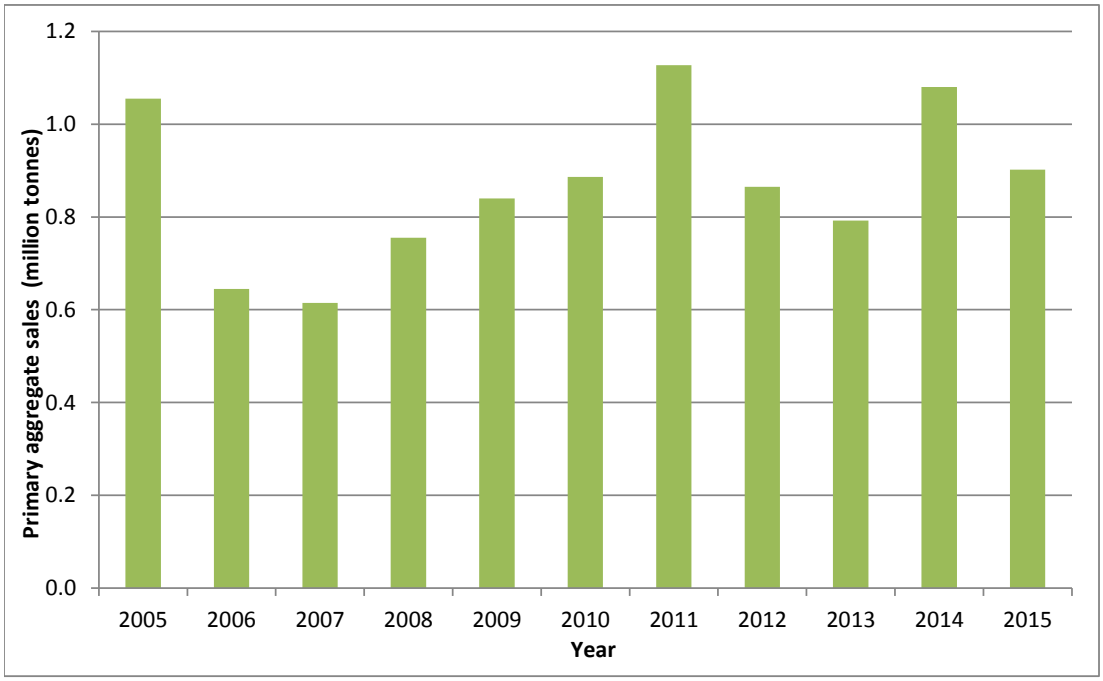

Figure 11-1: Combined sales of sharp sand, gravel and soft sand from quarries in Berkshire (2005 to 2015) from SEEAWP Aggregates Monitoring Surveys and 2015 Operator Survey (Berkshire Unitary Authorities, 2016).

11.2.1.8 When comparing the pattern of mineral sales in Berkshire to that of Great Britain, it is to be expected that sales for Great Britain as a whole will follow a smoother pattern than that of any individual Mineral Planning Authority area, because the latter will have fewer quarries, which means either the closing or opening of any single quarry has a more significant effect on the overall level of sales. In Berkshire's case, the increase in sales in 2014 can largely be attributed to the re-opening of one of Berkshire's quarries that year (Berkshire Unitary Authorities, 2016).

11.2.1.9 Berkshire's sand and gravel sales have been more constant than those of its neighbouring counties (i.e. Buckinghamshire, Hampshire, Oxfordshire, Surrey, and Wiltshire). The neighbouring authorities have all shown an overall decline in sales over the past ten years. As a result, Berkshire has changed from having

the lowest level of sales of its neighbouring counties between 2006 and 2007, to having the highest in 2014, and the second highest in 2015 (Berkshire Unitary Authorities, 2016).

11.2.1.10 Data provided by RBWM shows that there are six existing mineral extraction sites in the study area within the vicinity of Channel Section 1, the largest being Kingsmead Quarry (two sites), owned by CEMEX (Berkshire Unitary Authorities, 2016). There are also smaller sites; Datchet, Wraysbury Quarry, Hythe End Road Quarry and Yeoveney (Hythe End) Quarry (see Figure SW-DR-V-00043) (McEvoy et al., 2003).

11.2.1.11 RBWM has identified in its Borough Local Plan Preferred Options Consultation (2014) three preferred areas in which they plan to continue to support future mineral extractions (RBWM, 2014). One of these areas is within the study area: Railway Land, Kingsmead, Horton (Figure SW-DR-V-00043).

11.2.1.12 There is a large MSA defined by the RBWM, which covers the entire study area within the vicinity of Channel Section 1 (see Figure SW-DR-V-00043).

11.2.1.13 There are five landfill sites in the vicinity of Channel Section 1, namely Welley Road, Kingsmead Quarry, Station Road, Wraysbury Landfill Site, and Hythe End Farm Landfill (see Appendix D Table 1 and Figure SW-DR-V-00044 for more details).

Channel Sections 2, 3 and Desborough Cut

11.2.1.14 There are a number of primary minerals present in the county of Surrey, including soft sand, gravel, oil and gas, chalk, clay and peat; however as with Berkshire, the predominant minerals worked in the county are sands and gravels (SCC, 2011). Aggregate production in Surrey between 1997 and 2002 remained relatively constant at between 2 to 3 million tonnes (Bloodsworth et al., 2003), but has declined in recent years to 0.8 million tonnes in 2013 (see Figure 11-2 below).

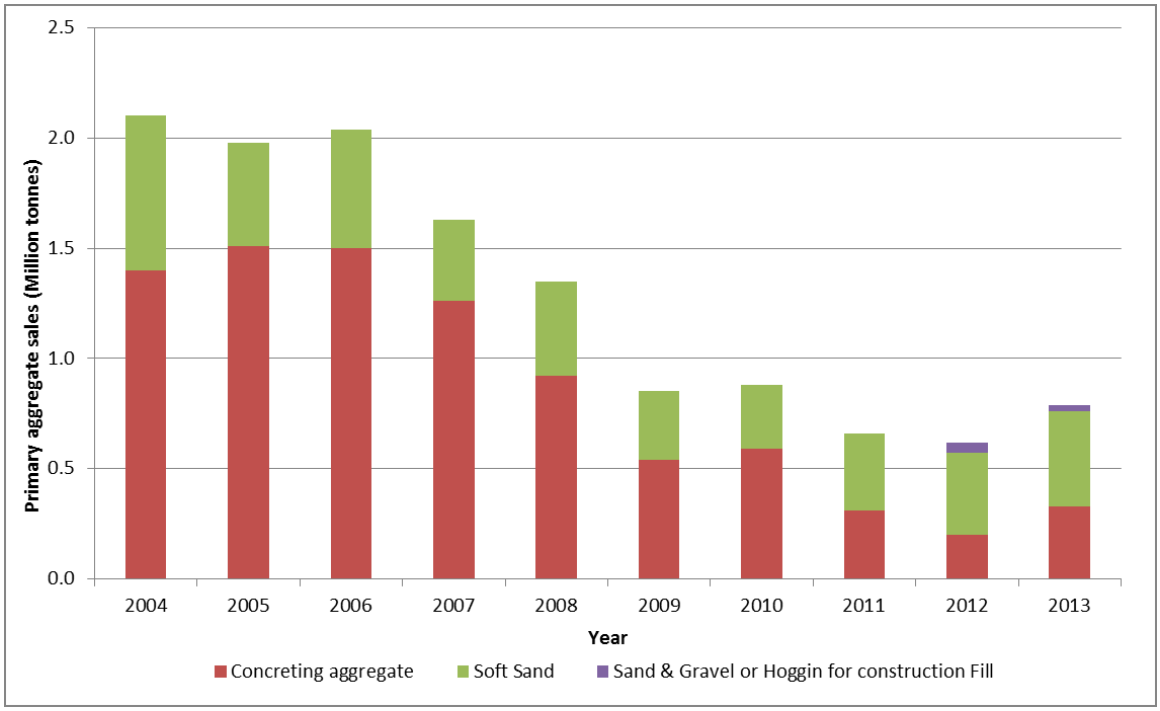

Figure 11-2: Sales of land-won primary aggregates in Surrey from 2004 to 2013 (SCC, 2014).

11.2.1.15 Data provided by SCC shows that there are existing sand and gravel sites at Norlands Lane and at Shepperton Quarry, on Littleton Lane (owned by Brett Aggregates) (Figure SW-DR-V-00043), however the majority of them are now inactive.

11.2.1.16 SCC have also identified preferred areas for future primary aggregate extraction for the period 2009-2026 and there are no preferred areas within the study area.

11.2.1.17 There are four MSAs in the study area covering the northern and southern sections of Channel Section 2 and the western half of Desborough Island (see Figure SW-DR-V-00043).

11.2.1.18 There are seventeen landfill sites in the vicinity of Channel Sections 2 and 3, namely Royal Hythe Farm, Green Lane Pitt, Norlands Lane, Elmcott and Coldharbour, Coldharbour Lane, Chertsey Lane, Twynersh Farm, Bretts Landscaping Ltd, Littleton Lane, Lavenders, Sheepwalk, Chertsey Road Tip, Pool End Lake, Manor Farm, Old Sheepwalk, Shepperton Ranges, and the Margins (see Appendix D Table 1 and Figure SW-DR-V-00044 for more details). Information provided by SCC on existing minerals and waste sites states that Norlands Lane landfill site is currently in the restoration stage of its planning permission.

Sunbury, Molesey and Teddington weirs, and Ham Lands

11.2.1.19 There are relatively small resources of workable sand and gravel in London; therefore the London Plan 2016 (Major of London, 2016) only requires four specific boroughs to undertake a LAA of mineral extraction potential their area. Neither the LBRUT, nor the RBKUT are required to undertake an LAA. Consequently, there is no information on existing or potential mineral extractions in LBRUT and RBKUT sections of the study area.

11.2.1.20 According to information provided by SCC there are no existing mineral extraction areas in Surrey, within the study area of the River Thames weirs.

11.2.1.21 Hurst Park, close to Molesey weir, has been designated as a MSA (see Figure SW-DR-V-00043).

11.2.1.22 There are four landfill sites within the study area of the three River Thames weirs, namely Land Adjoining the Leisure Centre, Hurst Road, Apps Court Farm and Broom Road Recreation (see Appendix D Table 1 and Figure SW-DR-V-00044 for more details).

11.2.2 Future baseline

11.2.2.1 Ground conditions and existing landfill areas 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, and landowners may apply to vary their mineral restoration schemes; therefore changes and updates will need to be checked for regularly.

11.2.2.2 Minerals 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. It is highly likely that any voids will be used for landfill.

11.2.2.3 Within the study area, any future mineral extraction is likely to be focused in the preferred locations identified by Surrey and Berkshire County Councils ('primary Aggregate Extraction Preferred Areas and Preferred Areas of Future Working - see Figure SW-DR-V-00043).

11.2.3 Key environmental constraints and opportunities

11.2.3.1 The key environmental constraints in relation to this topic are:

- The potential need for land take from existing minerals extraction sites, MSAs and landfill sites.

11.2.3.2 The key environmental opportunities in relation to natural resources and waste are:

- To improve flood risk to industrial assets in the area, such as quarries and landfill sites; and
- The potential to use excavated materials from construction of the Project to undertake landscape enhancements in the study area.

11.3 Predicted changes to the environment and scope of assessment

11.3.1.1 Potential effects on traffic and transport during construction and operation of the Project are discussed in Table 11-1.

Table 11-1: Potential effects during construction and operation.

Project activity	Potential effects and receptors	Could the effect be significant – Y/N?	Reason and Potential mitigation measures
Construction			
Excavation of flood relief channel.	Potential adverse effects of generating contaminated waste on waste management and disposal, water bodies, local communities, air quality, and traffic movements from excavation through landfills.	No.	Excavating the channel through existing landfills may encounter contaminated waste. A Waste Recovery Plan (WRP) will be produced applying 'duty of care' principles to demonstrate the possibility of recovering and re-using contaminated material on site where possible. The WRP will inform obtaining an Environmental Permit for the excavation of material. Contaminated waste unsuitable for re-use will be disposed of to landfill. Generating contaminated waste from excavating through landfill affects other topics. These affects are considered in the following: • Water – see Table 14-4 in Section 14.3; • Population – see Table 12-2 in Section 12.3; • Air quality and climatic factors - see Table 7-3 in Section 7.3; and • Traffic and transport - see Table 15-3 in Section 15.3.
	Potential beneficial effect from extracting natural resources (i.e. sharp sands and gravel) and thereby contributing to the economic and social development of the area, through the provision of raw materials, and employment opportunities.	No.	The channel runs through MSAs which contain existing or potentially viable mineral resources. Construction of the channel will facilitate extraction and sale of such resources by liaising with mineral extraction companies in the area, and the respective local authorities. Also see Table 12-2 in Population (Section 12.3) for effects of extraction of natural resources on economic and social development in the local community.
Project construction (including flood relief channel, flow control structures, associated features, and weirs etc.).	Potential adverse effect resulting from the amount of natural resources (i.e. materials and energy) required to construct the Project.	No.	In order to construct the Project, a large amount of natural resources (i.e. materials and energy) will be required. However, use of natural materials has been minimised through the outline design. For example, parts of the flood relief channel have been designed to have a 'natural channel' with no hard engineering, and the number of structures has been minimised, reducing the use of natural resources. A materials usage plan will be completed and maintained throughout construction as best practice. The plan will consider for example 1) responsible sourcing of materials, 2) their durability, 3) opportunities to use recycled / biodegradable materials, 4) acquired

Project activity	Potential effects and receptors	Could the effect be significant – Y/N?	Reason and Potential mitigation measures
			volumes and appropriate storage / use to avoid waste. For the construction phase, a carbon calculator and / or energy life cycle assessment of the key materials and components will be completed during design to quantify the amount of resources produced and used, which in turn will identify measures for minimising the overall resources usage. During construction, an energy management plan will be implemented, which will consider measures such as use of energy efficient plant and renewable energy sources.
	Potential adverse effect of generating a large quantity of general construction waste and excavated material, thereby putting pressure on local waste management and disposal facilities.	No.	Excavation of the flood relief channel will produce a large quantity of waste material. A WRP will be produced to demonstrate the possibility of recovering and re-using material on site where possible. The WRP will inform obtaining an Environmental Permit for the excavation of material. Wherever possible non-contaminated material will be re-used on site for landscaping and to create the LEAs, and flood and separation embankments. A Site Waste Management Plan (SWMP) will be completed and maintained throughout construction as best practice in order to ensure that materials are managed efficiently, and that materials recycling, reuse and recovery is maximised, thereby reducing waste sent to landfill.
Operation			
Maintenance activities.	Potential adverse effect on use of energy and materials.	No.	In order to operate the proposed Project, natural resources (i.e. materials and energy) will be required in addition to the existing weirs in the study area.
Existence of the flood relief channel, LEAs and areas of habitat creation.	Potential adverse effect on natural resources through sterilisation of MSAs.	No.	The proposed flood relief channel runs through MSAs which contain viable mineral resources that may no longer be workable once the channel is in place. However, only two locations will be affected (Abbey and Desborough Island) which represents only a small proportion of SCC's total identified MSAs. There may also be potential for extraction of minerals from these locations to be facilitated as part of constructing the Project, thereby avoiding total sterilisation of these MSAs.
Reduced risk of flooding.	Beneficial effect of reduced incidence of flooding to MSAs.	No.	Reduced incidence of flooding to potential MSAs will increase the viability and ease of extracting minerals.

11.4 Assessment methodology

11.4.1.1 Following review of the baseline information and the project proposals, no effects with the potential to be significant have been identified during construction or operation on natural resources and waste receptors. As a result, the assessment of natural resources and waste can be scoped out of the EIA.

11.5 Limitations and assumptions

11.5.1.1 The information and level of detail on minerals and MSA locations varies across the study area depending on which local authority the MSAs fall under.

11.5.1.2 This scoping assessment has been based on the following assumptions:

- That all MSAs are listed in the local authorities Minerals Plans; and
- That the majority of inert excavated material will be reused on-site so that the volume of waste requiring off-site disposal is minimised.

11.5.1.3 The available minerals information should be reviewed as part of undertaking the EIA, as a number of the local authorities (e.g. RBWM) have emerging plans and policies that may alter the baseline.

11.5.1.4 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 is likely to 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).

12 Population (including Noise, Vibration & Land Use)

12.1 Approach to identifying potential environmental effects

12.1.1.1 This section of the EIA Scoping Report considers potential effects on Population (including noise, vibration and land use) arising from the construction and operation of the Project, and as a result of the change in flood risk resulting from the project. For the purposes of this topic, the study area extends up to 500m from the flood relief channel, River Thames weirs and associated features; as well as including the area that will benefit from greater flood risk protection.

12.1.1.2 A desk-based assessment has been undertaken using a range of data sources including borough level statistics on population, health and employment from the Office of National Statistics (ONS); Agricultural Land Classification (ALC) data from Natural England; information on Green Belt areas, open spaces, footpaths, and cycle paths from Local Authorities, as well as mapping from Ordnance Survey (OS). Additional information has been obtained from analysis of a combination of ordnance survey mapping, satellite imagery and web searches.

12.1.1.3 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 has assisted with collation of baseline data on flood risk, commercial activity, recreation and land use within the study area.

12.2 Baseline information

12.2.1 Flood risk

12.2.1.1 The lower Thames area has a history of flooding with notable floods occurring in 2014, 2013, 2003, 2000, 1968, and 1947. Figure SW-DR-V-00037 shows the area at risk of flooding in a 1 in 100 flood (1 per cent chance of happening in any given year). The River Thames between Datchet and Teddington has the largest area of developed floodplain in England without flood defences. There are approximately 15,000 homes and businesses between Datchet and Shepperton at risk of fluvial flooding, and approximately 4,700 residential properties at risk from a flood with a 1 in 20 (5 per cent) chance of happening in any given year. Within the study area the greatest risk to the human population is in the urban areas of Staines, Egham and Chertsey. A 1 in 100 year flood (one per cent) would cause severe disruption to local communities, including roads, rail and disruption of several major drinking water abstractions supplying south-east England, as well as over 200 local electricity sub-stations.

12.2.2 Land use

12.2.2.1 There are a variety of land uses throughout the study area. The urban areas of Datchet, Wraysbury, Hythe End, Staines, Egham Hythe, Chertsey, Shepperton, Sunbury-on-Thames, East Molesey, Teddington and Ham are associated with residential, commercial and industrial developments and connecting road and rail infrastructure. Figure SW-DR-V-00039 shows the locations of the main urban areas in the wider study area.

12.2.2.2 There are several reservoirs and many lakes and gravel pits within the study area, the latter as a result of restored mineral excavations (Figure SW-DR-V-00039). Many of the lakes and gravel pits are used for commercial recreational purposes including angling and watersports (Section 12.2.4). Mineral

excavation and landfill sites are also located across the study area (see Figures SW-DR-V-00043 and Figure SW-DR-V-00044).

Urban areas and commercial land use

Channel Section 1

12.2.2.3 The main residential settlements in the vicinity of Channel Section 1 are Datchet to the north, Wraysbury, Horton and Hythe End to the south.

12.2.2.4 The majority of the water bodies in the Wraysbury, Horton and Hythe End areas are associated with commercial recreation ventures including angling, sailing and diving; this is detailed in the Section 12.2.4 and shown on Figure SW-DR-V-00039. Thames Water manages the Wraysbury Reservoir which extends into the eastern extent of the study area. There are several industrial sites in the study area: a CEMEX concrete plant and quarry is located in Horton, and further south at Hythe End are the industrial complexes of Charles Morris Fertilisers and Fowles Crushed Concrete.

Channel Section 2

12.2.2.5 The urban areas in this section of the study area comprises of Staines to the north and Chertsey to the south, as well as the village of Thorpe to the west (Figure SW-DR-V-00039).

12.2.2.6 The Thorpe Park Resort, including Manor Lake, Abbey Lake and Fleet Lake, represents a significant commercial area (over 100ha), in this part of the study area. There are also commercial landfill and mineral processing operations including the Coldharbour Lane landfill site. Thorpe Industrial Estate lies just north of Thorpe on the western extent of the study area.

12.2.2.7 Affinity Water operates the Chertsey Water Treatment Works adjacent to the River Thames at Abbey Meads. There are also many general commercial areas associated with the urban areas of Chertsey and Staines. The Causeway Industrial Estate, a 26ha site on the A308 between Egham and Staines, contains a number of industrial buildings. The Sainsbury Centre provides a hub for commercial businesses in Chertsey.

Channel Section 3 and Desborough Cut

12.2.2.8 The villages of Shepperton and Shepperton Green are the main residential areas in the vicinity of Channel Section 3 (see Figure SW-DR-V-00039). There are also residential properties along Chertsey Bridge Road, Chertsey Road and Ferry Lane, between Chertsey and Shepperton.

12.2.2.9 Landfill operations within the study area include the Brett Aggregates site on Littleton Lane. Sand, gravel and aggregate suppliers, including George Killoughery Ltd and Breedon Group Plc, are also based on Littleton Lane. The Waymeadows Business Park, on Chertsey Road, contains a number of automotive and vehicle businesses. Desborough Island Water Treatment Works, operated by North Surrey Water Company, is situated on Desborough Island.

Sunbury weir

12.2.2.10 The land on the left bank of the River Thames is a mixture of the residential and commercial properties of Sunbury-upon-Thames.

12.2.2.11 Sunbury gas works is situated on the right bank of the River Thames adjacent to Sunbury Lock and next to this are the commercial recreational facilities associated with the Xcel Leisure Centre complex, detailed in Section 12.2.4.

Molesey weir

12.2.2.12 The land immediately surrounding the study area at Molesey weir and Hurst Park is predominantly urban, with a mixture of commercial and residential properties. There are residential properties opposite the weir along the right bank of the River Thames, set back from the river behind the towpath. The left bank is dominated by the open space of Hampton Court Green and Bushy Park although does

include part of the suburban area of Hampton. This suburban area includes Hampton Business Centre and Hampton Court Water Works, owned by Thames Water.

Teddington weir and Ham Lands

12.2.2.13 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 in the area relates to sporting facilities detailed in Section 12.2.4 and shown on Figure SW-DR-V-00038. On the right bank of the River Thames, downstream of the weir is Ham Lands LNR.

Agriculture

12.2.2.14 Figure SW-DR-V-00040 illustrates the Agricultural Land Classification in the 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 study area is limited, the quality is generally high with the majority of agricultural land classified as good to moderate or higher. The western section of the study area contains the majority of the agricultural land although isolated patches occur throughout the study area. The Greater London area in the north east is dominated by urban areas and so has little agricultural land.

12.2.2.15 The highest quality agricultural land is confined within isolated areas near Datchet, Horton, Wraysbury, Thorpe, Laleham and Shepperton. The largest continuous swathes of agriculture grade land are in the west of the study area, south of Windsor (Grade 3 – good to moderate) and between Egham and Chertsey (Grade 2 – very good and Grade 3 – good to moderate). Farms within these stretches of agricultural land area include Southlea Farm, Ankerwycke Farm and Mead Farm. There are other areas of rough grazing or unknown agricultural interest around the Kingsmead Lakes, Hythe End, adjacent to Thorpe Hay Meadow, and across Abbey Meads on Channel Section 2.

Green Belt

12.2.2.16 The majority of land within the study area is designated as Green Belt (Figure SW-DR-V-00039), punctuated by the urban areas of Datchet, Old Windsor, Egham, Chertsey, Staines, Shepperton and Sunbury. Both Molesey weir and Teddington weir are located outside of the Green Belt.

12.2.3 Population and health

12.2.3.1 Summary population and social information from each local authority within the study area is presented in Table 12-1. All data is from the 2011 census apart from unemployment figures (2016) and mortality ratio (2015). Figure SW-DR-V-00041 shows the spatial trends in population density across the study area, with population density greatest in the London Boroughs to the east of the study area.

12.2.3.2 Studies have shown that groups within communities that have higher levels of vulnerability (e.g. lone parent households, the unemployed, elderly and those in poor health etc.) are likely to suffer more pronounced effects of flooding (Tapsell et al., 2002).

12.2.3.3 Generally people within the boroughs of LBRUT, RBKUT and EBC have the highest level of education and social grade. However, the London area has a notably higher population density with a greater proportion of the population living in flats or apartments rather than houses.

12.2.3.4 In general the population within the LBRUT and EBC are healthier and less vulnerable than the rest of the boroughs within the study area. Both boroughs have the lowest proportion of lone parent households, the lowest standardised mortality ratio scores and highest levels of general health. The boroughs of RBC and SBC score poorly on several health and vulnerability statistics including standardised mortality rate, people providing unpaid care and general health. Despite the variations throughout the study area, in general the population within the study area is wealthier, healthier and less vulnerable than England as a whole. Data from the 'Index of Multiple Deprivation' corresponds with this, showing that generally there is a very low instance of deprivation across the study area.

Table 12-1 Population summary statistics.

	Topic Area	Low	High	Range within study area	Spatial Trend	Study area compared with England average
Education and Social Statistics	**Population density**	Lowest in Windsor & Maidenhead and RBC.	Highest in RBKUT and LBRUT.	7.4-39.54 persons per hectare.	Population density increases west to east.	Study area higher than England.
	Unemployment	Lowest in EBC and RBC.	Highest in SBC, RBKUT and RBWM.	2.7 - 3.3%.	None.	Study area lower than England.
	Ethnicity	Highest % of ethnic minorities in RBKUT and LBRUT (particularly Indian and Other Asian).	Lowest % ethnic minorities in SBC, RBC and EBC.	63.1 – 81 % white.	Highest % ethnic minorities in Outer London but lower in Surrey and Berkshire.	SBC and RBC lower % ethnic minorities, EBC and RBWM, LBRUT and RBKUT higher % ethnic minorities than England average.
	Qualification	SBC and RBC have lowest % population with degree and highest with no qualifications.	LBRUT, EBC and RBKUT have highest % population with degree and lowest with no qualifications.	% with no qualification: 10.6 – 20.4%.	Outer London most qualified. Least qualified in SBC and RBC.	Study area better qualified than England average.
	Average social grade	SBC and RBC have the lowest social grade.	LBRUT and EBC have the highest social grade.	% grade AB[10]: 24.4 – 48.1% % grade DE: 10.1 – 16.4.	Generally higher in London boroughs.	Higher average social grade throughout study area.
	Accommodation	EBC, RBC, Windsor & Maidenhead and SBC have the highest % resident in unshared houses. RBC and EBC have lowest % in flats.	LBRUT and RBKUT lowest % in unshared houses and highest % in flats.	Residents in unshared houses: 60.0 – 78.1%. Residents in unshared flats: 20.4 – 39.2%.	Surrey and Berkshire have higher number of residents living in houses and lower in flats.	Generally fewer people living in houses and more in flats within the study area thanthe England average apart from RBC.
Health and Vulnerability	**General health**	Lowest % in good/very good health and highest % in bad/very bad health in SBC and RBC and RBKUT.	Highest % in good/very good health and lowest % in bad health/ very bad in EBC and RBKUT.	Good/ very good health: 84-88%. Bad/ very bad health: 3.2-4.1%	None.	Health is significantly better in the study area than in England average.
	People who provide unpaid care	Lower % of people providing unpaid care in RBKUT, LBRUT and EBC.	Higher % of people providing unpaid care in SBC, RBC and RBWM.	8.3 – 10.3%.	Higher % of people in Surrey and Berkshire than London.	Less people provide unpaid care in study area than the England average apart from SBC.
	Elderly people	Lowest % of people over 65 in RBKUT. Lowest % of people over 90 in RBKUT, SBC and RBWM.	Highest % of people over 65 in SBC. Highest % of people over 90 in EBC.	% of people over 65: 11.9 – 16.6%. % of people over 90: 0.8 – 1%.	Higher % of elderly people in Surrey and RBWM	RBKUT and EBC have less over 65s than England, but Windsor & Maidenhead, RBC and SBC have more. There are generally more or equal % of people over 90 within study area than the England average.
	Lone parent households with dependent children	Lowest in EBC, RBC and LBRUT.	Highest in SBC and RBKUT.	4.7 – 5.6%.	None.	Lower proportion of lone parent households in study area than England average.
	Standardised mortality ratios	Lowest in EBC and LBRUT.	Highest in SBC and RBC.	83 – 98.	None.	Study area has lower mortality rate than Englandaverage.
	Index of Multiple Deprivation	Generally very low level of deprived neighbourhoods within study area.	Six wards that intersect study area in LBRUT have the highest Index of Deprivation but are not highly deprived.	Rank of Index of Multiple Deprivation falls between 7479 and 32029.	None.	Study area lower than England average.

[10] Social grade is a classification based on occupation. The classifications used in Table 12-1 are as follows: A) High managerial, administrative and professional. B) Intermediate managerial, administrative and professional. D) Semi-skilled and unskilled manual workers. E) State Pensioners, casual and lowest grade workers, unemployed with state benefits only.

12.2.4 Recreation and tourism

12.2.4.1 The River Thames as a whole is of major importance for tourism and visitor activity. It is estimated that powered craft on the River Thames generated almost 2.35 million visitor days and unpowered craft nearly 1.1 million visitor days per annum in 2001 (Ecotech Research and Consulting, 2002).

12.2.4.2 Angling is an important recreational activity, with some 210,000 anglers estimated to use the River Thames with associated local spending of some £180 million. The River Thames also attracts up to 13.9 million leisure visits (Ecotech Research and Consulting, 2002). The lakes within the study area are also an attraction for anglers as discussed below.

12.2.4.3 The Thames Path National Trail is a 128km long distance trail which runs throughout the study area and attracts an estimated 522,000 users a year (Countryside Agency, 2000). Excluding the London area an estimated 275,145 user days are spent on the Thames Path (RBWM, 2004a). Within the Port of London Authority (PLA) area (i.e. the tidal River Thames), an estimated 9,960,000 people use the National Trail each year (Oxford Economics, 2015). Parts of the National Cycle Network also run adjacent to the River Thames, between Staines and Chertsey, then between Shepperton and Teddington. In addition to these long distance trails, there are numerous other PRoW including footpaths, bridleways and cycle routes within the study area.

12.2.4.4 Due to the amount of water bodies in the study area, there is a propensity of water based recreation. The River Thames is used by a number of rowing and boating clubs and many of the lakes in the study area are used for commercial recreation businesses such as sailing, wakeboarding, waterskiing and angling. Details of these water based recreation opportunities are provided below and shown on Figure SW-DR-V-00038.

Channel Section 1

12.2.4.5 As a result of the numerous water bodies, a variety of water based recreational pursuits are available within the study area; the majority of these are operated by commercial businesses. Angling is a common recreational pursuit, with several lakes claiming to have prized fish species, attracting anglers from outside the local area. RK Leisure operate a commercial angling business from several lakes in the Wraysbury area including Kingsmead Island Lake, Crayfish Pool, Horton 1, Kingsmead 1 (S), Kingsmead 1 (N), Church Lake, Wraysbury 1 (N), Wraysbury 1 (S) and Wraysbury 2 (N). Several smaller angling clubs including Blenheim Angling Society (Blenheim Lake), British Airways Angling (Wraysbury 2 (S)), Twynersh Angling (Twynersh Lakes), Longfield Fishery (Lower Hythe Angling Pits), and Runnymede Angling Association (Abbey 1 and Abbey 2) use additional lakes in the study area and also charge membership fees. Angling lakes have been highlighted on Figure SW-DR-V-00038, sheet 1.

12.2.4.6 Liquid Leisure operates a waterski and wakeboarding venture from Datchet 3 North and South; the British Disabled Waterski and Wakeboarding association are based at Hythe End East Lake; Silverwing Sailing Club uses Wraysbury 2 (S) Lake for sailing and Dragon boating; and Wraysbury Dive Centre operate from Douglas Lane Lake. Wraysbury Skiff & Punting Club and Wraysbury Dragons use the River Thames along this reach and are based at Runnymede Pleasure Grounds. There are Environment Agency short-term moorings, allowing a 24hr stay on the River Thames near Egham and Staines, along with permanent moorings at Bell Weir Lock (Environment Agency, 2014b).

12.2.4.7 Areas of Public Open Space and woodland areas provide opportunities for informal recreation such as walking and picnicking. Areas of Public Open Space of note include National Trust Land at Ankerwycke Farm Estate, and Runnymede Pleasure Ground on the right bank of the River Thames. Wraysbury village contains designated areas of Public Open Space including 'The Green', a small locally designated Important Urban Open Space. Key PRoWs within the area allow walks around the Wraysbury area and between Wraysbury and Horton.

Channel Section 2

12.2.4.8 Thorpe Park Resort, the UK's third largest theme park, operates within the study area attracting almost 2 million visitors per year (Statista, 2015). Merlin, the parent company also operates recreational

watersports facilities on surrounding lakes including Manor Lake, Fleet Lake and Abbey Lake. Additionally JB Ski run a Waterski and Wakeboarding site from St Ann's Lake, which is also used by St Ann's Lake Fishing Syndicate who run an angling business.

12.2.4.9 Penton Hook Marina, Britain's largest inland marina, is situated off the right bank of the River Thames, at Staines and provides a base for Penton Hook Yacht Club. W. Bates & Son provide individual pontoon and bank moorings for up to 110 boats just south of Chertsey Bridge (Bates Wharf, 2017). Staines [Rowing] Boat Club and Staines Sailing club are both based downstream of Staines Bridge and use the River Thames from Penton Hook Lock as far as Bell Weir Lock and Staines Bridge respectively. Burway Rowing Club is based adjacent to Laleham Park and race downstream of Penton Hook Marina to Chertsey Lock. Additional commercial recreation facilities in the area include Laleham Golf Club and Laleham camping club.

12.2.4.10 Areas providing opportunities for informal recreation include the Public Open Spaces of Thorpe Hay Meadow, a designated SSSI, and Laleham park (SBC refer to Public Open Spaces as Amenity Areas). There are also clusters of Public Open Space within Chertsey itself including the Orchard Public Gardens, Abbey Field Recreation Ground, Gogmore Farm Park and Bourne Meadow Park. The main PRoW in this part of the study area extends from Thorpe Park Resort towards Thorpe Hay Meadow and Laleham.

Channel Section 3 and Desborough Cut

12.2.4.11 Much of the commercial recreation activities in the study area are based on the surrounding water bodies. Mid Kent Fisheries and Taywood Angling, Spelthorne Water Ski and Surrey Canoe Club all operate from Littleton North Lake. Littleton Sailing Club sail on Littleton East Lake. Shepperton open water swimming club is based on Ferry Lake. Elmbridge Canoe Club, Weybridge Sailing Club and Weybridge Rowing Club are all based in the area downstream of Shepperton Lock. Shepperton Marina is located downstream of the Desborough Cut and provides berths for 380 boats (Shepperton Marina, 2017). Other commercial recreation activities include Chertsey Camping and Caravanning Club on the right bank of the River Thames, near Littleton Lake; Weybridge Lawn Tennis club, just upstream of Desborough Cut and the Weybridge Vandals Rugby Football Club on Desborough Island.

12.2.4.12 Areas of Public Open Space in the study area which can be used for informal recreation activities include the northern section of Chertsey Meads, a wildflower meadow on the right bank of the River Thames; Dumsey Meadow SSSI; Funky Footprints Nature Reserve near Shepperton and parts of Desborough Island. PRoWs in the area allow walking routes along the banks of Littleton East Lake towards Shepperton and also connect Chertsey and Weybridge.

Sunbury weir

12.2.4.13 The Middle Thames Yacht Club is located on Sunbury Lock Ait. Walton Rowing Club is located 1km upstream of Sunbury weir and uses the stretch of the River Thames between Shepperton Lock and Sunbury Lock. Numerous moorings are connected to the club. The Elmbridge Xcel Leisure Complex, on the right bank of the River Thames next to the Sunbury Gas Works, provides indoor sports facilities and an outdoor football pitch, which is used as a base for Walton Casuals Football Ground.

12.2.4.14 Sunbury Park, Flower Pot Green, the Old Bathing Fields and the Kings Lawn areas of locally designated Public Open Space are located opposite Sunbury Lock Ait and together (with some additional areas of open space 600m and 950m north-west of the River Thames) provide approximately 20ha of open space for informal recreational use on the left bank of the River Thames within the study area.

Molesey weir

12.2.4.15 Commercial recreation and tourism opportunities are present in the Molesey weir study area. Hampton Court Palace, a major visitor attraction, attracting almost 600,000 visitors in 2015, is located approximately 500m east of Molesey weir on the left bank of the River Thames. Immediately downstream of Molesey Lock is the long established J. Martin and Sons boat hire which provides water based recreation opportunities for large numbers of visitors to the area every year. Hampton Ferry Boat

House is located upstream of Molesey Lock and operates a ferry and boat hire service to the public (with a reduced service between April and October).

12.2.4.16 Upstream of the weir complex are the headquarters of Molesey Boat Club, Hampton Sailing Club and Hampton Canoe Club. In addition, stand-up paddle boarding also takes place on this section of the River Thames with Blue Chip SUP School launching from Hurst Park. East Molesey Cricket Club is situated in Hurst Park on the right bank of the River Thames.

12.2.4.17 Together, Hampton Court Palace, Hampton Court Green and Bushy Park provide over 115ha of open space for informal recreational use on the left bank of the River Thames, the majority of which is freely open to the public. The parks contain a mixture of ponds, water features, woods and grasslands with Bushy Park visited by over 8 million people a year (Royal Parks, 2017).

Teddington weir and Ham Lands

12.2.4.18 St Mary's University has sporting facilities on the left bank of the River Thames at their Teddington Lock Campus, approximately 200m from Teddington weir. The Lensbury Club, on the left bank of the River Thames is a private sports resort. There are several water sports clubs located near the Broom Road Recreation Ground including; the Royal Canoe Club, Walbrook Teddington Rowing Club, Kingston Rowing Club and Tamesis Sailing club. These clubs use the River Thames up to Teddington Lock. Boat moorings are located on the left bank downstream of Teddington weir as well as on the left bank of Teddington Ait.

12.2.4.19 Ham Lands LNR provides approximately 70ha of grassland and scrub with abundant wildlife, for recreational use on the right bank of the River Thames, downstream of Teddington weir. Other recreational amenities at Ham Lands include Ham Polo Club, Ham & Petersham Rifles Club, Ham playing fields, and Ham House Stables. King George's Field is located nearby offering football and tennis facilities. Manor Gardens Recreation Ground, on the left bank of the River Thames, and Grove Gardens, near Teddington town centre, provide Public Open Space on the right bank. A footpath crosses Teddington weir, connecting the communities of Ham and Richmond upon Thames.

12.2.5 Noise and vibration

12.2.5.1 Environmental noise has been linked to a range of human health problems such as cardiovascular disorders (Babisch, 2006 and Welch et al., 2013) and so it is important to consider noise levels particularly in relation to human population.

12.2.5.2 Ambient noise and vibration in the study area is generally that associated with urban areas, the main sources being traffic from the local road network, boat movements and the flow of water over the weirs.

12.2.5.3 Air traffic associated with Heathrow Airport also generates noise, which is more noticeable in the northern section of the study area.

12.2.5.4 The M3 and M25 motorways traverse through the study area. The surrounding areas are likely to experience increased levels of ambient noise as a result, with residents in Egham, Staines, Chertsey and Shepperton particularly affected.

12.2.5.5 The larger areas of parkland, such as Ankerwycke, Laleham Park, Ham Lands, Hampton Court Green and Bushy Park generally have lower ambient noise levels due to their distance from local roads.

12.2.6 Future baseline

12.2.6.1 The population within the study area is likely to increase. The population of England as a whole is expected to increase by 4.05 per cent to 56.5 million by 2024 and 16.5 per cent by 2039 to reach 63.9 million (ONS, 2015). In London the population is expected to increase by 28.5 per cent to 11 million over the period 2014-2039, whilst in the South East, there is projected to be an 18.4 per cent increase over the same time period to reach 10.5 million (ONS, 2016).

12.2.6.2 The population of the study area is also likely to live longer as health care improves. The percentage of people over 75 is expected to increase from 5 per cent to 8 per cent in London and from 9 per cent to 14 per cent in the South East over the period 2014 to 2039 (ONS, 2016).

12.2.6.3 This increase in population is likely to increase demand for development in the area which could result in a greater population at risk of flooding 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 within the floodplain and an improvement in flood warning, resilience and evacuation measures.

12.2.6.4 Future land use change is likely to occur, following the framework set out in Local Plans, which may be subject to change in the future. Timeframes of the relevant Local Plans are detailed in the Section 5.

12.2.6.5 Residential, commercial, industrial, agricultural and recreation 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). The impact of climate change on river flows is not conclusive, with changes predicted to both rainfall patterns and temperature. However, studies indicate an increase in both peak flows and flood frequency (Bell et al. 2012). To account for this, the latest guidance from the Environment Agency indicates flood alleviation schemes should take into account potential increases in peak river flows in the River Thames basin of 15 per cent, 25 per cent and 35 per cent for the 2020s, 2050s, and 2080s to adjust for associated increases in flood risk (Environment Agency, 2015a)

12.2.6.6 Popular attractions in the area are likely to be maintained into the future. With government framework and plans to have more people regularly and meaningfully taking part in sport and physical activities, it is likely that participation in such activities will grow in the future (Cabinet Office, 2015), although membership at individual clubs may decline. There is a risk that budget cuts to local authorities could threaten spending on parks and green spaces with possible impacts on associated informal recreation activities (Policy Exchange, 2014).

12.2.6.7 Potential increases in traffic (Section 15) could lead to increased noise levels in the study area. Similarly the proposed expansion of Heathrow Airport is likely to increase noise levels in the northern part of the study area as a result of the associated increase in air traffic.

12.2.7 Key environmental constraints and opportunities

12.2.7.1 The key environmental constraints in relation to population are:

- Potential land take from residential, industrial/commercial and agricultural assets;
- Existing commercial and 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.

12.2.7.2 The main opportunities in relation to population are:

- A reduction in flood risk for residential and industrial/commercial properties, as well as land use assets (e.g. agricultural and recreational areas);
- Improvement in quality of life and wellbeing through reduced property damage and stress as a result of flood risk reduction;
- There is scope within the project to provide additional recreational, access and landscape enhancement opportunities including navigation, angling, mooring, footpaths and cycle ways, and areas of Public Open Space; and
- Potential to create new or improved links to existing (or new) recreation and tourist attractions, and thereby improve access to the outdoors with the potential benefits to physical wellbeing that this can bring.

12.3 Predicted changes to the environment and scope of assessment

12.3.1.1 Potential effects on population and human health, land use and recreation and tourism during construction and operation are discussed in Table 12-2.

Table 12-2: Potential effects during construction and operation.

Project activity	Potential effects and receptors	Could the effect be significant – yes / no?	Reason	Potential mitigation measures
Construction				
Flood Risk				
Creation of site compounds, temporary materials processing sites and storage of excavated material.	Temporary adverse effect of increase in flood risk to homes and businesses.	Yes.	The creation of areas of hard standing and the stockpiling of excavated material within the floodplain has the potential to significantly affect flood risk during construction. The main locations would be at the material processing sites as described in the Project Description (Section 4.2).	A flood protocol will be put in place (in accordance with an Environmental Permit for Flood Risk Activities). This is likely to include the requirement to store material parallel to the direction of water flows within the floodplain so that the stockpiles do not impede drainage.
Land Use				
Earthworks and general construction activity.	Adverse effect of temporary loss of land from residential properties.	No.	Only a small number of private residential properties will be affected. The alignment of the channel has been designed to avoid properties and businesses as far as possible. Landowners will be compensated, most likely through the Compulsory Purchase Order (CPO) process.	
Earthworks and general construction activity.	Temporary adverse effect on commercial businesses from loss /disturbance of land, effects on land drainage patterns etc.	Yes.	In some cases businesses could be affected and become temporarily non-viable or less profitable.	Business owners will be compensated, most likely through the CPO process.
Excavation through landfill (construction of flood relief channel, flood storage area, installation of services and any further ground investigation (GI) works).	Temporary adverse effect of potential release of leachates to water bodies causing potential effects on commercial land uses.	No.	This risk will be managed through good construction practices in accordance with a CEMP, following best practice in handling materials and CIRIA, Government and BS guidance. Measures are likely to include control of runoff from disturbed ground using a water collection system, keeping hard standing clean and covering stockpiled material.	
Population and Health				
Excavation of flood relief channel.	Potential benefit of economic and social development of the area from	No.	There is potential for aggregate or mineral processing businesses to gain a temporary increase in revenue as a result of the flood relief channel running through MSAs which	

Project activity	Potential effects and receptors	Could the effect be significant – yes / no?	Reason	Potential mitigation measures
	facilitating the extraction of natural rescources (i.e. sharp sands and gravel) and thereby contributing to the, through the provision of raw materials, and employment opportunities.		contain existing or potentially viable mineral resources. Construction of the flood relief channel may facilitate the extraction and sale of these rescources.	
Excavation through landfill (construction of flood relief channel, flood storage area, installation of services and any further GI works).	Temporary adverse effect on air quality and odour through release of landfill gases with potential implications for the health of local communities and associated effects on livelihoods of commercial businesses.	Yes.	GIs have shown that the landfills with the greatest potential to release harmful gases are Shepperton Ranges, Norlands Lane, Sheepwalk and Manor Farm (the latter having the greatest potential to release odours). Emissions of landfill gases such as CH_4, CO_2, carbon monoxide (CO), NH_3, and hydrogen sulphide (H_2S) may be released into the air during excavation. Some of these gases have potential to harm human health and cause odour nuisance. Elevated levels of CO_2 and CO can cause asphyxiation in low O_2 level conditions; while short-term exposures (up to two weeks) to elevated levels of NH_3 and H_2S in the air can effect health. Humans can detect odours of H_2S and NH_3 at very low levels over a large distance (below levels causing health effects), which could potentially cause nuisance to a large number of people. In certain locations excavation through landfill will occur within 100m of residences.	Continuous air quality monitoring of landfill boreholes will be done during construction to monitor gaseous emissions and odours. Areas of exposed landfill waste will be minimised. Construction site best practices will be followed such as observing uncovered ground and ensuring proper reporting procedures are followed. An Odour and Air Quality Management Plan 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 day, temperatures or wind conditions.
	Temporary adverse effect of potential release of leachates to water bodies causing potential effects on human	No.	This risk will be managed through good construction practices in accordance with a CEMP, following best practice in handling materials and CIRIA, Government and BS guidance. Measures are likely to include control of runoff from disturbed ground using a water	

Project activity	Potential effects and receptors	Could the effect be significant – yes / no?	Reason	Potential mitigation measures
	health.		collection system, keeping hard standing clean and covering stockpiled material.	
Earthworks and general construction activity.	Temporary adverse effect of dust and particulate matter generated from construction activities leading 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.	Yes.	Dust and particulate matter generated from earthworks, construction activities and vehicle movements could pose a risk to human health. The effect could be significant to those with respiratory conditions. The institute of Air Quality Management recommends that assessment of dust is done where people are within 350m of the site boundary or within 50m of the routes used by the construction vehicles.	Dust mitigation is likely to include keeping compounds, areas of hard standing and roads clean, washing vehicles to avoid build-up of excess material, damping down stockpiles with water or covering them, and the use of dust screens to act as wind breaks.
General construction activities.	Temporary adverse effect of light pollution from construction works leading to disturbance of local communities in close proximity.	No.	There are limited residential or commercial sites in close proximity to the flood relief channel, LEAs and material processing sites. Construction will largely be completed in daylight hours, and lighting will be positioned to minimise light trespass or nuisance glare.	
Influx of construction workers.	Temporary beneficial effect of additional income generation for local businesses during the construction period.	No.	The income generated will likely be limited to certain types of businesses and will be temporary.	
Construction traffic on and off site.	Temporary adverse effect of traffic congestion from construction plant on local roads causing disturbance and stress to local communities.	Yes.	Large increase in vehicle movements on local roads has the potential to increase congestion in the study area which may cause disturbance and stress to local communities.	Traffic movements will be controlled or reduced through: the reuse of excavated material on site, the use of on-site haul roads (where possible), the use of Traffic Management Plans, a CEMP and following construction site best practice. A transport assessment will be completed to identify likely construction effects on congestion and any required mitigation.
Recreation and Tourism				
Excavation and building	Temporary adverse effect to recreation	Yes.	Works in lakes where recreational	Mitigation is to be discussed further with

Project activity	Potential effects and receptors	Could the effect be significant – yes / no?	Reason	Potential mitigation measures
activities (including construction of the flood relief channel, River Thames weir capacity improvements and habitat creation areas, movement/ installation of services, and materials processing sites).	in lakes and rivers (such as commercial and club-based fishing, swimming, diving and sailing) through construction disturbance.		activities occur will reduce or prohibit use during construction.	owners / operators. Measures could include timing, phasing and / or positioning of works to minimise disruption to recreation and tourism. Typically works will occur over a six to nine month period. Where possible the works will be timed to minimise effect on recreational users. This will be considered on a site by site basis, also taking into account nature conservation requirements. See Table 15-3 in Traffic and Transport Section 15.3 for consideration of effects upon navigation on the River Thames.
	Temporary adverse effect to land based recreation (such as PRoW, Thames Path National Trail, Public Open Spaces etc).	No.	Disruption to/closure of PRoW and areas of Public Open Space that transect the working areas will be temporary and localised. Temporary diversions (as opposed to closure) of footpaths/bridleways will be implemented where possible.	
Excavation through landfill (construction of flood relief channel, flood storage area, installation of services and any further GI works).	Temporary adverse effect of potential release of leachates to water bodies causing potential effects on recreation (such as commercial and club fisheries, sailing, swimming).	No.	This risk will be managed through good construction practices in accordance with a CEMP, following best practice in handling materials and CIRIA, Government and BS guidance. Measures are likely to include control of runoff from disturbed ground using a water collection system, keeping hard standing clean and covering stockpiled material.	
Noise and Vibration				
Construction traffic on and off site.	Temporary adverse effect of noise and vibration from construction plant on local roads causing disturbance to local communities.	Yes.	Large increase in vehicle movements on local roads. HGVs and other large plant have the ability to generate noise and vibration which may disturb local communities.	Traffic movements will be controlled or reduced through: the reuse of excavated material on site, the use of Traffic Management Plans, a CEMP and following construction site best practice. A noise assessment will be completed to identify likely construction effects on noise levels and any required mitigation.
Excavation and building	Temporary adverse effect of noise and	Yes.	The main potential sources of	A noise assessment will be completed to

Project activity	Potential effects and receptors	Could the effect be significant – yes / no?	Reason	Potential mitigation measures
activities (including construction of the flood relief channel, River Thames weir capacity improvements and habitat creation areas, movement/installation of services, and materials processing sites).	vibration causing a disturbance to local communities in close proximity to construction areas.		construction noise on site are earth moving plant, HGVs and other large plant, and piling. The linear nature of the flood relief channel will avoid construction activities being concentrated in one location for very long periods (years). However, construction of some elements will take several months, and noise from compounds/ processing sites may persist throughout construction.	identify likely construction effects on noise levels and any required mitigation. Measures in the CEMP could include: • Controlling noise at source e.g. by selecting quieter equipment; and • Barriers or acoustic screens if work is being done near vulnerable receptors (e.g. residential properties).
Operation				
Flood Risk				
Use of the flood relief channel during times of flood.	Beneficial effect on reducing flood risk in the study area, with subsequent beneficial effects on the safety and wellbeing of local communities and businesses.	Yes.	Reduced disruption to local residents and businesses through reduced property damage and loss of income and reduced stress levels.	The small increase in downstream water levels resulting from the use of the flood relief channel will be mitigated for through the upgrades to the three River Thames weirs and use of flood storage at Ham Lands to ensure no downstream detriment.
	Accumulation of sediment in the flood relief channel over time will potentially adversely affect its conveyance capacity during floods, increasing flood risk to homes and businesses.	No.	Sediment modelling is informing the design and possible mitigation measures. These include: • Create an area to trap sediment in the upstream section of the flood relief channel; • Design the shape and positioning of flow control structures to reduce the volume of sediment reaching the flood relief channel; and • Periodic reinstatement of the flood relief channel design profile.	
Operation of the flood relief channel.	Changes in ground levels and areas of hard standing may have an adverse effect on land drainage patterns, and potentially increase runoff, increasing flood risk to homes and businesses.	No.	A Flood Risk Assessment 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 LEAs) will be designed with drainage to avoid flooding from runoff. An Environmental Permit for Flood Risk Activities will be submitted detailing how the project will mitigate for increased runoff.	

Project activity	Potential effects and receptors	Could the effect be significant – yes / no?	Reason	Potential mitigation measures
Land Use				
Existence of flood relief channel, LEAs and areas of habitat creation.	Adverse effect through permanent loss of land from residential properties.	No.	Only a small number of private residential properties will need to be acquired. Landowners will be compensated, most likely through the CPO process.	
	Adverse effect on commercial businesses (such as farming and lake based businesses) from permanent loss /disturbance of land, effects on land drainage etc.	Yes.	In some cases businesses could be affected and become permanently non-viable or less profitable.	Business owners will be compensated, most likely through the CPO process.
	Adverse effect on local residents by overlook from the Beacons to private residential property.	Yes.	At Datchet, Hythe End, Ferry Avenue, Old Shepperton and at the three River Thames weirs existing residential properties are located close to Project elements. See Table 10-1in Landscape and Visual Amenity (Section 10.3).	
	Adverse effect from change in land use in the Green Belt.	No.	The Project features will not be at odds with the purpose of the Green Belt. Master planning and Urban Design Assessment will be undertaken, which will consider the effects upon the Green Belt of creating the project features. If proposals for the LEAs change substantially from current proposals this effect may need to be scoped back into the EIA.	
	Potential adverse effect on soil quality from changes in ground water level. This could reduce the value of land for agriculture and other activities.	No.	There is a limited amount of agricultural land within the study area. Water level control structures have been designed into the project, to maintain existing ground water levels in areas surrounding the new flood relief channel. Therefore, preventing any substantial changes to surrounding ground water levels and soil structure and quality.	
Introducing augmentation flow and flood water to lakes without separation embankments.	Potential for permanent adverse effect on water quality of lakes from the introduction of River Thames water to previously unconnected lakes, with subsequent adverse effects upon the commercial use of these lakes.	Yes.	In some cases businesses could be affected and become permanently non-viable or less profitable.	Business owners will be compensated, most likely through the CPO process.
Population and Health				
Reduced flood risk.	Adverse effect of potential rise in	No.	Potential for an additional levy to be added to the council tax of affected local authorities in	

Project activity	Potential effects and receptors	Could the effect be significant – yes / no?	Reason	Potential mitigation measures
	council tax.		order to fund the Project.	
Use of publically accessible areas within the project.	Potential beneficial and / or adverse effects on traffic movements on roads, public transport services and existing parking facilities could cause disturbance and stress to local communities.	Yes.	Creation of new walking and cycling routes along the flood relief channel may relieve traffic congestion on existing networks Creation of new Public Open Spaces and areas of habitat creation may attract more visitors resulting in a potential increase in pressure on local roads, public transport and existing car parking facilities.	As built-in mitigation additional parking facilities have been included at each of the LEAs. Master planning and Urban Design Assessment will be undertaken to consider the effects upon the public realm of creating areas of public access in terms of connectivity with existing transport links etc. A transport assessment will be completed to identify likely effects on congestion and any required mitigation.
	Beneficial effect of creating opportunities for businesses to establish new ventures in and around new areas of Public Open Space / public access.	No.	There will be planning restrictions on the type and extent of uses possible in publically accessible areas however discussions are ongoing with potential investors / maintainers.	
	Benefical effect on public health by encouraging more outdoor recreation in and around new areas of Public Open Space.	No.	Newly created areas of Public Open Space as well as improved links to existing areas will improve access to the outdoors. This is improved access will potentially benefits physical wellbeing and public health.	
Existence of flood relief channel and flood storage area in landfill.	Potential adverse effect on water quality from contaminants reaching surface water bodies with implications for the health of users.	No.	Measures have been built-in to the project to reduce the risk of contaminants from landfill areas reaching surface water bodies. This includes, separating the flood relief channel from the landfill by sheet piling the sides and replacing the base of the channel with inert natural material or capping it with concrete. GI surveys are planned at the flood storage area in Ham Lands to determine the type and depth of contaminated material. Following this, measures will be built-in to reduce the risk of contaminants reaching surface water, e.g. removing all the contaminated material from the flood storage area or capping the remaining landfill with an inert material.	
Existence of flood relief channel, LEAs, areas of habitat creation and flood storage.	Adverse effect of risk to public health and safety through presence of project features (particularly new water bodies) and effects on flow dynamics at	No.	Project features (particularly new water bodies) and effects on flow dynamics at Molesey weir could pose a health and safety risk (e.g. to houseboats downstream of Molesey weir C). A PSRA will be completed during the design, with likely mitigation including signage, walls, fences, handrails, grab chains and escape ladders.	

Project activity	Potential effects and receptors	Could the effect be significant – yes / no?	Reason	Potential mitigation measures
	Molesey weir.			
	Adverse effect of light pollution from Project operation causing nuisance to local community in proximity.	No.	Lighting will be restricted to control structures on the flood relief channel and will only be used when these structures need to be accessed or operated.	
Introduction of an augmentation flow (in normal conditions) into the flood relief channel and increased abstraction to Thames Water reservoirs.	Potential adverse effect on availability of water for surface water abstractions, including PWS's from the diversion of water away from the River Thames.	No.	Disruption of PWS's could lead to economic effect on water utility businesses. See the operations – water abstraction section of Table 14-4 in Surface water, groundwater and WFD (Section 14.3).	
Recreation and Tourism				
Existence of enhancement opportunities.	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).	Yes.	Master planning and Urban Design Assessment will be undertaken to consider the effects upon the public realm of creating areas of public access in terms of connectivity with existing transport links etc.	
	Existence of new areas of public access may adversely affect the security of surrounding privately owned land.	No.	The inclusion of segregation from private land, for example fencing along footpaths and positioning of access points will decrease the security risk. Security will be an aspect influencing detailed design of the new areas of Public Open Space.	
Existence of flood relief channel, LEAs and areas of habitat creation.	Adverse effect of decreased access to existing Public Open Spaces or recreational facilities in the study area for local communities.	No.	There will be permanent change to some areas of Public Open Space, for example: Ham Lands and Desborough Island. Master planning and Urban Design Assessment will be undertaken to consider the effects upon the public realm of creating project features in terms of connectivity with existing transport links etc.	
Introducing augmentation flow and flood water to lakes without separation	Potential for permanent adverse effect on water quality of lakes from the introduction of River Thames water to previously unconnected lakes, with	Yes.	Introducing water (from the River Thames and other tributaries), with typically elevated nutrient content, suspended sediment loads and potential	Water quality modelling is being undertaken. This will inform mitigation measures.

Project activity	Potential effects and receptors	Could the effect be significant – yes / no?	Reason	Potential mitigation measures
embankments.	subsequent adverse effects upon the recreational opportunities available for the public.		INNS to previously unconnected lakes, risks permanently altering water quality. This may affect recreational activities that are heavily influenced by water quality (such as fishing, swimming and diving, commercial and club-based).	
Noise and Vibration				
Use of publically accessible areas within the project.	Adverse effect of noise from users and potential uses of new areas of publically accessible space.	No.	The design and features of new areas of publically accessible space have not yet been defined. However, master planning and Urban Design Assessment will consider the usage of proposed areas of Public Open Space within the wider setting and include sensitive design to minimise disturbance to surrounding areas.	

12.4 Assessment methodology

12.4.1 Flood risk

12.4.1.1 The Lower Thames Strategy included a strategic flood risk assessment which considered fluvial flood risks associated with alternative options.

12.4.1.2 For this project, a detailed flood risk assessment is being conducted as a key part of the project in accordance with National Planning Policy and relevant planning practice guidance on flood risk.

12.4.1.3 Two levels of hydraulic flow modelling have been undertaken: a 1D-only model and a 1D-2D model. The 1D-only model is being used for design development, such as option testing to improve the engineering design. The 1D-2D model is being used to test the final design of the project – to determine the change in flood risk due to the project and to inform the assessment of economic effects.

12.4.1.4 A flood damages economics model will calculate the likely economic benefits to local businesses and residences through increased flood protection. It will also consider the likely reduction in 'risk to life' and in flooding of transport infrastructure.

12.4.2 Land use

12.4.2.1 The assessment of effects upon land use will i) categorise the existing land uses in the study area, ii) determine the extent of land affected, iii) determine the regional extent of each land use category, and iv) calculate the proportion of the regional extent of each land use being affected by the project. This will also include consideration of land use categories that are being created by the project.

12.4.2.2 In addition to the above, commercial land use can also be determined using a further set of criteria: i) the degree to which a business depends on its location in terms of supply factors ii) the degree to which a business depends on its location in terms of demand factors iii) the degree of specialism of the business (e.g. if it were to close, is there an alternative for customers or employees?).

12.4.3 Population, health, recreation and tourism

12.4.3.1 The study of effects upon population and health will be carried out through a desk top study reviewing key statistical information. The assessment for the construction phase will focus on the number of direct and indirect jobs that are likely to be associated with the construction of the Project. The assessment will also identify effects on demand for local services and amenities, including any additional requirements for health and education services. It will also consider the effect of the Project on existing recreation and tourist facilities and the likely usage of visitor facilities proposed as part of the Project.

12.4.3.2 A Health Impact Assessment will be undertaken to consider the effects (beneficial and adverse) upon the health of local communities as a result of the Project. This will be informed by the results of several other assessments in particular noise (see Section 12.4.4), transport (see Section 15.4), and air quality (see Section 7.4).

12.4.3.3 The levels of contaminants will be tested for significance against accepted industrial threshold standards including generic assessment criteria such as EQS, LQM/CIEH S4ULs and CLEA to assess whether measured concentrations of contaminants present a potential risk to human health.

12.4.3.4 Master planning and Urban Design Assessment will be undertaken to consider the effects upon recreation and tourism from altering the public realm to create new areas of public access and new linkages with existing recreation and tourist infrastructure.

12.4.3.5 The assessment of the effects on business relating to tourism will be assessed using the method described above for the assessment of commercial business. Effects on recreational and tourist assets are closely linked to effects on the tourist industry, including for example the change in visitor numbers and associated change in expenditure in the sector.

12.4.3.6 There are no recognised standards or guidelines for defining the significance of effects upon population. In order to assess significance, statements can be used, against which a judgement on the degree of change can be assessed, such as:

- major – intensive change to the local area, or noticeable change to extensive area e.g. due to job creation, use of services or recreational facilities;
- moderate – clearly identifiable benefit or loss to the local population over the long term;
- minor – slight or short term changes to local population; and
- negligible – no identifiable effects.

12.4.4 Noise and vibration

12.4.4.1 The assessment of effects from noise will be conducted in accordance with BS 7445, which specifies the descriptions and measurements of environmental noise. Existing ambient noise levels will be monitored at the most affected noise sensitive receptors. The assessment methodology, in particular the locations for monitoring noise levels, will be determined through consultation with local planning authorities and other relevant consultees.

12.4.4.2 With regards to construction, BS 5228 (2014) provides guidance on the assessment and control of noise and vibration from construction activities; this will be used to predict noise and vibration for specific project elements and identify methods for noise and vibration control where appropriate. Annex E of BS 5228 identifies methods for evaluating the significance of noise effects due to construction works. If construction noise exceeds appropriate threshold values then there is potential for a significant effect to occur.

12.5 Limitations and assumptions

12.5.1.1 The ONS data used to inform this section of the Scoping Report is based on surveys undertaken at fixed points in time. For the purpose of this assessment it is assumed that this data has not changed significantly.

12.5.1.2 Where secondary data has been obtained from third parties it is recognised that these may not be complete. For example many recreational and commercial businesses were identified based on OS data which may not provide a complete list of all businesses. In addition, data obtained from third parties on Public Open Space and amenity areas is incomplete.

12.5.1.3 It has been assumed in the baseline section that noise levels in urban environments within the study area is higher than in rural areas and larger areas of Public Open Space.

13 Soils & Geology (including Contaminated Land)

13.1 Approach to identifying potential environmental effects

13.1.1.1 This section of the EIA Scoping Report considers the potential effects on soils and geology (including contaminated land) arising from the construction and operation of the proposed project. For the purposes of this topic, the study area extends 250m from the proposed flood relief channel, River Thames weirs and associated features. It is considered that receptors beyond this would not be affected.

13.1.1.2 Baseline ground conditions have been established from extensive GI surveys undertaken in 2015/16 to inform the project. These included tests for contaminants, soil conditions, moisture content and particle size. In addition, records from the Environment Agency on landfill sites and information on geology, soils and contaminated land have been collated from the BGS and Soilscape (a Cranfield University soils dataset).

13.1.1.3 The GI surveys gathered information on contaminated land within the flood relief channel alignment. Where landfill material was encountered, it was split into three categories (Fugro, 2016):

- **Construction and demolition waste;** variable deposits, generally granular material with low to medium cobble content. With any combination of bricks, concrete rubble, wood and timber fragments. In some cases, occasional asbestos, ash, brick, ceramic, concrete glass, metal, tarmacadam, tile/pottery, plastic, rebar, rope or wire were also found;
- **Domestic waste;** variable deposits with some abundant cohesive or granular deposits which included a combination of: black bin liners of general household waste, medical waste (e.g. syringes), plastic sheeting, timber/wood fragments, mixed materials. It was also noted that many of these areas had strong refuse odours; and
- **Undifferentiated landfill;** variable deposits with little to no domestic, construction or demolition waste. Gravel is predominantly natural, with rare brick and/or concrete fragments.

13.1.1.4 Consultation with Environment Agency Contaminated Land and Waste technical specialists has been undertaken and is ongoing.

13.2 Baseline information

13.2.1 Geology

13.2.1.1 The bedrock underlying the proposed project is shown in Figure SW-DR-V-00046. The most northern part of Channel Section 1 is within the Woolwich and Reading Formation of the Lambeth Group. The bedrock underlying the rest of Channel Section 1, the north of Channel Section 2, the three River Thames weirs and Ham Lands is identified as the London Clay Formation of the Thames Group. Further south, underlying the middle of Channel Section 2, the downstream end of Channel Section 3 and Desborough Cut, the Claygate Member of the London Clay Formation lies above its parent unit. The bedrock geology encountered in the south western section of the study area, the south of Channel Section 2 and most of Channel Section 3, is the Bagshot Formation of the Bracklesham Group overlying the Thames Group.

13.2.1.2 The natural superficial geology underlying much of the proposed flood relief channel includes Alluvium and River Terrace Deposits of the Shepperton Gravel Member. The River Terrace Deposits near the

three River Thames weirs, Ham Lands and Broom Road recreation ground are of the Kempton Park Gravel Formation and Langley Silt Member (Figure SW-DR-V-00045).

13.2.2 Soils

13.2.2.1 Soils within the study area are of variable permeability. Channel Section 1, west of Channel Section 2, the north of Channel Section 3, either side of Sunbury and Molesey weirs and the eastern side of Ham Lands (set back from the River Thames) are considered to be freely draining, slightly acidic, loamy soils (Soilscape, 2017). In contrast, the majority of Channel Section 2, the south of Channel Section 3 and the area immediately surrounding Teddington weir and Ham Lands are considered to be loamy and clayey floodplain soils with naturally high groundwater (Soilscape, 2017).

13.2.2.2 Southlea Farm, at the upstream end of Channel Section 1, is the only area that differs, with soil conditions that are freely draining, slightly acidic but base rich (Soilscape, 2017).

13.2.3 Contaminated land

13.2.3.1 Sources of potential contamination have been identified along the route of the flood relief channel. These include authorised and historic 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 and asbestos within areas associated with landfill activities. These contaminants, although in much smaller quantities, were also encountered within areas of natural soils (GBV, 2017).

13.2.3.2 Locations of the historic landfill and authorised landfill areas within the study area and a summary of the type of landfill material that they contain are provided in Figure SW-DR-V-00044 and Appendix D Table 1.

13.2.3.3 Some of the soils within the 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) were encountered at multiple sites including localised exceedances at: Kingsmead Landfill, Hythe End Landfill and Bretts Landscaping Ltd. A greater proportion of the samples tested identified exceedances in landfills at Wraysbury, Manor Farm, Shepperton Ranges and Sheep Walk. In addition asbestos was found to be present in most landfill sites.

13.2.3.4 Laboratory results found concentrations of contaminants[11] 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).

13.2.4 Future baseline

13.2.4.1 Ground conditions are unlikely to change between now and the start of construction and / or operation, however it is known that restoration works for the former mineral extraction site at Horton 2 are set to be completed and the existing lake infilled with inert waste.

13.2.5 Key environmental constraints and opportunities

13.2.5.1 The key environmental constraints and opportunities in relation to soils, geology and contaminated land are:

- 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;

[11] These concentrations of contaminants have been compared to numerous threshold values including RBMP, WFD (Standards and Classification) Directions (England and Wales) 2015, Defra Drinking Water Standards and Environment Agency indicative minimum reporting values for selected hazardous substances in clean water to establish the baseline situation and assess possible pathways in which contaminants could present a risk to water resources.

- There will be a need to protect soil structure, quality and quantity, particularly in agricultural areas and areas identified for future landscaping and planting; and
- There are likely to be opportunities for re-use of excavated soils within the project for landscaping (subject to approval).

13.3 Predicted changes to the environment and scope of assessment

13.3.1.1 Potential effects on soils and geology (including contaminated land) during construction and operation are discussed in Table 13-1.

Table 13-1: Potential effects during construction and operation.

Project activity	Potential effects and receptors	Could the effect be significant – yes / no?	Reason	Potential mitigation measures
Construction				
Use of vehicles / machinery and establishment of construction compounds / material processing sites, further GI works (such as archaeological and ground condition investigations) and the habitat creation areas.	Potentially adverse effect from tracking of vehicles, establishment of compounds and GI works, causing damage to soil structure, compaction, erosion or bank instability.	No.	Good construction practices, in accordance with a CEMP and BS guidance on handling soils (BS3882), will ensure that these effects will be minimised. Practices may include for example: • Restricting vehicles to delineated routes and keeping them away from banks; • Topsoil stripping, storage and replacement; • Laying of hardcore at the compounds and material processing sites; and • Laying matting on certain routes to protect the ground underneath.	
Storage of chemicals and liquids.	Potentially adverse effect of polluting soils and geology through spillages of chemicals and liquids.	No.	This will be managed through good construction practices in accordance with a CEMP and Government 'Pollution Prevention for Businesses' guidelines. These include ensuring chemicals and liquids are stored safely, drip trays are used underneath equipment and ensuring emergency spill kits are available etc.	
Excavation through landfill (including construction of the flood relief channel, the flood storage area at Ham Lands, movement / installation of services and any further GI works).	Potentially adverse effect of polluting uncontaminated soils and geology from landfill material.	No.	This risk will be managed by following best practice in handling materials in accordance with a CEMP (including following CIRIA, Government and BS guidance on good construction practices), such as ensuring there are different material streams and stock piles for the different types of material, ensuring contaminated and non-contaminated materials do not mix. The potential effects on human health and air quality from excavations through landfill isdiscussed in the Table 7-3 in Air Quality and Climate Change (Section 7.3) and Table 12-2 in Population (Section 12.3). The potential effects on water resources from excavations through landfill is discussed in the Table 14-4 in Surface Water, Groundwater and WFD (Section 14.3).	
Construction of LEAs and reuse of material at Ham Lands.	Potentially adverse effect of polluting uncontaminated soils from landfill material and soil compaction from deposited material.	No.	Environmental Permits will be required before contaminated material can be used in this way. This will include measures to prevent the spread of contaminants such as: • Sorting material prior to use to remove some contaminants, e.g. asbestos; and • Capping contaminated material with a cohesive material to separate it from uncontaminated topsoil.	

Project activity	Potential effects and receptors	Could the effect be significant – yes / no?	Reason	Potential mitigation measures
On site vehicle and machinery movements and temporary storage of material.	Potentially adverse effect of soil compaction from depositing material and vehicle use to construct embankments.	No.	Good construction practices, in accordance with a CEMP and BS guidance on handling soils (BS3882), will ensure that these effects will be minimised. Practices may include for example: • Topsoil stripping, storage and replacement; and • Loosening subsoils prior to receiving materials.	
Widening of the Desborough Cut.	Potentially adverse effect from excavating the left bank of the Desborough Cut, causing bank instability.	No.	The new bank profile has been designed to be of a stable and safe angle, reducing the risk of collapse. Where there is restricted space, and this angle cannot be achieved, the bank will be supported by sheet piling, further reducing the risk of bank instability.	
Operation				
Existence of flood relief channel.	Potentially adverse effect on soil structure from changes to groundwater levels.	No.	Water level control structures have been built-in to the project, to maintain existing ground water levels in areas surrounding the new flood relief channel. Therefore, preventing any substantial changes in soil structure and quality.	
Existence of flood relief channel and LEAs within existing landfills.	Landfill leachate reaching uncontaminated soil close to landfill sites and affecting its quality.	Yes.	Soils will potentially be adversely affected where the sheet piled sections require piling into the impermeable clay, creating barriers to groundwater flows of up to approximately 1.2km in length. The existence of the LEAs on top of existing landfill may cause change in groundwater flows and pathways as a result of compaction. These activities have the potential to substantially alter the direction of leachate flows through soils and alter quality permanently. Potentially adverse effect of harming human health and water resources through landfill leachate are discussed in Table 14-4 in Surface Water, Groundwater and WFD (Section 14.3) and Table 12-2 in Population (Section 12.3).	None identified at this stage. A hydrogeological risk assessment will be undertaken during detailed design which will identify any mitigation measures, if required.
Operational failures.	Potentially adverse effect from operational failures causing or including bank instability and erosion of soils within the flood relief channel and on the River Thames	No.	Mitigation measures have been built-in to the project to reduce the risk of these potential effects. Mitigation measures include bank protection works and profiling the new flood relief channel 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 bank instability.	

Project activity	Potential effects and receptors	Could the effect be significant – yes / no?	Reason	Potential mitigation measures
	where the flood relief channel leaves and re-joins the river.			
Maintenance activities.	Potentially adverse effect from tracking of vehicles causing damage to soil structure, compaction, erosion or bank instability.	No.	Vehicle movements due to maintenance activities are likely to be infrequent and of short duration, minimising any effects. In addition, good maintenance practices will ensure that these effects will be minimised, such as: • Restricting vehicles to delineated routes; and • Keeping vehicle routes away from banks.	

13.4 Assessment methodology

13.4.1.1 Following review of the baseline information and the project description, one effect with the potential to be significant has been identified on the soils and geology receptors – the potential effect on soil quality from mobilising contaminants during operation. In addition, excavating through contaminated land has been identified as a source of potential significant effects to Population, Air Quality and Climatic Factors.

13.4.1.2 A hydrogeological risk assessment will be required to assess the effects of altering groundwater flow and pathways around existing landfills.

13.4.1.3 There is no specific methodology for determining the significance of effects from contaminated land. The appraisal of significance will therefore be based on the general EIA assessment methodology as detailed in Section 17 and professional judgement.

13.4.1.4 The levels of contaminants will be tested for significance against accepted industrial threshold standards including generic assessment criteria such as EQS, LQM/CIEH S4ULs and CLEA to assess whether measured concentrations of contaminants present a potential risk to human health.

13.5 Limitations and assumptions

13.5.1.1 This assessment is based on information currently available. Changes to channel alignment since the 2015/16 GI surveys have meant that there is only limited information available on ground conditions in some areas. Further GI surveys are likely to be required within:

- The channel alignment section adjacent to Horton 2 lake;
- The Royal Hythe Landscape Enhancement Area;
- Land between Littleton East and Sheepwalk West 2; and
- The habitat creation areas at Abbey, Desborough Island and Ham Lands.

13.5.1.2 Further, more focused, GIs 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.

14 Surface Water, Groundwater & Water Framework Directive

14.1 Approach to identifying potential environmental effects

14.1.1.1 This section of the EIA Scoping Report covers the potential effects on the surface water, groundwater and WFD receptor water bodies arising from construction and operation of the Project. Any potential effects from changes to water bodies on other receptors, such as biodiversity and population, will be considered in their relevant sections. The study area for this topic is defined as the extent of the surface and groundwater water bodies that intersect with, and could be impacted by, the proposed flood relief channel and River Thames weirs. It also considers upstream and downstream water bodies connected to those intersecting the Project. In addition, the standard study area (see Section 6) has been applied, to enable consideration of potential effects arising from the change in flood risk resulting from the project.

14.1.1.2 Information on surface water and groundwater bodies has been collated from the Environment Agency, water companies, lake owners and land operators. This includes information on WFD water bodies, licensed abstraction and discharge points, water quality and level monitoring, fluvial morphology, bathymetric surveys, aquifers and results from the three-year (2012-15) baseline RTS Ecological Monitoring Project (Environment Agency, 2016c). A WFD screening assessment has been carried out to identify the water bodies and the potential for risks to compliance with the objectives of the WFD. This includes any potential deterioration from the existing ecological status/potential of water bodies, or preventing future improvements in status due to the proposed new modifications. An early stage assessment of the potential effects of the Project in relation to WFD compliance had previously been considered within the SEA (Environment Agency, 2009).

14.1.1.3 Consultation with the Environment Agency's Fisheries, Biodiversity and Geomorphology technical specialists has been undertaken and is ongoing. This has included a series of workshops, meetings and a hydromorphology site walkover of the key tributaries that will be intersected by the proposed flood relief channel.

14.2 Baseline information

14.2.1.1 The study area encompasses a mixture of surface and groundwater receptors. As well as the River Thames, there are numerous tributaries of varying size, man-made lakes located in former gravel pits that are fed by a combination of surface water and groundwater. These water body types and specific receptors are introduced in the following sections.

14.2.2 Surface water

14.2.2.1 The official tidal limit of the River Thames is located approximately 15km downstream of the proposed flood relief channel at Teddington. In reality, tidal influence can be observed as far upstream as Molesey weir under some flood conditions.

14.2.2.2 The River Thames has a number of tributaries and there are numerous other smaller watercourses and lakes within the study area, many of which will be intersected by the proposed flood relief channel or will have a change in how often they are flooded by water from the River Thames as a result of the project. These rivers and lakes are listed in Table 14-1 and Table 14-2, respectively and are shown on Figure SW-DR-V-00048. Where available, information on water quality and water levels for these water

bodies recorded by the RTS Ecological Monitoring Project (Environment Agency, 2016c) is provided in Appendix I Table 1.

14.2.2.3 There are 21 WFD surface water bodies within the study area (Figure SW-DR-V-00047). All these water bodies are covered by the Thames RBMP. Details of these water bodies, their current status, objectives and additional information recorded for the RTS Ecological Monitoring Project (Environment Agency, 2016c) is provided in Appendix I Tables 2 to 5.

Table 14-1: River Thames tributaries and other small water courses within the study area. WFD water bodies have been indicated, those intersected by the flood relief channel have been marked with an * and those that flooded in 2013/14 have been marked with an (F).

Channel Section	Tributaries and other small water courses	
Channel Section 1	Datchet Common Brook (WFD)* (F) Midridge Green Drain* Colne Brook (WFD) (F) Wraysbury Stream* (F) New Cut	Horton Brook (WFD)* (F) Foot Drain (F) County Ditch (F) River Colne (WFD) (F) Wraysbury River
Channel Section 2	Mead Lake Ditch* (F) The Moat (WFD)* (F) Chertsey Bourne (WFD)* (F)	Abbey River* (F) Burway Ditch* (F) Sweep's Ditch (F)
Channel Section 3	Pool End Ditch (F) Engine River (F)	The Chap* (F) River Wey (F)
Sunbury, Molesey & Teddington weirs	River Ash (WFD) (F)	

Table 14-2: Lakes within the study area; WFD water bodies have been indicated and those that flooded in 2013/14 have been marked with an (F).

Channel Section	Lakes	
Channel Section 1	Queen Mother Reservoir (WFD) Datchet 1, 2 (F) & 3 (F) Sunnymeads Lakes 1 – 4 (F), 5 & 6 Kingsmead Island Lake (F) Church Lake (F) Crayfish Pool Kingsmead 1 (North & South) (F) Horton Lakes 1 (F), 2 (F) & 4 (F) Douglas Lane Blenheim Lake (F) Wraysbury Reservoir (WFD)	Wraysbury 1 (North & South) (WFD) (F) Wraysbury 2 (North & South) (WFD) (F) Lower Hythe Gravel Pits 1, 2 (F), 3 (F), 4 & 5 (F) Hythe End East (F), Central (F) & West (F) Wraysbury Hilton (Heron Lake WFD) The Moor Gravel Pit (F) Church Lammas Lake (F) Queensmead Lake (WFD) (F)
Channel Section 2	Egham Hythe Pond (F) Meadlake (F) Lake South of Green Lane (F) Lake South of Norlands Lane 1 (F) & 2	Fleet Lake (WFD) (F) Abbey Lake (WFD) (F) St Ann's Lake (WFD) (F) Abbey 1 (F) & 2 (F)

Channel Section	Lakes	
	Manor Lake (WFD) (F) Penton Hook Marina (F)	Twynersh Lakes (F) Reservoir at Chertsey Water Works
Channel Section 3	Littleton North (F), South (F) & East (F) Sheepwalk East (F) Sheepwalk West 1 (F), 2 (F) & 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) & 3 (F) Ferry Lane Lake (F)
Sunbury, Molesey & Teddington weirs	Molesey Reservoirs	

14.2.2.4 The proposed flood relief channel is within a surface water safeguard zone[12] that is currently 'at risk' of deterioration due to the use of substances such as pesticides, nitrates or from land management. The 'at risk' classification means that extra treatment of water may be required before it is suitable for human consumption due to the presence of pesticides, nitrate, turbidity and benzo(a)pyrene.

14.2.2.5 There are several licensed surface water abstractions from the River Thames and its tributaries in the study area; for irrigation, mineral works, agriculture and other industrial uses (Figure SW-DR-V-00048). There are seven abstractions for public water supply[13] in the reaches of the River Thames intersected by the proposed flood relief channel (Table 14-3). These abstractions are managed under the TCAMS (2014) which has classed the River Thames as over-abstracted within our study area, and it is proposed that the most sustainable approach for the future will be to maintain this status.

Table 14-3: Surface water abstractions for public water supply.

Location	Flood Relief Channel Section / weir	Distance from flood relief channel / weir (km)
Datchet	At channel intake for Channel Section 1.	0
Sunnymeads	Between intake and outflow of Channel Section 1.	0.5
Hythe End	Between intake and outflow of Channel Section 1.	0
Egham	Downstream of Channel Section 1.	0.6
Laleham	Between intake and outflow of Channel Section 2.	1
Chertsey	Between intake and outflow of Channel Section 2.	0.3
Desborough Island	On the Desborough Loop.	0
Walton-on-Thames	Downstream of Sunbury weir.	0.75
Hampton	Upstream of Molesey weir.	3
Surbiton	Downstream of Molesey weir.	3

[12] Safeguard zones are a joint initiative between the Environment Agency and water companies. They are areas where water supplies are at risk of deterioration due to the use of substances such as pesticides, nitrates or land management.
[13] Due to the sensitivity of this information, the exact locations cannot be published on a map.

14.2.3 Hydromorphology

14.2.3.1 Within the study area, the River Thames displays many characteristics of the lower reaches of a highly regulated, mature, lowland river, with wide meanders and several divided channels around stable, mid-channel islands. The River Thames has been extensively modified by human activities and uses. 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, and dredging has, historically, been undertaken to maintain a navigable channel. The River Thames morphology has been stabilised by bank protection and the presence of developments up to the edge of the channel, limiting the river's ability to adjust its planform along the majority of its length.

14.2.3.2 Deeper pools are present immediately downstream of weirs. The increase in gradient and water velocity flowing over the weirs has encouraged local processes of erosion and deposition, which also occur around some meander bends. Depositional features (gravel shoals) are located slightly downstream of the weir pools, creating local diversity of flow types and depths and associated varied habitat niches, compared to the majority of the regulated channel.

14.2.3.3 The proposed flood relief channel will pass through a series of man-made lakes created from former gravel pits. These are of varying size and morphology, but are typically steep-sided and with small riparian areas. Some have islands while others are wide areas of open water. Although the lakes are relatively recent and man-made, their geomorphology and habitats are evolving over time. Bathymetric surveys and environmental surveys of the lakes were undertaken between 2012 and 2016 to provide baseline information for the project, this is summarised in Appendix I Tables 1 to 5.

14.2.3.4 A hydromorphology walkover survey of three key tributaries that will be intersected by the proposed flood relief channel was completed in July 2016:

- Datchet Common Brook has a confined course between roads, reservoirs, a railway line and residential developments. Within the study area it is not a dynamic river, but does have some areas of clean gravel bed and small woody debris creating varied flow;
- Horton Brook has a confined course between man-made lakes, used for fishing. The upper section within the study area, appears limited in dynamics being overwide with a silty bed. It joins with the Colne Brook and near the confluence at the downstream end it has a gravel bed and slightly steeper gradient creating more varied flow; and
- The Abbey River is a 'backwater' channel of the River Thames, flowing off the River Thames at Penton Hook and returning at Chertsey Lock. It is a low energy stream, and has a very low gradient, slow flow and a lot of aquatic and emergent vegetation.

14.2.3.5 Details of the river and lake hydromorphology in the study area have been assessed from a variety of sources. These include previous morphology studies, bathymetric surveys, historic river habitat surveys, cross-section surveys and geomorphology assessments undertaken of the River Thames and some of its tributaries.

14.2.4 Groundwater

14.2.4.1 Details of groundwater conditions have been assessed from a variety of sources. Historic boreholes have been analysed, boreholes installed as part of site investigations for the project have been monitored, and data has been obtained from the 2012-2015 period of the RTS Ecological Monitoring Project (Environment Agency, 2016c).

14.2.4.2 The hydrogeology across the study area is varied as a result of the geology in the area. The study area is underlain by a gravel aquifer, of mostly Shepperton Gravel Member, with Kempton Park Gravel Formation to the south east (Figure SW-DR-V-00045). This gravel layer is classed as a principal aquifer (Figure SW-DR-V-00049). The thickness of the gravels varies considerably from 2 to 14m, with an average thickness of around 5 to 6m, with considerable variations over relatively short distances (ESI, 2015).

14.2.4.3 Those sections of the study area not directly underlain by the Shepperton Gravel Member or Kempton Park Gravel Formation are classed as Secondary A superficial aquifers (Desborough Cut, Sunbury weir and Ham Lands). Molesey and Teddington weirs are within Secondary (undifferentiated) superficial aquifers. The intake of Channel Section 3 is within an unproductive superficial aquifer (SW-DR-V-00049).

14.2.4.4 In most areas there is a London Clay Formation, of low permeability, which separates the principal gravel aquifer from the minor aquifer below (the Lambeth Group) (see Section 13.2 for more details on geology in the study area). There is a low hydraulic gradient in the north western part of the study area, 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. The RTS Ecological Monitoring Project (Environment Agency, 2016c) 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.

14.2.4.5 Thirteen lakes were found to have potential hydraulic connections to groundwater[14] (Environment Agency, 2016c), details of these connections are summarised in Appendix I Table 6.

14.2.4.6 In addition to the natural geological influences on groundwater, a number of other activities affect its behaviour. This includes abstraction of large quantities of groundwater for public water supply, sewage systems, gravel quarrying and associated de-watering. There are also physical interruptions to groundwater flows; it is likely that all the recent landfills and the five main reservoirs[15] 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).

14.2.4.7 In terms of groundwater quality, monitoring between December 2012 and June 2015 (Environment Agency, 2016c) found limited exceedances of surface water WFD and drinking water standards. High levels of sulphate were occasionally recorded, which is likely to be from natural sources, as well as copper, boron, manganese, iron and zinc, which are commonly present in natural sand and gravel deposits. Monitoring to the south of Wraysbury 2 showed signs of pollution to the groundwater with exceedances of potassium, arsenic, boron, anthracene, fluoranthene, ammonium, hydrocarbons and benzene. The source of contamination is thought to be related to landfilling operations in the area.

14.2.4.8 Groundwater across most of the study area is of a calcium bicarbonate type, with some samples occasionally displaying a calcium sulphate type. Monitoring south of Wraysbury 2 showed a wider variation in groundwater type. It was generally also of calcium sulphate type, but was more sodium and potassium rich compared to the other borehole water samples.

14.2.4.9 Analysis between the different monitoring years found that groundwater quality were fairly similar when the spring and summer monitoring rounds are compared, however when comparing the winter monitoring rounds some locations exhibited higher bicarbonate content in 2014 than in 2013, and 2015.

14.2.4.10 Sections of the proposed flood relief channel are within Groundwater Source Protection Zones (GSPZ) (Figure SW-DR-V-00049); the upstream end of Channel Section 1, all of Channel Section 2, the upstream half of Channel Section 3 and Desborough Island. The Abbey Meads area of Channel Section 2 is within Source Protection Zone 1. There are 2 WFD groundwater bodies within the study area, Lower Thames Gravel WFD water body and Chobham Bagshot Beds WFD water body (Figure SW-DR-V-00047). These water bodies are covered by the Thames RBMP. Details of these water bodies, their current status and objectives and are provided in Appendix I Table 4.

[14] Datchet 2, Datchet 3, Sunnymeads 3, Wraysbury 1, Wraysbury 2, St Ann's, Thorpe Park Lakes (Fleet, Abbey & Manor), Abbey 1 & 2, Littleton East, Sheepwalk East, Sheepwalk West and Ferry Lane.

[15] The five main reservoirs are: King George VI Reservoir, Staines Reservoir (north of the study area), Queen Mother Reservoir, Wraysbury Reservoir and Queen Mary Reservoir.

14.2.5 Flood risk

14.2.5.1 The Lower Thames area has a history of flooding with notable floods occurring in 2014, 2013, 2003, 2000, 1968, and 1947. Figure SW-DR-V-00037 shows the area at risk of flooding in a 1 in 100 flood (one per cent chance of happening in any given year). The River Thames between Datchet and Teddington has the largest area of developed floodplain in England without flood defences.

14.2.5.2 As previously mentioned many of the existing rivers, lakes and groundwater bodies are hydraulically connected; this has an influence on flood risk and they often form pathways for flood waters. For instance, during the 2013-14 floods, the Sheepwalk West lakes were flooded from the River Thames via Littleton North and Littleton East. Those water bodies flooded during the 2013-14 floods are identified in Table 14-1 and Table 14-2.

14.2.5.3 The existing (baseline) flooding impact on population (including land use and recreation) and traffic and transport is discussed in the 'Population' and 'Traffic and Transport' sections respectively to avoid duplication of impacts (sections 12 and 15).

14.2.6 Future baseline

14.2.6.1 The WFD (through RBMPs) sets out methods to improve water quality and quantity in the future; this may lead to improvements to the local water environment prior to construction. Furthermore, improvements in the quality of water released from sewage treatment works to reduce organic pollution and address excess phosphorus loads are also likely to be progressed, driven by drivers other than the WFD.

14.2.6.2 The 2015 RBMP only sets out measures to improve the water environment for the next six years. It will need to be taken into consideration that a new RBMP may be in place before construction commences with potential changes in WFD water bodies and their condition classifications.

14.2.7 Key environmental constraints and opportunities

14.2.7.1 The key environmental constraints in relation to surface water, groundwater and WFD are:

- That the proposed works are underlain by a series of principal aquifers and are within GSPZs;
- Ensuring water quality is maintained to prevent derogation or reduction in quality of abstraction licenses; and
- There are 23 WFD water bodies which may potentially interact with the proposed works; there is a need to ensure compliance with WFD and must consider whether the proposed 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.

14.2.7.2 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 2015 RBMP measures.

14.3 Predicted changes to the environment and scope of assessment

14.3.1.1 Potential effects on surface water, groundwater and WFD during construction and operation are discussed in Table 14-4.

Table 14-4: Potential effects during construction and operation.

Project activity	Potential effects and receptors	Could the effect be significant – yes / no?	Reason	Potential mitigation measures
Construction				
Flood risk				
Creation of temporary material processing sites, site compounds and storage of excavated material.	Potential adverse effect to humans, flora and fauna and water of increasing flood risk by creation of additional areas of hard standing and from stockpiling material in the floodplain.	Yes.	The creation of areas of hard standing and the stockpiling of excavated material within the floodplain has the potential to significantly affect flood risk, by increasing surface water runoff and reducing the volume of the floodplain, during construction.	A flood protocol will be put in place (in accordance with an Environmental Permit for Flood Risk Activities). This may include the requirement to store material parallel to the direction of water flows in floodplain so that stockpiles do not impede drainage.
Works in and around watercourses, particularly vehicle trafficking, intersecting rivers with new flood relief channel and works to River Thames weirs.	Potential for adverse temporary increase in flood risk, e.g. through constructing coffer dams in watercourses, compacting soils leading to reduced infiltration and increased run-off and interrupting land drainage systems leading to changes in overland flow patterns.	No.	Implementation of built in mitigation will minimise the likely effects of works in proximity to watercourses. A flood protocol will be put in place to minimise the risk of increased flood risk should a flood occur during construction (in accordance with the Environmental Permit for Flood Risk Activities, required for the works). This will include measures such as use of geotextile matting, avoiding tracking of heavy machinery in the floodplain where practicable and opening coffer dams, allowing flows to pass through. Specifically for the River Thames weirs, works at Teddington and Sunbury weirs will not affect the ability to control water levels during high flows. However, the presence of the cofferdam across weir C at Molesey may affect the ability to control water levels. To minimise temporary increased flood risks, construction at all three River Thames weirs will be timed to be undertaken during the summer to avoid periods when high flows are more likely.	
Surface water				
Works in and around existing water bodies, particularly vehicle trafficking, intersecting rivers with new flood relief channel and works to the River Thames weirs.	Potential adverse effects on flow, hydromorphology, water quality and biological conditions of lakes and rivers (including WFD water bodies) intersected by the flood relief channel, through disturbance of sediment by works in water bodies and release of pollutants through spillages.	No.	Works within water bodies will be undertaken within coffer dams, stopping any pollutants or sediment from reaching the water body (there may be short term releases of sediments whilst the coffer dam is being installed). Water entering coffer dams will be pumped out via settling tank / pollution prevention system that will remove sediment and treat water before discharging to the water body. Good practice construction will be adhered to inside and outside coffer dams through mitigation including: good construction practices in accordance with a CEMP and Government 'Pollution Prevention for Businesses' guidelines. These include the use of drip trays underneath equipment, management of material stockpiles to avoid run-off to watercourses, maintenance of haul roads to prevent build-up of silt, ensuring chemicals and liquids are stored safely, and ensuring emergency	

Project activity	Potential effects and receptors	Could the effect be significant – yes / no?	Reason	Potential mitigation measures
			spill kits are available. Construction of the control structures at the intersection with existing rivers is likely to involve diverting the rivers prior to construction. This diversion will be minimised to the area intersected by the flood relief channel and be temporary, minimising the effect. It is expected that the smaller rivers / drainage ditches will not need control structures at the intersection - water will flow into the flood relief channel as soon as the channel is excavated, as it will be dug wet.	
Construction of separation embankments through existing lakes.	Potential for release / disturbance of sediment which may have an adverse effect on water quality of WFD and non WFD lakes.	No.	Any release / disturbance of silt during the construction of the separation embankments will be temporary. Measures will be undertaken to reduce the area of disturbance, including the use of silt curtains around the working area to minimise the spread of sediment.	
Excavation of flood relief channel and flood storage area in landfill.	Potential release of leachates causing temporary adverse effect on surface water quality (including WFD water bodies and within a surface water safeguard zone).	No.	This risk will be managed through built-in mitigation including: good construction practices in accordance with a CEMP, following best practice in handling materials and CIRIA, Government and BS guidance. This is likely to include control of runoff from disturbed ground with water collection systems, keeping hard standings clean and covering stockpiled material.	
Works to banks of the River Thames and Desborough Cut.	Loss of riparian vegetation may have an adverse effect on hydromorphology and shading of a WFD river.	No.	The areas of bank work are small, many of which are in locations which are already engineered and any potential effects will be localised and temporary. As a result, the bank works are not expected to result in deterioration of any WFD quality element at a water body scale. Where possible, plants will be replanted or allowed to naturally regenerate, allowing riparian vegetation and shading to re-establish. Good construction practices in line with a CEMP will be adhered to. See Table 13-1in Soils and Geology (Section 13.3) for mitigation to address bank instability.	
Construction works at Molesey weir.	Potential for temporary adverse effect of change in flow dynamics around Molesey weir C, on a WFD river.	No.	During the construction at Molesey, weir C will not be in use as the coffer dam will be built around it. Water will be diverted through the other weirs, altering flow dynamics. This will change only occur during construction and will not lead to any permanent or significant changes to flow dynamics.	
Foul drainage				
Dewatering of excavations in landfill and discharge of sewage /dirty water to foul drainage system.	Risk of contaminated water having an adverse effect on foul drainage system from discharges, accidental spillage and surface water run-off.	No.	Environmental Permits will be required for dewatering to be undertaken and will be managed through good construction practices in accordance with a CEMP. The water will be treated prior to discharge into the foul drainage system or taken off site if contaminated, liquids will be stored safely, and emergency spill kits will be available to deal with spillages.	

Project activity	Potential effects and receptors	Could the effect be significant – yes / no?	Reason	Potential mitigation measures
Groundwater				
Construction of coffer dams at River Thames weirs.	Potential for a temporary adverse effect on availability of groundwater in aquifers, WFD groundwater bodies, PWS abstractions and GSPZ's by altering flow regime.	No.	The construction of the coffer dams at the River Thames weirs requires deep piling into the impermeable clay, creating a barrier to groundwater flows. However, the coffer dams will only alter groundwater flows in very small, localised areas, minimising any effect.	
Excavation of flood relief channel and flood storage area in landfill.	Potential release of leachates causing temporary adverse effect on groundwater quality in aquifers, WFD water bodies, PWS abstractions and GSPZ's.	No.	This risk will be managed through built-in mitigation including: good construction practices in accordance with a CEMP, following best practice in handling excavating contaminated material and CIRIA, Government and BS guidance. This is likely to include dewatering of excavations, control of runoff from disturbed ground with water collection systems, keeping hard standings clean and covering stockpiled material.	
Construction of LEAs.	Potentially adverse effect of change in groundwater flow and pathways from compacting existing landfills.	Yes.	The LEAs involve ground raising of up to 10m on existing landfills. Due to the variable nature of the landfill material the degree of compaction is uncertain and difficult to quantify, however there will be a degree of settlement, within the landfill, caused by the increased pressure on the ground. There will a temporary increase in the rate of groundwater flow through the landfill, when the material is initially deposited, as some of the voids are filled through compaction. In the long term the permeability of the landfill is likely to marginally decrease which may alter the local groundwater regime.	None identified at this stage. A hydrogeological risk assessment will be undertaken during detailed design which will identify any mitigation measures, if required.
Construction of flood embankments.	Potentially adverse effect on groundwater from compacting natural ground.	No.	Flood embankments only involve minor ground raising, approx 1-2m which will cause minimal compaction of the underlying ground and is unlikely to have any measurable effect.	
Operation				
Flood risk				
Existence of the Project.	Beneficial effect on humans, flora and fauna and water of reducing flood risk in the study area.	Yes.	Operation of the Project will cause flood risk to be reduced to varying degrees across the study area.	N/A.

Project activity	Potential effects and receptors	Could the effect be significant – yes / no?	Reason	Potential mitigation measures
Use of the flood relief channel during times of flood.	Potential adverse effect on increasing flood risk downstream of the channel.	No.	The small increase in downstream water levels resulting from the use of the flood relief channel will be mitigated for through the upgrades to the three River Thames weirs and use of flood storage at Ham Lands to ensure no downstream detriment.	
	Accumulation of sediment in the flood relief channel will potentially adversely affect its conveyance capacity during floods.	No.	Sediment modelling is informing the design and possible mitigation measures. These include: • Create an area to trap sediment in the upstream section of the flood relief channel; • Design the shape and positioning of the flow control structures to reduce the volume of sediment reaching the flood relief channel; and • Periodic reinstatement of the flood relief channel design profile.	
Existence of flood relief channel and associated features.	Changes in ground levels and areas of hard standing may have an adverse effect on land drainage patterns, and potentially increase runoff.	No.	A Flood Risk Assessment is being completed, which is considering potential effects on land drainage pattersns. An Environmental Permit for Flood Risk Activities will also be obtained to ensure that the project cannot increase flood risk. Areas of hard standing (such as those within the permanent site compounds, car parks and LEA's) will be designed with appropriate drainage to avoid flooding from surface water runoff.	
Surface water				
- **Hydromorphology**				
Existence and use of flood relief channel, capacity improvements at the River Thames weirs and flood storage.	Potential adverse effect on the hydromorphology of the River Thames (all three WFD water bodies) due to the change in flood frequency.	No.	It is expected that the flood relief channel will only operate when the River Thames is at bank full and therefore flow within the River Thames is expected to have sufficient energy to maintain the current sediment regime.	
Introducing an augmentation flow and flood water to lakes.	Potential adverse and beneficial effect on the hydromorphology of WFD and non WFD lakes.	Yes.	The introduction of flows within the lakes is likely to alter the hydromorphological conditions, incuding the flow dynamics, residence time and the overall sediment regime. The structure of the lake shore and bed may be improved by provision of shallower and convoluted shores in some lakes (e.g within the Sunnymeads	Assessment of the hydromorphological conditions on the WFD lakes will undertaken as part of the WFD compliance assessment, which will inform possible mitigation measures. The inclusion of separation embankments in some lakes will reduce the exent of

Project activity	Potential effects and receptors	Could the effect be significant – yes / no?	Reason	Potential mitigation measures
			Lakes).	hydromorphological changes within these lakes.
Existence of habitat creation areas.	Increased diversity of water dependent habitat will have a beneficial effect on hydromorphology and biology of WFD and non WFD surface water.	Yes.	Large scale habitat improvements have the potential to significantly enhance some of the lakes and rivers in the study area and have the potential to help some WFD rivers achieve Good Ecological Potential in the future.	N/A.
Existence of capacity improvements at the River Thames weirs.	Adverse risk of changing the hydromorphological conditions downstream of the River Thames weirs (such as weir pools).	No.	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 are approximately 250m upstream of the main weir pool.	
Maintenance activities/ operational failures.	Potential adverse effect from maintenance activities / operational failures causing bank instability / erosion of soils adjacent to flood relief channel and on the River Thames.	No.	See Table 13-1 in Soils and Geology (Section 13.3).	
- **Water quality**				
Operational failures.	Potential adverse effect on water quality due to exposure to contaminants from nearby landfill.	No.	Measures have been built-in to the project to reduce the risk of failure of the flood relief channel lining through the areas of landfill. The flood relief channel will be lined with steel sheet piling and the base replaced with inert natural material or capped with concrete, rather than a 'geosynthetic clay liner' (as originally proposed) as it is more durable, and practical in terms of buildability.	
Existence of structures on intersected rivers and introduction of River Thames water (in normal and flood conditions).	Potential adverse effect on the flow, hydromorphology, water quality and biological conditions 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	Yes.	At this stage there is insufficient information available to understand the likely changes in water quality and hydromorphology in rivers intersected by the flood relief channel.	Water quality modelling is being carried out to inform possible mitigation. Likely mitigation includes: • Some rivers intersected by the flood relief channel will have intake and outlet structures. These will maintain flows in these rivers, upstream and downstream of the channel; and

Project activity	Potential effects and receptors	Could the effect be significant – yes / no?	Reason	Potential mitigation measures
	channel and the downstream sections of these rivers.			• Smaller rivers / drainage ditches will have an intake structure, allowing the drain to flow into the channel. There will be no outlet structure and the drain will be sealed on the downstream side, ensuring water from the flood relief channel cannot flow into it.
Existence of flood relief channel and flood storage in landfill.	Potential adverse effect on water quality from contaminants reaching surface water bodies (including WFD water bodies and surface water safeguard zones).	No.	Measures have been built-in to the project to reduce the risk of contaminants from landfill areas reaching surface water bodies. This includes, separating the flood relief channel from the landfill by sheet piling the sides and replacing the base of the channel with inert natural material or capping it with concrete. Furthermore, the water quality of surface water bodies in close proximity to the landfills is likely to already be influenced by landfill contaminants, therefore any changes in local groundwater flows (which may potentially be directed towards surface waters) are unlikely to alter these existing conditions. GI surveys are planned at the flood storage area in Ham Lands to determine the type and depth of contaminated material. Measures will be built-in to reduce the risk of contaminants reaching surface water, e.g. removing all the contaminated material from the flood storage area or capping the remaining landfill with an inert material.	
Introducing an augmentation flow and flood water to lakes without separation embankments.	Potential for 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.	Yes.	Introducing river water (from the River Thames and other tributaries), with typically elevated nutrient content and suspended sediment loads to previously unconnected, groundwater fed lakes, risks permanently and significantly altering the water quality of the lakes. For WFD lakes, this change in quality may cause deterioration of some of the water bodies WFD quality elements and prevent them meeting Good Ecological Potential in the future.	None identified at this stage.
Introducing an augmentation flow and	Potential adverse effect on the water quality of WFD and non-WFD lakes	No.	The presence of separation embankments within these lakes is a built-in measure to prevent	

Project activity	Potential effects and receptors	Could the effect be significant – yes / no?	Reason	Potential mitigation measures
flood water to lakes with separation embankments.	from the introduction of river water to previously unconnected lakes.		significant deterioration of water quality and sedimentation within the rest of the lake.	
- **Water abstraction**				
Introduction of an augmentation flow (in normal conditions) into the flood relief channel and increased abstraction to Thames Water reservoirs.	Potential adverse effect on availability of water for surface water abstractions, including PWS's from the diversion of water away from the River Thames.	No.	The flow through the flood relief channel during normal conditions has been designed to be as small a flow as possible (0.5-1m^3/s) whilst still achieving its purpose (i.e. sufficient to permit fish passage across the flow and water level control structures). In periods of low flows, when there is a risk to PWS abstractions, it is proposed that the flow may be reduced or stopped entirely, in accordance with set operating instructions as agreed with Thames Water.	
Groundwater				
Existence of flood relief channel through groundwater bodies.	Potential adverse effect on availability of groundwater.	No.	Water level control structures have been built-in to the project, to maintain existing ground water levels in areas surrounding the new flood relief channel. Therefore, preventing any substantial changes in groundwater levels.	
	Potential adverse effect on groundwater quality.	No.	Measures have been built-in to the project to reduce the risk of mobilising contaminants from landfill areas and reaching ground waters. This includes dewatering potentially contaminated excavations and removing all contaminated material where possible.	
Existence of flood relief channel in sheet piled sections.	Potential adverse effect on groundwater quality by altering the groundwater flow regime and creating new pathways for contaminants.	Yes.	The groundwater quality in aquifers, WFD groundwater bodies, public water abstractions and GSPZ's will potentially be adversely affected where the sheet piled sections require piling into the impermeable clay, creating barriers to flows of up to approximately 1.2km in length. This has the potential to substantially alter the direction of flows and groundwater quality permanently.	None identified at this stage.

14.4 Assessment methodology

14.4.1.1 The overall assessment of effects on water resources will be consistent with the WebTAG methodology for the 'Impacts on the Water Environment' which outlines the sensitivity of the different water receptors and sets criteria for assessing the magnitude of effects on these receptors.

14.4.1.2 A detailed flood risk assessment is being undertaken in accordance with National Planning Policy and relevant planning practice guidance on flood risk. Details of the methodology are provided in Section 12.4.

14.4.1.3 Further groundwater and water quality modelling may be required; this will inform the assessment of the potentially significant effects to groundwater (including aquifers, WFD water bodies and PWS abstractions) and surface water bodies. A hydrogeological risk assessment will be required to assess the effects of altering groundwater flow and pathways around existing landfills.

14.4.1.4 The RTS Sediment Modelling – Basic Analysis Report (GBV, 2017) has assessed the potential sedimentation issues associated with the project and identified the need to undertake further sediment modelling to understand the frequency of sediment accumulation within the flood relief channel. This additional modelling will therefore inform the assessment of the potentially significance effect on the flood relief channels conveyance capacity from the accumulation of sediment.

14.4.1.5 A WFD Compliance Assessment is being completed; this will inform the assessment of the potentially significant effects to WFD water bodies and identify any necessary mitigation.

14.5 Limitations and assumptions

14.5.1.1 Modelling of effects upon water quality, groundwater and sedimentation from operation of the Project 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 may be possible to scope out further receptors from the EIA.

15 Traffic & Transport

15.1 Approach to identifying potential environmental effects

15.1.1.1 This section considers the potential effects on traffic and transport arising from construction and operation of the proposed Project, which includes air, roads, railways and waterways. Cycle routes, footpaths, and recreational navigation are covered in the Population Section (Section 12).

15.1.1.2 The study area for the traffic and transport section has been applied to enable consideration of potential effects on the local transport network. This incorporates two areas, specifically the extent which encompasses the potential construction routes and the associated local roads (Figure SW-DR-V-00050), together with the area benefitting from greater flood risk protection up to and including a 'severe flood' (i.e. a flood which has a 1 per cent (1 in a 100) chance of happening each year) (Figure SW-DR-V-00050). To assist in defining the study area for this topic, potential transport routes likely to be utilised by the Project have been identified using site visits to consider access arrangements, and a desk study by using an online routing system specifically for HGVs called 'Freight Journey Planner' (2017). This ensures that vehicle size and weight are taken into consideration when planning potential routes.

15.1.1.3 Raw traffic count data from 2015, as well as Annual Average Daily Flow (AADF) numbers for the study area have been obtained from the Department for Transport (DfT) (2016). Information on roads and public transport (railways and bus stops) has been collated from the respective local authorities (RBWM, SCC, and the Surrey Borough Councils), the National Receptor Dataset, and from OS maps. Boat traffic data for the River Thames has been provided by the Environment Agency's Waterways Team.

15.1.1.4 Regular consultation with local authorities (RBWM, SCC) and transport related organisations (Network Rail, Highways England) has been carried out. Meetings with local authorities have included data exchange (e.g. traffic count data), access and programme management (to ensure there are no conflicts between other planned works to the local and regional road network at the time of construction), and 'approval in principle' discussions on the draft plans. Discussions with Network Rail have included establishing the benefits of the Project to Network Rail, the involvement of Network Rail in the design of the rail crossing over the proposed channel and a formal review of the Project design. Regular meetings have been held with Highways England to provide progress updates and reviews of the proposed channel design in relation to Highways England's assets, and any working arrangements required.

15.2 Baseline information

15.2.1 Road and rail

15.2.1.1 Due to proximity to Greater London, there is an extensive transport network within the study area, including the nationally important M3, M4 and M25 motorways, and regionally significant trunk roads, such as the A3, A240 and A308.

15.2.1.2 Motorway congestion data from March 2015 ('percentage of journeys completed on time' shown on Figure SW-DR-V-00057) shows that in most sections of the M25, 47 per cent to 82 per cent of journeys were completed on time. On the M3, 65 per cent to 100 per cent of journeys were completed on time, with the exception of the eastbound carriageway heading towards the M25, where only 28 per cent to 46 per cent of journeys were completed on time.

15.2.1.3 There are several railway stations within the study area, including Datchet, Sunnymeads, Wraysbury, Staines, Chertsey, Sunbury, Hampton Court and Teddington which connect the region to Reading, Alton, Guildford, Richmond upon Thames, Shepperton and London Waterloo. Richmond upon Thames and London Waterloo are also on the London Underground (Figure SW-DR-V-00050).

15.2.1.4 There are a number of public bus routes and bus stops within the study area (Figure SW-DR-V-00050). These broadly follow the route of the River Thames, providing public transport links between the communities of Datchet, Staines, Chertsey and Shepperton.

15.2.1.5 AADF data (i.e. the total number of vehicle traffic on a particular stretch of road for a year, divided by 365 days), where available, for main roads in the study area is provided in Table 15-1. Currently 90 per cent of London's freight is moved by road with the use of HGVs. All roads on the proposed construction and operational routes carry HGVs on a regular basis; accounting, on average for three per cent of the total vehicles using these roads. Comparatively, cars and LGVs collectively account for an average of 97.1 per cent (85.7 per cent and 11.4 per cent, respectively) of the total vehicles on these roads, while public buses only account for 0.4 per cent. As would be expected, the data below shows that motorways and A-roads have the highest AADF. B-roads have significantly lower AADF and also experience significantly less HGV movements; however, they have higher LGV movements (as a proportion of total AADF).

Table 15-1: 2015 annual average daily flow (AADF) data for main roads within the study area (see Figure SW-DR-V-00057) (DfT, 2016).

Location on map	Road Name	Cars	Buses	HGVs	LGVs	Total
Channel Section 1 (Windsor & Maidenhead)						
1	M25	147,983	793	14,319	26,002	189,097
2	A30 (a)	38,183	104	1,346	5,264	44,897
3	A308 (a)	16,158	44	206	1,720	18,128
4	A308 (b)	18,547	133	339	2,158	21,177
5	A308 (c)	20,733	131	465	2,418	23,747
6	B376 (a)	8,031	8	1,198	127	9,364
7	A308 (d)	23,346	135	353	2,854	26,688
8	A308 (e)	16,351	446	210	2,616	19,623
9	A30 (b)	19,526	275	743	4,019	24,563
Channel Sections 2 and 3 (Surrey)						
10	M3	46,557	211	2,519	7,272	56,559
11	A320 (a)	14,468	295	210	1,993	16,966
12	A320 (b)	15,760	114	303	2,661	18,838
13	A320 (c)	15,917	115	306	2,687	19,025
14	A320 (d)	12,736	122	202	1,573	14,633
15	B376 (b)	10,176	128	1,333	83	11,720
16	B388	8,079	22	1,410	276	9,787
Downstream (Sunbury, Molesey, and Teddington weirs, and Ham Lands)						
17	A308 (f)	18,125	272	3,117	459	21,973
18	A308 (g)	30,710	649	3,380	1,224	35,963
19	A309 (a)	19,906	80	3,996	573	24,555
20	A309 (b)	33,169	471	4,660	740	39,040
21	A310	12,821	180	1,118	233	14,352
22	A313	13,799	321	2,275	675	17,070

Location on map	Road Name	Cars	Buses	HGVs	LGVs	Total
23	B3379	7,015	100	1,045	96	8,256
24	A311	10,097	212	621	1,362	12,292
25	A3008	3,206	0	65	296	3,567
26	A308	35,450	1,105	649	4,622	41,826
27	A307	15,316	277	346	1,394	17,333
28	A310	14,131	341	589	1,857	16,918
29	A305	22,839	1,505	400	3,488	28,232
30	A240	20,622	323	698	2,206	23,849

15.2.1.6 At present, both road and rail infrastructure are directly affected in the event of a major flood (see Figures SW-DR-V-00050 and SW-DR-V-00057), resulting in the isolation of properties, the division of communities and limiting access to major transport links, increased stress and reduced access for emergency response and operation. This would in turn disrupt neighbouring areas through linkages in transport routes (e.g. road closures; cancelled and/or delayed public transport).

15.2.2 Air transport and associated road traffic

15.2.2.1 The UK's largest airport, Heathrow, is located approximately eight kilometres north-west of the proposed flood relief channel and attracts a significant amount of road, rail and air traffic. In 2016, Heathrow handled 75.7 million passengers over 473,231 air transport movements, with 81 airlines travelling to 194 destinations. Much of the study area lies within the 13km safeguarding zone for Heathrow airport.

15.2.2.2 Heathrow is currently served by the Piccadilly Underground Line and by the Heathrow Express and Heathrow Connect rail services. The Piccadilly Line is currently the most important of these, and accounts for the bulk of the rail and tube journeys to Heathrow (42 per cent of all air passenger journeys to the airport by public transport and sixteen per cent of all air passenger journeys to the airport by all modes of transport) (Bourn, 2013).

15.2.2.3 The presence of Heathrow Airport has a significant influence on road traffic within the vicinity. Analysis of traffic on roads leading to Heathrow Airport indicated a marked reduction in road traffic levels leading to the airport during the Heathrow closure in April 2010 (due to the volcanic ash cloud) (London Borough of Hillingdon, 2010).

15.2.3 Waterways navigation

15.2.3.1 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) (DfT, 2015b).

15.2.3.2 The numbers of boats transiting the River Thames and passing through the manned locks at Old Windsor, Bell weir, Penton Hook and Shepperton, as well as downstream at Sunbury, Molesey and Teddington between 2013 and 2016 is shown in Table 15-2, below. The approximate daily average number of boats passing though ranged from 28 boats at Teddington to 39 boats at Shepperton. The data shows that the highest annual total was in 2013 and highlights that the number of boats has progressively decreased year on year since. Shepperton lock experienced the most boat traffic, followed by Molesey and Old Windsor. Teddington and Sunbury locks experienced the least traffic.

Table 15-2: Boat traffic through River Thames locks/weirs in the study area (Environment Agency, 2017b).

Lock	2013	2014	2015	2016	Total per weir	Approximate daily average
Old Windsor	13,871	12,382	13,677	13,279	53,209	36/day
Bell weir	12,951	11,407	14,344	12,580	51,282	35/day
Penton Hook	13,700	12,389	12,705	11,426	50,220	34/day
Shepperton	15,123	13,427	14,108	13,624	56,282	39/day
Sunbury	13,440	14,267	7,245	10,684	45,636	31/day
Molesey	14,142	13,804	13,830	12,991	54,767	38/day
Teddington	10,550	10,245	10,228	9,556	40,579	28/day
Annual total	93,777	87,921	86,137	84,140	351,975	

Channel Section 1

15.2.3.3 A railway line runs north-west to south-east through the study area in close proximity to the proposed route of Channel Section 1. Railway stations on this line (running from Windsor and Eton Riverside to London Waterloo) in proximity to Channel Section 1 are Datchet, Sunnymeads and Wraysbury, and are operated by Southwest Trains. The typical off-peak service is two trains per hour to both London Waterloo and Windsor and Eton Riverside (reducing to one per hour on Sundays). Staines railway station is also in close proximity and on the same line, situated in between Channel Sections 1 and 2 (Figure SW-DR-V-00050). The proposed channel will cross the railway line in two places, in between Datchet and Sunnymeads stations and also just northwest of Wraysbury station.

15.2.3.4 There are several bus stops and routes situated nearby the proposed Channel Section 1, mainly along the B376, A308 and A320 (Figure SW-DR-V-00050). Bus services in the area include Buses 7, 8, 10 and 11, which are operated by First (Berkshire & Thames Valley) and provide services connecting Datchet and Wraysbury to Staines, Slough and Heathrow bus station. Bus 305 is run by Bear Buses and this service runs from Wraysbury to Staines.

15.2.3.5 The villages of Datchet, Horton and Wraysbury are within the study area, and all have a dense network of residential and minor roads, connecting to regionally important roads, such as the M4 and M25 motorways. The major roads within the vicinity of Channel Section 1 are listed in Table 15-1, together with data on AADF, where available.

Channel Sections 2 and 3

15.2.3.6 Staines and Egham railway stations are located just outside of the study area, but the associated line crosses into the study area in between Channel Sections 1 and 2. The lines are operated by South West trains, and during off-peak times, there are direct services every 30 minutes to London Waterloo (via Staines and Hounslow), Reading, and towards Channel Section 1 (i.e. Wraysbury, Sunnymeads and Datchet railway stations).

15.2.3.7 There are a great number of public bus stops and routes in the study area, mainly along the B3376, B375, B376, A320 and A3050 (Figure SW-DR-V-00050). Abellio Surrey, Abellio London and London United run the majority of services in the area, providing buses towards Windsor, Hounslow, Egham, Kingston upon Thames, Sunbury, Hampton, Heathrow Airport (bus station and Terminal 5), and London. Staines bus station is a key interchange with 17 bus services terminating here, running to various destinations, such as Windsor, Hampton, Kingston upon Thames, Heathrow bus station, and Royal Holloway College.

15.2.3.8 Shepperton to Weybridge pedestrian ferry is located approximately 0.25km upstream of Desborough Cut (Figure SW-DR-V-00050), running every fifteen minutes from 8am on weekdays, 9am on Saturdays, and 10am on Sundays with the last ferry at 5.30pm each day.

15.2.3.9 The closest towns to Channel Sections 2 and 3 are Staines, Egham, Chertsey, Weybridge, and Shepperton; all of which have a dense network of residential and minor roads, as well as some significant B roads (e.g. B375, B377, B3366, and B387) which lead to major trunk roads (e.g. A320, A308, and A244), and motorways (M25 and M3) (Figure SW-DR-V-00057). The major roads within the vicinity of Channel Sections 2 and 3 are listed in Table 15-1, together with data on AADF, where available.

Sunbury weir

15.2.3.10 Sunbury Railway Station is a suburban station located approximately 1.6km north-west of Sunbury weir. Sunbury station is located outside the study area, however the train line, which serves routes between London Waterloo and Shepperton, does pass through the study area.

15.2.3.11 There are many public bus stops and routes in the study area around Sunbury (Figure SW-DR-V-00050). Abellio Surrey and Cardinal Buses operate the majority of services in the area, with many buses travelling from Wraysbury, Egham, Staines, Heathrow airport towards Twickenham, Kingston upon Thames and the rest of London via Sunbury. From Teddington towards London, the majority of buses are operated by Transport for London (TfL), travelling via Sunbury to Heathrow Airport and the rest of London

15.2.3.12 There are few roads close to Sunbury weir (Figure SW-DR-V-00057). The A3050 is the nearest main road, approximately 800m south-east of the preferred option, running parallel to the River Thames between Walton-on-Thames and East Molesey. Sunbury weir is accessed from the A3050 by Waterside Drive, a minor road, which leads to a private road with restricted access adjacent to the river.

15.2.3.13 The left bank of the River Thames is dominated by the town of Sunbury-on-Thames accompanied by a dense network of residential roads and minor roads. There is no direct road connectivity to the weir from this side of the River Thames.

Molesey weir

15.2.3.14 Hampton Court Railway Station is a suburban station located approximately 0.3km south-east of Molesey weir, close to Hampton Court Bridge, falling within TfL's Zone 6. The station is the end of the line, and the typical off-peak service is two trains per hour to London Waterloo via Surbiton and Wimbledon

15.2.3.15 There are a number of public bus stops and routes in the study area, mainly along the A308 and A309 (Figure SW-DR-V-00050). Abellio London and Abellio Surrey operate the majority of services in the area from Molesey to Kingston upon Thames. The majority of services from Kingston upon Thames towards London are operated by TfL.

15.2.3.16 The Hampton ferry bay is situated on the River Thames, approximately 1km upstream of Molesey weir (Figure SW-DR-V-00050). This is the oldest ferry on the River Thames, providing a service since 1514, and runs as a channel crossing between the Bell Inn in Hampton and Hurst Park in Molesey. The full service runs from May to September, from 7:45am on weekdays, and 10am on weekends, with the last ferry at 6pm each day. In April and October, a restricted service runs from 7:45am to 9am and from 4pm to 6pm (depending on demand).The ferry does not operate during the winter (November to March).

15.2.3.17 Ditton Cruisers and Harts Cruisers are boat hire companies, based approximately 2km and 4km downstream from Molesey weir respectively (Figure SW-DR-V-00050). They both offer boat cruises between Hampton to Teddington.

15.2.3.18 The right bank of the River Thames near Molesey weir is dominated by housing accompanied by a dense network of residential roads and Hurst Park (Figure SW-DR-V-00057). The A3050 is the nearest main road on the south side of the River Thames, approximately 270m south-west of the preferred option, running adjacent to the river between East Molesey and Walton-on-Thames.

15.2.3.19 The nearest road bridge over the River Thames to Molesey weir is Hampton Court Bridge (A309), approximately 300m downstream. Horse Fair Bridge (A308) is located approximately 3.5km downstream. The closest upstream road bridge is Walton Bridge (A244), approximately 6km away.

Teddington weir

15.2.3.20 Teddington Railway Station is a suburban station located approximately 1km south-west of the weir, falling within TfL's Zone 6. The station does not fall within the study area, however the train line does and serves routes between Shepperton and London Waterloo, of which four per hour run via Kingston upon Thames and Wimbledon, while two per hour run via Richmond upon Thames and Putney. Two trains per hour run to Shepperton.

15.2.3.21 There are a number of bus routes in the study area, particularly along the A240 and A310 (Figure SW-DR-V-00050). TfL operates the majority of the bus services in the area, which include Buses R68, X26, 371, 281, 285, the 371 and 481 that connect to Hampton Court, Kingston upon Thames, Surbiton, Kew Retail Park and Tolworth Broadway and other areas of London. Additionally, Bus 285 goes to Heathrow Airport central bus station.

15.2.3.22 Turk Launches is located approximately 3km upstream of Teddington weir and provides daily boat services along the River Thames from April to October. The service includes journeys from Hampton Court Bridge to Kingston Bridge and Richmond Bridge (Figure SW-DR-V-00050).

15.2.3.23 The left bank of the River Thames near Teddington weir is dominated by the urban area of Teddington, accompanied by a dense network of residential and minor roads. Manor Road (A310) is the nearest main road, approximately 200m south-west of the preferred option, running parallel to the River Thames between Twickenham and Hampton Wick.

15.2.3.24 The nearest road bridge to Teddington weir is Horse Fair Bridge (A308), approximately 2.6km upstream. Richmond Bridge (A305) is located approximately 4.5km downstream.

Ham Lands

15.2.3.25 Strawberry Hill Railway Station is a suburban station located approximately 0.8km west of Ham Lands, falling within TfL's Zone 5. The station falls outside of the study area but serves routes between Shepperton and London Waterloo via Richmond upon Thames, Wimbledon and Kingston upon Thames, where the train line crosses into the study area (in between Hampton Wick and Kingston upon Thames Stations) (Figure SW-DR-V-00050).

15.2.3.26 There are several public bus stops and routes along the A310 and A305, which run along the opposite river bank to Ham Lands and connect the area to multiple regionally important locations (Figure SW-DR-V-00050). TfL operates the majority of the bus services in the area; some of the services include Bus R68, which runs from Hampton Court to Kew Retail Park; Bus 33 runs from Fulwell to Hammersmith; Buses H22 and 490 run from the Heathrow/Hounslow area to Richmond upon Thames; and Bus R70 runs from Hampton to Richmond upon Thames.

15.2.3.27 There are few roads close to Ham Lands (Figure SW-DR-V-00057). The A310 and A305 are the nearest main roads, which run adjacent to the opposite river bank, approximately 0.3km to 0.5km west and northwest of Ham Lands. There is a network of minor residential roads connecting to Riverside Drive (which borders the Ham Lands area) and Ham Street (recognised as a potential construction access route). It is also important to note that there are four schools in this area, namely Grey Court School, Strathmore School, The Russell School, and the German School, as well as a number of recreational amenities such as Ham Polo Club, Ham & Petersham Rifle Club, Ham playing fields, and Ham House Stables, which will all use the local road network in the area. With regards to regionally important major roads, the A307 is approximately 1.3km away, while the A308 and A3 are approximately 4km and 5km away, respectively.

15.2.4 Future baseline

15.2.4.1 Since the 1950s, the long-term trend in traffic has been one of growth. Vehicle miles travelled between 1949 and 2015 have increased more than tenfold and national traffic levels are forecast to continually increase in all modelling scenarios undertaken by the DfT (DfT, 2015); ranging from nineteen per cent to 55 per cent growth between 2010 and 2040. Traffic growth is expected to be particularly strong on the

Strategic Road Network (motorways and major 'trunk' A-roads), between 29 per cent and 60 per cent from 2010 to 2040; while it is twelve per cent to 51 per cent on other principal roads, and ten per cent to 54 per cent on minor roads (DfT, 2015).

15.2.4.2 Growth in LGV traffic is expected and makes a significant contribution in the DfT forecast of national road traffic. The forecast growth of LGVs means national traffic levels are forecast to be nineteen per cent higher in 2040 (DfT, 2015).

15.2.4.3 However, it should be noted that the size of predicted traffic growth varies depending on three uncertainties: the number and types of journeys that people make; the effect of rising incomes on car ownership and use; and future trends of income growth and fuel prices (DfT, 2015).

15.2.4.4 Expansion at Heathrow Airport is planned, as set out by the 2003 Aviation White Paper (DfT, 2003), the Heathrow Airport Masterplan (BAA, 2005), and the Secretary of State for Transport's decision, following Heathrow Airport Holdings Limited (then the British Airports Authority) consultation in 2005 (BAA, 2005). This proposes a third runway which will allow the airport to handle approximately 700,000 air transport movements per year by 2030 (nearly 50 per cent more than today); however it is initially proposed to increase capacity to 605,000 movements by 2020. In October 2016, the government announced its support for a new runway at Heathrow and this proposal will now be taken forward in the form of a draft 'National Policy Statement' for consultation (DfT, 2016).

15.2.4.5 New public transport infrastructure (new lines and upgrades to existing) to Heathrow Airport includes a total of five railway lines by 2032 (London Underground Piccadilly Line upgrade, Crossrail, Heathrow Express, Western Rail, Southern Rail and easy access to HS2), and they have promised double the trains per hour and almost triple the seats by 2040. In summary, this will treble Heathrow's rail capacity and enable 30 million more passengers to use public transport rather than travelling by car (Your Heathrow, 2016). This may reduce road traffic in the study area associated with Heathrow airport.

15.2.4.6 It is recognised that travel trends continue to evolve, as do the range of factors behind them, and there is still uncertainty around travel behaviour. Continued updates on forecasts are necessary to ensure accurate predictions are made on future traffic and transport in the study area. This will be all the more important as with London's population predicted to increase from 8.6 million to approximately 10 million by 2030, the transport infrastructure in the study area is going to be under increasing pressure, therefore disruption to roads due to flooding would have a large 'knock on' effect to the surrounding area.

15.2.5 Key environmental constraints and opportunities

15.2.5.1 Existing transport infrastructure (especially major motorways, Heathrow Airport and railway lines) which are already congested, is a major constraint.

15.2.5.2 The key constraint in relation to traffic and transport is the disruption that Project related traffic (both at construction and operational stages) 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 during construction.

15.2.5.3 The key opportunity in relation to traffic and transport is the prevention of, or reduction in, flooding of key routes, which will avoid disruption to road, rail, airport and river traffic networks.

15.3 Predicted changes to the environment and scope of assessment

15.3.1.1 Potential effects on traffic and transport during construction and operation of the Project are discussed in Table 15-3.

Table 15-3: Potential effects during construction and operation.

Project activity	Potential effects and receptors	Could the effect be significant– yes/no?	Reason	Potential mitigation measures
Construction				
Creation of site compounds, temporary materials processing sites and storage of excavated material.	Temporary adverse effect of increase in flood risk to local and regionally important roads.	Yes.	The creation of areas of hard standing and the stockpiling of excavated material within the floodplain has the potential to significantly affect flood risk, and in turn roads and transport links, during construction.	Where possible, stockpiling material within the floodplain will be avoided. A flood protocol will also be put in place (in accordance with an Environmental Permit for Flood Risk Activities). This is likely to include the requirement to store material parallel to the direction of water flows within the floodplain so that the stockpiles do not impede drainage.
On and off site vehicle and machinery movements.	Increased traffic on local roads, as well as 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.	Yes.	A substantial number of vehicle movements will be required during construction to bring plant, equipment and materials to site and to move them between different working areas. HGVs will be needed to move excavated materials to the reprocessing sites. Mitigation has been built into the design to reduce vehicle movements: • Use of barges on the River Thames for transporting plant, equipment and materials between the working areas at the River Thames weirs and the site compounds; and • Re-using most of the excavated materials on-site for landscaping and creation of the LEAs rather than transporting off site. The potential effects on air quality from on and off site vehicle and machinery movements is discussed in Table 7-3 in Air Quality and Climatic Factors (Section 7.3).	A detailed traffic and transport assessment will be completed to inform required mitigation. A Traffic Management Plan will be prepared to plan traffic movements including: timings, routes, traffic restrictions, diversions and calming measures, deliveries and queuing etc. The new channel will be used as a haul road in certain areas during construction, to reduce use of local roads (e.g. using the channel under road bridges as an underpass).

Project activity	Potential effects and receptors	Could the effect be significant– yes/no?	Reason	Potential mitigation measures
Influx of site personnel.	A large number of construction site personnel will need to access the working areas in order to construct the Project, resulting in a potential adverse effect on traffic congestion, journey times and the condition of local roads.	Yes.	A substantial number of personnel vehicle movements will be required during construction to bring operatives to site, and to move them between different working areas and site compounds.	A detailed traffic and transport assessment will be completed to inform required mitigation. A Traffic Management Plan will be prepared and will include measures to reduce effects on traffic from site personnel. For example car sharing schemes, cycling facilities and park & ride bus services for site operatives could be used to reduce the number of vehicle movements on local roads.
Excavation of flood relief channel crossing the Windsor & Eton Riverside to London Waterloo railway line in two locations on Channel Section 1.	Potential adverse effect (temporary closure between Staines station and Windsor and Eton Riverside station) on the Windsor & Eton Riverside to London Waterloo railway line.	Yes.	Temporary disruption to the line and stations for approximately 28 days. This will result in longer or cancelled journeys for rail passengers, and increase road traffic in the local area during the closure, due to train passengers seeking alternative modes of transport.	A detailed traffic and transport assessment will be completed to inform required mitigation. Where possible this work will be undertaken as part of planned closures of the line, to avoid additional closures. Discussions with Network Rail are ongoing.
Excavation of flood relief channel and installation/ diversion of transport services and roads.	Potential adverse effect (temporary closure/diversion due to flood relief channel excavation) on local roads (e.g. Littleton Lane, Chertsey Road, Ferry Lane Road, B375, B376 and B3021), as well as on regionally (e.g. A308, A310, A320) and nationally (e.g. M3, M25) important roads.	Yes.	Potential road closures/diversions may be required resulting from the need to construct the new flood relief channel under numerous roads (including the M3), and to install or divert services in these locations which could cause significant disruption to road users.	A detailed traffic and transport assessment will be completed to inform required mitigation. A Traffic Management Plan will be prepared to plan traffic movements including: routes, traffic restrictions, diversions and calming measures, deliveries and queuing etc.
Construction of capacity improvement at the River Thames weirs.	Construction works on the River Thames weirs could cause a potentially adverse effect on boat traffic on the River Thames (obstructing navigation).	No.	Construction works to the River Thames weirs will be temporary (undertaken across a single year at each location), and navigation of the River Thames will be maintained throughout. Fenders/buoys, signage and Notices to Mariners may be required to advise waterway users of the works taking place. Movement of materials onto the lock islands will be undertaken outside of peak periods of boat traffic	

Project activity	Potential effects and receptors	Could the effect be significant– yes/no?	Reason	Potential mitigation measures
			which occur in summer.	
Operation				
Reduced risk of flooding.	Potential beneficial effect of reduced disturbance to use of rail and local, national and regionally important roads during times of flood.	Yes.	Reduced incidence of disruption to railway lines (including the Windsor and Eton Riverside, Shepperton and Hampton Court, all to London Waterloo via Kingston upon Thames, and Clapham Junction) and the road network (e.g. M3, M4, M25, A3, A240, A308 etc.) resulting from the reduction in flooding therefore reducing potential disruption to rail users.	N/A.
Change in areas of public access, e.g. public access routes, LEAs, and areas of habitat creation.	Potential beneficial and / or adverse effects on traffic movements on roads, public transport services and existing parking facilities.	Yes.	Creation of new walking and cycling routes along the flood relief channel may relieve local traffic congestion on existing networks due to residents and workers in the area choosing to walk/cycle rather than make short journeys by car; however these numbers are unlikely to be significant, and seasonal differences are likely (i.e. higher use in Spring/Summer). Creation of new Public Open Spaces and areas of habitat creation may attract more visitors resulting in a potential increase in pressure on local roads, public transport and existing car parking facilities.	As built-in mitigation additional parking facilities have been included at each of the LEAs, to mitigate for additional pressure on existing parking facilities. Master planning and Urban Design Assessment will also be undertaken to consider the effects upon the public realm of creating areas of public access in terms of connectivity with existing transport links etc. A transport assessment will be completed to identify likely effects on congestion and any required mitigation.
Creation of navigable sections of flood relief channel.	Presence of boats using the new channel (most likely canoes or boats using mooring facilities) could have potential beneficial and / or adverse effects on boat traffic using the River Thames.	No.	Creation of navigable sections along the new flood relief channel may either relieve or attract more boat traffic to the main River Thames; however it is unlikely to cause a significant increase in the number of boat users on the River Thames.	
Existence of flood relief channel and	Project features could attract additional geese / gulls to the area, which could cause a	No.	Regular discussions have been carried out with Heathrow Airport Ltd., to ensure that bird strike risk will be kept to a minimum. Heathrow Airport Ltd has a list of avoidance measures which will be adhered to	

Project activity	Potential effects and receptors	Could the effect be significant– yes/no?	Reason	Potential mitigation measures
associated features.	potential adverse effect on aeroplanes using Heathrow Airport from bird strike.		wherever possible. Avoidance measures include for example: • Any development / activity which would encourage an increase in geese and gull populations; • Creation of shallow-sided water bodies connected to a short, grassed area immediately beyond it (i.e. ideal habitat for geese); • Creation of large water bodies (i.e. >200m in diameter) which attract roosting gulls; • Creation of islands within lakes which attract Canada geese to breed; and • Anything causing flocks of birds to rise up into the air on mass. The potential effects on air quality from the existence of the flood relief channel and associated features is discussed in Table 7-3 in Air Quality and Climatic Factors (Section 7.3).	
Maintenance activities.	Increased traffic on local roads causing a potential adverse effect on traffic congestion, journey times and the condition of local roads.	No.	Vehicle movements due to maintenance activities are likely to be infrequent and of short duration, resulting in minimal effects.	

15.4 Assessment methodology

15.4.1.1 A Transport Assessment will be produced and the scope of this assessment will be agreed with the local highways authority.

15.4.1.2 To undertake this assessment it will be necessary to further inform the traffic and transport baseline by collecting up-to-date traffic data for the key routes likely to be affected by construction and operation traffic (Figure SW-DR-V-00057).

15.4.1.3 It will also be necessary to further inform the understanding of the likely effects of the Project including:

- The anticipated number of vehicle movements required during construction;
- The anticipated number of operatives active on site at any one time during construction;
- Identification of all temporary or permanent diversions or closures of roads and rail required; and
- The anticipated number of visitors that might utilise the new LEAs and areas of habitat creation once the Project is operational.

15.4.1.4 The Transport Assessment will include modelling of the likely effects on transport. It is likely that the Surrey Integrated Transport Model (SINTRAM) belonging to SCC will be used to identify the locations that may require further investigation in the Transport Assessment. The model categorises vehicles into three classes (car, LGV and HGV), and can assess the difference in vehicle kilometres, vehicle hours, junction delays and average speed against a range of scenarios. The model also incorporates predicted future baseline increases in traffic movements.

15.4.1.5 Following the use of SINTRAM, it may be necessary to undertake targeted transport modelling and assessment to inform any necessary mitigation that is required to minimise effects on the transport network.

15.4.1.6 The Transport Assessment will examine the impact of the Project in terms of the magnitude of change in traffic flows as a result of the construction and operation. A change in flows in excess of a defined percentage will be considered significant, taking into account professional judgement (for construction, the length of likely disruption will also be considered).

15.4.1.7 If the Transport Assessment indicates that changes in traffic flows may occur, mitigation measures will be proposed.

15.5 Limitations and assumptions

15.5.1.1 The following limitations with availability of baseline information were encountered:

- Road traffic counts were limited or non-existent for many of the B roads in the study area, making it difficult to accurately describe the traffic baseline for these roads; and
- Bus stop information for the RBWM was limited. The majority of bus route information was collected from the Traveline Southeast & Anglia website (2017).

15.5.1.2 This scoping assessment was based on the best information on potential construction routes available at outline design stage of the Project. It is possible that construction routes may change, which will be considered as part of the Transport Assessment.

16 Stakeholder Engagement

16.1 Engagement planning

16.1.1.1 The RTS communication strategy is to 'consult regularly, welcome feedback and provide clear evidence of how this was used in our design'. A stakeholder Engagement Plan has been created for the RTS and is regularly updated. The plan aims to define an approach to engagement that will help facilitate an RTS that maximises flood risk management and wider benefits to communities and the environment.

16.1.1.2 We are using the 'working with others' approach to ensure effective engagement on the Project. This works through a series of iterative steps, being:

- 1) WHAT do you want to achieve?
- 2) WHY work with others?
- 3) WHO do you need to work with?
- 4) HOW will you involve them?
- 5) DELIVER – let's do it!
- 6) EVALUATE - how did it go and what did we learn?

16.1.1.3 The Project has over 250 organisations as stakeholders, as well as thousands of effected individuals from a broad range of interests including internal, statutory authorities, land owners and operators, environmental groups, businesses and potential funders, supply chain, and others.

16.2 Consultation methods

16.2.1.1 There are a range of engagement methods and 'tools' which are being applied to engagement with the Project stakeholders. The methods chosen for particular stakeholders depend on the type of engagement that is to be undertaken and the target audience for the engagement. Depending on the stakeholders' needs and level of participation engagement can range from simply providing stakeholders with information to being involved in shared decision making. Engagement methods being used with different stakeholders include:

- Meetings with partners (e.g. Consents and Authorisations Advisory Group, the RTS Sponsoring Group, and workshops with technical staff);
- One to one meetings (e.g. with landowners, investors and statutory authorities);
- Seven deliberative workshops for three 'Discussion Groups' with 100+ representatives;
- 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;
- RTS webpage;
- Print media, TV, radio;
- Social media; and
- Emails to the RTS inbox – circa 40 enquiries a month.

16.3 How engagement has informed the design

16.3.1.1 In autumn 2015, and in autumn and winter 2016 facilitated workshops were led with over 100 individuals from a broad range of interests to discuss design options in areas of uncertainty, and work towards consensus on preferred options and potential enhancement opportunities. In addition, an online public consultation exercise and public drop-in events were held in March 2016 and winter 2016 to get stakeholder feedback on options and opportunities. Following consultation, the preferred options are those with the least stakeholder opposition.

16.3.1.2 In all over 400 enhancement opportunities were suggested by stakeholders. To prioritise these, the Project design team divided them into three categories:

- 'Proposed Features' - Features that are proposed in the design, as they can be incorporated into the construction with minimal cost;
- 'Potential Opportunities' – Features that could provide the opportunity for additional government funding (by providing improved access, and more public space), or help to mitigate for effects of the Project; and
- 'Other suggested opportunities' – These are suggestions that are not currently being considered within the design. If people would like to see these happen they would need resources outside the current RTS funds.

16.4 Future consultation

16.4.1.1 The design team will continue to consult with stakeholders as the Project progresses to detailed design stage.

16.4.1.2 Key upcoming consultation milestones include the planning application submission in summer 2018. The regular newsletter and other consultation activities will continue to keep stakeholders updated on the project as it progresses.

17 Approach to the EIA

17.1 Introduction

17.1.1.1 This section sets out the general approach to be adopted in conducting the EIA, up to the submission of the ES with the planning application (see Figure 2-1 in Section 1). In so doing, it describes the approach that will be used to identify, evaluate and mitigate environmental effects. It also sets out the proposed temporal, spatial and technical scope of the EIA. Further details on individual topics are given in Sections 7 to 15.

17.1.1.2 Following consultation on this Scoping Report, the RTS project partners will continue to consult with relevant stakeholders during assessment and this will be documented as part of the assessment process. The EIA process will culminate in the production of an ES that will in turn be the subject of consultation by the Local Authorities as part of the planning application process.

17.2 Basis of the assessment

17.2.1.1 EIA is a procedure required under the terms of EU Directive 2014/52/EU on assessment of the effects of certain public and private projects on the environment. The UK implements this Directive through the Town and Country Planning (EIA) Regulations 2017 (SI 2017/ 571).

17.2.1.2 The primary objective of an EIA is inscribed under Article 2 of the Directive, which states that: "Member States shall adopt all measures necessary to ensure that, before development consent is given, projects likely to have significant effects on the environment by virtue, inter alia, of their nature, size or location are made subject to a requirement for development consent and an assessment with regard to their effects on the environment."

17.2.1.3 Article 8 of the Directive also states that: "The results of consultations and information gathered pursuant to [the EIA procedure] shall be duly taken into account in the development consent procedure".

17.2.1.4 In practical terms, the purpose of the ES is to inform the decision-maker (in this case, the Local Authorities), other stakeholders and to provide a source of information for the public, regarding the likely significant environmental issues attached to the development during its construction and operation.

17.2.1.5 The environmental effects of the proposed development will be predicted for each relevant environmental topic (water quality, commercial fisheries, traffic, socio-economics etc.) by comparing baseline environmental conditions (i.e. the situation without the proposed development) with the conditions that would prevail were the proposal to be constructed and operated.

17.2.1.6 Effects will be predicted in relation to environmental receptors, that is: population (e.g. residents of buildings, users of facilities, employees of businesses), built resources (e.g. Listed Buildings) and biodiversity (e.g. a site of ecological importance).

17.2.1.7 In addition to the EIA Regulations, the EIA will be undertaken with reference to the following documents, amongst others:

- Guidelines for Environmental Impact Assessment, IEMA, 2004; and
- EIA planning practice guidance, DCLG, 2014.

17.3 Work undertaken to confirm baseline

17.3.1.1 A large amount of baseline data collection has already been undertaken, or is currently underway for the Project, in particular:

- Site investigation of ground conditions;
- Groundwater monitoring (level and quality);
- Monitoring of lake water level and quality, and ecological function (phytoplankton, zooplankton, phytobenthos, macroinvertebrates, macrophytes and fish) and winter bird use of lakes;
- Monitoring of River Thames flow, water quality and ecological function (phytobenthos, macroinvertebrates, macrophytes and fish);
- Ecological Extended Phase 1 habitat Survey and Preliminary Ecological Appraisal;
- Site walkovers to determine landscape character;
- Bathymetric surveys of lakes;
- Topographic surveys; and
- Archaeological DBA and setting assessment of designated heritage assets.

17.3.1.2 The baseline data gathered to date will form part of the EIA work going forward and will be valuable in contributing towards an understanding of the existing environmental conditions in the area. More detail is given on baseline conditions in the relevant parts of Sections 7 to 15.

17.3.1.3 Where necessary, additional information and data will be obtained from various sources to allow a robust determination of the environmental baseline, appropriate to the nature and scale of the proposed works. In line with the EIA Regulations, the ES will also indicate any difficulties encountered in compiling current and predicted environmental baseline conditions.

17.3.1.4 The existing environment forms the general baseline for the assessment, against which likely changes arising from the Project are predicted and evaluated. However, to enable the likely significant effects of the Project to be evaluated, the assessment needs to compare the 'proposed development case' against the likely future environmental conditions at the site in the specified assessment year without the Project, which is referred to as the 'base case'. Future baseline conditions have been considered in the relevant parts of Sections 7 to 15 to allow for the time difference between existing conditions and the base case for construction and operation of the Project.

17.4 Defining the significance of environmental effects

17.4.1.1 The EIA Regulations require an ES to report on those environmental effects arising from a project that are considered likely to be significant.

17.4.1.2 While there is no statutory definition of what constitutes a significant effect, the primary purpose of reporting significant effects is to inform the decision-maker when making their decision. In many cases, such as for noise, there are accepted methods for quantifying effects and determining the threshold of significance. In others, such as visual impact, the effects cannot be measured scientifically and only established practice or guidance offers an approach to assessing the significance of effects. In these cases it is necessary to define more qualitative criteria and thresholds.

17.4.1.3 On this basis, a significant effect has been defined for the purposes of this project, as an effect that, either in isolation or in combination with others, should – in the opinion of the competent experts carrying out the EIA – be taken into account in the decision-making process.

17.4.1.4 It is proposed to use a common framework within which to predict the significance of Project effects all environmental topics. This framework has three key stages:

- Identification of the baseline conditions, and the sensitivity and importance of receptors;
- Identification of the magnitude of change (effect) upon each receptor; and
- Identification of the significance of the effect, which is the product of a combination of the above two variables.

17.4.1.5 In identifying magnitude of change (effects), the EIA will take into account their nature and duration, including: site specific and wider effects; positive and negative effects; temporary and permanent effects; direct, indirect and secondary effects; and cumulative effects (including interaction of project effects acting in-combination upon a receptor). Definitions of each type of effect can be found in the Glossary.

17.4.1.6 The combination of the sensitivity of a receptor with the magnitude of change, in order to evaluate the significance of an effect, is shown as a matrix in Table 17-1. As part of the EIA, certain topics will have specific methodologies for defining significance of effect that may expand on or vary the common framework outlined in Table 17-1 (below).

Table 17-1. Matrix for the evaluation of significant environmental effects.

Magnitude of change	Sensitivity of receptor			
	High	Moderate	Low	Negligible
High	Significant	Significant	Significant	Not Significant
Moderate	Significant	Significant	Not Significant	Not Significant
Low	Significant	Significant / Not Significant	Not Significant	Not Significant
Very Low	Not significant	Not significant	Not significant	Not significant
None	None	None	None	None

17.5 Mitigation of environmental effects

17.5.1.1 Schedule 4 of the 2017 EIA Regulations requires that where significant effects are identified that any "measures envisaged to avoid, prevent, reduce or, if possible, offset any identified significant adverse effects on the environment" should be included in the ES.

17.5.1.2 The achievement of high environmental standards is integral to the Project. Measures to avoid, reduce and if necessary mitigate environmental effects have been built into the outline design, and will continue to be developed through detailed design for inclusion as part of the Project (see Section 3).

17.5.1.3 For each significant adverse effect of the Project that is identified during the EIA, the competent experts undertaking the assessments will review the potential mitigation measures stated in the assessment tables in Sections 7 to 15 and develop these further where needed in line with statutory requirements and good practice in their respective field. Mitigation will be committed through a number of routes, for example by proposed conditions or through a CEMP or equivalent.

17.5.1.4 Residual effects will be classified as non-significant or still significant (albeit reduced), as appropriate. Where effects are still significant, the extent of any mitigation will be reported in the ES, along with any requirements for monitoring.

17.5.1.5 Beyond the mitigation of adverse effects, there are opportunities for the Project to make a positive environmental contribution through enhancements. Enhancements currently proposed are described in Section 3 and will be refined as part of overall design development and incorporated into the planning submission as appropriate.

17.1 Scope of the assessment

17.1.1 Technical scope

17.1.1.1 The range of environmental topics to be addressed in the ES is generally referred to as the technical scope. As defined in Schedule 4 of the 2017 EIA Regulations, an ES is required to report on impacts particularly in relation to "population, human health, biodiversity (for example fauna and flora), land (for example land take), soil (for example organic matter, erosion, compaction, sealing), water (for example hydromorphological changes, quantity and quality), air, climate (for example greenhouse gas emissions, impacts relevant to adaptation), material assets, cultural heritage, including architectural and archaeological aspects, and landscape".

17.1.1.2 Potential significant environmental effects of the Project have been identified as part of this scoping exercise, and it is proposed that these be included in the EIA. This exercise has also identified effects that are deemed not likely to be significant, and have therefore been "scoped out" of the EIA. Those issues scoped in will form the technical scope of the EIA, and an assessment undertaken by competent experts will be carried out for each.

17.1.1.3 Regulation 18(4) of the 2017 EIA Regulations states that where a scoping opinion or direction has been issued (in accordance with regulation 15 or 16), that the ES must be based on the most recent scoping opinion or direction.

17.1.2 Spatial scope

17.1.2.1 The spatial, or geographical, scope of the EIA may differ from that defined as part of scoping the effects of the Project. It will take into account the following factors:

- The physical extent of the proposed works, as defined by the Project design;
- The nature of the baseline environment and the manner in which the effects are likely to be propagated; and
- The pattern of governmental administrative boundaries, which provide the planning and policy context for the project.

17.1.2.2 For example, any potential effects on archaeology would tend to be confined to those areas physically disturbed by the works, whilst the effects of noise or visual intrusion could potentially be experienced at some distance from the works.

17.1.2.3 In most cases the Project activities are likely to affect interests for a limited area around the Project. For some issues (such as socio-economics) activities may affect regional and county level interests, or even have an effect of national significance.

17.1.2.4 Appropriate study areas will be considered for each environmental topic by the specialist(s) undertaking that assessment.

17.1.3 Temporal scope

Overview

17.1.3.1 The temporal scope of the assessment generally refers to the time periods over which impacts may be experienced. This will be established for each topic, where appropriate through discussion with the relevant statutory consultees.

17.1.3.2 In general, the following terms will be used:

- Short-term – the effect is temporary and lasts for up to 1 to 2 years;
- Medium-term – the effect occurs for up to 10 years; and
- Long-term – the effect remains for a substantial time, perhaps permanently.

17.1.3.3 Two main categories of effects that will be assessed in the EIA are construction effects and operational effects; these are distinguished in the potential effects tables in Sections 7 to 15.

17.1.3.4 The assessment of construction effects will identify short or medium effects arising during the demolition, enabling works and construction which cease after the completion of construction. Examples include construction noise, dust and traffic.

17.1.3.5 The assessment of operational effects will identify long term effects arising from the existence and operation of the Project, including:

- Existence effects - arising from the physical presence of the development which are generally unchanging (e.g. effects from land take for the development such as loss of ecological resources); and
- Effects from operational activities - these may vary from hour to hour, day to day and year to year (e.g. changes in flow and water quality).

17.1.4 Cumulative effects

17.1.4.1 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.

17.1.4.2 As per Schedule 4 of the EIA Regulations "*other existing and/or approved projects*" in the vicinity of the Project study area will be considered in the assessment of cumulative effects in the EIA, where relevant information is available. The assessment of cumulative effects is an integral part of the EIA process and ensures that all aspects of potential effects from a proposed development have been addressed to ensure minimum effect on society and the natural environment. Those projects considered in the EIA may potentially include, but are not limited to those detailed in Appendix C. These schemes will be considered, alongside other planned developments identified through consultation, as part of the EIA where effects could overlap temporally or spatially and an application for consent has been submitted.

17.1.4.3 The initial assessment of cumulative effects in Appendix C provides details of each project considered, and has identified the potential for cumulative effects with eight other projects. The potential for cumulative effects with other projects has been identified for the following receptors:

- Air quality and climatic factors;
- Biodiversity;
- Population (including noise, vibration and land use);
- Landscape and visual amenity;
- Surface water, groundwater and WFD; and
- Traffic and transport.

17.1.5 Vulnerability of the project

17.1.5.1 Schedule 4 of the EIA Regulations requires the EIA to include "a description of the expected significant adverse effects 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".

17.1.5.2 The Control Of Major Accident Hazard Regulations, 2015 defines a "major accident" as "….an occurrence such as a major emission, fire, or explosion resulting from uncontrolled developments in the course of the operation of any establishment…..and leading to serious danger to human health or the environment (whether immediate or delayed) inside or outside the establishment, and involving one or more dangerous substances".

17.1.5.3 The Civil Contingencies Act, 2004 offers a definition of such events under the term 'emergency', but the terms disaster, major accident, incident or emergency may be considered as one and the same. The Civil Contingencies definition is:

- "An event or situation which threatens serious damage to human welfare in a place in the United Kingdom;
- An event or situation which threatens serious damage to the environment of a place in the United Kingdom; or
- War, or terrorism, which threatens serious damage to the security of the United Kingdom."

17.1.5.4 With reference to these definitions and the interpretations included in the above regulations, major accidents or disasters that could be considered 'relevant' to the Project are:

- War and terrorism;
- Natural disasters: flooding, earthquakes, hurricanes, tornadoes, tsunami, volcanic eruptions, drought, landslides and avalanches;
- Manmade disasters such as rail or motorway accidents;
- Industrial accidents such as explosions, chemical spills or fires;
- Disease outbreaks;
- Events resulting in disruption of: communication systems, transport facilities and health services;
- Events resulting in disruption of: supply of money, food, water, energy or fuel;
- Events resulting in: loss of human life, human illness or injury, and homelessness; and
- Damage to property.

17.1.5.5 Consideration of potential interactions between the above major accidents and/or disasters and the Project has been considered and documented in Appendix J. No potential significant adverse effects on the environment resulting from vulnerability of the development to risks of major accidents and/or disasters have been identified.

17.1.5.6 Furthermore, the aim of the Project is to provide flood relief 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 Population and Traffic and Transport (Sections 12 and 15).

17.2 Scope of the EIA

17.2.1.1 The likely significant effects of the Project that therefore form the scope of the EIA are identified in Sections 7 to 15; this is summarised in Table 17-2.

Table 17-2. Likely significant effects scoped into the EIA.

Key to bullets in table: ● = Significant adverse effect; ● = Significant beneficial effect; and ● = Both significant adverse and beneficial effect.

Air Quality & Climatic Factors
Construction
● Potential adverse effects on air quality and AQMAs from dust; ● Potential adverse effects on local residents and businesses through the release of odours from excavated landfill; and ● Potential adverse effect on air quality and AQMAs due to emissions from an increase in traffic.
Operation
● Potential adverse effect on air quality and AQMAs due to permanent increase in road traffic accessing the new LEAs.
Biodiversity
Construction
● Adverse disturbance to designated site interest features (birds) from noise, vibration, lighting and visual disturbance; ● Potential adverse effect on Thorpe Hay Meadow from construction dust; ● Potential adverse effect on designated sites from spread of INNS; ● Potential adverse disturbance to aquatic and terrestrial protected and notable species via noise, vibration, lighting and visual disturbance; ● Spread of INNS could adversely affect aquatic / terrestrial habitats and protected and notable species; ● Adverse effect of clearance of vegetation on terrestrial protected and notable species; ● Potential for release / disturbance of sediment which may have an adverse effect on aquatic habitats, protected and notable species; and ● Potential adverse effect of loss of bat roosts.
Operation
● Potential for changes in water quality to negatively affect interest features of designated sites; ● Adverse effect on aquatic habitats in designated sites from spread of INNS; ● Potential adverse effect from loss of open water habitat within SWLW SPA as a result of presence of separation embankments; ● Potential positive effect on designated sites via provision of enhanced or new habitats (and new habitat corridor); ● Habitat severance caused by existence of the flood relief channel might lead to negative effects on movement of terrestrial protected and notable species; ● Adverse effect on aquatic habitats, protected and notable species from spread of INNS; ● Potential changes in water quality may negatively affect aquatic habitats, protected and notable species; ● Potential negative disturbance of terrestrial habitats, protected and notable species through increased public access; and ● Potential beneficial effect of net gain in biodiversity during operation.
Cultural Heritage
Construction
● Damage to or disturbance of unknown buried archaeology.
Operation
● Beneficial reduction in flood risk to designated heritage features;

- The reduction in flood risk may have beneficial effect on the preservation of unknown buried archaeology; and
- Adverse effect on the setting (both visual and conceptual) of key designated heritage assets; including Scheduled Monuments, Conservation Areas and Listed Buildings.

Landscape & Visual Amenities

Construction

- Adverse visual effects on residents at home;
- Adverse visual effects on users of the Thames Path (National Trail), National Cycling Routes, other PRoW and Public Open Space;
- Adverse visual effects on leisure users of recreational facilities (such as moorings, fishing lakes, sailing lakes, watersports lakes, Thorpe Park and golf courses);
- Adverse visual effects on users of public highways, (i.e. motorways, roads and railways) and on people at their places of work;
- Adverse effects on the character and quality of national and local landscape designations; and
- Adverse effects on the character and quality of undesignated local landscape character areas.

Operation

- Adverse visual effects on residents at home;
- Adverse visual effects on users of the Thames Path (National Trail), National Cycling Routes, other PRoW and Public Open Space;
- Adverse visual effects on leisure users of recreational facilities (such as moorings, fishing lakes, sailing lakes, watersports lakes, Thorpe Park and golf courses);
- Adverse visual effects on users of public highways, (i.e. motorways, roads and railways) and on people at their places of work;
- Adverse or beneficial effects on the character and quality of local landscape designations (i.e. ALLI);
- Adverse or beneficial effects on the character and quality of undesignated landscape character areas; and
- Beneficial effects to public access and the public realm.

Population

Construction

- Temporary adverse effect of increase in flood risk to homes and businesses;
- Temporary adverse effect on commercial businesses from loss /disturbance of land, effects on land drainage patterns etc.;
- Temporary adverse effect on air quality and odour through release of landfill gases with potential implications for the health of local communities and associated effects on livelihoods of commercial businesses;
- Temporary adverse effect of dust and particulate matter generated from construction activities leading 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;
- Temporary adverse effect of traffic congestion from construction plant on local roads causing disturbance and stress to local communities;
- Temporary adverse effect to recreation in lakes and rivers (such as commercial and club-based fishing, swimming, diving and sailing) through construction disturbance;
- Temporary adverse effect of noise and vibration from construction plant on local roads causing disturbance to local communities; and
- Temporary adverse effect of noise and vibration causing a disturbance to local communities in close proximity to construction areas.

Operation

- Beneficial effect on reducing flood risk in the study area, with subsequent beneficial effects on the safety and wellbeing of local communities and businesses;
- Adverse effect on commercial businesses (such as farming and lake based businesses) from permanent loss /disturbance of land, effects on land drainage etc.;
- Adverse effect on local residents by overlook from the Beacons to private residential property;
- Potential for permanent adverse effect on water quality of lakes from the introduction of River Thames water to previously unconnected lakes, with subsequent adverse effects upon the commercial use of these lakes;
- Potential beneficial and / or adverse effects on traffic movements on roads, public transport services and existing parking facilities could cause disturbance and stress to local

communities;
- Beneficial increase in public access (e.g. footpaths, cycle ways, navigable sections of channel) and provision of recreational facilities (e.g. moorings, fishing, bird watching and visitor facilities); and
- Potential for permanent adverse effect on water quality of lakes from the introduction of River Thames water to previously unconnected lakes, with subsequent adverse effects upon the recreational opportunities available for the public.

Soils and geology

Operation

- Potential adverse effect of landfill leachate reaching uncontaminated soil close to landfill sites and affecting its quality.

Surface water, groundwater and WFD

Construction

- Potential adverse effect to humans, flora and fauna and water of increasing flood risk by creation of additional areas of hard standing and from stockpiling material in the floodplain; and
- Potentially adverse effect of change in groundwater flow and pathways from compacting existing landfills.

Operation

- Beneficial effect on humans, flora and fauna and water of reducing flood risk in the study area;
- Potential adverse and beneficial effect on the hydromorphology of WFD and non WFD lakes;
- Increased diversity of water dependent habitat will have a beneficial effect on hydromorphology and biology of WFD and non WFD surface water;
- Potential adverse effect on the flow, hydromorphology, water quality and biological conditions 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;
- 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; and
- Potential adverse effect on groundwater quality by altering the groundwater flow regime and creating new pathways for contaminants.

Traffic & Transport

Construction

- Temporary adverse effect of increase in flood risk to local and regionally important roads;
- Increased traffic on local roads, as well as 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;
- A large number of construction site personnel will need to access the working areas in order to construct the Project, resulting in a potential adverse effect on traffic congestion, journey times and the condition of local roads;
- Potential adverse effect (temporary closure between Staines station and Windsor and Eton Riverside station) on the Windsor & Eton Riverside to London Waterloo railway line; and
- Potential adverse effect (temporary closure/diversion due to flood relief channel excavation) on local roads (e.g. Littleton Lane, Chertsey road, Ferry Lane road, B375, B376 and B3021), as well as on regionally (e.g. A308, A310, A320) and nationally (e.g. M3, M25) important roads.

Operation

- Potential beneficial effect of reduced disturbance to use of rail, local, national and regionally important roads during times of flood; and
- Potential beneficial and / or adverse effects on traffic movements on roads, public transport services and existing parking facilities.

18 Next Steps

18.1 Summary

18.1.1.1 This EIA Scoping Report has provided detail about the Project, and set out the intended EIA scope and methodologies for the assessment of likely significant environmental effects.

18.1.1.2 The aim is to ensure that the Project has due regard for the environment, by mitigating significant adverse environmental effects where possible, while taking advantage of opportunities for environmental and social enhancement.

18.2 Next steps

18.2.1.1 The next steps of the EIA process are as follows:

- Receipt of formal EIA Scoping Opinion from statutory consultees (RBWM, SCC, EBC, RBC, SBC, LBRUT, RBKUT, Environment Agency, Natural England, Historic England, Marine Management Organisation, Highways England, TfL and Network Rail);
- Update and finalise the EIA Scoping Report based on consultee's comments; and
- Submission of the EIA ES with the planning application (Summer 2018).

18.2.1.2 The Project partners invite all recipients of this report to provide comments and opinions such that they can be taken into account as the EIA progresses. All responses should be returned to both of the following individuals:

- Dr Jessica Salder, Principal Environmental Assessment Officer at Surrey County Council, who will be coordinating the formal Scoping Opinion on behalf of the interested Local Planning Authorities. Please email: jessica.salder@surreycc.gov.uk; and
- Kerry Quinton, Principal Environmental Scientist at Galliford, Black & Veatch JV Ltd. Galliford, Black & Veatch authored this EIA Scoping Report on behalf of the RTS project partners. Please email: rts.pars@bv.com.

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Datasets

Data Source/ Supplier	Name of dataset	GBV dataset ID number
40seven	Bathymetric Data	122368-BVL-Z0-SW-RE-Z-00004
ALGG Area Frameworks	All London Green Grid	Enplan
Berkshire Archaeology	HER – Berkshire County Council	2191
BGS/Minerals Plans	Minerals and quarries (including mineral type)	599
Buckinghamshire County Council	Buckinghamshire Green Infrastructure Strategy Area	Enplan
Colne Valley Regional Park/Groundwork South	Colne Valley Regional Park	Enplan
Defra	Agricultural Land Classification	157
Defra.	UK Air Quality Management Areas (AQMAs).	2111
Department For Transport	Traffic counts	648 & 1362
ENSIS	Macrophyte data – LEAFPACS2	2071
Environment Agency	Authorised landfill sites (P2_1412).	1199
Environment Agency	Local Records Centre protected species and site records.	1028
Environment Agency	Non-native invasive species by water body	1601
Environment Agency	Species Surveys Non Native Species	62
Environment Agency	River Thames Scheme: Preliminary lake fish survey results	2277
Environment Agency	River Thames fish catch records -2004-2014	644

Environment Agency	Electrofishing data for the Colne Brook	1800
Environment Agency	Navigable waterways	162
Environment Agency	Boat Traffic Data at River Thames Locks	1940
Environment Agency	RTS Licensed abstraction points	1814
Environment Agency	Aquifer Designation Map (Bedrock Geology)	5
Environment Agency	Aquifer Designation Map (Superficial Deposits)	6
Environment Agency	Source Protection Zones (Merged)	61
Environment Agency	WFD water body results (RBMP 2015 – cycle 2)	79
Environment Agency	Thames Waterway Plan Area	Enplan
GBV	SPA supporting sites (GBV defined)	1831
GBV	RTS waste management	10156-8
Greater London Archaeological Advisory Service	HER – GLHER	2174; 2179; 2183
Green Arc Steering Group	North West London Green Arc & South West London Green Arc	Enplan
Local Authorities	Public Rights of Way	700-704, 1943
Local Authorities	Green Belt	726-30
Local Authorities	Minerals Plans	714-6
Local Authority	Historic landfill sites (P1_1411).	35
Local Authority	Local sites: SNCIs, SINCs, LWS, CWS	155
Natural England	Special Protection Areas (SPAs).	1719
Natural England	Special Areas of Conservation (SACs)	1718
Natural England	Sites of Special Scientific Interest (SSSI)	1717
Natural England	Local Nature Reserves	128
Natural England	National Nature Reserves	130
Natural England	Long distance paths/ routes/ National Trails	165
Office of National Statistics	Social Equity, Population and Deprivation (based on 2011 census results)	1198
Royal Borough of Kingston upon Thames	Kingston GIS data	1941-4
Royal Borough of Kingston upon Thames	Green Corridor	1941
Royal Borough of Windsor and Maidenhead	Mineral Safeguarded and Extraction Areas	708
Runnymede Borough Council	Green Belt	Enplan
Runnymede Borough Council	Area of Landscape Importance	Enplan
Runnymede Borough Council	Landscape Problem Area	Enplan

Runnymede Borough Council	Heathrow Airport Birdstrike Zone	Enplan
Sport England	Sports facilities (e.g. golf courses)	595
Sport England	Water-based recreation (e.g. canoeing, angling)	596
Surrey Biological Information Centre	Surrey Biological Information Centre species and site records	1913-1916
Surrey History Centre	HER – Surrey County Council	2204; 2205; 2206
Surrey Wildlife Trust	NVC 2013	1385
Sustrans	National Cycle Network / National Cycle Route	164
Thames Valley Environmental Records Centre	Thames Valley Environmental Records Centre species and site records.	2143-2148
The Thames Landscape Strategy	Thames Landscape Strategy Area	Enplan
Transport For London	Bus stops and routes	1862
Transport For London	Train stations	1868

List of abbreviations

AADF	Annual Average Daily Flow
AD	Anno Domini
ALC	Agricultural Land Classification
ALLI	Areas of Local Landscape Importance
AMRI	Annual Mineral Raised Inquiry
AQMA	Air Quality Management Area
AQO	Air Quality Objectives
BCE	Before Common Era
BCT	Bat Conservation Trust
BGS	British Geological Survey
BS	British Standard
CEMP	Construction Environmental Management Plan
CFMP	Catchment Flood Management Plan
CH_4	Methane
CIEEM	Chartered Institute for Ecology and Environmental Management
CI&FC	Capacity Improvements and Flood Channel
CIEH	Chartered Institute of Environmental Health
CLA	Country Land and Business Association
CLEA	Contaminated Land Exposure Assessment
CPO	Compulsory Purchase Order
CO_2	Carbon Dioxide
CRoW	Countryside and Rights of Way
DBA	Desk Based Assessment
Defra	Department of Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges
DfT	Department for Transport
EBC	Elmbridge Borough Council
EA	Environment Agency
EcIA	Ecological Impact Assessment
EIA	Environmental Impact Assessment
EQS	Environmental Quality Standards
ES	Environmental Statement
EU	European Union
GBNNSS	Great Britain Non-Native Species Secretariat
GBV	Galliford Try, Black & Veatch
GCN	Great Crested Newts

GI	Ground Investigation
GiGL	Greenspace Information for Greater London
GLVIA3	Guidelines for Landscape and Visual Impact Assessment 3
GSPZ	Groundwater Source Protection Zone
GWDTE	Groundwater Dependent Terrestrial Ecosystems
HER	Historic Environment Records
HGV	Heavy Goods Vehicle
HMWB	Heavily Modified Water Body
HRA	Habitats Regulations Assessment
IEMA	Institute of Environmental Management and Assessment
INNS	Invasive Non-Native Species
LAA	Local Aggregates Assessment
LBRUT	London Borough of Richmond upon Thames
LEA	Landscape Enhancement Area
LGV	Light Goods Vehicle
Lidar	Light Detection and Ranging
LNR	Local Nature Reserve
LQM	Land Quality Management
LTFRMS	Lower Thames Flood Risk Management Strategy
LVIA	Landscape and Visual Impact Assessment
MSA	Minerals Safeguarding Area
N	North
N_2	Nitrogen
NCA	National Character Area
NE	Natural England
NERC	Natural Environment and Rural Communities
NBN	National Biodiversity Network
NH_3	Ammonia
NNR	National Nature Reserve
NO_2	Nitrogen Dioxide
NPPF	National Planning Policy Framework
O_2	Oxygen
ONS	Office of National Statistics
OS	Ordnance Survey
P1HS	Phase 1 Habitat Survey
PEA	Preliminary Ecology Appraisal
PLA	Port of London Authority
PM_{10}	Fine Particulate Matter
PRoW	Public Rights of Way
PSRA	Public Safety Risk Assessment

RBC	Runnymede Borough Council
RBMP	River Basin Management Plan
RBKUT	Royal Borough of Kingston upon Thames
RBWM	Royal Borough of Windsor and Maidenhead
RFCC	Regional Flood and Coastal Committee
RSPB	Royal Society for Protection of Birds
RTS	River Thames Scheme
S	South
S4UL	Suitable For Use Levels
SEA	Strategic Environmental Assessment
SAC	Special Area of Conservation
SBC	Spelthorne Borough Council
SBIC	Surrey Biodiversity Information Centre
SCC	Surrey County Council
SEEAWP	South East England Aggregates Working Party
SI	Statutory Instrument
SINTRAM	Surrey Integrated Transport Model
SNCI	Sites of Nature Conservation Interest
SO_2	Sulpher Dioxide
SoP	Standard of Protection
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
SWLW	South West London Water bodies
TAG	Technical Advisory Group
TCAMS	Thames Catchment Abstraction Management Strategy
TfL	Transport for London
UKCIP	UK Climate Projections
WCA	Wildlife and Countryside Act
WFD	Water Framework Directive
WRP	Waste Recovery Plan
ZVT	Zone of Theoretical Visibility

Glossary

Air quality management area (AQMA)	Area defined by the local authority as an area requiring management because air quality levels do not meet national air quality objectives.
Agricultural Land classification	A series of six grades classifying soil in terms of its suitability for agriculture, from 1 (excellent) to 5 (very poor).
Ancient Woodland	Land continuously wooded since 1600 in England and Wales or 1750 in Scotland.
Appropriate Assessment	Development applications that may have significant environmental impacts on a European Protected site for nature conservation (for example an SPA) are assessed under the EU Habitats Directive. Such assessments are generally carried out at project level; however a Strategic Appropriate Assessment is sometimes undertaken at Strategy level. This involves less detail and is intended to give an early indication of whether the proposal is likely to be acceptable or not to the relevant Statutory bodies.
Aquifer	An underground layer of rock with water storage capability.
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.
Area of Outstanding Natural Beauty (AONB)	Areas formally designated under the National Parks and Access to the Countryside Act (1949) to protect parts of the countryside of high scenic quality that cannot be selected for National Park status as they do not have opportunities for outdoor recreation. The Countryside Agency is the government agency responsible for designating AONBs and advising the government.
Augmentation flow	A small flow required in non-flood conditions to facilitate fish passage at flow and water control structures.
Baseline	A description of the present state of the environment with the consideration of how the environment would change in the future in the absence of the plan/programme/project as a result of natural events and other human activities.
Baseline studies/ survey	Collection of information about the environment which is likely to be affected by the project.
Benthic Invertebrates	These are 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). Benthic invertebrates live either on the surface of bedforms (for example rock or sediment) or within sedimentary deposits, and comprise several types of feeding groups for example deposit-feeders, filter-feeders, grazers and predators. The abundance, diversity, biomass and species composition of benthic invertebrates can be used as indicators of changing environmental conditions.
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).
Bird strike	The risk of birds hitting an aircraft close to an airport on take-off or landing. Specific hazards include large birds (geese) being ingested in to jet aircraft engines.
Brownfield site	A site which has been previously developed, often a disused factory site or industrial area.
Abstraction Licensing Strategies	Used to manage water resources to balance the need for abstraction and management of the aquatic environment in consultation with local interested parties.
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.
Catchment Flood Management Plan (CFMP)	A high level plan carried out by the Environment Agency in order to manage the risk of flooding to people, property and the environment in an integrated way. These plans form the basis of future flood risk management proposals.

Character area	An area of land with distinctive landscape features resulting from an interaction of wildlife, landforms, geology, land use and human activity as defined by the Countryside Agency.
Cumulative impacts	The combined effects of several projects within an area, which individually are not significant, but together amount to a significant effect.
Climate Change Adaptation	Whilst the EIA Directive does not explicitly require the assessment of resilience of a proposed development to the effects of climate change, good practice guidelines urge that EIA has a role to play in helping to adapt our existing society to climate change.
Climate Change Mitigation	Focuses on the effects of the project on greenhouse gas (GHG) emissions and how they contribute to climate change.
Diversion channel	A new channel cut through the floodplain of an existing river channel, with the purpose of providing a new route for flood flow, together with some additional storage capacity.
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) features of at least equivalent (often better) value than those lost.
Conservation Area	An area designated under the Town and Country Planning Act, 1990 to protect its architectural or historic character.
Countryside and Rights of Way (CRoW) Act 2000	This Act applies to England and Wales and has five parts: - Access to the countryside Public rights of way and road traffic Nature conservation and wildlife protection Areas of outstanding natural beauty Miscellaneous and Supplementary This act increases the protection of SSSIs. Environment Agency plans/programmes/projects must gain consent for works in or near SSSIs using a CRoW form.
Countryside Character Areas	Sub-divisions of England into areas with similar landscape character as categorised by the Countryside Agency. These are used when assessing the impact of a plan/programme/project on its local landscape.
Countryside Stewardship	The Countryside Stewardship provides incentives for land managers to protect and enhance the natural environment in particular the diversity of wildlife and water quality.
Cumulative Effects	The combined effects of several projects within an area, which individually are not significant, but together amount to a significant impact.
Department for Environment, Food and Rural Affairs (DEFRA)	The government department responsible for flood management policy in England.
Direct effects	Effects that arise from the impact of activities that form an integral part of the project (e.g. new infrastructure).
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, flora, fauna, geological or geomorphological features and buildings, sites and objects of archaeological, architectural or historical interest.
Environmental Action Plan (EAP)	A standalone report or section within another environmental impact assessment document which ensures that constraints, objectives and targets set in the main Environmental Statement are actually carried out on the ground. Actions are separated into those to be carried out before, during and after construction.

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." **www.iema.net/eiareport**.
Environmental Statement (ES)	The document produced to describe the environmental impact assessment process where statutory environmental impact assessment is required.
Flood Cell	A discrete area subject to flooding from failure of defences at a specific point or length.
Flooding	Refers to inundation by water whether this is caused by breaches, overtopping of banks or defences, or by inadequate or slow drainage of rainfall or underlying ground water levels.
Floodline	EA flood warning system, accessible by telephone or internet and updated every 15 minutes
Flood risk management strategy (FRMS)	A long term (50 years or more) plan for coastal or river management to reduce the risk of flooding and carry out. They are more detailed than CFMPs.
Flood management unit (FMU)	A river or coastal reach subject to flooding from similar processes. Such a unit may consist of one or more flood cells.
Flood risk mapping	A system of maps created by the Environment Agency to show areas that are at risk of a flood that has a 1 in 100 chance (or higher) of occurring in any given year.
Fluvial geomorphology	An understanding of the processes of water and sediment movement in river catchments and channels and their floodplains.
Geographical Information Systems (GIS)	A computer based system for capturing, storing, integrating, manipulating, analysing and displaying data spatially.
General Permitted Development Order (GPDO)	The Town and Country Planning (General Permitted Development) Order 1995 sets out what may be built without needing planning permission. Part 15 applies specifically to the Environment Agency.
Ground truth	A term used in various fields to refer to information provided by direct observation as opposed to information provided by inference.
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.
Habitats Directive	EC Directive (92/43/EEC) on the Conservation of natural habitats and of wild flora and fauna. Implemented (with the Birds Directive (79/409/EEC)) in the UK as the Conservation (Natural habitats, &c.) Regulations (1994). This establishes a system of protection of certain flora, fauna and habitats considered to be of International or European conservation importance. Sites are designated as Special areas of conservation (SACs), special protection areas (SPAs) and/or Ramsar sites. Any developments in or close to these designated areas are subject to the Habitat Regulations for approval of Natural England. Together these sites are referred to as the Natura 2000 network.
Habitats Regulations Assessment (HRA)	The Conservations of Habitats and Species Regulations 2010 impose a duty on operating authorities to maintain the integrity of Natura 2000 complexes. Under these regulations, if there are assessed to be likely significant effects, there is a requirement to undertake an Appropriate Assessment to assess the effects of implementing the project upon the conservation objectives of the designated sites, in order to determine whether it is likely to result in an adverse effect upon the integrity of the sites.
Health impact assessment	"A combination of procedures, methods and tools by which a policy, programme or project may be judged as its potential effects on the health of a population, and the distribution of

	those effects within a population." World Health Organisation.
Herpetofauna	The reptiles and amphibians of a particular region or habitat.
Historic landfill	Historic landfill sites are where records exist of waste being received and buried that are now closed or covered.
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.
Indicative landscape plan (ILP)	Overlay of existing environment and scheme proposals to highlight environmental constraints and opportunities including designated sites and landscape character.
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).
Interactive Effects	Interactive effects arise where receptors are affected by a combination of environmental effects (for example, from noise, dust and traffic)
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.
Listed Building	Identifies buildings with special architectural and historic interest and ensures they are considered within the planning system so that they can be protected.
Local Biodiversity Action Plan (LBAP)	A local plan with targets to protect and enhance biodiversity to achieve national targets and also to protect locally important species.
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.
Marginal vegetation	Plants growing along the base of the bank 'with their feet in the water'. Marginal vegetation can provide valuable habitat for wildlife and erosion protection for the bank.
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).
Mitigation measures	Actions that are taken to minimise, prevent or compensate for adverse effects of the development.
National Nature Reserve (NNR)	Nature reserves designated under the National Parks and Countryside Act (1949) for nationally important wildlife or geological features (these may be the best examples in the country). They are controlled by English Nature.
Natural Areas	Sub-divisions of England, characterised by wildlife and natural features. There are 120 Natural Areas in England. Designations are managed by English Nature.
Natural England	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.
Nature Improvement Areas	12 new nature zones in England covering hundreds of thousands of hectares receiving Government funding to create wildlife havens, restore habitats and encourage local people to get involved with nature.
Negative effects	Effects that have an adverse influence on receptors or resources.
Nitrate vulnerable zone (NVZ)	Area where surface or ground waters are above the standards set by the Nitrates Directive (91/676), as implemented in England and Wales by SI2164/2002.
Ordinary water course	A watercourse not designated as main river. The local authority or Internal Drainage Board has permissive powers to maintain them.
Permanent effects	Effects, which result from an irreversible change to the baseline environment (e.g. land take) or which persist for the foreseeable future (e.g. noise from operation).
Phase 1 Habitat Survey	The Phase 1 habitat classification and associated field survey technique provides a relatively rapid system of recording semi-natural vegetation and other wildlife habitats. Each habitat type/feature is defined by way of a brief description and is allocated a specific name, an alpha-numeric code, and unique mapping colour. The system has been widely used and continues to act as the standard 'phase 1' technique for habitat survey across the UK.
Plotlands	'Plotlands' historically, are land which was originally used by itinerant people for the construction of temporary dwellings on riverside 'plots', hence 'plotlands'. Typically, such development took place rapidly in the immediate post WWII period as people looked for alternative or new homes to inner London sites following the Blitz
Positive effects	Effects that have a beneficial influence on receptors and resources.
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.
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).
Scheduled Monument	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).
Scoping	The process of deciding the scope or level of detail of an EIA/ SEA. During this stage the key environmental issues (likely significant effects) of a project/strategy 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	(1) For environmental impact assessment, the process of deciding which developments require an environmental impact assessment to be carried out and whether this will be statutory. (2) For strategic environmental assessment, the decision on which plans, strategies or programmes require strategic environmental assessment to be carried out and whether this will be statutory.
Screening opinion	Statutory opinion from the competent authority as to whether a proposed project requires statutory environmental impact assessment according to the Environmental Impact Assessment Regulations.
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).
Site of Special Scientific	Nationally important sites designated for their flora, fauna, geological or physiographical features under the Wildlife and Countryside Act (1981) (as amended) and the Countryside

Interest (SSSI)	Rights of Way (CRoW) Act (2000).
Site Specific Effects	Effects that result from a geographically localised impact and which are significant primarily at a neighbourhood or district level.
Source Protection Zone	This is an area that is a source of potable groundwater supply that is to be protected from future contamination by potentially polluting developments. The zones are defined through the identification of groundwater source catchments. The vulnerability of these source catchments to pollution is then superimposed to identify the zones for protection. Zone 1 (Inner protection zone) is defined by any pollution that can travel to the borehole within 50 days from any point within the zone. This applies at and below the water table. These criteria are designed to protect against the transmission of toxic chemicals and water-borne disease. Zone 2 (Outer protection zone) is defined by pollution that takes up to 400 days to travel to the borehole, or 25 per cent of the total catchment area – whichever area is the biggest. This travel time is the minimum amount of time that pollutants need to be diluted, reduced in strength or delayed before they reach the borehole. Zone 3 (Total catchment) is defined as the total area needed to support removal of water from the borehole, and to support any discharge from the borehole.
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) and proposed Special Protection Area (pSPA)	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). They are also SSSIs. Proposed sites receive the same protection as fully protected sites.
Standard of protection (SoP)	The level of protection from flooding, for example a SoP of 1 in 100 means that the flood defences in an area provide protection from floods up to a size of flood with a probability of occurring of 1 in 100 in any year.
Sustainable development	A concept defined by the Brundtland Report (1987) as “Development that meets the needs of the present without compromising the ability of future generations to meet their own needs”.
Temporary effects	Effects that persist for a limited period only, due for example to particular construction activities (e.g. noise from construction plant). Where possible, the likely duration of effects will be identified.
Unitary Development Plan	A local authority plan that combines the functions of structure and local plans and include minerals and waste policies. The plan identifies areas that are suitable for housing, industry, retail or other uses, and set out the policies which the authority proposes to apply in deciding whether or not development will be permitted.
Water Framework Directive (WFD)	EC Directive (2000/60/EC) on integrated river basin management. The WFD sets out environmental objectives and current classifications for water status based on ecological and chemical parameters, common monitoring and assessment strategies, arrangements for river basin administration and planning and a programme of measures in order to meet the objectives.
Wider effects	Effects that are individually significant at a regional level, but which are unlikely to be significant locally.