Oxford Flood Alleviation Scheme




Environmental Statement

February 2022

Prepared by Jacobs on behalf of the Environment Agency

Supported by the Local Growth Fund

Quality Assurance

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Author	*Peter Sketch*

Approvals

Name	*Signature*	*Title*	*Date*	*Version*
Phil Marsh	*PM*	*Project Manager*	*Mar 2018*	*1*
Phil Marsh	*PM*	*Project Manager*	*Feb 2022*	*2*

EIA Quality Mark

This Environmental Statement, and the Environmental Impact Assessment (EIA) carried out to identify the significant environmental effects of the proposed development, was undertaken in line with the EIA Quality Mark Commitments.

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1 Background

1.1 Introduction

We, the Environment Agency, together with our partners, are proposing a flood alleviation scheme (hereafter referred to as 'the Scheme') to manage the flood risk to the city of Oxford. The Scheme comprises a combination of a new stream, a second stage channel to carry flood flows, modifications to existing channels and new flood defences, to move flood water away from developed areas and reduce the frequency of flooding.

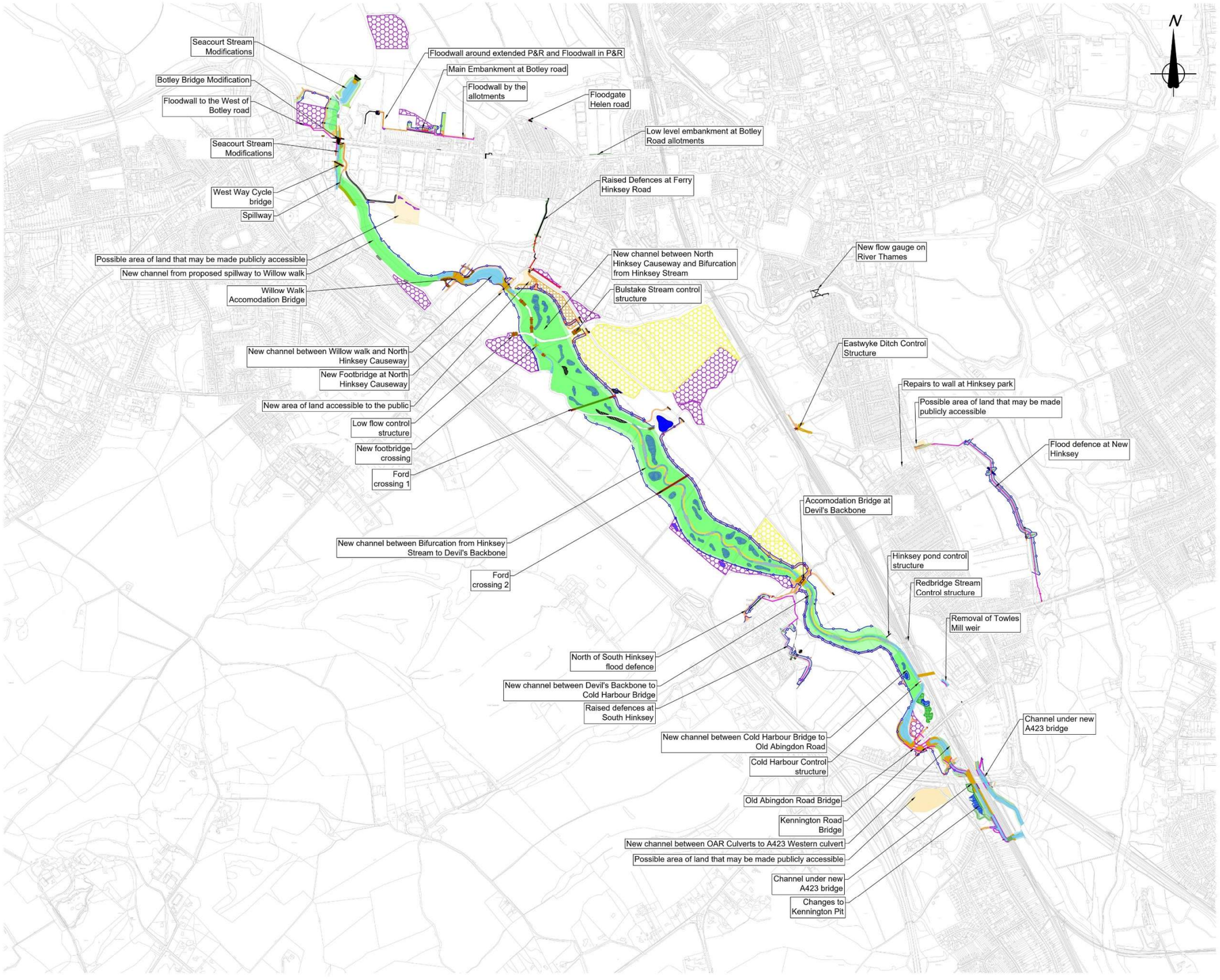
We have designed a fully integrated multi-beneficial Scheme, which not only protects people and property from flooding but also maximises opportunities for biodiversity to deliver a net gain in habitats, enhances existing meadow landscapes and river habitat and provides some new amenity features for the local community. Unavoidable impacts on habitats of existing value are mitigated or compensated for as part of the Scheme.

The Thames splits into several channels through Oxford and much of the natural floodplain around these has become developed. The city will become more vulnerable to flooding with changes in rainfall intensity that are predicted to result from climate change, and there is already evidence of this in the 21st century. The Scheme therefore aims to maximise the volume of water moving through areas of undeveloped floodplain, keeping it away from residential areas while not increasing river levels downstream of Oxford. The works for the Scheme extend from north of the A420 Botley Road to south of the A423 Southern Ring Road (see Figure 1.1, and see Figure 3.1 for a higher-resolution version of the same drawing).

The Scheme will comprise (see Chapter 3 'Scheme description'):

- Construction of a new two-stage channel between the A34 to the west and the railway to the east, to the west of Oxford city centre. The channel will extend for a length of approximately 5km connecting with parts of the existing braided river network, south-easterly from the confluence of the Botley and Seacourt Streams north of Botley Road, to just south of Kennington. The new channel, will accommodate excess flow from the Seacourt Stream, Bulstake Stream and Hinksey Stream, reducing the water level in the main River Thames and so reducing the frequency of flooding in built-up areas. The channel will comprise two stages (see typical cross-section in Figure 1.2):
    - First stage, a new stream that will look natural and connect with the existing braided network of streams at different points. The new stream will be permanently wet and carry flowing water all of the time; and
    - Second stage, a wide, shallow-sloped channel, shallower than the first stage, created by lowering the ground between 0.5m and 1.2m from existing ground level on one or both sides of the first stage stream and blending into existing ground level, which will increase the capacity of the floodplain during higher flows while remaining dry during low flows.
- New flood embankments and walls to defend homes and businesses which would otherwise continue to flood even with the reduced river levels;
- New culverts and bridges to maintain access routes;
- Creation of new and/or improved habitat for wildlife;
- A new path providing a permissive route for pedestrians north-south between Osney Mead and Devil's Backbone; and
- Removal of Towles Mill weir which, will help facilitate unimpeded fish passage around Oxford for the first time in over a century.

Figure 1.1 Scheme overview



PLAN

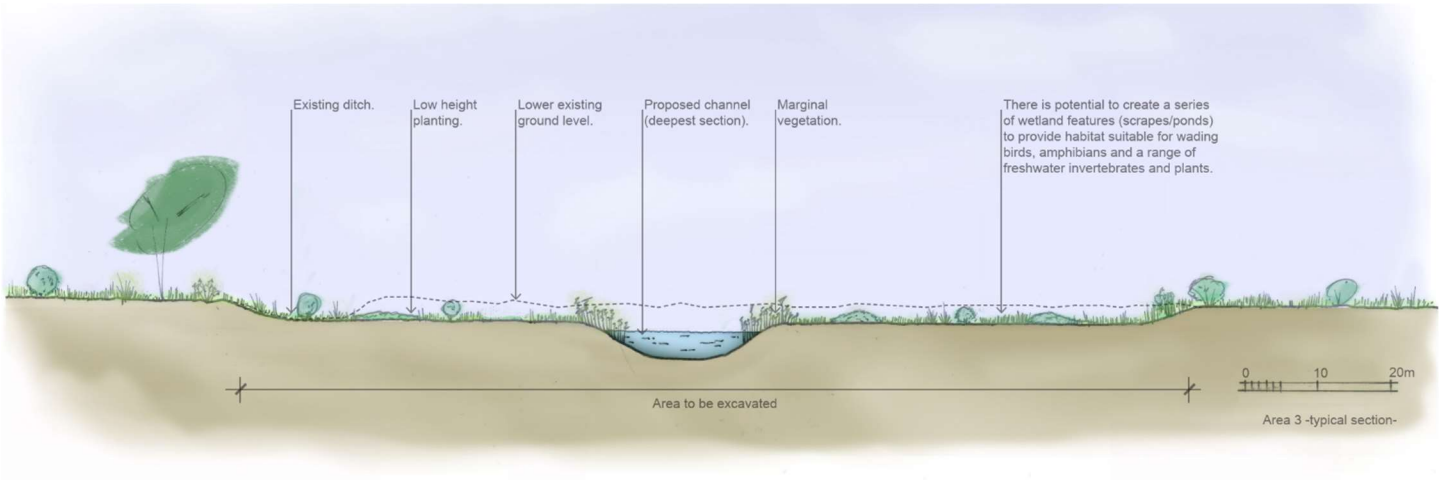
SCALE 1:10000 AT A1, 1:20000 AT A3

0 100 200 300 400 500 600 700 800 900 1000

SCALE 1:10,000 (A1)
SCALE 1:20,000 (A3)

METRES

Figure 1.2: Typical cross-section of new channel and second stage channel



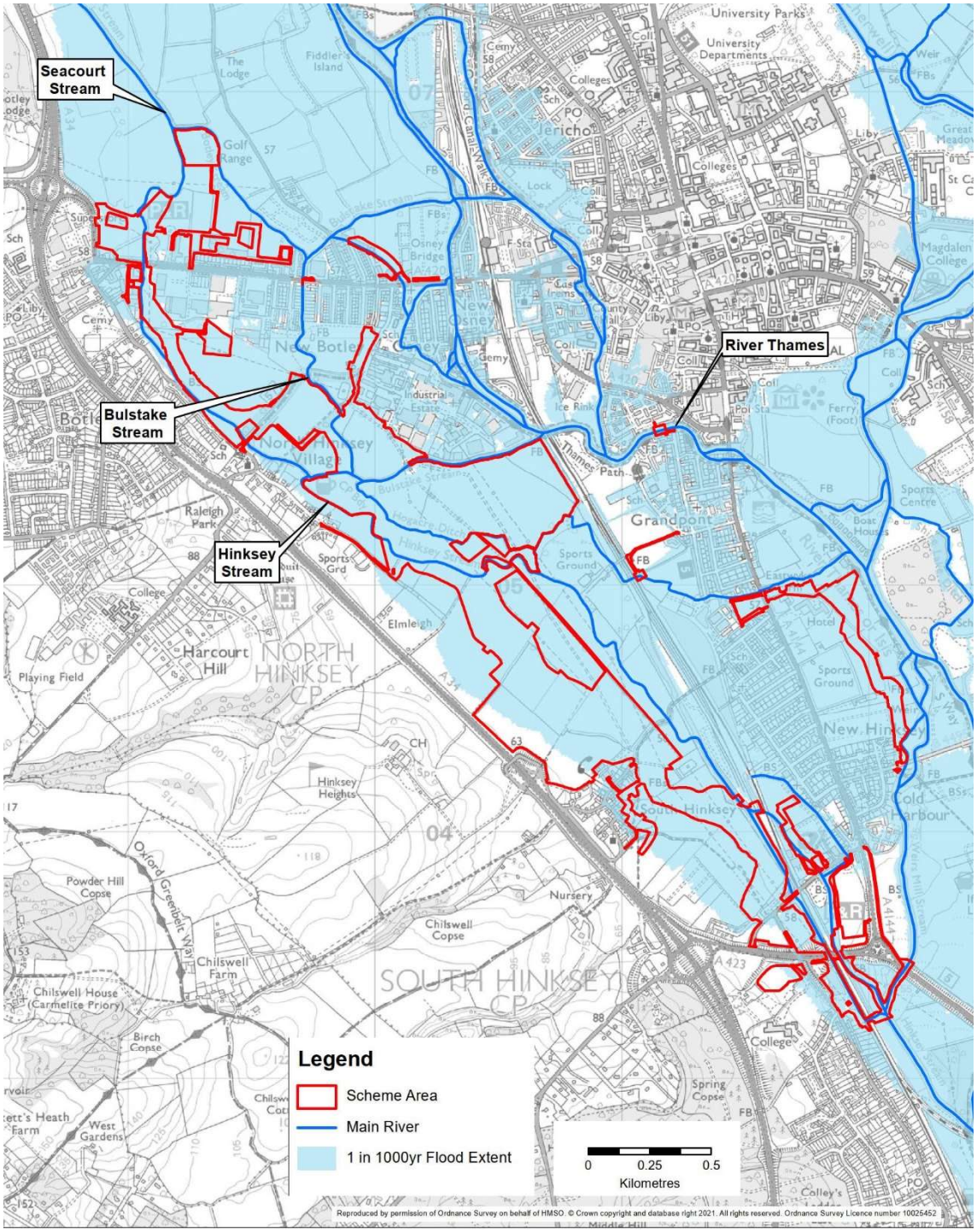
We have prepared this Environmental Statement (ES) to present the statutory Environmental Impact Assessment (EIA) of the Scheme. This ES has been prepared to accompany a planning application to Oxfordshire County Council (see Section 1.5).

1.2 Location and site description

Oxford is a historic city with a prestigious university, located on the River Thames in Oxfordshire. The River Thames flows in a north to south direction through predominantly agricultural land to the west of the city (see Plate 1).

The study area for the overall Scheme, which is shown on Figure 1.3, encompasses areas of the River Thames' floodplain to the west of Oxford's city centre that are susceptible to flooding (i.e. 1 in 1000 annual risk of occurring - 0.1% chance of flooding in any year).

Figure 1.3: Study Area and Scheme area boundary



The Scheme area extends from north of the A420 Botley Road to south of the A423 ring road, running predominantly between the A34 to the west and the Oxford to London railway line to the east. It comprises all of the permanent Scheme works (i.e. the footprint of the final completed Scheme) and temporary working areas required for construction of the Scheme. Chapter 16 describes the additional temporary working area which will be added to the Scheme area if a separate planning consent is granted to access the rail sidings for transport of some of the material excavated from the site as an alternative to transporting all of the material using road vehicles and the trunk road network.

The footprint of the Scheme lies predominantly within flood meadows and agricultural grazing land but also passes through areas of high nature conservation value,

allotments, access tracks and a small number of domestic gardens.

The nature conservation importance of the study area is reflected in the designation of international (e.g. Oxford Meadows Special Area of Conservation) and national conservation sites (outside the Scheme area). There are also local sites of wildlife value within the Scheme area, some of which support nationally rare habitats and species including the nationally scarce snakeshead fritillary, with the protected creeping marshwort present close to the Scheme. The Scheme footprint also passes through areas of high heritage value including North Hinksey Causeway and the Old Abingdon Road culverts Scheduled Monument (which is considered to have national significance).

Within the Scheme area, channels of the River Thames (Plate 1), namely Seacourt Stream (Plate 2), Bulstake Stream (Plate 3) and Hinksey Stream (Plate 4), flow through the city's residential, industrial and commercial areas, as well as through meadows and farmland. The proposed works will directly connect with and modify these channels at various points.

Plate 1: River Thames, upstream of Iffley Weir, west of Oxford city

Plate 2: View of Seacourt Stream, facing north from Botley Road Bridge

Plate 3: View of Bulstake Stream, from near North Hinksey Causeway

Plate 4: View of Hinksey Stream, facing downstream from Devil's Backbone

1.3 The problem

The city of Oxford has a long history of flooding (see Plates 5 to 7), being located at the confluence of the Rivers Cherwell and Thames. Since 2000, there have been several

notable floods, resulting in inundation of properties, closure of roads and railway infrastructure. Areas liable to flooding include Wolvercote, Wytham, New Botley, Osney, Kennington, South Hinksey, North Hinksey, New Hinksey and the city centre areas of Jericho and Grandpont.

The flooding in Oxford results from heavy and prolonged rainfall (sometimes combined with snowmelt) on the large upstream catchments of the Thames and Cherwell. This causes rivers and other smaller watercourses to over-top their banks and, through connectivity into the gravel aquifer, also leads to groundwater flooding in a number of areas. Due to the size of the Thames and Cherwell catchments, there is often a delayed response of 48 to 72 hours between the onset of rain and a noticeable increase in flows through Oxford. These floods normally occur during the winter months but exceptions occurred in June 1903 and more recently in July 2007.

If nothing is done to manage flood risk, over 2,200 properties would be at risk in a flood that has a 1% Annual Probability Exceedance (AEP) event risk of occurring. Our existing flood risk management activities reduce this but around 1,600 properties still remain at risk. This proposal will reduce the likelihood of flooding for all of these properties, with over 1,050 benefiting from a standard of protection greater than a 1% AEP event risk of flooding after completion of the Scheme. If we do not take action, the impacts of climate change means that a predicted 5,626 properties will be at flood risk in 50 years' time in a 1% AEP flood. This threat of climate change will not only increase the extent of flooding, but its frequency and disruption to the city.

We have therefore designed a Scheme to reduce the frequency of floods affecting properties and infrastructure in Oxford whilst avoiding an increase in peak river levels downstream of Oxford during floods so that flood risk is not increased for downstream communities. Floods in this part of Oxford also cause transport disruption and can result in closure of the Oxford to London railway line and main roads to the west (A420 Botley Road) and the south (Abingdon Road) of the city. These roads are important for access to the city by cars, buses (including Seacourt and Redbridge Park and Rides) and bicycles. The Scheme will also offer greater resilience to important utilities such as the sewer network, electricity sub-stations and broadband communications.

Figure 1.4 'Flood Extents' shows the current flood risk due to floods with a 20%, 5%, 2% and 1% AEP chance of occurring, together with the reduced flood risk with the Scheme in place.

Plate 5: View looking west along Botley Road (2007)	**Plate 6:** View looking north onto the railway line from the footbridge off Whitehouse Road (2007)	**Plate 7:** View of Earl Street, just off Botley Road (2007)
		

1.4 Project objectives

Our four key objectives for the Scheme are set out in Table 1.1.

Table 1.1: Project objectives

Item	Objective
Objective 1	Reduce flood damages to at least 1000 homes and businesses currently at risk in Oxford
Objective 2	Reduce flood impacts on transport infrastructure and utilities in Oxford, particularly to Botley and Abingdon Roads, the railway line and the sewerage system
Objective 3	Safeguard Oxford's reputation as a thriving centre of commerce that is open for business
Objective 4	Create and maintain new wildlife habitat, naturalised watercourses and recreational amenities accessible from the centre of Oxford

We also defined more detailed environmental objectives, with our partners and key environmental stakeholders, as set out in Table 1.2.

In meeting our project objectives and discharging our functions in accordance with the Environment Act 1995 'to protect and enhance the environment', we have had to address various environmental challenges. These challenges have included avoiding and minimising impacts on areas of high ecological and archaeological sensitivity as far as possible and compensating for residual impacts. The Scheme we have developed represents a unified design that reduces the flood risk to Oxford.

Table 1.2: Project environmental objectives

Topic	Objectives
Landscape	L1. To develop a Scheme that enhances the setting of the city of Oxford. L2. To integrate the Scheme into the existing landscape whilst maintaining the character of the pastoral floodplains and river meadowlands. L3. To respect the unique townscape characteristics and contribute to an attractive public realm.
Heritage	H1. To raise awareness of the special qualities of the natural, built and cultural heritage of Oxford. H2. To maximise the potential of the city's heritage.
Biodiversity	B1. To achieve a net gain in biodiversity. B2. To minimise impacts on existing high quality sites and to fully mitigate or compensate for unavoidable impacts. B3. To create a bio-diverse wildlife corridor to the west of Oxford that links up existing wildlife sites and increases opportunities for local communities and visitors to access the natural environment.
Water Environment	W1. To contribute to the achievement of environmental objectives as set out in the Thames River Basin Management Plan. W2. To ensure the Scheme does not cause deterioration nor prevent achievement of good ecological status for any water body. W3. To ensure that the River Thames (Evenlode to Thame) and associated water bodies affected by the Scheme are managed and conserved properly to protect and enhance the multiple benefits provided by the water environment in Oxford.
Recreation	R1. To improve the existing cycle and footpath network in West Oxford. R2. To reduce the number of journeys made by motor vehicles and contribute to cutting air pollution. R3. To increase access to nature and to improve physical and mental health and well-being.

Topic	Objectives
Education & Research	ER1. To develop a Scheme that provides ongoing opportunities for environmental education and research in Oxford.

1.5 Legislation and regulatory requirement

There are three local authorities with regulatory responsibility for the area of the Scheme, two Local Planning Authorities (Oxford City Council and Vale of White Horse (VoWH) District Council) and Oxfordshire County Council, which is responsible for minerals and waste planning. Following discussions with all three authorities, it was agreed that it will be preferable to submit a single planning application for the entire Scheme. We are submitting the planning application to Oxfordshire County Council who will consult the other two councils.

The Scheme falls under the Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 2011 (SI 2011 No.1824) rather than the current Town and Country Planning (Environmental Impact Assessment) Regulations 2017 (SI 2017 No.571), as scoping had already been carried out when the new regulations came into force. The Scheme is likely to give rise to significant environmental effects and therefore requires a statutory EIA. Planning permission is also required for the Scheme.

Some aspects of the Scheme, particularly channel management, bed lowering and habitat enhancement on existing streams, could in principle be carried out under our Permitted Development rights. However, as the Scheme requires statutory EIA, we will include all Scheme activities in a single planning application, to simplify the approval process.

We submitted a planning application to Oxfordshire County Council in 2018 (reference number MW.0028/18, validated 23 April 2018). While the Council was considering the application, we were informed that structural problems with the A423 bridge over the railway meant that our proposed culverts under the A423 could not be built. We therefore withdrew that planning application and are submitting a new planning application after having modified our Scheme to take account of partnership working with the county council to combine part of the Scheme into the replacement A423 bridge. The revised Scheme is dependent on completion of the county council's works on the bridge as our Scheme depends on the new channels either side of the railway being available for our new channel to connect into.

In parallel we will submit a second planning application, for access to the rail sidings to transport part of the material excavated from the Scheme area instead of using only road transport. The second application will not cover any activities necessary to construct the Scheme, only the rail sidings activities and the resulting reduction in HGV traffic on the A34. Chapter 16 of this ES covers this second application; the remainder of the ES assumes that only the main application is consented.

1.6 Structure of the ES

The ES is presented in three volumes:

Volume One, comprises the Non-technical Summary which provides an outline of the Scheme and highlights the key impacts and mitigation measures of the Scheme in non-technical language.

Volume Two, is the Main Report, which is presented as follows:

- Chapter 1 'Background': provides a background to the Scheme, and describes the purpose and structure of this document, and how comments on its content can be made.
- Chapter 2 'Project development': presents information on how the Scheme developed through the preliminary stages and on the alternative options considered.
- Chapter 3 'Scheme description': describes the Scheme in detail, with information on both construction and operational aspects.
- Chapter 4 'EIA methodology': presents the approach and EIA methods used during the assessment.
- Chapters 5 – 14: present the results of the EIA for each environmental issue. In each case, sections on baseline conditions, potential impacts during construction and operation, mitigation and residual impacts are provided.
- Chapter 15 'Cumulative effects': presents the assessment of cumulative impacts with the phases of the Scheme and other known developments.
- Chapter 16 'Potential changes to impacts if the rail sidings are used': presents the differences in the predicted environmental effects if both planning consents are granted and the rail sidings are used for transport of a proportion of the spoil material.
- Chapter 17 'Management and monitoring': presents the proposals for post-construction management of the Scheme and for monitoring to check that mitigation measures have been effective.
- Chapter 18 'Summary': presents the key findings of the assessment.
- List of references.

Environmental figures are provided at the back of the Main Report.

Volume Three provides the Supporting Information for the Main Report (Volume 2). It comprises a series of appendices, as follows:

Appendix A Engineering Design Drawings

Appendix B Scoping Opinion, Pre-Planning Application advice and Environmental Update Note

Appendix C Ecological Appraisal and Survey

- Appendix C-1 – Designated Sites
- Appendix C-2 – Ecology Walkover Survey Report
- Appendix C-3 – Habitat and Botanical Survey Report
- Appendix C-4 – Hinksey Meadow National Vegetation Classification (NVC) Survey
- Appendix C-5 – Floodplain Meadows Partnership Assessment of impacts on species-rich floodplain meadow habitat
- Appendix C-6 – River Condition Assessment

Appendix D Protected Species Survey Reports

- Appendix D-1 – Aquatic Invertebrate and Mussel Survey (2016)
- Appendix D-2 – Kennington Pit Macrophyte Plant Survey (2017)
- Appendix D-3 – Kennington Pit Macrophyte Plant Survey (2020)
- Appendix D-4 – River Habitat and River Corridor Surveys (2017)
- Appendix D-5 – Breeding Bird Surveys (2017)
- Appendix D-6 – Wintering bird surveys (2017)
- Appendix D-7 – Badger Assessment (2020) – not made publicly available as it contains confidential information
- Appendix D-8 – Badger Sett Activity Survey (2020) – not made publicly available as it contains confidential information
- Appendix D-9 – Preliminary Bat Survey (2016)

- Appendix D-10 – Bat Surveys and results of Tree Climb Inspections (2017)
- Appendix D-11 – Ecological Report: Bat Surveys (2018)
- Appendix D-12 – Ecological Report: Bat Surveys (2020)
- Appendix D-13 – Bat Mitigation Strategy (2021)
- Appendix D-14 – Reptile Survey (2020)
- Appendix D-15 – Great Crested Newt Survey (2021)
- Appendix D-16 – Water Vole and otter survey (2016)
- Appendix D-17 – Water Vole Survey (2018)
- Appendix D-18 – Water Vole Survey (2021)
- Appendix D-19 – Otter Survey (2018)
- Appendix D-20 – Otter Survey (2020)
- Appendix D-21 – Oxford FAS Fisheries Survey (2016)
- Appendix D-22 – Hinksey Ponds Macrophyte Survey (2017)
- Appendix D-23 – MG4 Mitigation Strategy
- Appendix D-24 – Creeping Marshwort Mitigation Strategy
- Appendix D-25 – Whorled Water-Milfoil Mitigation Strategy

Appendix E Invasive Species Survey Reports

- Annexe E-1 Invasive Species Updated Survey (2020)
- Annexe E-2 Invasive Species Management Plan

Appendix F Arboricultural Assessment, Tree Survey and Vegetation Management

Appendix G Environmental Action Plan (EAP)

Appendix H Air Quality

- Appendix H-1 Construction Dust Assessment
- Appendix H-2 Modelling Methodology
- Appendix H-3 Air Dispersion Modelling
- Appendix H-4 Air Quality Model Summary

Appendix I Landscape

- Appendix I-1 National Character Area profiles:
- Appendix I-2 Regional Landscape Character: Oxfordshire Wildlife & Landscape Study
- Appendix I-3 Local Landscape Character: Oxford Flood Risk Management Strategy – Landscape Character Report
- Appendix I-4 Historic Landscape Characterisation: Oxfordshire Historic Landscape Characterisation Project
- Appendix I-5 Green Infrastructure Study
- Appendix I-6 General Arrangement Landscape Plans
- Appendix I-7 Local Landscape Policy Areas
- Appendix I-8 Viewpoint sheets

Appendix J Archaeological and heritage information

- Appendix J-1 – Cultural Heritage Gazetteer
- Appendix J-2 – Oxford Flood Alleviation Scheme Phase 2 Heritage Desk-Based Assessment
- Appendix J-3 – Oxford Flood Alleviation Scheme Phase 2 Heritage Statement
- Appendix J-4 – Oxford Flood Alleviation Scheme Geoarchaeological Assessment Report
- Appendix J-5 – Oxford Flood Alleviation Scheme Report on Archaeological Geophysical Surveys
- Appendix J-6 – Oxford Flood Alleviation Scheme: Old Abingdon Road Archaeological Evaluation Report
- Appendix J-7 – Oxford Flood Alleviation Scheme Archaeological Evaluation Report
- Appendix J-8 – Oxford Flood Alleviation Scheme, Field 3: Archaeological Evaluation Report

Appendix K Habitat Regulations Assessment (HRA) Screening Report

Appendix L Water Environment Regulations (WER) Compliance Assessment
Appendix M Transport Assessment
Appendix N Planning Policy
Appendix O Materials Management Plan
Appendix P Soil Resource Survey Report
Appendix Q Modelling Review of removing channel
Appendix R Flora and fauna legal compliance
Appendix S Biodiversity Net Gain

1.7 Review and comments

Copies of this ES together with copies of the plans and supporting information including appendices will be made available for inspection on the www.gov.uk website and at the following addresses:

- Oxford City Council offices, Town Hall, St Aldate's, Oxford, OX1 1BX;
- Oxfordshire County Council office, County Hall, New Road, Oxford, OX1 1ND;
- South Oxfordshire District Council office, 135 Eastern Ave, Milton, Abingdon OX14 4SB;
- Vale of White Horse District Council office, 135 Eastern Ave, Milton Park, Milton, Abingdon OX14 4SB;
- Oxfordshire County Library, Queen St, Westgate, Oxford OX1 1DJ;
- Kennington Library, Kennington Village Centre, Kennington Rd, Kennington, Oxford OX1 5PG; and
- Abingdon Library, The Charter, Abingdon OX14 3LY.

2 Project development

2.1 Strategic context

An essential design activity has been to review the direction and objectives of relevant national and regional strategic level documents, together with relevant policies in the planning and legislative framework, including Oxfordshire County Council's, Oxford City Council's and Vale of White Horse District Council's Development Plans (see Appendix N). This helps us to ensure that our designs are capable of meeting the relevant policies or directions, and do not prejudice their achievement by others.

These objectives (related amongst other things to flooding, recreation and access, health and well-being, biodiversity, culture, landscape, cultural heritage and transport) are considered in the environmental technical chapters of this ES. If there is a risk that the delivery of the Scheme could compromise the objectives of other strategies and projects, then we describe this as an impact.

Appendix N 'Planning legislation, policy and guidance' summarises relevant key legislation, plans, polices and guidance and their influence, during the development of the Scheme.

2.1.1 Flood risk management plans and strategies

The Scheme falls within sub-area 8 (heavily populated floodplain) of the Thames Catchment Flood Management Plan (CFMP) (Environment Agency 2009a). The CFMP recommended Policy 5 for this area, i.e. 'areas of moderate to high flood risk where we can generally take further action to reduce flood risk through floodplain management'. Policy 5 was selected to ensure continued protection to people, property, schools, health centres and other critical infrastructure.

The actions we identified in the CFMP to implement the preferred policy for this sub-area are:

- To deliver the actions recommended in Flood Risk Management Strategies for Oxford [and others] once they are approved;
- In the short-term, to encourage partners to develop policies, strategies and initiatives to increase the resistance and resilience of all new development at risk of flooding. We will also look at protecting land that may be needed to manage flood risk in the future, and work with partners to identify opportunities for this and to recreate river corridors in urban areas;
- In the longer-term, we need land and property owners to adapt the urban environment to be more flood resilient. This includes the refurbishment of existing buildings to increase resilience and resistance to flooding; and
- We need to promote the management of flood consequences. By working with our partners we will improve public awareness and local emergency planning, for example identifying critical infrastructure at risk and producing community flood plans.

Subsequently, the Oxford Flood Risk Management Strategy (Environment Agency 2009b) was published, which provided a detailed study of the flood risk from rivers in Oxford. The strategy described how flood risk can be managed in Oxford over the next 100 years.

Additionally, Oxfordshire County Council, as Lead Local Flood Authority, developed a Local Flood Risk Management Strategy for Oxfordshire in 2016 to set a long-term programme for reducing flood risk in the county.

2.1.2 Green and blue infrastructure

Green Infrastructure (GI) is defined in the National Planning Policy Framework (NPPF) as '*a network of multi-functional green and blue spaces and other natural features, urban and rural, which is capable of delivering a wide range of environmental, economic, health and wellbeing benefits for nature, climate, local and wider communities and prosperity*.'

As an integral part of the development of the Scheme options, we produced a GI Study (Appendix I-5) to set out the existing and potential GI in the Scheme area. The Scheme will be carried out within or adjacent to a range of GI assets including allotments (e.g. on Botley Road, South Hinksey), churchyards/cemeteries, ecological spaces, green links, amenity land, sports ground, parks, Public Rights of Way, playgrounds, common land, operational land (e.g. Seacourt Park and Ride) and squares/gardens.

Various opportunities were identified in the GI Study to improve access, habitat connectivity, green space and heritage, which we investigated to determine their viability. We also consulted landowners to identify if there were other opportunities, not identified by the original study. Of these opportunities, those that we will take forward as an integral part of the Scheme are:

- Increased length and improved blue infrastructure through the creation of new watercourses, i.e. a new first stage stream, which has an enlarged, second stage channel in most areas;
- New path using parts of the maintenance track for permissive pedestrian access north-south between Osney Mead and Old Abingdon Road, where there is currently a combination of official public footpath and informal access. Limited permissive cycle access will also be provided between Osney Mead and the Devil's Backbone at South Hinksey.
- Enhanced setting of existing archaeological assets through the provision of new interpretation boards for Old Abingdon Road Culverts Scheduled Monument;
- Raised parapet height on Devil's Backbone bridge to cycleway standards (height of 1.4m) to enable the possibility of the Devil's Backbone path being upgraded to a cycleway in the future;
- Uncovered new archaeology through field evaluation as part of the development of the Scheme, which has allowed greater interpretation and understanding of the archaeology in Oxford; and
- Creation of wetland features including backwaters, scrapes and ponds within the second stage channel to maximise available habitat for wetland and aquatic species. We are creating/restoring meadow habitat outside the second stage channel.

2.2 Consultation

2.2.1 General

Effective stakeholder and public engagement is central to the development of the Scheme to arrive at a solution that addresses the project objectives whilst being acceptable to as many parties as possible, and to engage those parties in the appraisal and design process. Consultation is also an essential part of the EIA process. This consultation has informed and will continue to assist decision-making by:

- Raising awareness of flood risk management issues within and around Oxford, and informing stakeholders of the development process and how decisions have been made;
- Informing the development of the Scheme by involving, providing information to and working closely with stakeholders to understand their views, concerns and values, and ensure their views are clearly considered;

- Gathering information from stakeholders to inform the development of the Scheme;
- Forming a partnership with key stakeholders to encourage decision-making and investment in the Scheme;
- Minimising project risks and managing public relations and perceptions; and
- Ensuring our Scheme:
    - informs and involves people who live, work or have an interest in Oxford and who will be affected by the Scheme;
    - influences related decisions, plans and strategies (e.g. development planning); and
    - is successfully implemented, subject to planning consent.

2.2.2 Stakeholder events

Consultation has been carried out with statutory, non-statutory and local organisations, businesses and members of the general public during the development of both the Oxford Flood Risk Management Strategy and the proposed Scheme.

To date, the following stakeholder events have been held in Oxford to introduce the Scheme to consultees, to discuss the development of flood risk management options and to present the preferred Scheme:

- Public events, exhibitions and consultation:
    - June/July 2015: four public events were held in Oxford and one in Abingdon to introduce the Scheme and seek local knowledge to inform development of the Scheme. Feedback from these events, along with ground investigations and analysis, allowed the preparation of options to alleviate flood risk using the capacity of the western floodplain.
    - January to March 2016: four public events were held in Oxford and one in Abingdon to present the options being considered for the seven areas into which we divided the Scheme and seeking views on which options were acceptable to the public. The public were asked to complete feedback forms. Additionally, we held an e-consultation, allowing the public to make further comments and allowing NGOs to make formal submissions. 876 people attended the events and we received more than 300 written submissions.
    - June 2016: a public exhibition was held at Oxford Town Hall in the city centre, to share the outcome of the public consultation, to explain how the Scheme has been modified to take account of feedback received and to announce the route of the Scheme.
    - May 2017: Four drop in events were held; one of which was at the Oxford Deaf & Hard of Hearing Centre in 2017 and three at local community centres – St Luke's, South Oxford and West Oxford Community Centres. We had dates organised for detailed design consultation, but a snap General Election was called, and during election periods no consultation on major publicly-funded schemes is allowed to take place. These events were therefore more of an information sharing exercise, and to let people know about the forthcoming online consultation.
    - 22 June - 20 July 2017: an online public consultation was held to obtain public views about detailed design options for the Scheme. These included the design of new bridges, location of benches and cycle racks and style of information boards. Additionally, three public drop-in events were held at libraries (Kennington, Central and Botley) to assist people without access to computers, or who are not computer literate, or who may have difficulty in completing an online consultation.
    - 11 August 2017: a public drop-in session was held at West Oxford Community Centre on Botley Road with local residents and Oxfordshire

Badger Group to inform and discuss the alignment of Botley Road flood defences.
    - December 2017: a public drop-in session was held at West Oxford Community Centre on Botley Road with local residents of Botley Road and Osney island. For Osney Island residents, the latest modelling results were shared and included information on permanent and temporary works and what reduction in flood risk they can expect to benefit from, as well as the limitations on improving protection on the Island. We invited Botley Road residents to share more detailed information on the plans for the flood wall and embankment at the back of their homes. Allotment holders were engaged ahead of this drop-in, but this event gave them a second opportunity to discuss any queries with us.
    - 15 February 2018: a public drop-in session was held at West Oxford Community Centre on Botley Road with residents from Osney island to inform them of the final proposals for this area.
    - 17 – 28 May 2021: virtual public engagement to inform the public about the changes since the planning application was withdrawn. Questions received from the public during this engagement were answered.
    - Any further questions during the planning consultation period will be answered via the email OxfordScheme@environment-agency.gov.uk
- Other public engagement through pop-up 'engagement' shops in shopping centres, newsletters, leaflet drops, on-line consultation, (to enable wider engagement for those with reduced accessibility) and social media (e.g. facebook and twitter). We issue a regular newsletter which the public can subscribe to by contacting OxfordScheme@environment-agency.gov.uk and issue updates on Facebook at facebook.com/oxfordsheme and on Twitter at @oxfordfas.
- Meetings with landowners and landowner workshops
    - Meetings with individual residents and landowners have been undertaken throughout the development of the Scheme.
    - November 2016 and January 2017: workshops were held with landowners to discuss the Scheme, in particular, to discuss the alignment of the proposed new channel, environmental enhancements, impacts on agriculture including fences and boundaries and access issues.
    - Meetings and discussions with landowners have continued since the submission of the original planning application in April 2018.
- Downstream community focus groups
    - May 2016: three focus groups were held with downstream communities to better understand their concerns about the Scheme. These workshops were organised following public consultation earlier in 2016 during which it became clear that there were concerns about perceived increases in flood risk to downstream communities.
- Environmental stakeholder meetings
    - January 2016: meeting attended by The Oxford Badger Group, Floodplain Meadows Partnership, Low Carbon West Oxford, Oxford Flood Alliance, RSPB Conservation Officer and the Freshwater Habitats Trust to provide an update on the Scheme and programme for delivery.
    - July 2016: meeting held to discuss the preferred Scheme options attended by Hogacre Eco Park, Freshwater Habitats Trust, Floodplain Meadows Partnership, Oxford Preservation Trust, RSPB, Upper Thames Fisheries Consultative, Low Carbon West Oxford/North Hinksey Parish Council, Oxford Flood Alliance, Friends of Kendall Copse/Kennington Parish Council and Tim King (Biologist).
    - March 2017: meeting held with Freshwater Habitats Trust, Oxford Flood Alliance, Friends of Kendall Copse, Oxford Rare Plants Group, Wildfowl and Wetlands Trust, Oxford Preservation Trust, Trust for Oxford's

Environment, Thames Regional Flood and Coastal Committee and Hogacre Eco-Park, to discuss environmental issues relating to the Scheme including notable/rare plants, archaeology, fluvial/groundwater modelling.

- Other consultation:
  - Initial Meetings with Historic England (English Heritage at the time) and other Heritage consultees: Site meeting July 2014 and office meeting October 2014 - to discuss the potential impacts of the Scheme on the Scheduled Monument at Old Abingdon Road.
  - Attendance at Oxford Flood Alliance Symposium: March 2015 to contribute to discussions about natural flood management and Oxford.
  - Initial Meeting with Natural England: May 2015 to discuss the Scheme in relation to Oxford Meadows Special Area of Conservation, Iffley Meadows Site of Special Scientific Interest and land under High Level Stewardship.
  - Site Visit with Floodplain Meadows Partnership: June 2015 - to discuss the Scheme and any potential impacts on floodplain meadows.
  - Visit to Wolvercote Ponds with Oxford Preservation Trust (OPT): July 2015 to see the type of work they have done on that site and how that might relate to the Scheme design.
  - Attendance/assisting with annual Creeping Marshwort Survey: September 2015.
  - Meetings with Berks, Bucks & Oxon Wildlife Trust and Natural England - in January 2016, July 2016 and March 2017.
  - Meetings attended by planners/internal consultees from VoWH, County and City between September 2015 and June 2016 to discuss route options and preferred Scheme.
  - Separate meetings with heritage consultees from Oxford City and Oxfordshire County:
    - Initial Meeting: June 2015 to discuss Old Abingdon Road
    - Route Options: June 2016
  - Meetings with Directors of Hogacre Eco-park:
    - October 2015 to introduce the Scheme
    - March 2016 to discuss modelling results
    - August 2016 to discuss preferred option
    - March 2017 to discuss concerns over the potential impact on groundwater levels
    - March 2017 to agree dipwell locations
  - Site meeting with Secretary of Friends of Kendall Copse September 2016 to discuss the story behind the copse/community involvement, the potential impacts on Kendall Copse, particular trees that might be preserved and mitigation proposals.
  - Site meetings at Botley Road with the Oxfordshire Badger Group
    - October 2016 to discuss options for wall/embankment alignment in relation to badgers.
    - August 2017 to explain the decision to keep the wall/embankment to the rear of the Botley Road houses.
  - Site meeting with Oxford City Council Tree Surveyor December 2016 to discuss City's proposed tree maintenance work on Willow Walk and to discuss potential Scheme impacts on Willow Walk and mitigation.
  - Meeting with OPT and local botanists to discuss Creeping Marshwort impacts and mitigation

April 2017. Attended by Graham Scholey, Penny Burt, Robert Oates (RFCC), Judy Webb, Jeremy Biggs, Peter Rawcliffe.
        - Presentation at Upper Thames Fisheries Consultative AGM May 2017 to explain the Scheme and answer questions.
- Meetings with Parish Councils:
    - We attended a series of Parish Council meetings during the development of the Scheme and will continue to do so. The main focus for these meetings was to raise awareness, provide information, keep the groups informed, listen to any concerns and answer questions. We met with a number of the Parish Councils on multiple occasions providing updates and sharing new information as we had it.
    - Meetings were held from 2015 onwards with the following:
        - Wallingford Town Council, 4 March 2015
        - Kennington Parish Council, 13 May 2015
        - Sutton Courtenay Parish Council, 1 September 2015 (this update included information about a separate scheme at Abingdon too)
        - Lower Radley Parish Council, 11 January 2016
        - Marcham Parish Council, 25 May 2016
        - North Hinksey Parish Council, 23 February 2017, covering questions about options, fencing and compensation.
        - Oxford City Council Parish Council Forum, 6 March 2017
        - Kennington Parish council, 9 March 2017
        - Kennington and Sandford Parish councils, 9 April 2017, confirming that there will be no downstream impact caused by the Scheme
        - South Oxfordshire Town and Parish Forum, 5 July 2017, confirming that there will be no downstream impact caused by the Scheme
        - Vale of White Horse Town and Parish Forum, 12 July 2017
        - North Hinksey Parish Council, 19 October 2017
        - Sutton Courtney Parish Council, 5 December 2017 (update given by Vale of White Horse District Council)
        - South Hinksey Parish Council, 5 March 2018, at which the Parish Council stressed the importance of retaining the Devil's Backbone footpath and asked about traffic management on the A34.
        - Kennington Parish Council, 8 March 2018. Concerns were expressed regarding traffic and road closures and the impacts on the rush hour. We took questions about bridges along the Scheme (particularly the Willow Walk bridge), materials management, Scheme maintenance and the Kennington Ponds.
        - North Hinksey Parish Council, 28 June 2018. Updated them about the Scheme and answered questions.
        - South Hinksey Parish Council, 17 January 2019. We discussed the accessibility of the footpath over the future Devil's Backbone bridge and footpath. We discussed that we had spoken with the landowner and the tenant about moving the construction compound to the field to the north of the planned compound. We explained that if we do consider use of this field, further environmental investigation including an intrusive archaeological excavation would be required. We said we had asked Highways England (now National Highways) whether it would be possible to construct a new access near to the closed layby. The parish council requested we employ an active Traffic Management System (such as at Botley Westway), to hold lorries away from the village and give priority to local users. They requested we re-visit

the rail sidings as a means of removing excavated material from the site. We agreed to revisit it.

- South Hinksey Parish Council, 10 June 2019. We updated the council on progress since our last meeting. They expressed concerns about the location of the compound again and we agreed to investigate whether we can move it one field further to the north.
- Kennington Parish Council, August 2019 (jointly with Oxfordshire County Council who updated them about the A423 bridge issues). We discussed the implications for the Scheme of Oxfordshire County Council having to replace the bridge carrying the A423 southern bypass across the railway. We outlined a twin track approach of either building the Scheme after the bridge construction or building the Scheme as part of bridge construction; subsequently it has been confirmed that the bridge works must be done first.
- Kennington Parish Council, 15 December 2020 (jointly with Oxfordshire County Council who updated them about the A423 bridge issues). We discussed the implications for Kendall Copse of the stream re-alignment and the temporary carriageway needed to keep Old Abingdon Road open. We agreed to a site visit to understand which trees were planted as memorial trees and review whether we can look to move / replant these trees where possible and share our proposed landscaping plans. We answered questions about tree loss in Kendall Copse and future channel maintenance and confirmed we have ensured there are no downstream effects of the Scheme.
- North Hinksey Parish Council, 17 December 2020 (jointly with Oxfordshire County Council who updated them about the A423 bridge issues). We took questions about our programme and the links to the A423 Kennington Bridge programme. We received requests to use rail transport to remove excavated material during construction.
- South Hinksey Parish Council, 1 March 2021 (jointly with Oxfordshire County Council who updated them about the A423 bridge issues). The main purpose of this meeting was to explain that whilst we had investigated moving the construction compound one field to the north we are unable to use the field due to the presence of rare MG5 grassland. We outlined our overview for the construction compound and took several questions about this issue.
- South Hinksey Residents, 14 May 2021, site meeting with residents who back onto Manor Farm Lane to describe details of proposed site compound in adjacent fields.

- Consultations held by others
  - During 2018 Oxfordshire County Council in their role as planning authority, consulted with statutory consultees and the public on the planning application twice, firstly in the spring/summer 2018 and for a second time when further information was submitted in December 2018.

2.2.3 Consultation responses

Key issues raised during the consultation and engagement events are summarised below:

- Need to protect habitats and species around the river and requirement for protected species surveys (public, Environment Agency and Natural England responses);
- Key concerns from residents in Oxford were landscape and natural habitat, particularly wildflower meadows, and concerns over channel maintenance. Also, the public told us that they consider a benefit of the Scheme is the opportunity to protect or enhance wildlife spaces and natural habitats;
- Anxiety amongst those living on the River Thames downstream of Oxford that the Scheme will pass on the flooding problem to their communities. There is a concern that water could be carried around Oxford more quickly and on to lower reaches of the river. Residents of Abingdon were concerned over whether the Scheme would increase river levels downstream. This issue has been addressed by the subsequent modelling study and through a separate independent review undertaken by the VoWH District Council;
- Interest in taking a wider catchment approach to flood management using natural processes. Some respondents were concerned that the solutions focus too much on Oxford when other areas are also vulnerable to flooding;
- Concern that road closures on Old Abingdon Road and Kennington Road could cause disruption elsewhere, including the possibility of traffic backing up onto the A34. This issue has been addressed by including a temporary carriageway into the design, to keep these roads open during construction works;
- Ensuring the landscape is considered sensitively; and
- The creation of new cycle ways and footpaths including both north-south and east-west routes. This issue is addressed through new proposals for a permissive path along the new maintenance access track for a significant part of the Scheme to the north and south of South Hinksey village.

2.2.4 Future communication

Communication and engagement will continue with stakeholder groups, including statutory consultees, key organisations and interest groups (including water users, conservation and fishing interests), landowners, residents and the general public throughout the development and construction of the Scheme. We will use various communication and engagement methods and material to keep stakeholders informed including: regular newsletters, social media updates, press releases about Scheme milestones and virtual meetings, throughout the planning application process and beyond. This engagement will include an explanation of the nature and timing of the Scheme if approved, and likely disruption and impact caused by the construction works. A Communications Construction Action Group for the Scheme will be reinstated by Oxfordshire County Council closer to the start of construction to ensure all partners are working collaboratively across the city to manage and communicate about construction disruption related to the Scheme and to other, partner, schemes.

2.3 Alternative options

2.3.1 High level option development

Flood risk management options generally fall under one of four main categories: increased capacity, raised flood defences, water transfer or upstream storage (or a combination of these). However, following the flooding in 2007 and given the complexities of the flooding mechanisms in Oxford over 100 different combinations of options were reviewed. The options were assessed in the context of technical issues and, through the process of Strategic Environmental Assessment, were also assessed in the context of existing social and environmental constraints and potential integrated environmental improvements.

HM Treasury requirements for public spending are set out in the Green Book. The Flood and Coastal Risk management Appraisal Guidance (FCERM-AG) is used to assess flood defence schemes and builds on the techniques and issues described in the Green Book. The FCERM-AG clearly states that a proportionate approach should be adopted in reviewing options and that "*appraisals need to be sufficiently detailed to robustly justify the actions needed*", "*should be proportionate to the amount of information required to choose a preferred option*" and "*avoid excessive data collection or abortive work*". One of the skills of the project team is "*deciding when enough information has been collected to make a robust and defensible decision*". Effectively this allows non-viable options to be eliminated quickly, based on experience and knowledge

Some of the options considered included (this is not an exhaustive list): maintaining the existing defences (a 'do minimum' option), raised defences at the village of Wolvercote, development of a multi-agency flood plan for Oxford, improved watercourse maintenance regime, provision of flood resilience measures, enhanced maintenance on secondary watercourses, a new channel west of the main River Thames, upstream flood storage area and a 'do nothing' option.

The options of doing nothing or simply maintaining the existing flood defences were discounted during the appraisal process as these would lead to an unacceptable increase in flood risk over time.

Standalone raised defences were discounted on technical grounds, whilst water transfer was discounted due to the high cost and infrastructure required. Standalone upstream storage showed that the volume required to reduce flood risk in Oxford was substantial (estimated in the order of 50Mm^3) and this would need to be stored in the existing floodplain. No locations close to the area north of Oxford were identified that could physically store this volume and it was concluded that upstream storage as a standalone option to specifically solve flooding in Oxford was also not technically feasible.

The results of this appraisal are set out in the Oxford Flood Risk Management Strategy, which was published by the Environment Agency in 2010, following public consultation. The Strategy recommended a three phased approach to managing flood risk in Oxford over the next 100 years.

The first phase of this Strategy was the implementation of local channel works to achieve some immediate localised flood risk reduction and this phase has already been completed. The second phase is the creation of more space for water within the existing western floodplain of the city. The third phase is potential future upstream flood storage, should predicted climate change result in the reduced effectiveness of the first two phases.

This Scheme represents the development of phase two of the Strategy to manage the risk of flooding to people, property and the environment.

During the development and appraisal of alternative options to deliver a Scheme, we consulted key stakeholders and the public in Oxford, presenting the alternative options (with a range of illustrations). Additional targeted stakeholder meetings provided further specific information and opinion feedback.

2.3.2 Selection of the preferred Scheme

Following selection of a broad route for a proposed new flood channel to the west of Oxford, six options were taken forward for detailed consideration:

1 Do nothing (i.e. allow existing defences and other structures to fail) – this option was included only as a baseline against which to compare the other options.

2 Do minimum (i.e. maintain existing structures but make no improvements) – included for comparison with the improvement options.

3 Raised defences only, with no new channel.

4 New channel only, with no raised defences.

5 New channel and raised defences.

6 New channel and raised defences with additional upstream flood storage.

Most of these options have alternative sub-options, which were considered as part of the Strategy. Among these were options to vary the capacity of the proposed new channel. Modelling showed that a channel significantly smaller than that proposed would not work as intended, while a significantly larger channel would be impossible to construct given known constraints (e.g. bridge and culvert crossings at Old Abingdon Road and the railway).

The proposed solution was identified as Option 5, comprising a new flood channel and the construction of localised raised flood defences (see Chapter 3 'Scheme description').

The appraisal process requires the assumed solution to be tested at each stage of its development to ensure it remains the preferred solution. At each stage interim solutions, similar to those undertaken as the first phase of the Oxford FRMS were re-introduced as a sense check to ensure we did not jump to a major intervention if further measures, at minimal cost, could be implemented. At each review point the preferred option remained a new channel and localised raised defences.

The option for raised defences, with no channel only has been rejected as this solution, whilst reducing flood risk behind the defences, displaces the flood water and creates additional flood risk issues elsewhere.

The option for the new channel with no raised defences reduces flood risk across similar areas to the proposed Scheme as the channel will reduce flood levels. Whilst it lowers water levels it does not provide the maximum achievable benefits in some of the residential areas.

The proposed solution which is a combination of channel and raised defences delivers the optimum solution bringing together the benefits of the new channel and the raised defences with no adverse flood risk management risks which are not being mitigated within the Scheme.

During the development of the Scheme alternate proposals have been promoted by landowners, interest groups and individuals. These alternative proposals have been reviewed but none was considered to reduce flood levels to the same extent across the whole area as the proposed Scheme or to provide the same robust certainty of operation or long term wider environmental enhancements. Several would simply transfer risk elsewhere.

There are two main Scheme-wide alternative proposals being promoted by others: the twin pipe, pumped option and the 'no channel' or smooth floodplain option:

The twin pipe pumped option would involve the construction of a large underground pump house north of Botley Road and the installation of two large pipes running from this point under the western floodplain discharging in the Redbridge area. This is similar to the culvert option which was discounted at strategy stage due to costs, risk and our policy against culverting if possible. In addition, the Environment Agency, wherever possible promotes passive solutions that operate automatically in a flood event requiring no human intervention or mechanised operation. This removes a significant risk that the intervention needed for non-passive schemes is unavailable when needed, access to equipment isn't possible due to the wider effects of flooding or the mechanised equipment fails to operate when needed.

The 'no channel' or smooth floodplain option would mean the parts of the new river

channel and the main section of lowered floodplain being omitted from the Scheme and a smooth section of floodplain created by removing hedges and fences to prevent them creating barriers to the flow. Building part of the Scheme without increasing the capacity of the western floodplain would cause the water to redistribute through existing channels and the floodplain through different flow routes – the existing floodplain and interconnected braided river network to the west of Oxford is complex and changes in one area can lead to unintended consequences elsewhere. Additionally, reliability and certainty of the Scheme would be compromised requiring enhanced maintenance and intervention, greater risk of failure and earlier activation of contingency plans. The wider environmental benefits proposed in the western floodplain could also not be delivered. See Appendix Q for a modelling review of two alternative 'no channel' options.

Local changes to the proposed Scheme layout have also been promoted, most notably at Hinksey Meadow to reduce impacts on the ecologically-valuable grassland. Early work had identified that widening of the Seacourt Stream would provide the most economically viable option to reduce flooding in the Botley Road area and that it would not be possible to avoid Hinksey Meadow in its entirety without the loss of residential property, gardens and/or commercial property. We have minimised the impacts on Hinksey Meadow by utilising the existing stream as far as possible.

2.3.3 Alternative design options for the Scheme

The following design options were considered for the Scheme, which are described in Chapter 3 'Scheme description' (see Table 3.1 for the location of these works):

Alternative channel alignments, widths and route modifications

Various alignments for a new channel have been considered as part of the development of the Scheme. These alignments have been subject to further study and modelling to understand environmental, social, maintenance and engineering constraints, costs, risks, benefits and sensitivities. We also took the views of the public, statutory consultees, landowners and other stakeholders into account alongside engineering and socio-environmental criteria, which allowed the route for the new channel to be developed further. A detailed environmental appraisal of the route options was undertaken, taking into consideration the need to:

- Meet the objectives of the Scheme (see Section 1.4);
- Maximise the effectiveness of the existing assets;
- Meet some of the aspirations of the public/stakeholders to provide improved public realm, in line with a Green Infrastructure Strategy for the Scheme (Gillespies 2016);
- Keep maintenance to a reasonable level;
- Minimise land-take within the floodplain and areas of environmental sensitivity e.g. valuable habitat, archaeological sensitivities; and
- Maximise use of the floodplain and 'make space for water' whilst at the same time improving habitat, amenity and water body morphology.

After further appraisal and refinement following feedback from consultation, we selected the most appropriate route to minimise environmental harm, which meets environmental objectives and reflects the views of the public and statutory consultees, where possible, while not being economically prohibitive. The Scheme as proposed now differs from the Scheme presented in 2018, with two main option choices having changed, these being the route taken under the A423 Southern By-Pass and the temporary traffic arrangements at Old Abingdon Road (see below). Where adverse residual impacts on the environment have been identified, we are seeking to fully mitigate these impacts (for example, through the creation of new habitats).

Following public consultation in June 2015 we divided the broad route of the new channel into areas, numbered 1 to 7, and in each area we identified alternative alignments for the

route of the new channel. Following the design refinement process, we reduced the number of areas to four (1 to 4).

The key alignments and modifications that have been considered during the development of the Scheme are the following:

- The alignment of the new second stage channel, which has varying widths on either side of the first stage stream was designed to maximise the retention of existing ecological habitat (particularly MG4a nationally rare grassland at Hinksey Meadow), vegetation and trees, to minimise other environmental impacts including visual intrusion, to maintain existing access, and to minimise impacts on public amenity and private land, as follows:
    - North of Botley Road – we aligned the second stage at this location to avoid the loss of mature willow trees, which contribute to the landscape character of the area.
    - Hinksey Meadow – the channel alignment between the spillway and Willow Walk was dictated by the high ecological value of Hinksey Meadow Local Wildlife Site. Following consultation in January and February 2016 on the alignment of the channel, a route for a two-stage channel was selected based on strong stakeholder feedback and our understanding of the environmental sensitivities at this location. We moved the original route of the channel from the centre of the meadow to an alignment on the far western side of the meadow bordering Seacourt Stream, to minimise the loss of MG4a grassland. At the northern end of Hinksey Meadow, the alignment of the second stage channel was dictated by the need to avoid the electricity pylon and we re-routed the channel to avoid felling a row of tall poplars, which screen the pylon and the retail park. Additionally, modifications were made to the existing Seacourt Stream corridor, with various new second stage channel widths and depths modelled. The final dimensions of the second stage were selected to be as narrow as possible to reduce the amount of MG4a meadow lost while still providing the necessary flood benefit and ensuring the land would still be viable for meadow management and cattle grazing. Through further flood modelling we have evidence to support a reduction in land take in this area and subsequent reduced impact on the MG4a grassland.

- Willow Walk to Devil's Backbone – a channel alignment was selected further eastwards than the existing stone bridge to avoid a horse paddock within Willow Walk Meadow Local Wildlife Site (see Section 8.1.1) where the rare creeping marshwort *Helosciadium repens* grows. Additionally, we selected an alignment that used existing culvert locations to reduce tree loss.
- Kennington Pool – this pond at the southern end of the Scheme will be made smaller to enable the widening of the Hinskey Drain whilst still keeping it separate from the pond. An embankment with sloping sides will be constructed adjacent to the pond. We rejected an alternative option to replace this with a sheet piled wall to maximise the remaining surface area of the pond as this is significantly less favourable ecologically. There was also an alternative option for a larger embankment to be constructed adjacent to the pond.
- A423 Southern By-Pass Road – we considered a number of options for passing larger channels under the by-pass, including culverts which were proposed in 2018. Since 2018 it has become apparent that the bridge over the railway is not structurally sound enough and instead will be re-built with a longer span, accounting for both the railway and new channels either side of it. These channels will be built by Oxfordshire County Council when they rebuild the bridge, so are not part of our Scheme. We have adjusted the route of our new channel so that it will connect to these channels.

- Old Abingdon Road – we considered an alternative alignment for the proposed flood channel crossing and culverts below Old Abingdon Road, which was later rejected due to archaeological issues. The alternative alignment involved a direct route crossing Old Abingdon Road, using the existing stream route, following the railway in a southerly direction, and running in two new box culverts under the road between the existing Redbridge Culvert East and Redbridge Culvert West. The alternative option would have led to less traffic disruption (enabling Kennington Road to be kept open at all times), some fisheries benefits and less land-take within the former landfill to the west of Kennington Road, and less impact on Kendall Copse. However, the option chosen for the channel which swings out to the west, crossing Old Abingdon Road via new culverts, was agreed due to the archaeological importance of Old Abingdon Road. The existing culverts under the road are designated as a Scheduled Monument and the proposed route is preferred by Historic England. While this route will still cause harm to the truncated medieval historic causeway (considered to be of national significance), the proposed route will avoid the Old Abingdon Road Culverts Scheduled Monument and avoid aesthetic impacts through changes in view of the culvert mouths/arches further east.
- Old Abingdon Road – in our 2018 planning application we proposed to close the junction of Old Abingdon Road and Kennington Road for up to 15 months. This would have obstructed access between the two halves of Old Abingdon Road as well as preventing access onto Kennington Road. Following discussions with National Highways, Oxfordshire County Council and Oxford City Council we have designed a temporary road layout, which will be modified part way through the construction works, allowing vehicles to pass freely in both directions, maintaining the existing capacity of the local road network and avoiding both the diversion of bus routes and a potential for traffic congestion on surrounding roads.
- Weirs Mill Stream – we considered alternative modifications to increase the flow capacity of this channel in consultation with boat residents and landowners but these were later rejected as they would directly impact on a number of residential boat moorings or adversely affect Iffley Meadows Site of Special Scientific Interest. Following further assessment, the Scheme now includes raised defences to the north of Donnington Bridge Road, which provides similar levels of flood protection.
- Sandford – a previous alignment of the new channel extended from Kennington down to Sandford. However, the alignment to the south of Kennington was later rejected as investigations indicated that flood risk to properties could be reduced without impacting the Sandford area and thus avoiding any permanent disruption to residential moorings at Weirs Mill.

Additionally, following consultation with environmental stakeholders in 2017, we also considered options to drop proposals for some sections of the new channel whilst retaining other key structures (see Appendix Q). Two scenarios were tested: a Scheme without a new channel from 200m downstream of Botley Road down to Old Abingdon Road, and a scheme which removed the section of channel through North Hinksey Meadow from a point 200m downstream of Botley Road to Willow Walk. Both scenarios were tested under various flood scenarios to review the impact on peak flood levels compared to the proposed Scheme. It was concluded that without the new channel, the flood risk benefits would not be robustly achieved and these proposals needed to remain as part of the proposed Scheme.

Alternative types and alignments of flood defences

- Alternative defence types have been explored and incorporated into the Scheme design e.g. to retain privacy in some areas such as properties along Botley Road.
- Osney Mead: Alternative alignments of new flood defences at Osney Mead were reviewed, to avoid impacting on sensitive habitats including a dense area of trees,

Public Rights of Way, Oatlands Recreation Ground and buildings within the adjacent industrial estate. The selected option at this location is to construct a landscaped earth embankment along the eastern edge of the recreation ground. This will enable the tree belt along the western side of Ferry Hinksey Road to be retained as a screen between the residential properties and the industrial area. A reinforced concrete wall will be constructed past the National Grid pylon and around the south of Osney Mead Industrial Estate, due to the presence of the National Grid cables and limited space within the industrial area.

- Botley Road/Seacourt Park and Ride: we considered alternative routes for the flood bund/wall at the rear of gardens to the north of Botley Road and east of Seacourt Park and Ride, in order to comply with relevant legislation including the Protection of Badgers Act 1992 and Wildlife and Countryside Act 1981, and to minimise the numbers of trees that would require felling in this area while accounting for the extension to the Park and Ride.
- New Hinksey: we considered alternative alignments for the new flood bund and moved the bund to avoid the root protection zones of trees and hedgerow, to avoid fragile buried utility pipes and to reduce disturbance to badgers.

Alternative finishes of new structures were considered to ensure that they are appropriate to their location and landscape character. These are discussed in Section 7.1.7. Where possible we have also opted for more sustainable materials with lower carbon emissions during construction. The new structures have been designed to blend in with the valued landscape character of the study area, which has an internationally recognised skyline (see Chapter 7 'Landscape and Visual Amenity') as its backdrop. Where brick cladding to walls is proposed we will be utilising a low carbon cladding system rather than standard brickwork. We are also proposing to use textured ultra low carbon concrete in non-structural applications such as cladding to walls and cappings to sheet piles. We hope to be able to identify low carbon alternatives to stone cladding that can match the aesthetics of the natural product, as technology in this area is advancing rapidly and we have a number of years until construction starts. For example, we are looking into emerging technologies such as ultra-low carbon concrete which can be moulded to imitate stone and other finishes. If we identify alternatives we will consult with local authorities whether they are appropriate for use in locations where stone cladding has been proposed.

Alternative profiles of the ground to ensure maximum diversion of flood water away from the main River Thames while adopting an appropriate hydromorphological profile and maximising wetland habitats, have been explored and the optimum profiles have been incorporated into the Scheme design.

Additionally, we modified the design by adding sections of raised bed in some of the streams, with a fixed height but profiled and designed as riffles, to maintain water levels in areas of ecological sensitivity such as at Hinksey Meadow and Willow Walk Meadow during dry weather.

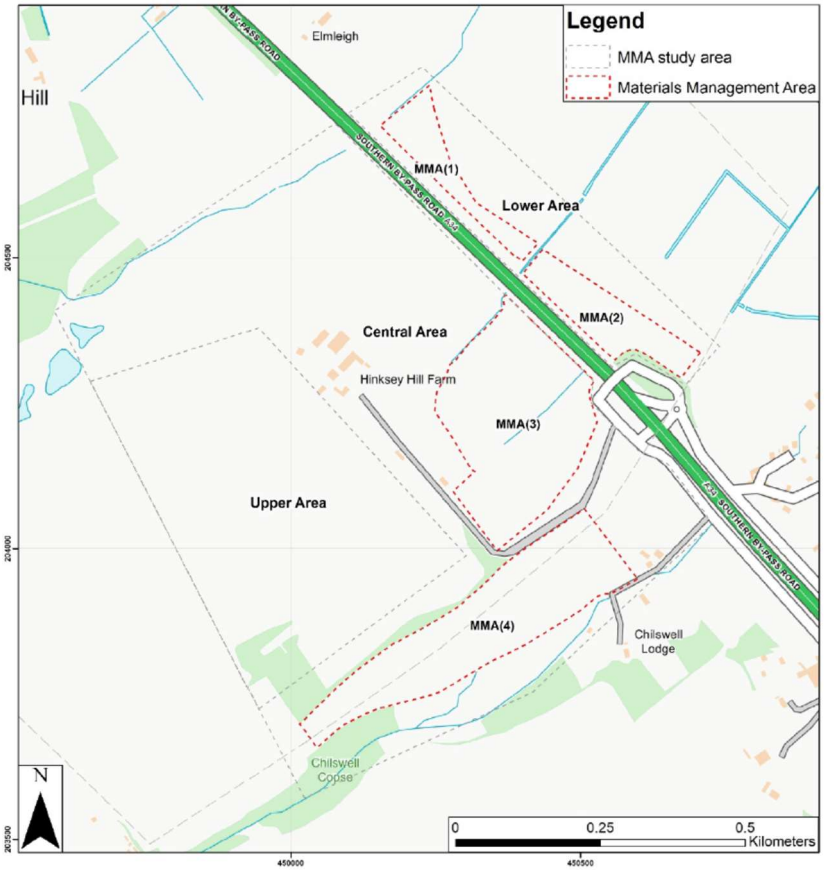
Options for re-use and disposal of materials

- An option was considered to over-dig the gravels along the route of the channel to sell, to help fund the Scheme and enable replacement with some of the excavated material from the Scheme. However, this would limit environmental opportunities within the channel corridor, and potentially have adverse impacts on the groundwater regime.
- The proposed Scheme will re-use some excavated material in the construction of a series of flood embankments at Botley Road, South Hinksey and New Hinksey. This reduces the need for raw materials and reduces carbon emissions, as well as reducing the cost of the Scheme.
- Alternative options for the beneficial re-use of soil were considered:

- Re-use in other flood alleviation schemes we are developing and on other projects such as High Speed 2, local authority and local infrastructure schemes, and private developments. These alternatives have all proved economically unviable at the current time, are located at too great a distance from the Oxford Scheme or the materials are considered unsuitable. However, the suitability of other schemes/sites will be considered if and when they arise.
- Re-use at South Hinksey Golf Course at Hinksey Heights to the west of the A34 was considered but rejected as the site is too small in comparison with the volumes of material arising from the Scheme.
- Several locations for permanent land raising ('material management areas') were considered at South Hinksey Golf Course and to the south of Hinksey Heights, as shown on Figure 2.1. These were not pursued due to a combination of planning restrictions (the sites are in the Green Belt) and engineering considerations relating to the steepness of the slope. See Appendix O 'Materials Management Plan' for further information).

All surplus soils from the Scheme (that cannot be re-used on-site) will therefore be transported to licensed restoration sites. Options for transporting soils are described below.

Figure 2.1: Potential sites for permanent land-raising



Options for soil movement:

- Road transport: for material removed from some parts of the Scheme area, road transport is the only viable option. We have sought access options to allow as

much of the material as possible to go directly onto the A34, reducing the use of busy local roads such as the A420 Botley Road.

- Rail transport: initially rejected due a lack of available capacity within the sidings at the time and concern over the use of the existing access which would clash with ongoing operations at the sidings. However following the change in programme, further discussions with the sidings operator have indicted an opportunity to revisit this option and we have subsequently developed an option which includes a new access; this is presented in Chapter 16. We do not have certainty whether we can proceed with this option and it is the subject of a separate planning application to the main Scheme. The separate planning application will provide us access to the sidings at New Hinksey directly from the site. The application will be taken forward if agreements can be put in place and planning permission is granted. We have reviewed the implications of using rail for carbon emissions and they are marginal; the lower carbon emissions per km of using rail in place of road are balanced by the extra emissions from transporting material longer distances.
- River: barges were considered to remove the material via the River Thames. Due to the size of the river in the Oxford area, and its current unsuitability for fully laden work barges, dredging would be required along a significant section of the river to avoid grounding, and this was not considered appropriate. The river's system of locks also has capacity only for a limited number of barge movements, so this option would only be able to handle a small proportion of the material.

Alternative environmental enhancements

- Recreational rowing lake – an option to provide a recreational rowing lake north of Devil's Backbone as part of the Scheme design was rejected as it was considered to have negative environmental impacts, particularly on existing ecology.
- Devil's Backbone bridge cycleway – various parapet heights for Devil's Backbone bridge were considered. As part of the proposed Scheme, we will raise the parapet to cycleway standards (1.4m) to enable the possibility of the Devil's Backbone footpath being upgraded to a cycleway in the future by a third party.
- New habitats – opportunities were explored to create a new backwater/scrape habitat to the north of Botley Bridge. Alternative alignments for the backwater were considered as part of the second stage channel design.
- The existing Jubilee Scrape (wetland area) in Hinksey Meadows will be modified where it is located within the second stage channel but retained. We considered creating further scrapes at Hinksey Meadows but have decided not to at the request of the landowner. As part of the Scheme design, we have however designed the Scheme to include a considerable number of scrapes and backwaters that will be created in flood meadows to the north of South Hinksey, adjacent to the new channel.

Alternative environmental mitigation

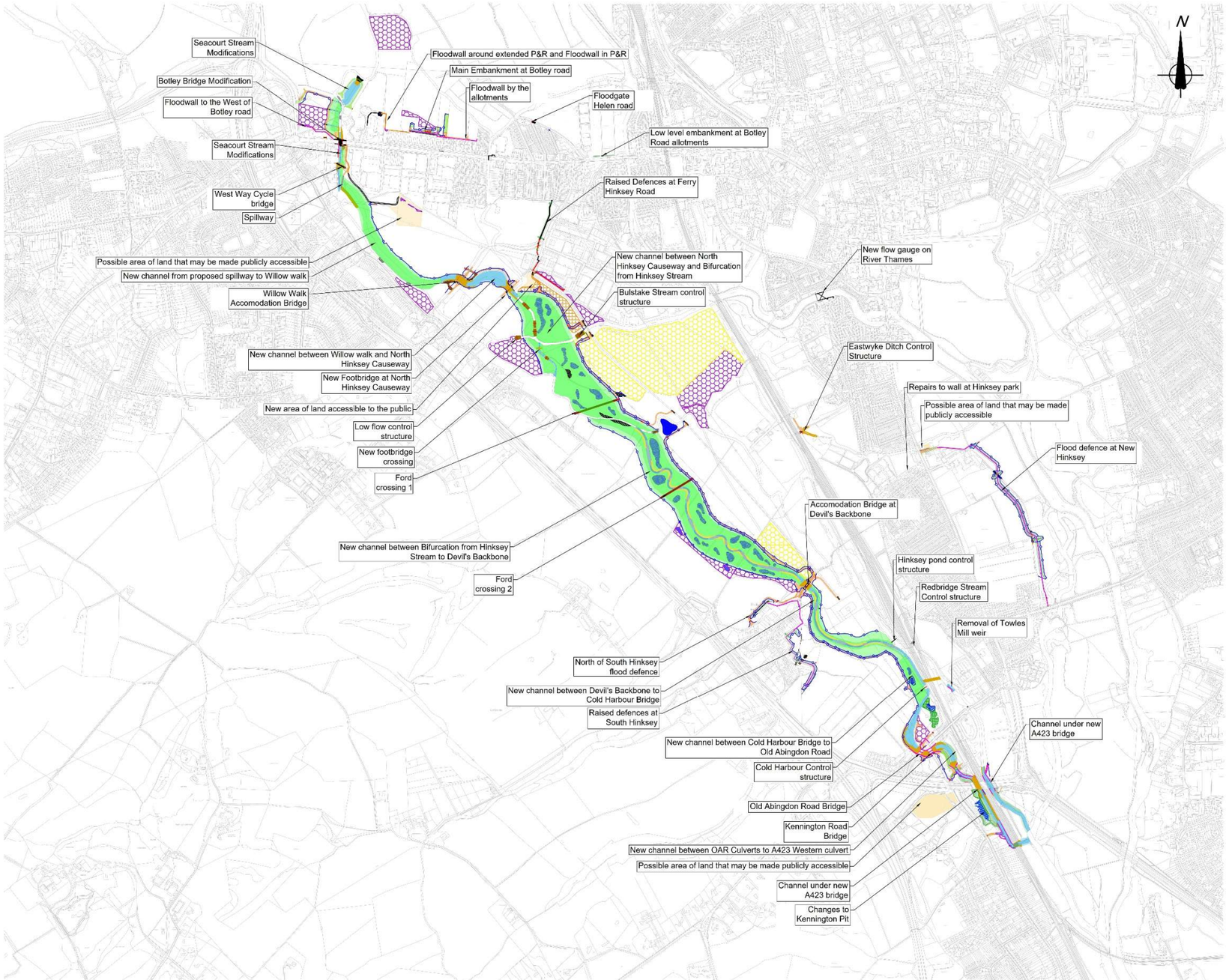
- We have modified our landscape planting proposals since the 2018 planning submission, in particular in relation to the planting of new areas of woodland. We have aimed to ensure the areas of highest value for grassland are retained, while keeping the same area of woodland as in the original proposals. We have also changed some of our proposed species mixes for new planting, particularly of woodland in areas of wet ground, to achieve better results for biodiversity.
- We have modified the design of a pond which we will create outside the second stage channel in the fields between North Hinksey and South Hinksey near the Hogacre Ecopark, so that it provides habitat more similar to that which will be lost at Kennington Pond.

Alternative working methodologies: options were considered to reduce the footprint of temporary access routes and working areas in areas of environmental sensitivity, as well as alternative locations for site compounds. The following alternative working methodologies were selected to minimise environmental disturbance and/or landowner concerns:

- Botley Road – we reduced the width of the haul route access adjacent to the new flood bund at the rear of gardens to the north of Botley Road and east of Seacourt Park and Ride, to minimise disturbance to wildlife and trees.
- Hinksey Meadows – we removed the need for a 20m wide haul route on the eastern side of the second stage channel between the new spillway and Willow Walk to reduce the footprint in the ecologically important Hinksey Meadows and the floodplain meadows to the north of Willow Walk. Instead, the temporary access track will be located predominantly within the footprint of the proposed second stage channel, with the exception of a 1m wide strip to allow fencing to be erected.

Site compound – we re-located a proposed site compound for the Scheme so as to be outside of the Oxford Air Quality Management Area. We investigated the use of several fields for the main contractor's compound and storage area, eventually focusing on three fields to the north of South Hinksey, and subsequently rejecting the most northerly of the three due to its higher ecological value and risk of damage to a Thames Water sewer. We also considered the use of the archery field at the Rugby Club in North Hinksey however this was not viable due to its size and location and the fact it is a regularly used multi-use sports facility which is impractical to use for construction while retaining safe access for sporting activities. Use of fields on the opposite side of the A34 is not practical due to environmental issues and the logistical problem of having to cross the A34 to access the site from the compound area.

Figure 3.1 – Scheme Overview



PLAN

SCALE 1:10000 AT A1, 1:20000 AT A3

0 100 200 300 400 500 600 700 800 900 1000

SCALE 1:10,000 (A1)
SCALE 1:20,000 (A3)
METRES

3 Scheme description

3.1 Description of works

For practical purposes associated with the design and environmental assessment of the Scheme, the study area has been divided into four areas as shown on Figure 3.1 'Scheme Overview':

- North of Botley Road (Area 1);
- Botley Road to Willow Walk North (Area 2);
- Willow Walk to Devil's Backbone (Area 3); and
- Devil's Backbone to the junction with Hinksey Stream and River Thames. Includes New Hinksey and South Hinksey (Area 4)

The proposed Scheme and associated works are summarised below, described in full detail in Table 3.1 and shown on figures in Appendix A:

- Construction of a new channel, between the A34 to the west and the railway to the east, to the west of Oxford city centre. The channel will extend south-easterly from the confluence of the Botley and Seacourt Streams lying approximately 0.6km north of Botley Road, to just south of Kennington (approximately 0.3km south of the A423 ring road). The new channel will carry excess flow from the Seacourt Stream, Bulstake Stream and Hinksey Stream channels during a flood event, thereby reducing the water level in the main River Thames and so reducing the frequency of flooding in built-up areas. The channel will comprise two stages:
    - First stage– a new stream that will look natural and connect with the existing braided network of streams at different points. The new stream will be permanently wet and carry water all of the time; and
    - Second stage – a wide shallow sloped channel created by lowering the ground between 0.5m and 1.2m to one or both sides of the first stage steam. This will slope up gently at the edges to blend in with the floodplain and will remain dry for most of the time. When river levels are sufficiently high, water will flow along the second stage channel. The shallow slope of this second stage channel will create a valuable habitat, a wetland corridor that links wildlife sites. During the winter months this area will become wetter; during large floods, the fields in the existing floodplain alongside the new second stage channel will also continue to be inundated.
- In some local areas, a second stage channel will be constructed without a first stage stream and vice versa. The Scheme also includes:
    - Provision of new flood defences (embankments and walls) to protect properties which would otherwise continue to flood even with the reduced river levels;
    - Provision of new culverts and bridges to cross highways and footpaths to maintain access routes;
    - Installation of flood gates for access (under normal, non-flood, conditions) through the new defences noted above;
    - A new track along much of the Scheme to allow access for maintenance. A proportion of the track will be made into a permissive

path that the public are allowed to use, except when maintenance or other activities would conflict with this.

- Creation of new and/or improved habitat for flora, fauna and fisheries. This habitat creation/restoration forms part of the integrated design of the Scheme to help mitigate habitat losses, to meet WER measures and support England Biodiversity 2020 habitat creation targets e.g. new wetland habitat within the footprint of the second stage channel, new channel connecting the Bulstake and Hinksey Streams, habitat improvements including scrapes, ponds and backwaters. The wetland features in the second stage channel will incorporate a variety of profiles and gradients, to include marginal shelves, steep banks and undulating bed profiles to maximise wetland habitat diversity;
- Removal of Towles Mill Weir which will help to facilitate unimpeded fish passage around Oxford for the first time in over a century;
- Change of use of land for public recreation to provide exchange for existing open space;
- Change of use of land to provide allotments;
- There will be 3 telemetry cabinets located at different points across the Scheme; and
- Eastwyke Ditch flood control structure.

There are four areas of public open space within the Scheme boundary, Seacourt Nature Park, Oatlands Recreation Ground, Kendall Copse community woodland and Kennington Pool Local Wildlife Site. Where land is defined under the Acquisition of Land Act 1981 as open space land and where an acquiring authority is purchasing that land or rights over it which affect its use as open space, subject to several exceptions, suitable areas of other land, known as “Exchange Land”, must be provided in exchange for the affected open space and made available for public recreation.

If any of the open space land and rights over open space land is secured by agreement, there will be no need to use CPO powers in respect of that land or rights over land and therefore to provide the corresponding Exchange Land. In these cases, we would not implement the relevant change of use for Exchange Land granted through the planning permission. This situation may arise on a case by case basis for each area of open space land.

Table 3.1: Description of Scheme
[note reference to left and right bank is based on looking downstream]

Location/ Receptor	Description of Flood Alleviation Works
North of Botley Road (Area 1)	
Seacourt Stream Modifications	• Construction of new second stage channel (a lowered section adjoining the Seacourt Stream) starting at Seacourt Stream, approximately 600m to the north of Botley Road. The new second stage channel will be up to 55m wide with a reduction in ground levels by up to 1.2m.
	• Locally reprofile Seacourt Stream near Botley Bridge to remove sediment and create a continuous graded slope in the channel bed to allow greater water flows under the bridge. These works will not affect flows in the Bulstake Stream, which is fed by Tumbling Bay Weir.
	• Creation of a backwater up to 1.5m deep connected to the channel, which will be wet most of the year and planted with marginal vegetation, designed to retain existing mature trees on left bank of the Seacourt

Location/ Receptor	Description of Flood Alleviation Works
	Stream. An informal grass access track will circle the backwater for maintenance purposes. • Creation of a series of riffles in Seacourt Stream to provide more diverse channel substrates and varied profiles using gravel arisings from new channel works.
	• Removal of 225m length of vegetation and trees, predominantly along the right bank of the Seacourt Stream and within the footprint of the second stage channel. Existing hedgerow on western edge of Seacourt Park and Ride to be retained.
	• Localised reprofiling of left bank to create bays and low level marginal berms, with localised narrowing in places to improve low flow characteristics.
Botley Bridge Modifications	• Lowering of raised channel bed (channel clearance) beneath the bridge to the hard bed and reconstruct in concrete. [It is not practical to widen the bridge, which takes Botley Road over Seacourt Stream]. This will require sheet piling to be installed to form a cofferdam and toe piles. Water will need to be temporarily pumped through the bridge during construction to maintain the flow downstream. Piles will be installed along with rock scour protection. • Provision of a mammal ledge under Botley Road Bridge, on both banks. • Rebuild existing outfall under the bridge • Reinforce wall on right bank of Seacourt Stream, downstream of the bridge below Richer Sounds with a new piled wall clad in brickwork • Vehicle access point on right bank to facilitate debris clearance from the channel
Floodwall and embankment to the west of Seacourt Stream	• Construction of a flood wall (1.65m high (on average), 0.5m wide and 210m long) to the west of Seacourt Stream, to the west of Botley Road (and north of West Way).
Flood defences to the east of Seacourt Stream comprising floodwall in and around extended P&R, main embankment at Botley Road, and floodwall by the allotments	• Construction of a 1.75m high (on average), 0.6m wide and 180m long flood wall (including maintenance strip either side) that extends along the entire southern boundary of the proposed Seacourt Park and Ride extension and further east into the copse. The steel piled flood wall with brick cladding panels will have a 1.5m wide inspection strip on each side for maintenance, and an additional 1.5m buffer zone on the southern side between the inspection strip and the rear of the property gardens. • Linking to the eastern edge of the flood wall, construction of a 130m long earth bund that skirts the rear of residential properties on the northern side of Botley Road, to reduce risk of flooding and cut a flood flow path. The height of this above local ground level varies but is no more than 2m. The earth bund will have a 3m mowing strip at the base on the southern side to provide for a 1.5m inspection strip and a 1.5m buffer zone between the inspection strip and the rear of the property gardens. There will be a 4m wide vehicle access track on the northern side for maintenance vehicles to access the new embankment and for vehicle access to the allotments further east. The new earth bund will incorporate a layer of mesh to discourage badgers and other burrowing animals. • Construction of an additional 225m length, average 1.3m high of flood wall, linking to the earth bund on its eastern side. The flood wall will have a 1.5m wide inspection strip on each side for maintenance, and an

Location/ Receptor	Description of Flood Alleviation Works
	additional 1.5m maximum buffer zone on the southern side between the inspection strip and the rear of the properties. • Two grassed vehicle turning areas will be provided at each end of the flood bund. • Installation of a flood gate at SP 49261 06347 within Botley Road flood wall to allow pedestrian and emergency access to Seacourt Park and Ride extension. • Loss of extensive area of trees. It is currently estimated that there will be a loss of approximately 35 - 40 trees in this area. • Localised ground raising (up to 250mm) to the north of Botley Road on land within the allotments next to the West Oxford Community Centre at Tumbling Bay Walk.
Floodgates at Helen Road and Henry Road	• Installation of flood gates to the footbridges at the ends of Helen Road and Henry Road, adjacent to Botley Park, that restrict (but do not cut-off) flow. • Short sections of new brick wall to infill missing sections of wall to east of Helen Road. • Rebuilding parts of existing walls and minor repairs to existing walls along the right bank of the Osney Ditch within private gardens. • Installation of flap valves on existing drains through the wall along Osney Ditch
Mitigation tree planting	• Planting of three areas of native woodland, as follows: • 2.17ha to the north of Seacourt Park and Ride, at the confluence between Botley Stream and Seacourt Stream, with a temporary 4m wide soft access to the mitigation area, which avoids the tree line. • 0.31ha adjacent to new flood defences, to the west of Bulstake Close allotments, east of Seacourt Stream and north of residential properties fronting Botley Road • 1.09ha adjacent to new flood defences, to the north of Botley Road and west of Seacourt Stream
Allotment gardens	• Creation of a new area (approximately 660m^2) of allotment gardens, to the north of Botley Road and to the west of Bulstake Allotments (as mitigation for the loss of some allotments)
Ancillary works	• Replacement of kerb on eastern side of Seacourt Park and Ride entrance road, adjacent to New Barclay House. Hand-digging to retain trees. • Installation of flap valves on existing drainage outfalls.
Botley Road to Willow Walk North (Area 2)	
Seacourt Stream modifications and new channel between Spillway and Willow Walk	• Construction of a second stage channel adjoining Seacourt Stream (i.e. ground lowering in some areas on the left bank of Seacourt Stream) south of Botley Road initially through the nature reserve at the northern end of Osney Mead Local Wildlife Site (LWS), before creating a short section of new channel to the south of a new spillway (see below). • After diverting the new second stage channel (lowered ground) around the pylon and trees, it will re-join Seacourt Stream to the north of Willow Walk. As the second stage channel nears Willow Walk, it separates from Seacourt Stream again, where it will be narrow and deepen, to pass under a new Willow Walk bridge. From this point on, the new channel will contain water year-round, being a backwater of Bulstake Stream, when the second stage channel is not flowing. As far as possible, construction will be undertaken in the new channel's footprint to minimise impacts on MG4a grassland (with the exception of a 1m width to allow

Location/ Receptor	Description of Flood Alleviation Works
	the installation of temporary fencing during re-establishment of the grass in the new channel and the area nearest to Willow Walk). • The new spillway at the head of this small channel will prevent water from entering it during low-flow periods, when taking water out of Seacourt Stream could cause ecological damage. Our modelling suggests that there will only be water in the second stage channel here during higher flow conditions. • The width of the second stage channel will be kept to a minimum to minimise impacts on MG4a grassland. • Removal of 200m length of vegetation and trees (predominantly on the left bank of the stream). Pollarding of trees bordering car park in Minns Industrial Estate on western side of Seacourt Steam. • Retention of Jubilee Scrape in line of an old channel within the second stage of the new channel. This is a meandering wetland area created as one of several Oxfordshire Jubilee Wildlife Spaces to mark the Queen's Golden Jubilee in 2002. • Creation of riffles in Seacourt Stream to provide more diverse channel substrates and varied profiles using gravel arisings from new channel excavations. Localised low level marginal berms and localised narrowing to improve low flow characteristics. • Construction of a new permanent gravel access track from Botley Road to the pylon to provide access for National Grid.
Spillway	• Construction of new spillway (fixed-crest weir with shallow side slopes) off-take and localised ground re-profiling. The spillway will be wide enough for vehicle use, so that National Grid can access their pylon.
West Way Cycle bridge	• Lengthening of the existing pedestrian and cycle bridge across Seacourt Stream, with the new extended bridge section taking people across the second stage channel.
Tree planting	• New tree planting on right bank of Seacourt Stream, where there are gaps in the trees
New Willow Walk Bridge	• Construction of new bridge over new channel and permanent hardstanding area for bridge maintenance, with new access gates for maintenance vehicles. Alternative options for the surfacing and railings of the new Willow Walk bridge have been discussed with the Local Authority and other stakeholders during the detailed design to ensure the bridge is in keeping with its historic setting and sensitive to the semi-rural landscape of the area. Abutments will be clad with stone or a lower-carbon alternative that is in keeping with the setting. A combination of asphalt and a cobble verge(s) will be used for the path, and a combination of timber and corten steel will be used for the railings. The width of the bridge has been chosen to accommodate the combined usage bridleway with verges to avoid the use of high parapets. The bridge will also be used by maintenance vehicles. • No change to existing stone bridge. Bridleway, cycleway, vehicular and pedestrian access on Willow Walk will be maintained. • Removal of existing flood relief culverts, which will be replaced by the new bridge • Construction of new first stage stream starts at this location, with the second stage channel flowing into it. The first stage stream here will be a backwater, with flow only when there is flow in the second stage channel. • Loss of 30 individual trees of varying sizes including 12 white willows *Salix alba,* and a group of mixed species trees at Willow Walk.

Location/ Receptor	Description of Flood Alleviation Works
	Replanting of trees at Willow Walk to maintain the local landscape character of the area. • We are working with Oxford City Council to develop a long term maintenance plan for Willow Walk; our tree-planting proposals will reflect this arrangement.
Mitigation tree planting	• Planting of areas of native woodland, as follows: • 0.75ha between Seacourt Stream and North Hinksey Lane, adjacent to Willow Walk • 0.03ha to the east of the new second stage channel, to the south of Botley Road Retail Park
Willow Walk to Devil's Backbone (Area 3)	
New channel	• Construction of new backwater channel continues south of Willow Walk to the next footpath (North Hinksey Causeway). The new channel heads eastwards to connect with Bulstake Stream immediately south of North Hinksey Causeway. The new channel north of this point will be a backwater of the Bulstake Stream during normal flow conditions, flowing only when the second stage further north is flowing. • South of the meeting of the new backwater with Bulstake Stream, Bulstake Stream will form the first stage stream with a second stage on both banks. The existing ditch connecting Seacourt Stream to Bulstake Stream here, which does not carry much flow at present, will be severed except during high flows by using a low weir. All flow in Seacourt Stream will continue to flow into Hinksey Stream which we will leave in its current course. • Construction of a new first stage stream approximately 10 metres south-east of the current connecting ditch between Seacourt Stream and Bulstake Stream, which will divert from the route of Bulstake Stream, carrying all the current flow of Bulstake Stream under normal and low-flow conditions. • Provision of a fixed crest control weir in the lower reach of the Bulstake Stream, which will become a backwater of the Thames under normal and low flow conditions but will flow when the level of the Bulstake stream exceeds the height of the weir. The weir will be set slightly above the standard headwater level of the River Thames to ensure water cannot flow from the Thames into Bulstake Stream during low flow conditions when water is needed to keep the Thames open for navigation. The new two-stage channel will flow south and will merge with Hinksey Stream. • Installation of four fixed riffle features to maintain groundwater levels in Hinksey Meadows (to maintain existing groundwater conditions in the MG4a grassland). • Further south, the new channel will diverge from Hinksey Stream (see Figure 3.1 'Scheme Overview'). Most of the combined flow will go down the new channel under normal and high flows, while all will go down the new channel during low flows. Some flow will continue down the old Hinksey Stream (i.e. the section of abandoned watercourse, which will be cut off and is on the downstream side of the new channel), except under low flow conditions when it will just hold water that backs up from the fishing lakes alongside the railway. • Creation of a series of riffles in new and retained channels, to provide more diverse channel substrates and varied profiles using gravel arisings from new channel works.

Location/ Receptor	Description of Flood Alleviation Works
	• We will retain the gravel arisings for re-use in the lining of the bed of Bulstake Stream, if possible; due to limited available gravel we anticipate needing to bring most of the gravel needed in from elsewhere. • Construction of new permanent rough stone access track for maintenance. At one location this will be constructed from grasscrete or similar and be seeded, immediately south of Willow Walk to give a green appearance. Elsewhere, it will be a rough stone track, similar to other farm tracks in the area except that it will be lightly topsoiled and seeded. The track runs along the northern edge of the second stage channel, except in two places where it moves away from the channel in order to cross Bulstake Stream and Hinksey Stream using existing bridges, which currently carry the Electric Road. Where the track joins with the Electric Road, the cable troughs will be bridged by a metal plate for a few metres of its length, in order to protect the electric cables from any risk of damage. • Widening of existing ditches to maximise wetland habitat. • Installation of new fences and planting of hedge along the outside of the access track, except where the track leads away from the second stage channel, where there will be gates across the track. • Creation of new backwaters, ponds and scrapes forming a mosaic of wetland habitats within the second stage channel.
North Hinksey Causeway	• Construction of a footbridge to maintain access along North Hinksey Causeway, faced with stone or a lower-carbon alternative that is in keeping with the setting. Native shrubs will be planted in front to hide the bridge and reduce visual impact. The decking of North Hinksey Causeway footbridge will be timber. The railings will be constructed from a combination of steel and timber. Steel sleeves will form the main post with rectangular vertical and horizontal railings, and there will be timber post inserts and a timber top to soften the visual impact of the overall parapet structure and to enhance the qualities of the rural and historic setting of North Hinksey Causeway.
Control structures	• Bulstake Stream control structure – as described above, new fixed crest low flow structure to divert majority of low flow into new channel, with Bulstake Stream being retained as a backwater during low flows. During flood flows the structure will be submerged. Water levels in the River Thames will be maintained during low flow periods for navigation purposes. The structure will be built using rocks and gravel to give an appearance of a gravel shoal. • Construction of a tilting weir at Eastwyke Ditch - to the east of the railway line, the Eastwyke ditch, which connects to a culvert under the railway line will be fitted with a new electric-powered tilting weir and headwall. This will normally be open but during flood conditions, the weir will close to form a barrier to flood water. It may also be used in periods of very low flows to help retain levels in the River Thames which the Eastwyke Ditch is connected to. • Construction of a new control structure (small fixed-crest weir) where the new channel and the Hinksey Stream diverge.
New footbridge crossing	• New steel and wooden footbridge crossing over the new channel at Bulstake Stream for existing informal path
Ford crossings	• Construction of three (3) new ford crossings (see Figure 3.1), one of which is for maintenance access while the other two are for use by farmers to access their land.

Location/ Receptor	Description of Flood Alleviation Works
Devil's Backbone bridge	• Construction of new bridge with 1.4m parapet height (designed to cycleway standards so the Devil's Backbone footpath could be upgraded by others in the future, if required). This new bridge will also provide a new access to the National Grid 'electric' compound. • Permanent hardstanding area for bridge maintenance. • Handrailing and abutment cladding will be of the same appearance as Willow Walk bridge to give a consistent theme across these two bridges.
Flood defences at Ferry Hinksey Road	• Construction of new earth embankment (180m long, 4m wide crest, on average 1.4m high) with 1 in 3 slopes across Oatlands Recreation ground in a north/south direction, starting at the cycleway on the northern edge of the recreation ground. New permanent grass access track along crest of embankment for maintenance. New ramp will be constructed over embankment across to the recreation ground, for access for the less able and pushchairs. • At the southern end of the recreation ground, the embankment will connect to a new flood wall (315m long, 0.5m wide, on average 1.2m high), which will follow the boundary of Osney Mead Industrial Estate, tying into an existing wall. The new flood wall will require the removal of a light industrial building and re-routing of the public footpath to provide improved access and maintenance access without encroaching on an existing National Grid compound. • Construction of new gates and low ramp in the flood defence to enable continued access along public rights of way and National Grid.
Mitigation tree planting and MG4a habitat creation	• Planting of four areas of native woodland, as follows: • 1.76ha along the southern edge of Osney Mead Industrial Estate • 3.48ha adjacent to Hinksey Stream and Hogacre Ditch, between the new second stage channel and the railway, north-east of Hogacre Common • 0.53ha on land between the Hinksey Stream and Hogacre Ditch adjacent to North Hinksey • 1.49ha bordering the southern boundary of the new second stage channel, just north of Devil's Backbone, to the north-west of South Hinksey. • Translocation and creation/restoration of 17.8ha of MG4a grassland in two new areas, as follows, in addition to replacing 2ha of meadow (1.33ha of MG4) in Hinksey Meadow with non-MG4 meadow: • 15.7ha in an area between Bulstake Stream and Hogacre Ditch, between the new second stage channel and the railway • 2.1ha in an area just north of South Hinksey, between Hinksey Stream and the new second stage channel, of which 1.33ha will be translocated turf from Hinksey Meadow subject to owner's approval.
Devil's Backbone to the junction with Hinksey Stream and River Thames, including New Hinksey and South Hinksey (Area 4)	
New channel and Hinksey Stream / Mill Stream modifications	• Continuation of channel southwards. It will connect with existing ditches through the flood plain and then rejoin the Hinksey Stream at the existing Coldharbour culverts below the railway line. At this point, during floods flows will be split between the existing culverts and the new stream which will channel additional flow down to Old Abingdon Road through the Kendall Copse area and ultimately to Munday's Bridge. • Creation of new backwaters, ponds and scrapes forming a mosaic of wetland habitats within the second stage channel. • Limited channel clearance required to the east of the railway on Hinksey Stream above the confluence with Weirs Mill Stream, and for the western stream at Munday's Bridge under the railway line. This will involve

Location/ Receptor	Description of Flood Alleviation Works
	vegetation removal and minor dredging, with no change to the bank profile. • Modifications to the existing channel at the rear of the first few properties along Kennington Road, upstream of Munday's Bridge, with the channel wall/parapet extending above ground level. • To the west of the railway, the new channel will continue to the ring road, passing through part of the current Kendall Copse. Tree removal required. The channel needs to be water-tight at this location to prevent leaching of pollutants from the former landfill site. Therefore, the channel will need to be engineered to ensure pollution pathways do not open up, however the finishes will use natural materials such as rock and grass reinforced geotextiles above the liner. The southern section of the channel upstream of the A423 bridge will need to sheet piled due to the physical constraints and infrastructure in the area. • Construction of new permanent gravel access track for maintenance.
Control structures	• Control structures/weirs to ensure water levels are retained: 1. Hinksey Pond– new low broad crested weir to maintain water levels in the fishing ponds. 2. Redbridge Stream – new flow control is required to keep water in the stream after it is severed by the new channel. 3. Cold Harbour – low flow control weir to allow existing Hinksey Stream to be favoured at low flows. 4. Removal of Towles Mill weir to increase the flow capacity of Hinksey Stream and to improve fish migration. 5. Additional flow restrictor on entrance to existing channel which runs north between the railway lines.
Use of existing culverts	• Existing culverts under the railway (including a new one constructed in recent years by Network Rail) will direct approximately half of the flow from the new channel to the existing channel east of the railway during flood events while half remains in a new channel to the west. Under low flows the existing channel will be favoured.
Two bridges at the junction of Old Abingdon Road and Kennington Road	• Construction of a new bridge at Old Abingdon Road and a new bridge at Kennington Road – each bridge will have a total span of 20m and will include a central pier. The timing of bridge construction will be phased (except during service diversions) to minimise traffic disruption. A temporary road connection will be provided so that traffic can divert around the road closures required for the two bridges.
A423 rail bridge	• We anticipate that Oxfordshire County Council will have built artificial channels on either side of the railway, larger than the existing channels and with enough capacity to take the full flow required for the Scheme during a flood of 1% annual exceedance probability. The Scheme will connect to these channels in order to cross the A423, with no need for any new culverts.
Changes to Kennington Pit	• Loss of 0.35ha of Kennington Pit to accommodate a widened channel and embankment. Reinstated areas of pond will be smaller than existing but reprofiled to mitigate for some of the loss, creating more varied pond profiles. A new off-line pond will be created in Area 3 of a similar size and depth to the original Kennington Pit as mitigation, along with a number of smaller off-line ponds within the second stage. • New scrub/tree planting and natural regeneration upon Scheme completion

Location/ Receptor	Description of Flood Alleviation Works
Flood Defence at South Hinksey	• Construction of permanent flood defence (embankment and wall up to 1.5m above ground level) at South Hinksey to replace the existing temporary defences. • Provision of ramps over defences to maintain existing highway and public footpath access, with suitable slopes for pedestrian or vehicle access as appropriate. All existing public footpaths will use ramps with slopes of no more than 1 in 12; in some places minor diversions of the path will be required to achieve this or to avoid the embankment completely. • Where the wall is constructed using sheet piling or concrete, it will be faced with stone or a lower-carbon alternative that is in keeping with the setting, to reduce visual impact. • Closure of existing farm access to fields and National Grid pylon compound. Construction of 500m long, 4m wide new stone access track around the north of Manor Farm for improved maintenance access for National Grid and Environment Agency to avoid need to go through farmyard.
Flood Defence at New Hinksey	• Construction of 2m high flood wall (245m long, 0.5m wide) to the north of (and parallel to) the access road off the A4144 Abingdon Road, adjacent to Oxford Spires Hotel. • Construction of new ramp (constructed from locally won materials) taking the access road to the Oxford Spires Hotel over the flood defence and maintaining pedestrian access to the River Thames for those with existing access rights. • Construction of 700m length of new earth bund (on average 1.5m high, 4m wide crest) using locally won materials, extending from the hotel access road to the south-eastern extent of Cowmead allotments, and set back from field margin to avoid damage to mature trees. The new earth bund will incorporate a layer of mesh to discourage badgers and other burrowing animals. • New 2m high floodwall (140m long) extending from the southern end of the embankment and tying into road embankment at Donnington Bridge. Due to limited space between Weirs Mill Stream and residents' gardens, maintenance access will be only 1.5m wide on both sides of the wall. • Towards the northern end of the earth bund, the existing field drainage ditch will be routed under the embankment in a culvert and a new field drain will be dug, so that both sides of the embankment drain. At the south end, the drain will be diverted around the embankment, with most of the existing ditch left in place to provide local drainage. 'Redundant' ditch lengths to be in-filled. • Provision of two access ramps for the landowner's use. • New flap valves on the existing headwall on the ditch outlet on the south side of Weirs Lane in the Weirs Mill pool to prevent back flow.
Mitigation tree planting	• Planting of three areas of native woodland, as follows: • 0.22ha of woodland to the north of Old Abingdon Road between the railway and the new second stage channel • 0.31ha at Kendall Copse (east and west) • 0.48ha to the south of the A423 and to the east of the railway
Throughout study area	
Diversion of services	• Diversion of cables and pipes to cross new channel and new alignment of some services across new bridges.
Mitigation strategies for	• Mitigation strategies for protected species have been produced; see Section 8.3.2 and Appendices D-13, D-23, D-24 and D-25.

Location/ Receptor	Description of Flood Alleviation Works
protected species	
Hydrometric stations	• Upgrading of the existing telemetry cabinet at Bulstake Bridge on Botley Road. Installation of two new telemetry cabinets; one at Botley Bridge on Botley Road and one at Marlborough Road on the River Thames. These will be used for monitoring the flow in the various watercourses to enable the performance of the Scheme to be monitored. They will comprise permanent moss green coloured steel freestanding telemetry cabinet with typical dimensions 1.4x0.85m in plan and 1.5m high. These will be sited on a concrete base and be protected with a 1.8m palisade fence around them. An access track will be provided for the Botley Bridge site.

3.2 Construction

3.2.1 Construction duration and working hours

The implementation of the works will be split, the section of the Scheme to the north of Old Abingdon Road will be commenced first and the section south of Old Abingdon Road will be commenced once the replacement A423 Kennington Rail Bridge has been replaced by Oxfordshire County Council. We estimate works to the north of Old Abingdon Road, which includes the main earthworks for the Scheme, are estimated to take three calendar years. Within the three years, the majority of the works will be undertaken during a 15 month period due to the need for a winter break each year when the ground is too wet. Works south of Old Abingdon Road will follow on once the A423 bridge replacement has been completed, with the main compound moving from South Hinksey and two more local compounds in Kendall Copse and Redbridge Park and Ride being used.

There will be several months of work on site before the main works start, which will involve setting up facilities, diverting/protecting services, carrying out environmental mitigation works and removing vegetation. After the earthworks period, there will be a third year in which further heavy construction activities will be needed, including constructing flood bunds and walls. Overall, we expect the works will take five years.

The working hours for the construction of the Scheme will be 7.00am to 7.00pm Monday to Friday and 8.00am to 1.00pm on Saturdays (with piling works restricted to 8.00am – 6.00pm Monday to Friday). We will avoid construction activities on Sundays, Public Holidays other than in emergency or other exceptional circumstances. Note that, if the rail sidings are used, there will be work outside these hours, confined to the rail sidings (see Chapter 16).

The proposed Scheme will employ up to an estimated 100 staff on site at the busiest point during construction of the Scheme.

3.2.2 Working areas

The contractor will use all areas within the red line boundary for access and as temporary working areas. The main haul road for HGVs moving around the site will be stone-surfaced in order to reduce issues with mud and dust. Some materials, particularly topsoil, will be stored near where work is taking place; longer-term stockpiling will be at the main construction compound, immediately north of South Hinksey (see Figure 3.2). This compound will also hold the contractor's site offices and welfare facilities and will have limited parking; most staff accessing the compound will arrive via bus transport from one of the Park & Ride car parks.

3.2.3 Indicative construction methods

Excavation of channel

The main channel will be dug using 35 to 50 tonne 360-degree excavators. Each area will be dug and reinstated (including topsoiling) before opening a new area, with the exception of the connections between the existing streams and the new first stage stream which will be the last parts of the Scheme to be dug. The ground conditions will be wet and soft, restricting the size of plant that can run over areas stripped of topsoil. Topsoil will be stored locally in the fields it is removed from, for later reinstatement. Any surplus soil will be loaded on to dump trucks and taken to the South Hinksey compound, utilising the temporary haul road constructed within the Scheme area. The surplus soil will be stockpiled at the compound, ready for removal off site to restoration sites. Where possible, material will be loaded directly to lorries and removed from the Scheme area.

The material excavated from the former landfill site at Kendall Copse (Area 3) will be loaded directly to lorries and taken off site to a licensed tip as controlled waste, to prevent any contamination or leachate into the ground.

Construction of flood defences

The earth flood bunds will be constructed using materials sourced from other parts of the Scheme area where possible. The material will be levelled with bulldozers and compacted with heavy duty rollers. The side slopes will be cut after compaction of the material. The topsoil previously stockpiled locally in the area will be replaced once the bund shaping has been completed.

The bund to the north of Botley Road will be constructed using material (approximately 2,000m^3 of clay) sourced from Area 2, which will be transported by lorry to Area 1. The footprint of the new flood wall and associated working area to the north of Botley Road will be stripped of topsoil using excavators and stockpiled on site. This soil will be reused following construction, to reinstate the ground either side of the proposed wall and the bund. The wall will be cast in situ using conventional formwork, casting the base/toe first and then the wall.

At New Hinksey, part of the new wall will need to be constructed in the garden of a bungalow where access will be restricted to small plant. The construction of the wall will be designed to accommodate the limited access. The material for the new earth bund at New Hinksey will be sourced from Area 2.

Piling work

Where possible a standard excavator mounted vibratory piling rig will be used to install piles; the size of the rig will depend on the length and weight of the piles and the radius the machine is working in. Traditional piling techniques with a crane mounted percussive hammer will be used for areas where reach/pile lengths are beyond what the vibratory can achieve. In areas of noise sensitive receptors and close to buildings or railways, a silent type silent/vibration free system may be required to minimise damage and noise, this pushes the piles into the ground using hydraulic rams but is much slower than other methods. Using a silent piling technique will require a crane to feed each pile to it from a stockpile as work progresses.

In-channel clearance

Although the majority of the channel of the existing watercourse will remain some limited quantities of material will be removed from the existing channels. This is to widen

channels in specific limited and localised areas, these areas are shown on the plans, to facilitate additional flow capacity. In some locations, access can only be gained using a long-reach or from working in the channel so a floating platform will be used to put the excavator on, or floating plant will be used. Some of this material will be very wet and silty and will be loaded onto a barge and transported to an offloading area. At the offloading area, if no storage area is available then the material will be reloaded to sealed lorries for transportation off site. Where possible, the material will be left on site to drain before reloading, to reduce the need for sealed lorries. Where direct access to the side of the existing channels is possible, the material will be loaded onto dump trucks and taken to the storage area.

Bridges under public highways

The two bridges at the junction of Old Abingdon Road and Kennington Road will each require the existing road junction to be closed for an extended period. We will build a temporary carriageway on land at Kendall Copse (see Figure 3.3) to allow vehicles to continue to use the route while either of the road closures is in place. We will program the works so that there is no occasion on which both closures are in force.

3.3 Access routes

The main access routes used by all construction vehicles will be as follows:

- The A34 via the A420 Botley Road/West Way in Area 1 (providing access for construction traffic using Areas 1 and 2).
  Area 1 will be accessed from the Park and Ride site via the main Area entrance/exit off the A420 West Way and via the Park & Ride Exit off Botley Road. As the access currently hosts Park and Ride service buses, its present arrangement will enable its use by construction traffic with minimal alteration. As construction traffic will share the access with bus services, HGV movements will be carefully controlled to avoid interference with public transport efficiency.
  Botley Road will also provide a minor access point for the works at the Northern end of Area 2.
- The South Hinksey Interchange on the A34 in Area 3 (providing access for construction traffic in Areas 2, 3 and 4).
  We will construct a stone-surfaced internal haul road along the length of the proposed channel within the main body of the Scheme area (Areas 2, 3 and part of Area 4), which will allow most HGVs to access the A34 directly from the Area 3 entrance/exit at the South Hinksey junction. This arrangement will act to limit the volume of vehicles travelling along locally sensitive highway routes such as the A420 Botley Road and Abingdon Road, and avoid HGV movements through South Hinksey village. The site entrance / exit will be via the existing field gate next to Manor Farm Road off Parker Road (see Figure 3.2). We will improve the access into the field from this gate to accommodate the large amount of heavy traffic which will need to use it. We will use wheel-wash facilities to clean vehicles before accessing the A34.
- Old Abingdon Road and the A4144 Abingdon Road in Area 4 (providing access for construction traffic in Area 4 only). Access to the works and compound at New Hinksey, east of Abingdon Road will be taken from Abingdon Road via the existing route to the University College Boathouse. The entrance from Abingdon Road will require widening to allow construction traffic to pull in off the main road. Temporary access tracks will be laid across the fields on the line of the new bund at New Hinksey to allow construction vehicles to travel the length of the bund.

A number of temporary ‘construction’ access points will be constructed for the Scheme due to the large area covered by the construction works. Of these new accesses, the

majority will be minor accesses onto roads, continued access into fields, access to car parks and access for emergency services. However, the following accesses will form the major highway interfaces for the bulk of construction traffic:

- Shared use of the Seacourt Park and Ride site main access on Botley Road (using a one-way system off the bypass slip via a field gate and then out again via the Park and Ride).
- Continued use of existing field access on eastern side of Parker Road 30m south of the A34 slip road roundabout.
- Upgrade of the existing track off eastern side of Abingdon Road opposite Hinksey Park alongside the Spires Hotel.
- Western end of Old Abingdon Road for works in this location.

Some of the works will require use of other access routes, particularly excavation north of Botley Road (which will be via the Seacourt Park and Ride to utilise the traffic light signals) and south of Old Abingdon Road (via Abingdon Road), plus construction of the New Hinksey embankment (via the track alongside the Spires Hotel).

3.4 Vehicle movements

We have estimated the total number of vehicle movements for various locations throughout the Scheme area during the construction of the Scheme. These are presented in Table 11.3 and the Traffic Assessment in Appendix M.

3.5 Materials management and movement

We will build the embankments mainly using material excavated as part of the Scheme. This will use only a small proportion of the material and it is assumed that approximately 360,000 cubic metres of alluvium, gravel, topsoil and other materials will need to be taken offsite to restoration sites. We have prepared a Materials Management Plan for the Scheme, which is presented in Appendix O.

3.6 Operation and maintenance

We have designed the Scheme to operate passively, with no need for regular operation by our staff. Most maintenance visits after construction is complete will be for habitat management (see section 3.8) and to look after the cattle grazing in the second stage channel. Unlike the weirs on the main River Thames, there will be no need for regular adjustments to the weir heights in line with changes in river level. Our staff will however visit regularly to check the channel for blockages and to monitor how the landscape planting and environmental mitigation measures are doing (see chapter 17).

When our staff need to bring vehicles onto the site, for example during scrub clearance, they will use the maintenance access tracks and highway accesses shown on Figure 3.1. As there will be permissive public use of the section of the track between Osney Mead and Devil's Backbone as a footpath, we may sometimes need to close this path for safety reasons. However in most cases we anticipate that vehicles used will be able to use the track while members of the public are using it; we will impose a speed limit on our vehicles whenever the track has not been closed.

3.7 Landscaping works and habitat management

Once the Scheme is constructed, we will be returning some areas to the current landowners, signing agreements to cover habitat management where necessary. However, much of the Scheme area will remain in the ownership of the Environment Agency because of the impracticality of multiple landowners managing land in the second stage channel where boundaries cannot be permanently fenced because of the risk of trapped debris during floods.

We propose to manage the vegetation and habitats in the second stage channel through conservation grazing in the summer months. This will be with a breed of cattle suited to floodplain grazing marsh, such as the Belted Galloway. The cattle will be managed in such a way that they can quickly be moved to higher ground if the second stage is predicted to flood while they are present. We intend to use the same herd in late summer for aftermath grazing (grazing that takes place once the hay has been cut) the areas of species-rich floodplain meadow, which are going to be created as part of the Scheme. We have included a new ford across the existing Hinksey Stream to allow the cattle to be moved from the second stage channel to an exit location close to Devil's Backbone in the event of high river levels during the grazing season.

We have produced a Landscape and Habitat Creation: Delivery and Management Plan (see Appendix I), which sets out the long-term landscape and habitat management proposals for areas of land affected by the Scheme and for the proposed habitat mitigation areas. The plan includes Landscape Maintenance Operations Schedules and provides detailed management guidelines for the first 25 years in respect of all soft landscaping areas. It also provides outline guidelines for maintenance beyond the first 25 years to ensure the delivery of biodiversity net gain.

For land which will remain in our ownership, including the new parts of the first stage stream and most of the new second stage channel, we have formed a collaboration with the environmental charity Earth Trust and we are working with them on our plan for the long-term environmental benefits of the Scheme. The landscape and habitat creation work will initially be carried out by a landscape contractor before being handed over to a local environmental partner. Once we are near construction, we will work in partnership with a local environmental organisation to secure dedicated specialist resources for this long-term habitat maintenance. They will also ensure there are opportunities for local people to be involved in its management and future use and will promote opportunities for health and wellbeing and scientific research. For land which we will return to its current landowner, we will provide landowners with our plans but it will be up to them whether they wish to follow the plans once the 5-year maintenance period is over.

At Willow Walk, we are working with Oxford City Council Direct Services to develop a maintenance plan that will enable them to undertake pro-active management and succession planting along the full length of Willow Walk, with a view to improving the appearance of this important landscape feature in the long-term.

4 EIA methodology

4.1 Scoping methodology

We prepared a scoping technical note (September 2016) to provide a record of the initial environmental scoping of the early Scheme design, and to assist the planning authorities in the determination of an EIA Scoping Opinion. A formal Scoping Determination (see Appendix B) was received from Oxfordshire County Council in November 2016 that outlined the scope of the statutory EIA required under the Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 2011.

We prepared a Preliminary Environmental Information Report (PEIR) (January 2017) to provide a record of the options appraisal process and a summary of the environmental scoping of the early Scheme design. A summary of this PEIR was prepared and submitted as an 'Environmental Update Technical Note' to Oxfordshire County Council in May 2017 to accompany a request for formal pre-application advice. This Environmental Update Technical Note (see Appendix B) took into account comments made in the formal Scoping Opinion and provided an update on changes to the Scheme since the Scoping Opinion.

A summary of the key issues and potentially significant effects relevant to the Scheme, identified during the scoping stage and through the subsequent pre-planning application, is provided in Table 4.1. We have assessed these issues during the EIA process, both in the ES for the 2018 planning application and in this ES for the revised Scheme.

Table 4.1 Scoping of environmental topics in and out of further assessment for the Scheme

Key Issues
Local Community
• Temporary noise/vibration from construction plant and increased traffic • Socio-economic impacts of Scheme on people, shops and businesses • Impacts on health of temporary loss of recreational land/footpaths • Changes in air pollution on public health during construction, operation and ongoing maintenance • Operational effects on health through changes in recreational use of the area and potential for changes in commuting by walking or cycling • Health impacts associated with exposure of existing ground contamination Scoped out • Baseline noise surveys • Noise and vibration during Scheme operation • Health surveys
Recreation and access
• Impacts on recreation, green belt, recreation space and navigation and safety during construction • Positive recreational outcomes • Impacts on public access (public open land, public rights of way, permissive paths and other informal access routes) and associated recreational users, existing residents, tenants and businesses along the river corridor

Key Issues
Landscape and visual amenity
• Impacts on the visual amenity of sensitive visual receptors with views of the Scheme, both during the construction works and operation • Impacts on protected views in Oxford, and views looking out from high points in the city and inwards; reference to Oxford View Cones • Changes in local landscape character, National Character Areas and value of rural floodplain meadows • Impact on iconic landscape and green belt, and links to GI study • Impacts of construction, altering topography and associated vegetation, new structures and channels on the baseline landscape and cityscape potentially affected by the works, during construction and operation • Summary of historic influences on landscape character and changes in heritage landscape • Landscape and visual mitigation through integrated Scheme design, use of locally appropriate hard/soft landscape works and careful consideration of the aesthetic appearance of flood defences in sensitive areas • Changes in important landscape resources
Flora and fauna
• Integrating Scheme design with habitat management and creation • Temporary and permanent impacts on designated nature conservation sites, Conservation Target Areas and Eco Park • Assessing impacts on international sites - Habitat Regulations Assessment • Terrestrial and wetland habitat losses and gains (habitat creation) • Impacts on groundwater sensitive habitats and MG4a grassland • Impacts on other terrestrial habitats including trees (reference to arboricultural survey), hedgerows and community woodland • Impacts on wetland Priority Habitats during the construction works including severing of ponds and watercourses • Impacts on protected and notable species including otter, water vole, creeping marshwort, great crested newt, badger, reptiles and bats, hedgehog, toad, mussels and aquatic macro-invertebrates • Impacts of construction on fish passage and in-channel construction works and permanent impacts of improved fish passage and providing appropriate mitigation including timing in-river channel works to minimise disturbance to migratory and spawning fish • Management of invasive species Scoped out • Habitats assessed to be of low or negligible value • Hedgehog and toad surveys as these are not protected species; Thames Valley Environmental Records Centre data for hedgehogs and toads will be included and records of breeding ponds for toads will be obtained from the local Froglife group • Terrestrial invertebrate surveys but consideration of the impacts on these species will be discussed with regard to their habitat

Key Issues
Water and hydromorphology
• Impacts on watercourses; notably River Thames, Seacourt, Bulstake, Osney and Hinksey streams, and their geomorphology • Changes in flood risk and Flood Risk Assessment • Changes in flows and water levels (and associated impacts on ecology, navigation etc) • Impacts on groundwater regime (with associated impacts on ecology) and changes in flood risk to residential areas due to groundwater • Groundwater modelling during normal flows, low flows and floods • Changes in water quality during the construction works, as a result of sediment bound contaminants being mobilised into the water column, and from increased suspended sediment • WER assessment to consider impacts on the existing condition of the river bed and bank, the potential for new modifications (i.e. new defences) to conflict with other morphological modifications already in place • Opportunities for improvements to water bodies
Cultural heritage
• Impacts on Old Abingdon Road Culverts Scheduled Monument and areas for potential high value unknown archaeology, e.g. Old Abingdon Road, Ruskin's Walk and North Hinksey Causeway • Assessing impacts and mitigation on heritage identified in the archaeological desk-based assessment and following archaeological field survey • Effects on settings of cultural heritage features including the Scheduled Monument, Conservation Area at North Hinksey, a historic settlement at South Hinksey and Listed Buildings • Impacts on the cultural heritage value in the use of the fields for recreation and of the River Thames for navigation Scoped out • Archaeological impacts on completion of Scheme
Traffic and transport
• Impacts on road network, likely volumes of material and proposed routes of access for construction delivery vehicles • Materials management and traffic management Scoped out • Traffic during Scheme operation
Sustainable use of land
• Impacts on geological sites • Soils and the ecosystem services they provide as a natural resource • Changes to current and proposed land uses • Impacts on agricultural use, farm structure and viability (e.g. continuation of current farm practices) from direct land-take, from change in the nature of the soil in the second stage channel and from severance effects, and agricultural improvements • Geotechnical risks and potential for the disturbance of contaminated sediments/made ground and land contamination, with links to associated risks to aquatic life Scoped out • Land contamination during Scheme operation; the channel has been designed to be water-tight where it passes contaminated areas, thus ensuring that engineering measures avoid leachate entering the new channel and thereby reaching the main river • Financial losses to landowners or tenants, since these will be compensated as part of the Scheme • Soil sampling of contaminated land areas
Air quality
• Air pollution resulting from increased traffic emissions due to construction vehicles • Increased dust emissions from the excavations and from temporary storage areas • Impacts on Air Quality Management Areas (AQMA) and residential areas within AQMAs

Key Issues
Scoped out • Baseline air quality surveys during the EIA – six months of air quality surveys will be undertaken pre-construction and during construction • Air quality during Scheme operation as there is no mechanism for significant effects to be generated during operation
Carbon and sustainability
• Carbon dioxide emissions from construction and management and carbon footprint • The use of excavated material for flood defence construction and opportunities to reduce waste, recycle and beneficial re-use of materials, including land raising • Opportunities for re-use of excavated materials within the Scheme Scoped out • Carbon management and sustainability during Scheme operation • Climatic factors during Scheme operation

4.2 Baseline information

Environmental baseline information for the study has been collated from, or reported in:

- Previous reports and existing studies including the Green Infrastructure Strategy (Gillespies 2016)
- Local authority data including:
    - Oxfordshire County and National Highways traffic counts, traffic collision, traffic flow and speed data (Appendix M)
    - Baseline air quality data available from Oxford City Council and the VoWH District Council and information held on the Defra website (https://uk-air.defra.gov.uk/aqma/list).
- Desk-based assessments as part of this EIA including:
    - Archaeological Desk-Based Assessment– Appendix J-2
    - Heritage Statement – Appendix J-3
    - Habitat Regulations Assessment (HRA) Screening Report– Appendix K
    - Water Framework Directive (WFD) Compliance Assessment (CH2M 2017a)
    - Water Environment Regulations (WER) Compliance Assessment – Appendix L
    - Flood Risk Assessment (Jacobs 2021a)
    - Transport Statement – Appendix M
- Modelling work as part of this EIA:
    - Groundwater modelling (ESI 2018)
    - Fluvial modelling (Jacobs 2021a)
    - Air quality modelling (Appendix H)
- Surveys as part of this EIA including:
    - Archaeological trenching throughout Scheme area
    - Archaeological Geophysical Surveys (2016, see Appendix J-5)
    - Old Abingdon Road archaeological fieldwork and reporting – Appendix J-6
    - Geoarchaeological Assessment Report – Appendix J-4
    - Pre-development Arboricultural Survey and Arboricultural Impact Assessment (2017, updated and extended 2020) – see Appendix F
    - Hinksey Meadow/Osney Mead Botanical survey (T. J. King, Wolfson College, Oxford University, 2016)
    - Creeping marshwort survey information (annual surveys made available by Dr J A Webb)
    - Wintering bird surveys (2017) – see Appendix D-6
    - Breeding bird surveys (2017) – see Appendix D-5

- Invasive species surveys (EcologyLink 2020) – see Appendix E
- Habitat and plant surveys (2020) – see Appendices D-2 and D-3
- Reptile survey (CH2M 2020) – see Appendix D-14
- Badger survey (2020) – results are in Appendices D-7 and D-8, but are confidential and so not published
- Fish surveys, using a combination of run catch-depletion and environmental DNA (eDNA) – see Appendix D-21
- Great crested newt surveys (2020) – see Appendix D-15
- National Vegetation Classification (NVC) survey (2020) – see Appendix C-4
- Water vole and otter survey (2016) – see Appendix D-16
- Water vole surveys (2018 & 2020) – see Appendices D-17 and D-18
- Otter surveys (2018 & 2020) – see Appendices D-19 and D-20
- Bat surveys (CH2M 2016, 2017 & 2020) – see Appendices D-10, D-11 and D-12
- Aquatic invertebrate and mussel survey (2016) – see Appendix D-1
- Kennington Pit Macrophyte Plant Surveys (2017 & 2020) – see Appendices D-2 and D-3
- Hinksey Ponds Plant and Invertebrate Surveys (2017) – see Appendix D-22
- River Habitat and River Corridor Surveys– see Appendix D-4
- River Condition Assessment – see Appendix C-6
- Soil Resource Survey (2017) – see Appendix P

- Consultation with Environment Agency specialists, key consultees, landowners and the general public (see Section 2.2) to help identify relevant environmental features in the study area and understand the key issues and interactions between receptors, to inform the route alignment and to help influence the design of the Scheme.

4.3 Assessment methodology

4.3.1 General approach

The following procedure was used to assess and evaluate the environmental impacts of the Scheme during the detailed design stage and production of this ES, except where separate technical assessment methodologies have been defined in the sub-sections below:

- Mapping of receptors and environmental resources likely to be affected by the implementation of the proposed Scheme.
- Overlay of the Scheme onto relevant baseline information. This provides a baseline against which the environmental effects of the Scheme can be measured and assessed for each receptor during the EIA.
- Identification of the value or sensitivity of the environmental resource according to the criteria in Table 4.2.

Table 4.2: General criteria for classifying the value or sensitivity of environmental resources or receptors

Value	Criteria
Very High	International importance
High	National importance
Medium	Regional/County importance
Low	District/Parish importance
Negligible	No listed importance

- Consideration of the interactions of the development with the environment, to identify the potentially significant impacts (e.g. physical change) as a consequence of the Scheme during both the construction and operational phases.
- Assessment of the magnitude of the potentially significant impacts on receptors or environmental resources using the criteria presented in Table 4.3. Magnitude is assessed on a seven point scale and includes the timing, scale, duration and nature (i.e. positive or negative) of the effect.
- Evaluation of the significance of the potential impacts on receptors and environmental resources based on their value or sensitivity and the magnitude of the potential impacts using criteria shown in Table 4.4. These may be modified to be receptor-specific.
- Consideration of the duration (temporary or permanent) of the impact.
- Where necessary, establishment of appropriate mitigation measures to ameliorate or reduce predicted significant impacts to an acceptable level.
- Identification of integrated design opportunities to include socio-environmental improvements and multiple benefits.
- Identification of the potential residual impacts of the mitigated Scheme.

Table 4.3: General criteria for classifying the magnitude of environmental effects

Magnitude	Definition
Major negative	Impact with serious consequences and/or on a large area
Moderate negative	Impact with undesirable consequences
Minor negative	Discernible negative impact and/or on a small area
Negligible	No impact or no discernible impact
Minor positive	Discernible positive impact and/or on a small area
Moderate positive	Impact with favourable consequences
Major positive	Impact provides substantial gains and/or on a large area

These criteria have been used to assess the impacts of the Scheme presented in this ES and have helped to identify appropriate mitigation where significant adverse impacts have been identified, and positive environmental outcomes.

Each technical chapter defines its own individual study area for assessment purposes. The Scheme area, which refers to the overall permanent and temporary working areas of the Scheme, is described in Section 1.2 and shown on Figure 1.3.

A significant effect under the meaning of the EIA Regulations is assessed in this ES to be moderate or major adverse.

Table 4.4: Assessment of significance of environmental effects and residual effects

	Value/Sensitivity			
Magnitude	Very High	High	Medium	Low
Major negative	Major adverse	Moderate adverse – Major adverse	Moderate adverse	Minor adverse – Moderate adverse
Moderate negative	Moderate adverse – Major adverse	Moderate adverse	Minor adverse – moderate adverse	Minor adverse

	Value/Sensitivity			
Magnitude	Very High	High	Medium	Low
Minor negative	Minor adverse – moderate adverse	Minor adverse – Moderate adverse	Minor adverse	Minor adverse
Negligible	No impact			
Minor positive	Minor beneficial – Moderate beneficial	Minor beneficial – Moderate beneficial	Minor beneficial	Minor beneficial
Moderate positive	Moderate beneficial – Major beneficial	Moderate beneficial	Minor beneficial – Moderate beneficial	Minor beneficial
Major positive	Major beneficial	Moderate beneficial – Major beneficial	Moderate beneficial	Minor beneficial – Moderate beneficial

4.3.2 Local community

The assessment of impacts on the local community follows the broad assessment methodology outlined in Section 4.3.1, with the exception of Table 4.2, which classifies the sensitivity and value of receptors. The 'local community' assessment has assumed that 'people' and 'residential, commercial and community buildings' have a 'very high' value or sensitivity, based on professional judgement. Utility services are considered to have a 'low to medium' value or sensitivity due to their district/regional nature.

4.3.3 Landscape and Visual Impact Assessment

The methodology used in the preparation of the landscape and visual impact assessment (LVIA) is based on the principles set out in the Guidelines for Landscape and Visual Assessment (GLVIA3) (Landscape Institute and Institute of Environmental Management and Assessment 2013) and guidance from Natural England on landscape character assessment (Natural England 2014).

A review of aspects of national and local planning guidance and policy relevant to the landscape and visual amenity effects of the proposed development is included in the LVIA.

The baseline landscape and visual conditions are identified, against which the changes made by the proposed development are assessed. Landscape and visual baselines and effects are identified separately although there will be a degree of overlap between the two in almost all cases.

Landscape baseline

The landscape baseline describes the wider landscape "its constituent elements, its character and the way this varies spatially, its geographic extent, its history (which may require its own specialist study), its condition, the way the landscape is experienced, and the value attached to it" (GLVIA3, 2013).

The landscape baseline is established through desk study and field work. It includes a consideration of the key characteristics of the wider landscape with reference to published landscape character assessments at a national, regional and local level where available. Elements and features within the site and the wider landscape are identified. A number of landscape receptors are identified; these include:

- Landscape character areas;

- Designated landscapes; and
- Individual landscape elements or features.

The baseline description includes establishing the value of the site and the wider landscape. The factors that can influence the value of a landscape include its landscape quality, scenic quality, rarity, representativeness, conservation interests, recreational value, perceptual aspects and cultural associations. *"This means the relative value that is attached to different landscapes by society, bearing in mind that a landscape may be valued by different stakeholders for a whole variety of reasons. Considering value at the baseline stage will inform later judgements about the significance of effects……. A review of existing landscape designations is usually the starting point in understanding landscape value, but the value attached to undesignated landscapes also needs to be carefully considered."* (GLVIA3, 2013).

Assessment of the significance of landscape effects
GLVIA3 stipulates that the assessment of the sensitivity of landscape receptors (on the Schemes area and in the wider landscape) is undertaken alongside the assessment of effects. GLVIA3 requires that the assessment of the sensitivity is specific to the proposed development and includes a consideration of the specific effects likely to arise from the development.

Landscape sensitivity is derived from 'combining judgements about its susceptibility to change arising from the specific proposals with judgements about the value attached to the receptors (The value attached to receptors is determined as part of the baseline but the susceptibility to change is defined as *"the ability of the landscape receptor (whether it be the overall character or quality / condition of a particular landscape type or area, or an individual element and / or feature, or a particular aesthetic and perceptual aspect) to accommodate the proposed development without undue consequences for the maintenance of the baseline situation and / or the achievement of landscape planning policies and strategies."* (GLVIA3, 2013).

As the assessment of landscape susceptibility is tailored to each individual project, determining the susceptibility of the landscape receptor requires:

- Identifying the key components of the landscape that are likely to be affected by the Scheme; and
- Identifying the various aspects of the proposed development, at all stages, that are likely to have an effect on those key components.

The susceptibility of the landscape receptors to the proposed change is assessed as high, medium or low.

The sensitivity of landscape receptors is assessed as high, medium or low.

The nature of landscape effects are categorised as beneficial, adverse or neutral. GLVIA 3 sets out the criteria which should be used in reaching a professional judgement on the nature of the effects. These include but are not necessarily restricted to;

- "the degree to which the proposal fits with existing character;
- the contribution to the landscape that the development may make in its own right, usually by virtue of good design, even if it is in contrast to existing character." (GLVIA3, 2013).

The magnitude of effect on each landscape receptor is assessed by considering *'… its size or scale, the geographical extent of the area influenced, and its duration and reversibility'* (GLVIA3, 2013). The magnitude of change is assessed as high, medium or low based on the criteria set out in GLVIA 3.

The overall significance of landscape effects during construction and operation is determined by combining the separate judgements about the sensitivity of the landscape receptors and the magnitude of the landscape effects.

Our methodology does not use matrices to determine the degree of significance but adopts the 'Overall Profile' approach, where *"all the judgements against the individual criteria can be arranged in a table to provide an overall profile of each identified effect."* GLVIA 3. The distribution of assessments for each criterion is reviewed to make an informed professional judgment of the overall significance of each effect.

For each landscape receptor a narrative description, which explains the rationale for the conclusion reached regarding the significance of the effects, is provided in the main text. This is summarised in a table, which sets out the overall profile for each assessment as in Table 4.5.

Table 4.5: Significance of Landscape Effects

	Value	Susceptibility	Sensitivity	Magnitude of Change	Nature of Effect	Significance and Nature of Effects
Landscape Receptor	Described	High, Medium or Low	High, Medium or Low	High, Medium, Low or Negligible	Adverse, Beneficial or Neutral	Major, Moderate, Minor or Negligible

The scale applied to the significance of effects varies depending on the location, the landscape and the type of proposal. However, the extremes of significance can be defined as:

- *"major loss or irreversible negative effects, over an extensive area, on elements and / or aesthetic and perceptual aspects that are key to the character of nationally valued landscapes are likely to be of the greatest significance;*
- *reversible negative effects of short duration, over a restricted area, on elements and / or aesthetic and perceptual aspects that contribute to but are not key characteristics of the character of landscapes of community value are likely to be of the least significance and may, depending on the circumstances, be judged as not significant;" (GLVIA3, 2013).*
- Where landscape effects are assessed as being between these extremes, a judgement is made as to whether they are significant or not and an explanation provided.

This assessment will consider the effects during the construction of the Scheme and once the Scheme is operational at year 1 and in 15 year when, for example, planting will have established.

Significance criteria for landscape effects are set out in Table 4.6.

Table 4.6: Significance criteria for landscape effects

	Significance Criteria
Major adverse effect	The Scheme would do one or more of the following: • be at considerable variance with the landform, scale and pattern of the landscape • result in a total loss or major alteration to key attributes and their setting • disrupt a finely balanced or intact landscape • be visually intrusive and disrupt valued views of the area • cause a major reduction in the current level of tranquillity • introduce dominant incongruous elements into the landscape • be incapable of adequate mitigation • be in serious conflict with local policy or with local guidelines, where they exist, for the landscape character area
Moderate adverse effect	The Scheme would do one or more of the following: • be out of scale with the landscape, or at odds with the local pattern and landform • result in a partial loss of key attributes, or reduce or remove their setting • be visually intrusive and adversely affect views into and across the area • cause a noticeable reduction in the current level of tranquillity • introduce prominent new elements that are not entirely characteristic • be incapable of full mitigation • be in conflict with local guidelines, where they exist, for the landscape character area
Minor adverse effect	The Scheme would do one or more of the following: • not quite fit the landform and scale of the landscape • result in a minor loss of key/characteristic elements or features or their setting reduced • although not very visually intrusive, would adversely affect certain views into and across the area • cause a minor reduction in the current level of tranquillity • introduce noticeable new elements that are not entirely characteristic • not fulfil local guidelines, where they exist, for the landscape character area
Neutral effect	The Scheme would do one or more of the following: • complement the scale, landform and pattern of the landscape • incorporate measures for mitigation to ensure that the Scheme will be appropriately incorporated with surrounding landscape • avoid being visually intrusive • have no adverse effect on the current level of tranquillity of the landscape • maintain existing landscape character • a neutral effect can also be the result of the removal of incongruous or intrusive elements and the introduction of new elements
Negligible	The Scheme would result in no noticeable change to: • the scale, landform and pattern of the landscape • the current level of tranquillity of the landscape • the existing landscape character

	Significance Criteria
Minor beneficial effect	The Scheme would do one or more of the following: • fit well with the scale, landform and pattern of the landscape • incorporate measures for mitigation to ensure they will blend in well with surrounding landscape • enable some sense of place and scale to be restored through well-designed planting and mitigation measures • make a minor improvement to the contribution that the Site makes to the local existing landscape character • be in line with local guidelines, where they exist, for the landscape character area • make a small contribution towards local guidelines, where they exist, for the landscape character area
Moderate beneficial effect	The Scheme would provide an opportunity to enhance the landscape because they do one or more of the following: • fit very well with the scale, landform and pattern of the landscape • have the potential, through mitigation, to enable the restoration of key/characteristic features, partially lost or diminished • make a noticeable improvement to the contribution that the Site makes to the local landscape character through well-designed planting and mitigation measures • enable some sense of quality to be restored or enhanced through beneficial landscape proposals and sensitive design • support objectives in local guidelines, where they exist, for the landscape character area
Major beneficial effect	The Scheme would do one or more of the following: • mitigate substantially an existing significant adverse effect • fulfil objectives in local guidelines, where they exist, for the landscape character area • make a major improvement in the contribution that the landscape makes to the local landscape character by restoring the integrity of a damaged landscape

Visual baseline

The visual baseline establishes the area in which the proposed development may be visible, *"the different groups of people who may experience views of the development, the places where they will be affected and the nature of views and visual amenity at those points."* GLVIA3.

Visual receptors (i.e. people, either as individuals or groups) are identified for any locations, including selected viewpoints, where there may be visual changes as a result of the proposals, both during construction and on completion of the works. The visual baseline against which the potential impacts of the proposals are assessed, is the site as it is at present.

Potential visual receptors are defined as residents, workers, users of recreational areas, public rights of way, users of public roads and railways and visitors. These receptors are checked on-site to ensure that they lie within the areas from where the site can theoretically be seen, known as the Zone of Theoretical Visibility (ZTV). For major developments, areas from which the proposed development may be seen are digitally mapped to produce a 'bare earth' ZTV, based on observer eye height of 2 metres above ground level. This is then refined through fieldwork, taking into account intervening screening and changes in topography.

Public viewpoints, transport routes, places of work and private viewpoints are identified and selected from the ZTV and the fieldwork. Representative viewpoints have been agreed in advance with Oxfordshire County Council.

The visual baseline provides information on:

- Type and relative numbers of people (visual receptors) likely to be affected;
- Location, nature and characteristics of the existing views; and
- The value attached to particular views. (GLVIA3)

Assessment of visual effects

Visual receptors are people and their sensitivity, which *"should be assessed in terms of both their susceptibility to change in views and visual amenity and also the value attached to particular views"* (GLVIA3). The sensitivity of a visual receptor to the proposed change is a function of:

- *"the occupation or activity of people experiencing the view at particular locations;*
- *the extent to which their attention or interest may therefore be focused on the views and the visual amenity they experience at particular locations." GLVIA 3*
- the value attached to the view

Those visual receptors most likely to be susceptible to change include:

- Residents at home;
- People engaged in outdoor recreation whose interest is likely to be focused on the landscape;
- Visitors to identified viewing places or heritage assets where the surrounding landscape makes an important contribution to the experience; and
- Communities where views contribute to the landscape setting.

Travellers on transport routes have moderate susceptibility to change. People in outdoor sport or recreation, which does not involve an appreciation of the landscape and people at their place of work are considered to have less susceptibility to change.

The sensitivity of visual receptors is assessed as high, medium or low.

As for landscape effects, the magnitude of the visual effects is assessed in terms of its size or scale, the geographical extent of the area influenced, its duration and whether it is reversible. The likely changes in views from identified viewpoints are systematically identified and include a consideration of the following factors:

- Nature of view (full, partial or glimpse);
- Portion of development visible (full, most, small, part or none);
- Distance of viewpoint from development;
- Whether the view is stationary or transient;
- Nature of changes; and
- Seasonal differences.

The assessment described above informs judgements regarding the magnitude of change which is described as high, medium, low or negligible based on the criteria set out in GLVIA 3. A judgement is also made as to whether the changes are beneficial, adverse or neutral.

For each viewpoint a narrative description, which explains the rationale for the conclusions reached regarding the significance of the effects on the visual receptors, is provided in the main text. This is summarised in a table which sets out the overall profile for each assessment. Table 4.7 provides an example from the current assessment.

Table 4.7: Significance of Visual Effects

	Sensitivity	Magnitude of Change	Nature of Effect	Significance of Effects
Viewpoint	High, Medium or Low	High, Medium, Low or Negligible	Adverse, Beneficial or Neutral	Major, Moderate, Minor or Negligible

The scale applied to the significance of effects varies depending on the location, the visual receptors and type of proposal, but generally:

- *"Effects on people who are particularly sensitive to changes in views and visual amenity are more likely to be significant.*
- *Effects on people at recognised and important viewpoints or from recognised scenic routes are more likely to be significant.*
- *Large-scale changes which introduce new, non-characteristic or discordant or intrusive elements into the view are more likely to be significant than small changes or changes involving features already present within the view"* (GLVIA3).

Table 4.8: Significance criteria for effects on visual amenity

Effect	Description
Major adverse	Where the Scheme would cause a major deterioration to the existing visual amenity.
Moderate adverse	Where the Scheme would cause a noticeable deterioration to the existing visual amenity.
Minor adverse	Where the Scheme would cause a minor deterioration to the existing visual amenity.
Neutral	Where there are noticeable changes but no deterioration or improvement to the existing visual amenity.
Negligible	Where changes are visible but they are not readily discernible, often because they are distant views.
Minor beneficial	Where the Scheme would cause a minor improvement to the existing visual amenity.
Moderate beneficial	Where the Scheme would cause a noticeable improvement to the existing visual amenity.
Major beneficial	Where the Scheme would cause a major improvement to the existing visual amenity.

4.3.4 Ecological Impact Assessment

The ecological impact assessment (EcIA) is informed by the guidelines published by the Chartered Institute of Ecology and Environmental Management (CIEEM, 2019).

The significance of likely effects was determined through a staged process, as follows:

- identification of the ecological features likely to be affected, and determination of their value;
- characterisation of ecological impacts and effects on important ecological features in the construction and operational phases of the Scheme;
- assessment of potential adverse effects without mitigation;
- formulation of appropriate mitigation to avoid, reduce or compensate; and
- assessment of the significance of residual effects following mitigation.

Cumulative effects and inter-relationships are assessed separately in Chapter 15.

Identifying ecological features

Baseline conditions were established using a combination of desk study and field surveys. The baseline was collected to meet the requirements of the following:

- assessment of the potential significant effects on ecological features;
- compliance with legislation relating to species protection; and
- compliance with legislation relating to European designated wildlife sites.

The general approach for identifying features that will be impacted by the Scheme is discussed in Section 4.3.1. However, study areas for the different ecological features in this assessment are as follows:

- International and national designated sites - 2km from the Scheme area;
- Local conservation sites - 1km from the Scheme area;
- Priority habitats - the Oxfordshire Biodiversity Action Plan (BAP) lists those priority habitats within Oxfordshire) and ancient woodland - 1km from the Scheme area; and
- Desk study for protected and notable species and invasive non-native species - 1km from the Scheme area.

Priority habitats are those identified under Section 41 of the NERC Act as habitats of principal importance for the conservation of biodiversity in England and have to be considered under planning policy.

The following data sources were used to create the desk study baseline:

- Thames Valley Environmental Records Centre (TVERC);
- the Multi-Agency Geographic Information for the Countryside (MAGIC) website (MAGIC, 2021);
- the Natural England Open Data portal (Natural England, 2019);
- the Environment Agency National Fish Populations Dataset (Environment Agency, 2019);
- Oxfordshire Bat Group http://www.oxfordshirebats.org/oxfordshire-bats.html;
- Oxford Amphibian and Reptile Conservation group (OxARG); and
- Ordnance Survey mapping and aerial photography.

Field survey areas were defined by best practice guidelines at the time of survey and are detailed and justified in each of the factual survey reports in Appendix D and Appendix E. See Table 4.9 for a summary of ecological information and surveys completed to establish the baseline.

Table 4.9: Summary of ecological information and surveys completed to establish the baseline

Ecological Resource	Survey type	Date(s)	Appendix Reference	Methodology	Study area
Desk study					
Statutory sites	Desk study: Complied from TVERC data search of study area	Nov 2020	Appendix C-1 Designated sites and Figure 8.1 Nature Conservation Designations	Professional judgement based on best practice and consideration of designated features	Scheme area plus a 2km wide buffer
Non-statutory sites	Desk study: Complied from TVERC data search of study area	Nov 2020	Appendix C-1 Designated sites and Figure 8.1 Nature Conservation Designations	Professional judgement based on best practice and consideration of designated features	Scheme area plus a 1km wide buffer
Protected species	Oxfordshire Bat Group. oxfordshirebats.org/ oxfordshire-bats.php	Oct 2016	Appendix D-9 (2016) Preliminary Bat Survey	Professional judgement based on best practice and consideration of potential ecological features present.	Scheme area plus a 1km wide buffer
	Desk study: Complied from TVERC data search of study area	Jan 2018 Updated Nov 2020	Incorporated into species reports		Scheme area plus a 1km wide buffer
	Local Amphibian and Reptile Conservation group	2017	Incorporated into Chapter 8 Flora and fauna		Scheme area plus a 1km wide buffer
Habitat surveys					
Habitats	Field survey: identifying habitats of potential biodiversity value	Jun 2020	Appendix C-2 (2020) Ecology Walkover Survey Report	Guidelines for Preliminary Ecological Appraisal, 2nd edition, Winchester (CIEEM, 2017). UK Habitat Classification survey methodology (UK Habitat Classification Working Group, 2018)	Within the 2020 Scheme area

Ecological Resource	Survey type	Date(s)	Appendix Reference	Methodology	Study area
	Field survey: UK Habitat Classification survey	Jul & Oct 2020	Appendix C-3 (2020) Habitat and Botanical Survey Report	UK Habitat Classification survey methodology (UK Habitat Classification Working Group, 2018)	Within the 2020 Scheme area
	Field survey: National Vegetation Classification (NVC) survey	Jun 2020	Appendix C-4 (2020) Hinksey Meadow NVC survey	Professional judgement based on on the NVC grassland methodology	Hinksey Meadows
Rivers	Field survey: River Habitat and River Corridor Survey	May 2017	Appendix D-4 (2018) River Habitat and River Corridor Surveys Part 1 Appendix D-4 (2018) River Habitat and River Corridor Surveys Part 2	River Habitat Survey in Britain and Ireland: Field Survey Guidance Manual (Environment Agency, 2003) River Corridor Surveys Methods and Procedures: Conservation Technical Handbook No. 1 (National Rivers Authority, 1992)	Within the 2017 Scheme area
	River Condition Assessment	Dec 2020	Appendix C-6 (2020) River Condition Assessment Results	The MoRPh Survey Technical Reference Manual (Gurnell et al.,2019). A Guide to Assessing River Condition Part of the Rivers and Streams Component of the Biodiversity Net Gain Metric Technical	Within the 2020 Scheme area

Ecological Resource	Survey type	Date(s)	Appendix Reference	Methodology	Study area
				Reference Manual (Gurnell et al., 2020)	
Hedgerows	Field survey: Hedgerow Survey	Jun 2020 Oct 2020	Appendix C-2 (2020) Ecology Walkover Survey Report Appendix C-3 (2021) Habitat and Botanical Survey Report	Hedgerow Survey Handbook (Defra, 2007)	Within the 2020 Scheme area
Species surveys					
Badger	Field survey: Presence / absence	Apr, Aug and Sep 2019, Jan 2020	Appendix D-7 (2020) Badger Assessment **CONFIDENTIAL**	Adapted from Design Manual for Roads and Bridges (DMRB) Volume 10, Section 1 – Part 5 HA59/92.	Within the 2020 Scheme area, plus a 30m buffer
	Field survey: Presence / absence	Jun 2020	Appendix C-2 (2020) Ecology Walkover Survey Report	Guidelines for Preliminary Ecological Appraisal (CIEEM, 2017). Professional judgement based on best practice	Within the 2020 Scheme area
	Field survey: Sett activity survey	Oct 2020	Appendix D-8 (2020) Badger Sett Activity Survey CONFIDENTIAL	Volume 10, Section 4, Part 2, HA 59/92. Mitigating against Effects on Badgers. Highways Agency (DMRB, 2005)	Targeted surveys within the 2020 Scheme area
Bats - all species	Field survey: Preliminary Bat Survey	Jun-Oct 2016	Appendix D-9 (2016) Preliminary Bat Survey		Within the 2016 Scheme area

Ecological Resource	Survey type	Date(s)	Appendix Reference	Methodology	Study area
	Field survey: Tree Climb Inspections	Aug to Sep 2016	Appendix D-10 (2017) Bat surveys – Results of tree climb inspections	Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd eds). Bat Conservation Trust, London (Collins, J., 2016)	Targeted surveys within the 2016 Scheme area
	Field survey: Tree inspections, emergence, static and transect surveys	May to Sep 2017 and Feb 2018	Appendix D-11 (2018) Bat Surveys	Bat Surveys: Good Practice Guidelines, 2nd edition. BCT, London (Hundt, L., 2012) Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd eds). Bat Conservation Trust, London (Collins, J., 2016).	Within the 2017 Scheme area
	Field survey: Tree inspections, emergence surveys	Jul to Sep 2020	Appendix D-12 (2021) Bat surveys		Within the 2020 Scheme area – reduced scope continuing from the 2017/18 surveys
	Field survey: Presence / absence	Jun 2020	Appendix C-2 (2020) Ecology Walkover Survey Report	Guidelines for Preliminary Ecological Appraisal (CIEEM, 2017). Professional judgement based on best practice	Within the 2020 Scheme area
Birds	Field survey: Wintering bird survey	Dec 2016 Mar 2017	Appendix D-6 (2018) Wintering Birds	An adapted Common Bird Census https://www.bto.org/ about-birds/ birdtrends/ 2011/ methods/ common-birds-census	Within the 2016/2017 Scheme area
	Field survey: Breeding bird survey	May and Jun 2017	Appendix D-5 (2018) Breeding Birds		Within the 2017 Scheme area

Ecological Resource	Survey type	Date(s)	Appendix Reference	Methodology	Study area
Fish	Field survey: Electric fishing and environmental DNA (eDNA)	Oct 2016	Appendix D-21 (2017) Fisheries survey	Environment Agencies Operational Instructions, Electric Fishing Operations: Equipment and Working Practices Environmental DNA metabarcoding of lake fish communities reflects long-term data from established survey methods. Molecular Ecology, 25, 3101-3119 (Hänfling et al., 2016) Dynamics of mitochondrial DNA evolution in animals: amplification and sequencing with conserved primers (Kocher et al., 1989)	Seacourt stream, Botley stream, Bulstake stream and Hinksey stream within and adjacent to the 2016 Scheme boundary
Great Crested Newt	Field survey: Habitat Suitability Assessment (HSI)	Apr 2020	Appendix D-15 (2021) Great Crested Newt Survey Report	Advice Note 5: Great Crested Newt Habitat Suitability Index (ARGUK, 2010)	Water bodies within 500m of the Scheme area
	Field survey: eDNA	Jun 2020	Appendix D-15 (2021) Great Crested Newt Survey Report	Technical advice note for field and laboratory sampling of great crested newt *Triturus cristatus* environmental	Waterbodies with an HSI score of Below Average or above

Ecological Resource	Survey type	Date(s)	Appendix Reference	Methodology	Study area
				DNA. Oxford: Freshwater Habitats Trust (Biggs *et al.*, 2014).	
Macrophytes – aquatic plants	Field survey: Presence / absence	Aug and Sep 2017	Appendix D-22 (2017) Ecological Assessment of Hinksey Pond North and Hinksey Pond	A guide to monitoring the ecological quality of ponds and canals using PSYM (Pond Action, 2002)	Hinksey Pond
	Field survey: Presence / absence	Aug 2016 Aug 2020	Appendix D-2 (2017) Biological Summary Report on Kennington Pit Appendix D-3 (2020) Kennington Pit PSYM Survey		Kennington Pit
Macroinvertebrates	Field survey: Presence / absence	May and Sep 2016	Appendix D-1 (2016) Aquatic Invertebrate and Mussel Survey	Environment Agency Technical Reference Material: Freshwater Macroinvertebrate Sampling in Rivers. Document Number 01_08 A guide to monitoring the ecological quality of ponds and canals using PSYM (Pond Action, 2002)	Within the 2016 Scheme area
	Field survey: Presence / absence	Aug and Sep 2017	Appendix D-22 (2017) Ecological Assessment of Hinksey Pond North and Hinksey Pond		Hinksey Pond
	Field survey: Presence / absence	Aug 2020	Appendix D-3 (2020) Kennington Pit PSYM Survey		Kennington Pit
Otter	Field survey: Presence/absence	Jul to Sep 2016	Appendix D-16 (2016) Water vole and otter survey report	Adapted from the DMRB, Volume 10 Environmental Design Section 4 Nature	Within the 2016 Scheme area

Ecological Resource	Survey type	Date(s)	Appendix Reference	Methodology	Study area
		Feb and Jul 2018 Apr and May 2020 Jun 2020	Appendix D-19 (2018) Otter survey Appendix D-20 (2020) Otter survey Appendix C-2 (2020) Ecology Walkover Survey Report	Conservation – Part 4 HA81/99 Nature Conservation in Relation to Otters (Highways Agency, 2001c). Best practice guidelines, and adapted from Otters: surveys and mitigation for development projects provided by Natural England and DEFRA (GOV UK, 2019) Guidelines for Preliminary Ecological Appraisal (CIEEM, 2017) Professional judgement based on best practice	New areas and targeted surveys, extended 200m from the 2018 Scheme area Extended 200m from the 2020 Scheme area Within the 2020 Scheme area
Reptiles	Field survey: Presence/absence	April, May and Sep 2020	Appendix D-14 (2020) Reptile Survey	Froglife (1999). Reptile survey: an introduction to planning, conducting and interpreting surveys for snake and lizard conservation. Froglife Advice Sheet 10, Froglife, Halesworth.	Within the 2020 Scheme area

Ecological Resource	Survey type	Date(s)	Appendix Reference	Methodology	Study area
				Gent, A.H., and Gibson, S.D., Eds (2003). Herpetofauna Worker's Manual. Joint Nature Conservation Committee, Peterborough.	
Water vole	Field survey: Habitat Suitability	Jul 2016 Jun 2018 May 2020	Appendix D-16 (2016) Water vole and otter survey report Appendix D-17 (2018) Water vole survey Appendix D-18 (2021) Water vole Survey	Water Vole Conservation Handbook (Strachan et al., 2011) The Mammal Society Mitigation Guidance Series: The Water Vole Mitigation Handbook (Dean et al., 2016).	Up to 100m up and downstream of the 2016 Scheme area Within 50m of the 2018 Scheme area Up to 100m up and downstream of the 2020 Scheme area
	Field survey: Presence/absence	Jul 2016 Jun 2018 May 2020	Appendix D-16 (2016) Water vole and otter survey report Appendix D-17 (2018) Water vole survey Appendix D-18 (2021) Water vole Survey	Water Vole Conservation Handbook (Strachan et al., 2011) The Mammal Society Mitigation Guidance Series: The Water Vole Mitigation Handbook (Dean et al., 2016). Guidelines for Preliminary Ecological Appraisal (CIEEM, 2017)	Up to 100m up and downstream of the 2016 Scheme area Within 50m of the 2018 Scheme area Up to 100m up and downstream of the 2020 Scheme area

Ecological Resource	Survey type	Date(s)	Appendix Reference	Methodology	Study area
				Professional judgement based on best practice	
Invasive Non-Native Species (INNS) - plants	Field survey: Invasive Species	Jun 2020	Appendix C-2 (2020) Ecology Walkover Survey Report	Guidelines for Preliminary Ecological Appraisal (CIEEM, 2017) Professional judgement based on best practice	Within the 2020 Scheme area
	Field survey: Invasive Species	Jun 2020	Appendix E-1 (2020) Invasive Species Updated Survey		Within the 2020 Scheme area

For ecological assessment the 'zone of influence' will be considered. This is the area over which ecological features may be affected as a result of the proposed Scheme and associated activities either during construction or operation. The zone of influence will vary for different impacts and is likely to extend beyond the Scheme area, for example where there are ecological or hydrological links to other habitats beyond the Scheme boundaries.

Determination of the value of receptors

The definitions presented in Table 4.10 have been used to classify the ecological value of features that may be affected by the Scheme. In this report and subsequent assessment, the term 'value' will be used in preference to 'importance' as is used in the CIEEM Guidelines. This is to provide consistency in terminology between different discipline chapters within the wider EIA.

For the purposes of this EcIA, effects on ecological resources were assessed in detail for those of sufficient value (i.e. county level or above), such that impacts upon them may be material in decision-making (see Table 4.11 and Table 4.12). Various characteristics contribute to the importance of ecological features, for example naturalness, species which are rare or uncommon, habitats which are rare or uncommon, and habitats which are in effect irreplaceable (CIEEM, 2019). Effects on ecological features at or below local value are not considered further as they do not reach the criteria for inclusion in the EcIA. Such features include tall herb in unmanaged areas around fields and along riverbanks, plantation woodland and artificial habitats such as urban parks.

Table 4.10: Criteria for classifying the importance of ecological features

Value	Criteria
International	European designated sites, including Special Areas of Conservation (SACs); also candidate or possible designated sites
National (Great Britain)	Statutory national designated sites, including SSSIs, NNR; Red List of Threatened Species; resident or regularly occurring species which may be considered at an international or national level where either of the following criteria is met: • the loss of these populations would adversely affect the conservation status or distribution of the species at the national scale; or • the population forms a critical part of a wider population at a national scale.

Value	Criteria
County (Oxfordshire)	Statutory designated sites: LNRs Non-statutory designated sites (i.e. Local Wildlife Sites (LWS), Sites of Local Importance for Nature Conservation (SLINC), Nature Reserve and Nature Parks designated by Oxford City Council or the Vale of White Horse (VoWH) District Council (Thames Valley Ecological Records Centre – TVERC) designated in the county/regional area context. Areas of key/priority habitats identified in the Oxfordshire BAP (i.e. habitats and/or species populations considered to be important within Oxfordshire). Species or habitats listed in accordance with the requirements of section 41 of the Natural Environment and Rural Communities (NERC) Act 2006. Resident or regularly occurring populations of species which may be considered at a regional or county level where either of the following criteria is met: • the loss of these populations would adversely affect the conservation status or distribution of the species at county level; or • the population forms a critical part of a wider population at the county scale.
Local (Oxford City)	Feature is relatively common and widespread but has elevated conservation status (e.g. it is listed in accordance with the requirements of the Section 41 of the NERC Act 2006, Local Biodiversity Action Plans, Birds of Conservation Concern Red or Amber listed, Red Data Book listed and /or is legally protected). e.g. habitats or species populations considered to be important within Oxford.
Within the zone of influence only	Feature is abundant and widespread, receives no legal protection and is not of elevated conservation concern status.

Characterising the ecological effect

Characterisation of impacts likely to cause significant effects upon ecological features refer to the following characteristics:

- positive or negative (i.e. a positive or negative change to the environment);
- extent (i.e. spatial or geographical area over which the effect may occur);
- magnitude (i.e. size, amount, intensity or volume);
- duration (i.e. timeframe see below);
- frequency and timing (i.e. number of times an activity occurs); and
- reversibility (i.e. a reversible effect is one from which spontaneous recovery or recovery assisted by mitigation measures is possible).

CIEEM methodology does not define duration, but in this assessment duration references are defined broadly as follows:

- Short term - construction phase 1-3 years;
- Medium term - 2-15 years post construction; and
- Long term - 15+ years post construction.

In accordance with the CIEEM guidance (CIEEM, 2019), we have assessed the effects with respect to the baseline conditions expected to occur over the life time of the Scheme, if the proposed Scheme were not to take place. The identification and the prediction of the scale of these effects upon ecological features are made with reference to aspects of the ecological structure and function on which the features depend. Aspects of ecological structure and function include available resources (such as food and water, shelter and roost sites, breeding sites and corridors for migration and dispersal), ecological processes (such as population cycles, competition, predation and seasonal behaviour) and human influences (such as the site's management regime).

Characterisation of impacts likely to cause significant effects upon ecological features make reference to the following:

- Positive or negative;
- Physical extent and magnitude;
- Duration and timing;
- Frequency; and
- Reversibility.

Determining ecologically significant effects/Magnitude of effect

To provide consistency across chapters within the ES, the magnitude of effect is assessed as one of four separate categories: major; moderate; minor and negligible and are set out in Table 4.11.

Table 4.11: Magnitude of effect on ecological features

Magnitude	Definition
Major	A permanent or long-term effect on the extent/size or integrity of a site, habitat, species assemblage/community, population or group. If negative, this is likely to threaten its sustainability and its conservation status; if positive, this is likely to enhance the conservation status of the ecological receptor.
Moderate	A long-term but reversible effect on the extent/size or integrity of a site, habitat, species assemblage/community, population or group. If negative, this is unlikely to threaten its sustainability; if positive, this is likely to be sustainable but is unlikely to enhance its conservation status.
Minor	A short-term but reversible effect on the extent/size or integrity of a site, habitat, species assemblage/community, population or group that is within the range of variation normally experienced between years.
Negligible	A short-term but reversible effect on the extent/size or integrity of a site, habitat, species assemblage/community, population or group that is within the normal range of annual variation.

Significant effects

Significance is a concept related to the weight that should be attached to effects when decisions are made. For the purposes of EcIA, a 'significant effect' is an effect that either supports or undermines biodiversity conservation objectives for important ecological features (CIEEM, 2019) and under the meaning of the EIA Regulations is assessed in this ES to be moderate or major.

In this report, and as a departure from CIEEM guidance so as to maintain consistency with other chapters, a matrix approach is used where the magnitude of effect is assessed against the value of the ecological feature to determine the level of significance, e.g. a minor negative magnitude of effect on a nationally valued feature has a minor adverse significance of effect, as shown in Table 4.12.

Table 4.12: Significance of ecological effects

	Value/Sensitivity			
Magnitude	International	National	County	Local
Major negative	Major adverse	Major adverse	Moderate adverse	Minor adverse
Moderate negative	Moderate adverse	Moderate adverse	Minor adverse	Minor adverse
Minor negative	Minor adverse	Minor adverse	Minor adverse	Minor adverse
Negligible	Nil impact			
Minor positive	Minor beneficial	Minor beneficial	Minor beneficial	Minor beneficial
Moderate positive	Moderate beneficial	Moderate beneficial	Minor beneficial	Minor beneficial
Major positive	Major beneficial	Major beneficial	Moderate beneficial	Minor beneficial

Assessment of significant residual effect

After assessing the impacts of the proposal, all attempts should be made to avoid or mitigate ecological impacts. Once measures to avoid and mitigate ecological impacts have been applied, any residual impacts that would result in effects that are significant, and the proposed compensatory measures, will be the factors considered against ecological objectives (legislation and policy) in determining the outcome of the application (CIEEM, 2019).

4.3.5 Water and hydromorphology

The assessment of impacts on water and hydromorphology follows the broad assessment methodology outlined in Section 4.3.1, with the exception of Tables 4.2 and 4.3, which classify the sensitivity and value of receptors, and the magnitude of receptors respectively.

The criteria for identifying the importance or sensitivity of surface water receptors are shown in Table 4.13.

Table 4.13: Sensitivity criteria for water and hydromorphology receptors

Importance/ Sensitivity	Criteria	Receptors within Study Area (and justification)
Very High	Water dependent features of international importance	Groundwater in River Terrace Deposits beneath Oxford Meadows SAC - the groundwater is critical to supporting the habitats in the SAC (an internationally important feature). Floodwater contributing to Oxford Meadows SAC water resource - due to potential contribution towards the ecology of the SAC (a nationally important feature).

Importance/ Sensitivity	Criteria	Receptors within Study Area (and justification)
High	Water dependent features of national importance, e.g. pristine river environments in high (or potential to achieve high) status, or national conservation sites such as SSSIs. Bodies of groundwater that provide a major resource contribution to the above.	Floodwater and groundwater contributing to Iffley Meadows SSSI water resource – this is important to) the ecology of the SSSI (a nationally important feature). Groundwater in River Terrace Deposits beneath Iffley Meadows SSSI - the aquifer may provide a contribution to some habitats in the SSSI (a nationally important feature).
Medium	Water dependent features of regional/county importance, e.g. County Wildlife Sites; stretches of major rivers, or minor rivers in good status (or objective of good); and any groundwater bodies that provide a major resource contribution to them. An aquifer of regionally important significance because of high quality and/or yield, typically with extensive exploitation for supply. Typically includes Principal Aquifers (and any overlying highly permeable superficial deposits where they are in good hydraulic continuity	All main watercourses in the study area (as they all have long-term objectives of good status) including River Thames. Osney Mead and Willow Walk Meadows Local Wildlife Sites which are dependent on the hydrological condition of the floodplain. (Ponds, wet woodland and areas of fen vegetation are priority habitats dependent on water. Effects on these habitats are assessed in Chapter 8, Flora and Fauna, rather than as water impacts.)
Low	Water dependent features of some localised importance, but not regionally significant, e.g. water bodies in Local Nature Reserves, or stretches of main river in moderate/poor status, with moderate objective. A groundwater aquifer of only local importance, because its quality/physical properties do not allow extensive potable abstraction, but can be importance for local supplies, and/or to provide a substantial component of resource to local water-dependent eco-systems. Typically includes Secondary Aquifers.	Ditches and lakes that support ecological habitat. Groundwater in River Terrace Deposits - excluding the SAC/SSSI (considered above), the aquifer may contribute to the resource of some water dependent ecosystems of local importance; and small-scale abstractions for non-potable use.
Negligible	Surface Water features that are significantly degraded and of negligible ecological value. A groundwater aquifer of low water quality and/or very low permeability that make exploitation of the aquifer unfeasible, or that is likely to provide very limited contribution to the overall resource of water-dependent eco-systems. Typically includes non-aquifers or Secondary Aquifers with	Groundwater in Oxford Clay - the aquifer is impermeable and of negligible ecological or resource significance

Importance/ Sensitivity	Criteria	Receptors within Study Area (and justification)
	substantial low permeability layers and/or poor water quality.	

The magnitude of the impact on the water and hydromorphology receptors has been determined using Table 4.14.

Table 4.14: Impact Magnitude Criteria for Water and Hydromorphology Impacts

Magnitude of Impact	Criteria
Major	Impact causing large scale change to morphology, quality or ecological element of a surface water feature that would cause a change in status either directly to or away from good status (or a failure to achieve objective) A major permanent or long-term change to groundwater quality or available yield over an extensive area and/or that has profound consequences. Includes changes to quality or water levels that have a major impact on water resource, ecology and/or a direct change in water body status, where specified.
Moderate	Impact causing a temporary impact to a surface water feature of a substantial nature; or a permanent effect of a moderate, localized nature that would significantly contribute to, but not directly cause a change in status (or prevent/facilitate achievement of objectives). Changes to the local groundwater regime that would have a substantial temporary or a limited, permanent effect on resource use; or supply to surface water features that would not be detrimental to those features, with minor impacts on local ecology and a significant contribution to a potential change in water body status, where specified.
Minor	Impact causing a change to a surface water feature's morphology, quality or habitat that is discernible, but would be only temporary and would make no significant contribution to a change in status (or achievement of objectives). Changes to groundwater quality, levels or yields that may be perceptible, but do not represent a likelihood of significantly changing existing resource use or ecology; and are likely to make no significant contribution or change to an overall status, where specified.
Negligible	Very slight change or no change from baseline conditions approximating to a 'no change' situation.

4.3.6 Cultural heritage

General

The assessment methodology follows the guidelines set out in the Design Manual for Roads and Bridges (DMRB), Volume 11, Section 3, Part 2, HA 208/07 including Annexes 5 (Archaeological Remains), 6 (Historic Buildings) and 7 (Historic Landscape) and professional judgement. Although this guidance was prepared for highways projects, it is equally applicable to other types of civil engineering projects including flood risk management.

The archaeological works and assessment were undertaken in accordance with: *Preserving Archaeological Remains: Decision-taking for Sites under Development* (Historic England 2016).

Chapter 10 'Cultural heritage' is informed by a heritage desk-based assessment (DBA) (Appendix J-2), a Heritage Statement (Appendix J-3) and the results of a number of field investigations (Appendices J-4 to J-8) undertaken for the Scheme.

Assessment of value

The cultural heritage assessment considers the value of cultural heritage receptors, where other topics consider sensitivity.

DMRB HA208/07 provides a methodology for the assessment of the value of cultural heritage assets. Use of this methodology in this assessment aligns with the guidance provided by the National Planning Policy Framework (NPPF), Planning Practice Guidance and Historic England Good Practice Advice Notes 2 and 3: Managing Significance in Decision-Taking in the Historic Environment (Historic England 2015a) and The Settings of Heritage Assets (Historic England 2015b). Conservation Principles (English Heritage 2008) guided the assessment of value.

Based on DMRB guidance, each cultural heritage asset is assigned a value against a six-point scale based on professional judgement, guided by the criteria provided in DMRB and presented in Table 4.15. DMRB provides a robust methodology for the assessment of value of heritage assets and is widely accepted by the main heritage bodies. Table 4.15 is consulted throughout to provide the appropriate value for each heritage asset identified below in conjunction with professional judgement.

For the purposes of this assessment, the term value has been employed, rather than significance as used in the NPPF and local planning policy, or importance, to avoid confusion when describing effects that are significant or not later on in the assessment process.

Table 4.15: Assessing the value of cultural heritage assets

Value	Criteria
Very High	• World Heritage Sites (including buildings and those inscribed for their historic landscape qualities) • Assets of acknowledged international importance • Assets that can contribute significantly to acknowledged international research objectives • Extremely well-preserved historic landscapes with exceptional coherence, time-depth or other critical factors
High	• Scheduled Monuments (including standing remains) • Designated historic landscapes of outstanding interest • Undesignated assets of schedulable quality and importance • Assets that can contribute significantly to national research objectives • Grade I and II* Listed Buildings • Other Listed Buildings that can be shown to have exceptional qualities in their fabric or historical associations • Conservation Areas containing very important buildings • Undesignated structures of clear national importance • Undesignated landscapes of outstanding interest, high quality or importance and of demonstrable national value • Well-preserved historic landscapes, exhibiting considerable coherence, time-depth or other critical factors
Medium	• Designated or undesignated assets that contribute to regional research objectives • Undesignated historic landscapes that would justify special historic landscape designations, or landscapes of regional value

Value	Criteria
	• Averagely well-preserved historic landscapes with reasonable coherence, time-depth or other critical factor • Grade II Listed Buildings • Conservation Areas containing buildings that contribute significantly to its historic character • Historic Townscape or built-up areas with important historic integrity in their buildings, settings or built settings
Low	• Designated and undesignated assets of local importance • Robust undesignated historic landscapes and historic landscapes with importance to local interest groups • Historic landscapes whose value is limited by poor preservation and / or poor survival of contextual associations • Assets compromised by poor preservation and/or poor survival of contextual associations • Assets of limited value, but with potential to contribute to local research objectives • 'Locally Listed' buildings • Historic (unlisted) buildings of modest quality in their fabric or historical association • Historic townscape or built-up areas of limited historic integrity in their buildings, or built settings
Negligible	• Assets with very little or no surviving archaeological interest • Buildings of no archaeological or historical note, or buildings of an intrusive character • Landscapes with little or no significant historical interest
Unknown	• The importance of the resource has not been ascertained, or buildings with some (hidden) potential for historical significance

Magnitude of impact

Magnitude of impact is the degree of change that would be experienced by an asset and its setting as a result of the Scheme, as compared with a 'do nothing' situation. Magnitude of impact was assessed without reference to the value of the asset, and may include physical impacts upon the asset itself, or impacts upon its setting or amenity value. Assessment of magnitude with and without mitigation is based on professional judgement informed by the DMRB methodology and criteria for archaeological remains, historic buildings and the historic landscape, set out in Table 4.16.

Table 4.16: Assessing the magnitude of impact

Magnitude	Factors in the Assessment of Magnitude of Impact
Major	• Change to most or all key archaeological materials, such that the resource is totally altered. • Change to key historic building elements, such that the resource is totally altered. • Change to most or all key historic landscape elements, parcels or components; extreme visual effects; gross change of noise or change to sound quality; fundamental changes to use or access; resulting in total change to historic landscape character unit. • Comprehensive changes to setting
Moderate	• Changes to many key archaeological materials, such that the resource is clearly modified. • Change to many key historic building elements, such that the resource is significantly modified.

Magnitude	Factors in the Assessment of Magnitude of Impact
	• Changes to the setting of a cultural heritage asset, such that it is significantly modified. • Changes to many key historic landscape elements, parcels or components, visual change to many key aspects of the historic landscape, noticeable differences in noise or sound quality, considerable changes to use or access; resulting in moderate changes to historic landscape character.
Minor	• Changes to key archaeological materials, such that the asset is slightly altered. • Change to key historic building elements, such that the asset is slightly different. • Change to setting of a cultural heritage asset, such that it is noticeably changed. • Changes to few key historic landscape elements, parcels or components, slight visual changes to few key aspects of historic landscape, limited changes to noise levels or sound quality; slight changes to use or access: resulting in limited changes to historic landscape character.
Negligible	• Very minor changes to archaeological materials or setting. • Slight changes to historic buildings elements or setting that hardly affect it. • Very minor changes to key historic landscape elements, parcels or components, virtually unchanged visual effects, very slight changes in noise levels or sound quality; very slight changes to use or access; resulting in a very small change to historic landscape character.
No Change	• No change to fabric, setting. • No change to elements, parcels or components; no visual or audible changes; no changes arising from in amenity or community factors.

Significance of effect

Three sub-topics are assessed in Chapter 10 'Cultural heritage'; archaeological remains, historic buildings including Conservation Areas and historic landscape including the designated Oxford View Cones.

For all three sub-topics assessed, the significance of effect with, and without, mitigation is determined by considering the value/sensitivity of the asset and the magnitude of impact. This is achieved using professional judgement informed by the matrix in Table 4.17. Five levels of significance are defined, which could apply equally to adverse and beneficial impacts.

Impacts have been assessed to be temporary or permanent. Temporary impacts would be short-term and normally not last beyond the construction period; permanent impacts would be irreversible.

Permanent impacts on heritage assets that cannot be avoided are regarded as requiring mitigation. Cultural heritage is a non-renewable resource and requires mitigation, for example, preservation by record, if impacts are irreversible, appropriate to the value of the asset.

For the purpose of this assessment, residual effects on designated cultural heritage assets of large or very large adverse significance were taken to be commensurate with 'substantial harm' as defined by the NPPF.

Where residual effects on designated cultural heritage assets are of moderate adverse significance or less, these are to be taken to be commensurate with 'less than substantial harm' as defined by the NPPF and should be balanced against the public benefits of the Scheme described elsewhere in this Environmental Statement.

Table 4.17: Significance of effect

Significance of Effect					
Magnitude of Impact	Value / Sensitivity				
	Very High	High	Medium	Low	Negligible
Major	Very large	Very large/ Large	Large/ Moderate	Moderate/ Slight	Slight
Moderate	Very large / Large	Large/ Moderate	Moderate	Slight	Slight/ Neutral
Minor	Large/ Moderate	Moderate/ Slight	Slight	Slight/ Neutral	Slight/ Neutral
Negligible	Slight	Slight	Slight/ Neutral	Slight/ Neutral	Neutral
No Change	Neutral	Neutral	Neutral	Neutral	Neutral

4.3.7 Traffic and transport

The assessment of impacts on traffic and transport follows the broad assessment methodology outlined in Section 4.3.1. The 'traffic and transport' assessment has assumed that 'A-roads' and 'bus services/Park and Ride sites' have a 'medium' value or sensitivity, based on professional judgement, and that 'B-roads or other minor roads have a 'low' value.

4.3.8 Sustainable use of land assessment

Ground contamination

For soil contamination health receptors, the receptor sensitivity and magnitude of impact have not been defined, as it is assumed that the health effects would need to be mitigated down to a neutral level suitable for protection of human health, as defined by statutory requirements.

Agricultural land use

There is no nationally recognised set of standard assessment criteria for effects on agricultural land and farm and rural businesses. In order to assess the impacts of the Scheme on agricultural resources, significance criteria have been adopted relating to the effects on agricultural land and soils (Table 4.18) and on farming and other farm-based enterprises (Table 4.19).

This bespoke set of criteria has been developed using relevant national and local policies and guidance. These criteria address both magnitude of impact and sensitivity of the resource (with the value of soil resources matching its agricultural quality e.g. Grade 3 land of moderate quality would have a medium value) and have been derived from consideration of the characteristics of the impact and the receptor.

Table 4.18: Significance of effects on agricultural land

Significance of Effect	Definition
Major	Loss of 20ha or more of the best and most versatile agricultural land, meaning ALC Grades 1, 2, or 3a.
Moderate	Loss of 10-19ha of best and most versatile agricultural land ALC Grades 1, 2 or 3a. Loss of 50ha or more of lower quality agricultural and ALC grades 3b, 4 and 5.
Minor	Loss of 5-9ha of best and most versatile agricultural land ALC Grades 1, 2 or 3a Loss of 10-49ha of lower quality agricultural land, ALC Grades 3b, 4 and 5.
Negligible	Loss of less than 4ha of best and most versatile agricultural land, ALC Grades 1, 2 or 3a Loss of less than 10ha of lower quality agricultural land, ALC Grades 3b, 4 and 5.

Table 4.19: Significance of effects on local farm businesses

Significance of Effect	Definition
Major	• Renders a full-time farm business, including any diversification enterprises, unworkable in its current form, such that it could not continue unchanged; the business would have to change the activities undertaken on the remainder of the holding as well as seeking some form of alternative income. • For farms let through short term farm business tenancies, serious loss of rental value (>20%).
Moderate	• Changes the workability of a full-time farm business, including any diversification enterprises, but without preventing the business continuing largely as before; there would be reductions in farm income and changes in day-to-day management, such as frequent longer journeys to access severed land parcels. • For farms let through short term farm business tenancies, significant loss of rental value (10-20%).
Minor	• Slight impact on the workability of a full-time farm business, including any diversification enterprises, but the business would continue largely as before. There would be a small decline (5-10%) in farm income. • For farms let through short term farm business tenancies, small loss of rental value (5-10%).
Very minor	• Very slight impact on farm business that can often be easily compensated for by modifications to management system. • For farms let through short term farm business tenancies, very small loss of rental value (<5%).
Negligible	• Affects the farm but does not affect the farm business, including any diversification enterprises. • For farms let through short term farm business tenancies, no loss of rental value.

4.3.9 Air quality

Methodology for on-site activities

The assessment of the air quality impacts due to dust associated with the construction phase of the proposed Scheme follows the Institute of Air Quality Management 'Guidance on the assessment of dust from demolition and construction activities' (IAQM 2014). The guidance is concerned with the risks of dust impacts from four construction activities (i.e. demolition, earthworks, construction and trackout) to determine the level of required mitigation measures. Sensitive human receptors are identified up to 350m from the construction boundary, while ecological receptors are considered up to 50m from the construction site. Both human and ecological receptors are chosen based on their sensitivity to dust soiling or deposition, and exposure to PM_{10} (i.e. airborne particulates). Full details of the methodology followed and results are presented in Appendix H, and are summarised in Chapter 13.

The estimated magnitudes of each construction activity (small, medium, large or negligible) are determined and are combined with the area sensitivity, which is determined by the number and proximity of receptors to the construction boundary and the background PM_{10} concentration. This qualitative analysis provides the overall level of risk of impacts for dust soiling, human health and ecology. The level of risk of each impact is used to identify appropriate mitigation measures.

Although there will be a large amount of material moved during the construction phase, for the purposes of the air quality chapter, the Scheme should be considered as a construction site as opposed to a mineral extraction site. Construction is not anticipated to occur over the entire area simultaneously. Furthermore, the water table across the Scheme area is high, therefore, most of the excavated material will be damp, which will limit the generation of dust as a result.

Mitigation measures, as presented in Section 13.3 are aimed at minimising any short-term dust impacts and residual effects anticipated from the temporary construction works.

HGV traffic

The methodology of the traffic-related air quality study is presented along with the results in Appendix H-4. Figure 13.1 shows the locations used in the assessment to predict air quality effects on residential areas and ecological sites.

The impacts of the Scheme on pollutant concentrations are assessed in accordance with Institute of Air Quality Management guidance: 'Land-Use Planning and Development Control' (IAQM 2015). The significance of the impact of the Scheme is assessed at each receptor and is based on percentage contribution of the absolute pollutant concentration and magnitude of change (between the do minimum and do something) to the Air Quality Assessment Level (AQAL). Specific criteria are used to determine significance relating to the percentage contribution of the absolute pollutant concentration to the AQAL. Table 4.20 provides the criteria required to define a significant impact.

Table 4.20: Magnitude of change criteria

Annual Average Concentration at Receptor in Assessment Year	% Change in Concentration Relative to Air Quality Assessment Level			
	1	2-5	6-10	>10
75% or less of AQAL	Negligible	Negligible	Slight	Moderate
76-94% of AQAL	Negligible	Slight	Moderate	Moderate
95-102% of AQAL	Slight	Moderate	Moderate	Substantial

Annual Average Concentration at Receptor in Assessment Year	% Change in Concentration Relative to Air Quality Assessment Level			
	1	2-5	6-10	>10
103-109% of AQAL	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Moderate	Substantial	Substantial	Substantial

Table 4.21 details the Significance Classification used in the assessment of the modelled NO_2 and PM_{10} concentrations results for the change between the do minimum and do something scenarios, i.e. DS-DM.

Table 4.21: Significance Classification

Change (DS-DM)	Significance based on IAQM Guidance
<-4	LARGE DECREASE
>-4 & <-2	MEDIUM DECREASE
>-2 & <-0.4	SMALL DECREASE
>-0.4 & <0.4	IMPERCEPTIBLE
> 0.4 & < 2	SMALL INCREASE
> 2 & < 4	MEDIUM INCREASE
>4	LARGE INCREASE

Assessment of air quality impacts on ecology

The impacts of the changes on designated sites have been assessed by comparison against the Air Quality Scheme objective for NO_x (30 µg/m^3) and the relevant critical loads for the habitat, including the consideration of the potential effects on the integrity of the habitat. Critical loads are a quantitative estimate of an exposure of one or more pollutants below which significant harmful effects on specified sensitive environmental receptors do not occur. There is a screening criterion of 1% increase on a critical load, as being a threshold below which no significant adverse effect is expected to occur. An assessment outcome that results in an exceedance of the objective would be treated as more significant than if an exceedance is already present.

4.3.10 Cumulative assessment

Combined or 'cumulative' effects can be defined as 'impacts that result from the incremental changes caused by other past, present and reasonably foreseeable future actions together with the project' (Hyder 1999).

Cumulative effects have been considered in Chapter 15 'Cumulative effects and inter-relationships' of this ES by:

- Reviewing the likely major, moderate and minor impacts of the Scheme and assessing the potential for cumulative impacts that might arise from the combined work activities over the three year construction period.
- Identifying other strategic, approved and likely development proposals in the study area, particularly those that share some geographical and temporal footprint with the Scheme.
- Assessing the potential for any of these additional developments to have a significant impact on any of the receptors impacted by the Scheme and undertaking a qualitative assessment of the potential for the combined effects.

The significance of cumulative effects has been determined qualitatively using the same criteria for each aspect of the environment as are used in the relevant chapter.

4.4 Uncertainties, difficulties and assumptions

The main sources of uncertainty with the Scheme and its impact assessment process (including cumulative assessment) relate to:

- Assessing with precision the effects of changes in groundwater levels on habitats, and viability of agricultural use such as grazing, following Scheme completion;
- There are a number of uncertainties with respect to the habitats that might form within and adjacent to the new channels, which also need to be considered when trying to offset predicted losses of habitats with predicted habitat gains. There is difficulty in predicting precisely which habitats will form within the site (due to the range of hydrological conditions across the two-stage channel) and how habitats are likely to evolve over time;
- There remains a risk that following ecological survey work and vegetation clearance in advance of the main works, additional protected and invasive species may be identified in the proposed working area, particularly badgers which are highly active in parts of the Scheme area. There are a few small areas that we have not been able to survey for protected species at this stage due to access restrictions including Network Rail land and land that is densely vegetated;
- Some areas of land were not surveyed as part of the soil resources survey and agricultural land quality reporting, due to changes in the Scheme design following the survey. There is the potential that some areas of higher grade agricultural land are present in the Scheme area than that already surveyed and identified as Grade 3b. However, the likelihood of higher grade land is relatively small as the Provisional Agricultural Land Classification mapping shows the main body of the Scheme area as Grade 4.
- There is potential during the works to encounter areas of further contamination, ground instability, and buried military ordnance;
- There is potential during the works to impact on buried archaeological features, not identified by survey work;
- Some data used in the preparation of this ES is secondary information derived from a variety of sources. It is assumed that this data is accurate; and
- The timing of other developments is currently uncertain and has the potential for significant cumulative effects with the proposed Scheme (see Chapter 15 ‘Cumulative effects and inter-relationships’).

In addition, we have not decided whether to use the rail sidings as part of the plan to remove excavated material from the site. Chapter 16 discusses the changes in environmental impacts which would be anticipated if the sidings are used, which would be covered under a separate planning submission to the main flood risk management works.

5 Local community

5.1 Existing environment

The study area used for this chapter is shown on Figure 5.1 and comprises the Scheme area and an approximate 250m buffer zone around the Scheme boundary.

Recreational and access issues are discussed in Chapter 6 'Recreation and public access'.

5.1.1 Strategic overview

The River Thames and its channels and tributaries are of fundamental importance for the local population that use the waterways in Oxford and the surrounding environment, and are key contributors to the tourist industry, leisure and economy of the city. We have therefore designed the Scheme to ensure that the current level of access to the river corridor will be maintained and to provide a natural looking channel that blends into the local landscape.

In the Oxford Local Plan 2036 (Oxford City Council 2020a), the following is said in relation to the Scheme: "The Oxford Flood Alleviation Scheme, a partnership project, will help to convey water away from development infrastructure and will help greatly in reducing flooding in the most at risk areas. It will bring considerable benefits to the city in terms of reduced risk of flooding to homes, businesses, major roads and the railway."

5.1.2 Local population and community buildings

The Scheme area comprises several small settlements including Botley, North Hinksey, South Hinksey, Kennington, Redbridge (including Redbridge Hollow traveller site) and New Hinksey to the west of Oxford's city centre. Within these settlements, there are residential and industrial areas that lie within or adjacent to the Scheme footprint.

Community buildings such as schools and colleges, places of worship, medical centres and local authority buildings (e.g. town halls) within 250m of the Scheme area include:

- North Hinksey Church of England Primary School
- North Hinksey pre-school and childcare clubs
- Saint Lawrence Church North Hinksey
- South Hinksey Village Hall
- St Lawrence Episcopal Church, South Hinksey
- West Oxford Community primary school on Ferry Hinksey Road
- West Oxford Community Centre
- New Hinksey Church of England primary school
- South Oxford community centre
- South Oxford health centre
- St John the Evangelist, New Hinksey

Other community assets such as playing fields, sports grounds, allotments, open space and the Hogacre Common Eco Park are described in Chapter 6 'Recreation and public access'.

5.1.3 Noise and vibration

Noise sensitive receptors have been identified for the Scheme using appropriate mapping and are shown in Table 5.1. These receptors are defined as residential dwellings and other noise sensitive receptors (e.g. occupied buildings such as schools,

offices and churches) lying at the closest distance to those construction activities likely to generate the most noise and vibration (e.g. piling operations, where sheet piling is anticipated). Public amenity areas, such as Public Rights of Way (PRoW) and parks, would also be sensitive to noise and vibration, during use. However, as the closest PRoW and open land in the floodplain informally used for recreation will be temporarily diverted or closed during the construction works for safety reasons and these are used on a voluntary basis, these sites have not been considered as sensitive receptors for this assessment. (The potential effect of closure of these sites on recreation and access are considered further in Chapter 6 'Recreation and Public Access'.)

In addition to noise sensitive receptors close to the work sites, there are also noise-sensitive receptors along the access routes for the construction traffic, which may be affected by the Scheme. These include:

- Residential properties along Botley Road. It is expected that only the first line of properties bordering the road have the potential to be affected;
- Properties close to the A34 in Botley. It is expected that only the first line of properties bordering the road have the potential to be affected;
- Properties at the northern end of Kennington Road;
- Properties along Abingdon Road (A4144) between the Travelodge and Lake Street. It is expected that only the first line of properties have the potential to be affected;
- Properties at Redbridge Hollow mobile home park; and
- Some properties on the north and east sides of South Hinksey.

For the purpose of the noise assessment, the noise-sensitive receptors in Table 5.1 and Figure 5.1 represent the areas where the most likely change in noise climate may occur. As agreed during scoping consultation, a baseline noise survey has not been undertaken.

Those receptors located within approximately 100m from the A34 are likely to be dominated by road traffic noise (with an existing flow of approximately 70,000 vehicles per day, pre-pandemic), and the baseline noise level would be considered as high. Beyond 100m, other noise sources will contribute to the baseline level and the noise from the A34 will reduce.

Table 5.1: Noise-sensitive receptors closest to construction works

Area	Noisiest activities e.g. piling operations	Noise-sensitive receptor
1	• Floodwall to the west of Seacourt Stream above Botley Road • Modifications to Botley Road Bridge • Embankment to the North of Botley Road	• Property on the junction of the A420 and West Way • Properties on Wallbrook Court, along the Junction of the Old Botley and West Way • Properties on the northern side of Botley Road, between Seacourt Park and Ride and Bulstake Close
2	• Westway Cycle Bridge • Willow Walk Bridge	• Properties on Wallbrook Court, along the Junction of the Old Botley and West Way and offices to the south of West Way • Properties on the junction of the North Hinksey Lane and North Hinksey Village • North Hinksey C of E Primary School

Area	Noisiest activities e.g. piling operations	Noise-sensitive receptor
		• Saint Lawrence Church North Hinksey
3	• Footbridge along North Hinksey Causeway • Pedestrian Bridge over Hinksey Stream • Eastwyke Ditch Control Structure • Devil's Backbone Bridge	• Properties on the eastern side of North Hinksey Village • North Hinksey C of E Primary School • Saint Lawrence Church North Hinksey • Properties on the junction of Whitehouse Road and Marlborough Road • Properties on the eastern side of South Hinksey
4	• Floodwall at South Hinksey (and site compound area) • Temporary carriageway construction through Kendall Copse • Old Abingdon Road Bridge • New channel in-between Old Abingdon Road Bridge and Kennington Road Bridge • Kennington Road Bridge • Widening of channel between new Kennington Road Bridge to A423 Railway Bridge • Channel downstream of A423 down to Munday's Bridge • Sheet piles at channel east of railway upstream of A423 • Sheet piles at the channel immediately downstream of A423 east of railway	• Properties on the eastern side of South Hinksey • Properties along Redbridge Hollow • Properties on the junction of Kennington Road with Upper Road • Properties on the junction of the A4144 with Wytham Street • Properties on the south-eastern side of Kennington Road

Alongside the A420 (where daily traffic flows range from approximately 24,000 at Botley Road west of Seacourt Park and Ride to 16,500 at Osney Bridge), the baseline noise level is also likely to be high at the receptors, especially with some receptors being within 10m of this road.

Baseline noise for receptors will reduce at an increasing distance from these A-roads and also the railway line.

5.1.4 Socio-economics

Oxford is a university city with two leading universities and a principal administrative centre that focuses on education, research and science. There are approximately 4,730 businesses securing 118,000 jobs (https://www.oxford.gov.uk/info/20124/economy/454/economic_statistics, accessed 2021), with key employment in the city centred on the universities and in the public sector, as well as publishing, hospitality, hi-tech, research and tourism. Tourism plays an important role in the local economy, attracting 7 million day-time and staying visitors annually, and generating an income of £780 million for local businesses (https://www.oxford.gov.uk/info/20124/economy/454/economic_statistics). There are approximately 46,000 people commuting into Oxford on

a daily basis (2011 census, as cited in http://www.oxford.gov.uk/info/20124/economy/454/economic_statistics).

The key businesses or organisations within and adjacent to the Scheme boundary (see Figure 5.1) that have the potential to affect or be affected by the Scheme include:

- Seacourt Park and Ride bordering the northern edge of Botley Road and the proposed construction of the flood bund/wall at Botley Road. This has recently been extended by the City Council.
- Johnson Cars Limited, a car-sales office located at New Barclay House on Botley Road.
- The Co-operative Group who retain a training space behind Johnson Cars on Botley Road.
- Businesses along Botley Road including Minty Beds and Richer Sounds.
- Botley Road Retail Park bordering the eastern edge of the proposed channel to the south of Botley Road.
- Minns Business Park bordering the western edge of the proposed channel to the south of Botley Road/West Way.
- Osney Mead Industrial Estate located on the eastern boundary of the proposed raised defences at Ferry Hinksey Road.
- The Fishes Public House located to the west of the new channel at North Hinksey.
- Manor Farm located at South Hinksey; there are various businesses that work out of the farm or occupy parts of the buildings as sub-tenants.
- Muller Dairies (Unigate) at Redbridge located adjacent to Hinksey Stream and channel clearance works.
- Redbridge Camping site and Go Outdoors on Old Abingdon Road.
- Travelodge located on Abingdon Road to the north-eastern edge of Redbridge Park and Ride, and close to the proposed site compound exit.
- Redbridge Park and Ride.
- Redbridge refuse centre on Old Abingdon Road.
- DB Cargo on Network Rail sidings accessed from Old Abingdon Road.
- Network Rail.
- Said Business School located at Egrove Park on Kennington Road.
- Oxford Spires Hotel located at New Hinksey, to the west of the proposed flood bund.
- Hinksey Heights Golf Course located to the west of the A34 – considered in this assessment due to potential for increased traffic movements on the A34.
- Wyevale Garden Centre located to the west of the A34, on the southern by-pass road – considered in this assessment due to potential for increased traffic movements on the A34.
- Utility companies whose infrastructure will be affected by the proposed Scheme.

One of our key partners to the Scheme, the Oxfordshire Local Enterprise Partnership (OxLEP) has produced the Oxfordshire Strategic Economic Plan (OxLEP 2017). This sets out the long term vision and ambitions for economic growth in the county. The overall vision for the Economic Plan is that by 2030 "*Oxfordshire will be recognised as a vibrant, sustainable, inclusive world leading economy, driven by innovation, enterprise and research intelligence*."

Oxford has very high employment levels, and the Job Seekers Allowance claimant rate (plus those who claim Universal Credit) is low at 1.8% or 1,915 individuals (https://www.oxford.gov.uk/info/20124/economy/454/economic_statistics, June 2019 figures as these are the most recent available before the temporary effects of the Covid-19 pandemic).

There are several sites (Figure 5.1) within or adjacent to the Scheme boundary that have been safeguarded by local authorities for existing/proposed employment and/or development sites. In the absence of the Scheme, there will be a continued risk of flooding to local businesses, tourism infrastructure and the local community in Oxford, which is expected to increase due to the effects of climate change. These effects will be exacerbated by urban development associated with the increasing population and in-commuting to the city. This will include increased flood risk for approximately 5,626 residential and commercial properties, and tourist and recreational assets over the next 50 years, while the flood risk to new development identified in the Core Strategy will remain unmanaged.

5.1.5 Human health

The health of those residing in Oxfordshire is generally good and better than the England average, although air quality is worse than government health-related targets in large parts of the City itself. Only 3.5% of the population of the County declare themselves as being in bad or very bad health, with the largest proportion of these residing in urban areas (ONS, 2011).

Of relevance to the study area, are any changes to the existing baseline that influence or affect human health, including changes to:

- **Flood risk** – the existing flood risk in the study area is described in Section 1.3 and shown on Figure 1.4. A Flood Risk Assessment has been undertaken for the Scheme (see Chapter 9). Flood risk has both psychological and physical impacts on human health. Living with the risk of regular flooding of properties and key infrastructure in Oxford causes major stress for residents and commuters, with traffic disruption along the arterial routes into the city centre, and homes are often cut off from emergency services. Several recent studies including a paper from Public Health England (February 2014) have identified that flooding can have profound effects on people's mental health and well-being that may continue over extended periods of time. This includes the constant worry of flooding during storm events and high river flows and the stress of coping with dealing with a flooded property and loss of possessions. By reducing flood risk this Scheme will have a positive impact on the mental wellbeing of residents in flood risk areas. This has the knock-on impact of reducing pressure of health care services and other mental health support groups.

- **Land use** – there are five PRoWs (see Section 6.1.1) and multiple green spaces and other community facilities/initiatives (see Section 6.1.2) including allotment gardens and community planted woodlands such as Kendall Copse in the study area, which provide opportunities for physical activity. There are also fields at North Hinksey, New Hinksey and South Hinksey, which are currently used to keep horses.

  Changes to access and availability of walking and cycling routes, open green space, horse paddocks and community facilities can affect levels of physical activity, which is a challenging issue for the county. Although levels of physical activity are comparable in the south-east to the rest of England, and estimated levels of physical activity and obesity are better than the England average; the Oxfordshire Partnership notes that obesity levels are rising across all localities and age groups (Oxfordshire County Council 2015).

  The current availability of the fields/meadows and green spaces (see Section 6.1.1) within the study area for walking and other outdoor activities has health benefits for the city's occupants. There are links between green space and mental and physical health improvement, which are dependent on the amount of exposure or exercise that people take in that environment. There is anecdotal

evidence of an increase in use of green space locally since the onset of the Covid-19 pandemic. A number of studies have noted that people living in areas close to accessible green space have a higher propensity to take moderate exercise that leads to enhanced physical health. There has been considerable research into the links between the natural environment and access to green space, and human health. A study by the University of East Anglia (Twohig-Bennett & Jones 2018) using data from 20 countries demonstrated that regular exposure to green spaces had wide-ranging physical and mental benefits. The study also reveals that exposure to green space reduces the risk of Type II diabetes, cardiovascular disease, premature death, preterm birth, stress, and high blood pressure. There is also evidence to show that exposure to nature reduces the experience of pain (Diette 2003), that areas of greater biodiversity promote greater health benefits (Lovell 2014) and group walks in nature are associated with lower depression (Marselle 2014).

- **Modes of travel** (e.g. to work) – the 2011 Census identified that Oxfordshire residents travelling out of the county to work are twice as likely to use public transport as commuters travelling into the county. Approximately 48,200 Oxfordshire residents said they travelled out of the county to work elsewhere, and of these, 19% travel mainly by public transport. Only 9% of the 57,400 commuters travelling into the county to work arrive by public transport; 85% arrive by car, the largest numbers travelling in from Aylesbury Vale (most to destinations in South Oxfordshire, but also to Oxford and Cherwell), South Northamptonshire (most to Cherwell district) and Swindon (most to Oxford).

  Approximately 246,000 journeys to work are made within Oxfordshire. Two thirds of these are made by car or motorcycle and 24% on foot or by bicycle (Census 2011).

  Any changes in modes of travel through disruption to roads, PRoW and bus services (see Chapter 11 'Traffic and Transport') can affect traveller anxiety, and result in changes to physical activity, and associated obesity.

  It should be noted that all available figures for modes of travel used predate the Covid-19 pandemic. It is not yet known whether this pandemic will result in a permanent reduction in the growth rate of car traffic or increase in pedestrian and cycle travel.

- **Traffic flows, volumes and distribution** – existing traffic flows and volumes are described in Chapter 11 'Traffic and Transport'. Increases in traffic flows and congestion can increase anxiety in vehicle travellers and has been linked to aggressive behaviour and increased likelihood of involvement in an accident. Additionally, increases in traffic are linked to a perceived increased danger of cycling and walking. There is a relationship between traffic growth and the reported decline in rates of walking and cycling in England. These effects can be either physical (observable) or psychological (unobservable) impediments to pedestrian movement (Hine, 1994).

- **Noise levels** – noise levels experienced by the local community are discussed in Section 5.1.3. Changes in noise levels from construction plant and traffic noise can interfere with the enjoyment of those working, visiting and residing in Oxford. Traffic noise can cause impaired communication (difficulty in making oneself heard), sleep disturbance, annoyance and increased aggression.

- **Air quality** – this is discussed in Chapter 13. Air pollution causes short term health effects on the respiratory system and more serious impacts due to long-term exposure including permanent reductions in lung function. Air pollution is linked to asthma, chronic bronchitis, heart and circulatory disease, and cancer

(Krzyzanowski *et al*, 2005).

- **Areas of made ground** containing potential contamination – these are discussed in Section 12.1.3.

5.1.6 Changes to local community in absence of Scheme

In the absence of the Scheme, local community assets, businesses and access routes for commuting and travelling in and around the city will continue to be vulnerable to flooding, which will have significant adverse effects on human health. These effects are expected to be exacerbated by climate change, which is predicted to increase the extent, severity and frequency of flooding. The increasing population growth and any continuing trend for in-commuting to Oxford city will place increasing strain on existing resources vulnerable to flooding.

5.2 Likely significant effects

5.2.1 During construction

Local population and community buildings

The Scheme will result in a range of social impacts on the settlements and sensitive community assets through which the new channel and new flood defences will be constructed. These effects will include elevated noise and dust levels, and access restrictions; all of which have been assessed elsewhere in this ES. Such changes may affect psychological and physiological health, as well as behaviour.

During construction of the Scheme, there will be some adverse impacts associated with temporary land-take (in addition to permanent land-take, discussed in Section 5.2.2). In particular, small sections of the Scheme will be constructed within some gardens of residential properties in Kennington Road near Munday's Bridge and adjacent to Manor Road in South Hinksey. This will affect approximately 2,200m^2 of domestic garden land during construction, primarily at Manor Road in South Hinksey plus two properties at Kennington Road and one in New Hinksey. This impact is considered to be **minor to moderate adverse** based on a very high value receptor and a minor negative magnitude i.e. affecting a small area (although it is recognised that individual residents may regard the impact as being more significant).

Noise and vibration

Construction works

The construction works will increase noise and vibration levels as a result of construction vehicles and plant and construction related activities including piling and general earthworks. A minor negative magnitude has been defined as a predicted outdoor noise level above 65dB(A) during the working day. This is in line with Category A as defined in Table E.1. of BS5228-1 for when predicted levels can be compared with the ambient levels, which in this situation is assumed to be less than 65dB(A) – the lowest category of baseline level defined in BS5228.

The calculation methodology set out in BS 5228-1 has been employed to estimate the noise level during the sheet pilling activities at the closest noise-sensitive receptors, since this is expected to be the noisiest single activity. Vibration levels from sheet piling activities have been estimated using the method contained in BS 5228-2. Empirical predictions (equations) for percussive piling have been calculated and the resultant level is given in terms of Peak Particle Velocity (PPV) in mm/s. A significant level of vibration

would be considered as 1 mm/s on humans. For risk of building damage, a PPV of above 10mm/s would be required before any building is at risk (assuming the building is structurally sound).

Table 5.2 presents the predicted levels of noise and vibration from the works associated with the sheet piling activities. Those locations where noise levels are marked in red are considered to have a **minor to moderate adverse effect** on nearby properties (based on very high value receptor and minor negative magnitude).

The receptors associated with these adverse effects are:

AREA 1:

- Property occupant on the junction of the A420 and WestWay
- Property occupants on the western side of the junction of Botley Road and Bullstake Close

These property occupants may experience elevated noise levels from proposed piling activities during construction of the new floodwall to the west of Seacourt Stream and the embankment construction to the north of Botley Road.

AREA 2:

- Property occupants on the junction of the North Hinksey Lane and North Hinksey Village
- School children and staff at North Hinksey Church of England Primary School
- People attending Saint Lawrence Church, North Hinksey

These receptors in Area 2 may experience elevated noise levels from proposed piling activities during construction of Willow Walk Bridge.

AREA 4:

- Property occupants on the northern and eastern sides of South Hinksey

These property occupants may experience elevated noise levels from proposed piling activities during construction of the new floodwall at South Hinksey.

No property occupants should experience nuisance or damaging levels of vibration.

Table 5.2: Predicted noise and vibration levels during sheet piling works and works at the construction compound

Location of piling works	Distance of closest receptor to piling activity (m)	Noise Level (dBA) at closest receptor	PPV (mm/s)
AREA 1			
Floodwall to the west of Seacourt Stream above Botley Road	25	78.6	0.2
Modifications to Botley Road Bridge	110	56.8	0.0
Embankment to the North of Botley Road	40	74.0	0.1
AREA 2			
Westway Cycle Bridge	120	55.9	0.0
Willow Walk Bridge	45	65.5	0.1
AREA 3			
Footbridge along North Hinksey Causeway	60	62.7	0.0
Pedestrian Bridge over Hinksey Stream	160	53.1	0.0
Eastwyke Ditch Control Structure	230	56.9	0.0

Location of piling works	Distance of closest receptor to piling activity (m)	Noise Level (dBA) at closest receptor	PPV (mm/s)
Devil's Backbone Bridge	70	61.2	0.0
AREA 4			
Floodwall at South Hinksey	30	76.8	0.1
Old Abingdon Road Bridge	150	53.7	0.0
New channel in-between Old Abingdon Rd Bridge and Kennington Road Bridge	170	59.8	0.0
Kennington Road Bridge	110	56.8	0.0
Widening of channel between new Kennington Road Bridge to A423 Railway Bridge	250	56.1	0.0
Channel downstream of A423 down to Munday's Bridge	150	53.0	0.0
Sheet piles at channel upstream of A423 east of railway	160	52.4	0.0
Sheet piles at the channel immediately downstream of A423 east of railway	200	58.2	0.0
Erection of construction compound (no piling anticipated)	60	63.4	0.0

This assessment only considers the noisiest operations, as a worst-case scenario, and hence only considers receptors at locations where sheet piling is anticipated (see Table 5.1) and those close to the construction compound. However, elevated noise levels are also likely to be experienced at other locations where construction works are proposed. Elsewhere, it is anticipated that there will be **minor adverse noise effects** based on very high value receptors and a minor negative to negligible magnitude. These effects would be from earthworks, tree felling, vegetation clearance, and some kerb works and paving activities.

The work to erect the construction compound would be a **minor adverse noise effect** based on very high value receptors and a minor negative to negligible magnitude. The noise from day to day operation of the compound will be less than that from its erection, and the 4m high earth bund will provide screening for some activities, including most of the works to remove the compound when it is no longer needed.

The predicted levels of vibration are not at a level where building damage, even cosmetic, would be expected, nor would levels reach those noticeable by people – **no significant impacts**.

There are a number of fields near the Scheme area which are currently, or have recently been, made available for horse paddocks. Up to four of these fields are sufficiently close to the Scheme area that construction work may make the fields temporarily unsuitable for horses, which are often sensitive to noise. This would be a **minor adverse** noise effect.

Noise from the changes to traffic

During the works, there will be additional traffic on the road network from construction vehicles.

The additional traffic on the A34 is predicted to be up to 67 additional two-way movements each day. Given the existing flow of approximately 70,000 vehicles per day on the A34, an increase of 134 vehicles would cause an increase of less than 0.5dB(A)

and will be of negligible magnitude, resulting in **no significant impact** on noise-sensitive receptors.

Socio-economics

During construction of the Scheme, there will be a temporary increase in labour (with up to 100 staff on site at peak periods), with associated impacts on local facilities, as it is expected that any who are not local to Oxford will stay in local accommodation during the construction period and may eat in local restaurants and visit local attractions at weekends. These are considered to be **minor beneficial impacts** based on a negligible to minor positive magnitude and very high value receptor.

The Scheme will result in temporary disruption to some existing businesses (notably those along Botley Road, Old Abingdon Road, Oxford Spires Hotel and those within adjacent retail/business parks and industrial estates to the Scheme) during the construction works. Such impacts will result from localised and temporary increases in noise, vibration and access disturbance (considered minor to moderate negative magnitude and a very high value receptor), mainly as a result of construction activities and to a lesser extent from associated localised increases in vehicle movements due to the delivery of materials, machinery and site personnel. There will also be disturbance to some commercial properties and businesses over which access will be required for construction, for example Seacourt and Redbridge Park and Rides. These are considered to be potentially **moderate adverse impacts.**

There will be no impact on users of water, gas or electricity utilities, as we have made arrangements for all utilities potentially affected by the Scheme to be protected or diverted before construction of the Scheme starts.

The volume of construction vehicles associated with the Scheme has the potential to adversely affect park and ride bus movements at both Seacourt and Redbridge, particularly at the former where heavy goods vehicles will be using the existing access into Seacourt Park and Ride. These impacts are assessed in Chapter 11 'Traffic and transport'.

Human health

Health and safety impacts on site workers and the public during construction, including the risk of accidents, will be addressed by the contractor with reference to the appropriate Health and Safety legislation and to the design of the Scheme, for example inclusion of security fencing.

During construction, potential temporary adverse effects on human health may result from the temporary loss of green infrastructure including public open space, recreational land, horse paddocks, and the temporary severance of footpaths and permissive paths. These changes may reduce levels of physical activity and result in changes to walking/cycling patterns. Further changes may be associated with temporary changes to bus services and reduced air quality. The significance of these impacts and associated mitigation for these changes are considered in Chapter 6 'Recreation and access' and Chapter 11 'Traffic and transport' and are therefore not repeated here.

Similarly, the Scheme will result in temporary increases in traffic flows along the A34, A420 Botley Road/West Way, and the A4144 Abingdon Road, and potentially some congestion resulting from the temporary carriageway at the junction of Kennington Road and Old Abingdon Road, which is discussed in Chapter 11 'Traffic and transport'. As it is likely that there is relationship between traffic growth and the reported decline in rates of walking and cycling, there is potential for changes in traffic conditions during construction of the Scheme to affect the behaviour of pedestrians and cyclists. The

increased traffic flows along some of the roads used by pedestrians and cyclists (for example, the A420 Botley Road/West Way and the A4144 Abingdon Road) may reduce the number of people walking and cycling along these routes with associated physical or psychological (e.g. reduced confidence and feeling unsafe) effects. Such effects may be more pronounced in vulnerable groups such as children, those with physical and/or learning difficulties, and the elderly. These temporary effects are considered to be **minor to moderate adverse** (based on very high value receptors and a minor negative magnitude).

The loss of most of the community-planted woodland at Kendall Copse may have **minor adverse effects** (such as feelings of demoralisation and behavioural changes e.g. not wanting to get involved in future community projects, loss of positive feelings from wandering the site thinking 'I planted that' etc) on those who were involved with its planting. There is also an additional effect resulting from the direct loss of this open space on recreational users, which is assessed separately in Chapter 6 'Recreation and access'.

The local and temporary increases in air pollution resulting from construction of the Scheme are assessed in Chapter 13 'Air quality'.

The potential for construction activities to expose contamination and create obnoxious odours and affect the health of construction workers and local land users is discussed in Section 12.2.1.

5.2.2 During operation

As there is no mechanism for significant noise or vibration effects to be caused during operation, noise and vibration issues were scoped out of this assessment.

The Scheme once operational, will lead to a long-term reduction in the risk of flooding at the 1% AEP event to over 1,050 residential and commercial properties, infrastructure and recreational assets in Oxford, with associated beneficial impacts on the health of inhabitants, workers and visitors. The Scheme will reduce flood risk to designated employment zones and some of the existing businesses (notably those along Botley Road, Abingdon Road, the grounds of and access to Oxford Spires Hotel and those within adjacent retail/business parks and industrial estates to the Scheme) that will be temporarily affected during construction. The Scheme will also complement the objectives of the Oxfordshire Strategic Economic Plan (OxLEP 2017) and the City's Local Plan 2036 through a reduction in flood risk. These positive changes represent a **major beneficial impact** to the city (based on a major positive magnitude and high value receptors).

The Scheme will also provide a long-term reduction in flood risk to critical transport infrastructure (including the key arterial roads into the city centre such as Botley Road and Abingdon Road and the railway), that is required to link new developments with the commercial hub of Oxford. Additionally, there will be a reduced flood risk at the Seacourt Park and Ride site. The reduction in flood risk to critical infrastructure in Oxford will significantly reduce stress and anxiety for vehicle travellers and those in-commuting, and is a **major beneficial impact** of the Scheme, influencing key indicators of health and fitness.

The Scheme will provide some significant health and well-being benefits that have been developed and promoted as an integral part of the Scheme by:

- Landscape and wildlife enhancements through the creation of a new natural looking channel and increased blue infrastructure. The improved recreational value of some parts of the Scheme area as a result of a more attractive (but natural looking) wetland landscape and the design of wildlife habitats, will enhance the experience of informal recreational activities, encouraging people

to use some of the existing walkways and areas with agreed public access, with associated health benefits;
- Improvements to green infrastructure by improving the surfacing of existing public footpaths; and
- Creation of new amenity features through the installation of interpretation boards around the Old Abingdon Road Culverts Scheduled Monument.

These impacts have been assessed in other sections and therefore not assigned a significance in this section.

Upon completion of the Scheme, there will be some adverse impacts on local population and community buildings associated with land-take. In particular, the Scheme will be constructed within some gardens of residential properties in Kennington Road near Munday's Bridge and adjacent to Manor Road in South Hinksey, which will result in total permanent land-take from residential property of approximately 300m^2 and 250m^2 respectively, which removes these areas from two properties at Kennington Road and one at South Hinksey. The proposed flood wall in the private garden in New Hinksey will be designed in conjunction with the landowner to blend into the existing patio area and avoid restricting access within the garden. This impact is considered to be **minor to moderate adverse** (based on a very high value receptor and a minor negative magnitude i.e. affecting a small area). The long-term loss of agricultural land is considered in Section 12.2.2.

5.3 Mitigation

We have developed a construction methodology which is designed to minimise the disturbance to the local community caused by the effects of the construction works. The methodology includes the following measures:

- Limiting use of equipment on site to defined working hours to minimise noise and light impacts i.e. 7.00am to 7.00pm Monday to Friday and 8.00am to 1.00pm on Saturdays (with piling works restricted to 8.00am – 6.00pm Monday to Friday). We will avoid construction activities on Sundays and Public Holidays other than in emergency or other exceptional circumstances.
- We will inform residents and commercial occupants of the nature and timing of construction activities through identified communications channels and means such as newsletters, where appropriate. We will act on any concerns arising from the local community, as a result of the main construction works through the appointment of a Community Liaison Officer who will provide specific feedback to the site management teams (Contractor, Site Supervisor and us), and identify responsibility for agreeing and instructing remedial actions.
- The use of Kennington Road and Old Abingdon Road (and associated temporary junction modification) will be managed to reduce disturbance to residents, commuters and other road users as far as possible, with advance advertising of roadworks.
- We will work with public transport providers to mitigate impacts on transport routes appropriately.
- If there are graziers using the affected horse paddocks immediately prior to construction, we will inform them of the nature and timing of the works and will assist them to identify local areas where the horses can be relocated for alternative grazing while the Scheme is constructed.
- We will programme and phase the works over the construction period to restrict impacts within any one area to the minimum time.
- We will adopt the Best Practicable Means (BPM) (as defined in Section 72 of the Control of Pollution Act 1974) on site to reduce temporary noise levels arising during the construction period. Additionally, we will implement the following control measures (set out in BS 5228:2009+A1:2014 Part 1) to

minimise noise disturbance to users of the Scheme area, caused by the construction works:

- Careful selection of equipment, for example any compressors brought to site will be super-silenced or sound reduced models fitted with acoustic enclosures or any pneumatic tools will be fitted with silencers or mufflers, wherever practicable;
- All plant and equipment will be properly maintained and operated in accordance with manufacturers' recommendations to avoid causing excessive noise;
- Equipment will be shut down when not in use for a period longer than five minutes; and
- No vehicles to wait or queue on public highways with engines running and care will be taken when unloading deliveries.

Mitigation measures to control noise during construction are incorporated in the Environmental Action Plan (see Appendix G) and will be supervised by an Environmental Clerk of Works (ECW). These will help to minimise the noise on-site and reduce the magnitude of the predicted impacts. However, it should be noted that where piling will be close to sensitive receptors, the options for noise reduction are limited.

5.4 Residual effects

The residual impacts on the local community are presented in Table 5.3.

Table 5.3: Residual impacts on local community (excluding access and recreation)

Receptor	Description of Potential Impact	Significance of Predicted Impact	Mitigation Measures	Significance of Residual Impact
Noise-sensitive receptors	Temporary construction noise disturbance from piling activities	Minor to moderate adverse (within 45m of piling/noisy activities – see Figure 5.1)	BPM - adherence to defined working hours. Having representatives available on-site. Careful selection of equipment and equipment shut down when not in use. No vehicles to queue on public highways with engines running. Working in accordance with EAP. Residents and commercial occupants to be informed of nature and timing of clearance and construction activities. Act on concerns from the local community.	Minor to moderate adverse (temporary) [Note long-term major beneficial impact of reduced flood risk – see below)
		Minor adverse (elsewhere – over 45m from piling)		No significant impact (elsewhere)
Existing businesses within and adjacent to Scheme	Temporary disruption from localised noise and access disturbance during construction	Moderate adverse		Minor adverse
Utility services	Temporary disruption through diversion and modification of utilities and services.	Minor to moderate adverse	Inform residents and commercial occupants of the nature and timing (as per defined working hours) of service diversions and temporary stoppages in	Minor adverse

Receptor	Description of Potential Impact	Significance of Predicted Impact	Mitigation Measures	Significance of Residual Impact
			service provision. Work in accordance with the EAP. Act on any concerns from the public. Advance advertising of works to utility services.	
Local population	Permanent reduced flood risk to properties (including some of the noise sensitive dwelling temporarily affected during construction), businesses and infrastructure (including development zones) once the Scheme is completed. Associated beneficial impacts on human health	Major beneficial	Not applicable	Major beneficial
	Temporary increase in labour during construction with positive impacts on local facilities and tourism	Minor beneficial	Not applicable	Minor beneficial
	Temporary impacts on the health of users of existing areas of open space through loss of opportunity for physical activity, socialisation and loss of restorative effects of nature	Nil to moderate adverse	Consultation and information notices explaining restrictions to open spaces. New open space provided during works – see Section 6.3.	Nil to minor adverse
	Temporary and permanent land-take within some gardens of residential properties.	Minor to moderate adverse	Continued consultation with affected residents.	Minor adverse
Vehicle travellers, pedestrians and cyclists along A34, A420 Botley Road/West Way, A423 Southern By-Pass and the A4144 Abingdon Road	Permanent reduced flood risk to key infrastructure including road and rail network upon Scheme completion	Major beneficial	Not applicable	Major beneficial
	Temporary increased anxiety and changes in human behaviour (e.g. from stress) during roadworks or due to increased HGV traffic	Minor to moderate adverse	Limit use of equipment to defined working hours. Inform residents and commercial occupants of nature and timing of construction activities and advance advertising of roadworks. Act on concerns from the community. Work in accordance with EAP.	Minor adverse

6 Recreation and public access

6.1 Existing environment

The study area is shown on Figure 6.1 and comprises the Scheme area and an approximately 250m buffer zone around the Scheme boundary.

6.1.1 Public access

Public consultation has helped to identify those areas of land which currently have formal or informal public access.

The following PRoW traverse the study area (see Figure 6.1), as follows:

- Bridleway (320/14 Willow Walk) and cycleway across Willow Walk, linking the junction of Ferry Hinksey Road and Osney Mead Road in the east, to North Hinksey Lane in the west. This bridleway is accessible for equestrians, cyclists and pedestrians, and has a branch that links up to Marlborough Court, Duke Street and Botley Road. Based on feedback from the public exhibitions, it is understood that Willow Walk is heavily used all day for walking and cycling by school children, commuters and for leisure.
- Footpath (320/16 North Hinksey Causeway) across North Hinksey Causeway to the immediate south east of Willow Walk, linking Ferry Hinksey Road at Osney in the north-east to North Hinksey in the south-west.
- Footpath (320/17 and 352/1 Devil's Backbone), that runs from the suburb of New Hinksey in the north-east, across the Hinksey Stream and the Oxford to London railway line to the village of South Hinksey and the A34 in the south-west. Based on feedback from South Hinksey Parish Council, it is understood that the Devil's Backbone is a busy commuter route.
- Footpath (352/3 South Hinksey to Old Abingdon Road), linking South Hinksey to Old Abingdon Road (part of Redbridge circular walk, passing through Chilswell Valley). Another section of this footpath runs around the south-eastern part of South Hinksey village.
- Footpath (352/2 South Hinksey to the A34), that runs in a southerly direction from South Hinksey Village.

In addition the following PRoW are relevant to the Scheme, while not passing within the Scheme area:

- Footpath (311/1 North Hinksey), linking North Hinksey Lane with footpath 320/16 North Hinksey Causeway.
- Bridleway (311/7 North Hinksey), linking North Hinksey Lane with bridleway 320/14 Willow Walk.
- Footpath (311/8), providing a central connection between two parts of North Hinksey Lane.
- Footpath (320/18), linking the B4495 Weirs Lane with the Thames tow path and footpath 320/118. The footpath includes a crossing over Weirs Mill Stream.
- Footpath (352/5 South Hinksey), linking St Lawrence Road to an area adjacent to Pin Farm Cottage.
- Footpath (352/6) running along Barleycroft Lane, linking St Lawrence Road to an area adjacent to Pin Farm Cottage.
- Footpath (352/18) running from the B4495 Weirs Lane, across Weirs Mill Stream to the River Thames tow path.

The Thames Path National Trail (320/5/10), which runs from its source at Kemble in Gloucestershire to the Thames Barrier near Greenwich, follows the River Thames at a distance of approximately 100m to the east of the closest part of the excavation works, immediately adjacent to a field which will be planted for ecological improvements as part of the Scheme.

There is informal access from the Thames Path into fields which will be planted as part of the Scheme, and also links to an informal footpath by the Fishes Public House in North Hinksey. There is also informal or permissive access in the following parts of the Scheme area:

- around Hinksey Meadows between Seacourt Nature Park and Willow Walk;
- on the Westway cycleway/footbridge over Seacourt Stream, which runs from Minns Industrial Estate to Oxford City Centre; and
- along a path that runs from Abingdon Road to the Thames Path alongside the north edge of the Oxford Spires Hotel.

Additionally, there are also footways (i.e. paths alongside highways), which are used as public paths in the study area.

There are several cycling links as follows:

- National Cycle Network 5 – this principal cycle route, which runs between Oxford City Centre and west of the A4144 Abingdon Road corridor crosses the southern part of the Scheme area. This route forms part of the UK-wide network of high quality cycling routes, from which local cycle routes radiate. The route crosses the A420 in Oxford City Centre and continues south on Marlborough Road and onto Wytham Street before accessing the A4144 Abingdon Road at its junction with Old Abingdon Road. The route continues past the A423/A4144 'through-about' junction along Eastern By-Pass Road before deviating right along the Thames towards Kennington and Abingdon. This route provides unhindered travel by cyclists between areas of high population density and major activity centres in Oxford, and connects with other parts of the national cycle network.
- 320/14 Willow Walk – this bridleway (described above) is a popular and formal local cycle route for recreation and commuting, which connects with the National Cycle Network 5 via an informal riverside route to the east of Osney Mead, or via North Hinksey Lane and Botley Road to the west.
- On- and off-road sections of cycle route along the A420 Botley Road/West Way. These local cycle routes, which link the railway station, Jericho and Oxford City Centre in the east with Botley in the west, help circulation within the city.
- On- and off-road sections of cycle route along the A4144 Abingdon Road. The cycle route is an additional route to National Cycle Network route 5 and links Oxford City Centre in the north to the New Hinksey area and links across the River Thames to the Iffley area of the City. The southbound section is largely on-road but segregated whereas northbound is on-road and is advisory.
- Off road sections of cycle route along the A423 Southern By-Pass Road. Connecting with National Cycle Network Route 5, this is a shared use section that links with Kennington Road.

Within the Scheme area, cyclists and pedestrians have informal access to a route known locally as the Electric Road, where major power cables from South Hinksey to Osney substations are located. The Electric Road extends from Osney Mead Industrial Estate to the north-east of North Hinksey Causeway to Devil's Backbone. Cyclists also have formal access to Willow Walk, as well as the local road network.

There are four areas of public open space within the study area that lie within the footprint of the Scheme:

- Seacourt Nature Park – see Figure 8.1. There is public access through this nature reserve, running from Botley Road in a southerly direction.
- Oatlands Recreation Ground – see Figure 6.1.
- Kendall Copse community woodland - see Figure 6.1. There is permissive access around the copse adjacent to Kennington Road.
- Kennington Pool Local Wildlife Site - see Figure 6.1. There is public access along a narrow footpath around the southern and eastern edge of Kennington Pit.

As part of the CPO process we have been carrying out recreational surveys to better understand how existing areas of open space are being used, to ensure that any replacement land delivered by the Scheme provides a suitable replacement. During February and March 2018, surveys were carried out to establish how people use the public open space at Seacourt Nature Park, Oatlands Recreation Ground and at Kendall Copse community woodland, and the results of the surveys is now presented below and in Annex E.

A questionnaire survey (see Annex E) was undertaken over the course of several days, within the same week. The surveys were carried out using opportunity sampling at the sites, asking members of the public who were willing to answer questions at the time of the surveys. The survey included questions to find out, amongst other things:

- How many people visited
- Locations travelled from
- Mode of transport and where (if applicable) they had parked
- What the space is used for
- How long the open space is used for
- How often the person visits

The survey data was analysed and the main findings are detailed below. Note that where responses from participants were ambiguous (e.g. location travelled from 'work', 'Oxford' or 'local'), this will have been omitted for that section of results.

Additionally, the University of Exeter's Outdoor Recreation Valuation Tool (ORVal) was accessed in September 2018 to help understand visitor numbers at open spaces within the Scheme area where recreational surveys were not carried out.

Seacourt Nature Park (surveyed 21 February – 24 February 2018)
The survey recorded 396 people visiting the site over four days, of which 112 persons took part in the questionnaire. A summary of the findings are as follows:

- The public travelled mostly from within the OX2 postcode. The results show 80 of the total 98 responses given were local to OX2 which equates to 82% of the sample travelling through Seacourt from within the same area. Notably, the next largest group was from OX3 and OX4 at 3% of participants travelling from the outer edges of Seacourt. Finally, only 2% came from the city centre. Annex E displays these results.
- The main mode of transport noted by over half of participants was on foot. This equated to 57 participants, which was 54%, arriving at Seacourt by foot, and the second largest was by car with 32 participants, which equated to 30%, driving to Seacourt. Bicycle users equated to 12% and the final 4% was from bus users. Of those who reported using a car, 59% parked at their 'Work Car Park' and 10% parked at South Minns. 16% used Seacourt Park and Ride, see Annex E.
- The space is mostly used for walking including dog walking, for leisure and for commuting.
- Over two thirds of respondents were very regular visitors (i.e. visiting the site more than once a week).

Oatlands Recreation Ground (surveyed 12 – 17 March 2018)
The survey recorded 64 people visiting the site over five days, of which 17 took part in the questionnaire. A summary of the findings is as follows;

- The majority (65%) of respondents travelled from within the OX2 postcode. Oatlands recreation park is within the OX2 postcode. Three respondents, equating to 17%, travelled from the OX4 postcode. One respondent travelled from the OX1 postcode, central Oxford. The results are displayed in Annex E.
- For the 16 responses on mode of transport to Oatlands Recreation Ground, one travelled by bus and the rest on foot. The one participant who travelled by bus came from the OX4 postcode.
- The area is mainly used for dog walking (11 of 17 respondents), walking (2), cycling (1) and for children (playing and sports) (2). Dog walking ranged from less than 30 minutes to 2 hours. All other uses were for less than 30 minutes, or in the case of entertaining children, not defined. Overall, the largest result for time spent was 41% of respondents visiting for 30 – 60 minutes. An additional 35% used the space for less than 30 minutes.
- The majority (76%) of respondents, visited every day and 18% visited more than once a week. Overall, all respondents visited very regularly and only 6% visited just once a week.

Kendall Copse (surveyed 5 - 9 March 2018)
Only one person visited the site over five days.

- They travelled from within the postcode of Kendall Copse (OX1), on foot and entered via Kennington Road. The purpose of their visit to Kendall Copse was for walking for 30 minutes to one hour, a few times a year. The individual was part of the 'Friends of Kendall Copse' membership body.

A large proportion of the farmland in the floodplain is accessed by the public, either formally, such as Hinksey Meadow which is owned by the Oxford Preservation Trust and open to the public, or informally e.g. along the Electric Road. The fields in the northern section of the study area (to the north of North Hinksey Causeway) are understood to be the most heavily used for informal recreation, particularly for dog-walking (based on public consultation feedback on the Scheme).

Along the highway network, there is a comprehensive network of footways and crossing points.

6.1.2 Recreational use of Scheme area

A variety of recreational interests are represented in the study area including:

- Walking (including dog-walking) and cycling – public footpaths and cycleways and informal access used by walkers and cyclists is covered in Section 6.1.1. Horse-riding – horse-riders can use the designated bridleway at Willow Walk (see Section 6.1.1).
- Angling and fisheries – formal angling within the area is predominantly on the River Thames to the east of the Scheme (adjacent to the proposed works at New Hinksey), on the Seacourt Stream upstream of the A34 and on the Weirs Mill Stream upstream and downstream of Donnington Bridge on the left bank. The latter stream is fished by the Thames Valley Angling Association. Informal fishing may take place on the Seacourt Stream, Hinksey Stream and Bulstake Stream within the study area i.e. there is no legal agreement regarding fishing rights between landowners and fishing clubs. The railway ponds on Hinksey Stream are also used for fishing.

- Boating (unpowered and motor boating) - for boat users, all river channels in the Scheme area are open for navigation by small boats, canoes and kayaks, and local people use the streams south of Botley Road. Only the main River Thames, with its lock system, is open to large vessels.
- Parks – two parks lie adjacent to the Scheme boundary:
    - Botley Park lies approximately 10m to the north-east of the proposed flood-gates at Helen Road and Henry Road. This park comprises a playground, games area, tennis courts and community centre.
    - Hinksey Park lies approximately 20m to the west of the proposed flood wall and bund at New Hinksey alongside the A4144 Abingdon Road. This park has been awarded the Green Flag Award for its high standard of open green space used for informal recreational activity and includes avenues of Giant Redwood and Pine trees.
- Recreation and sports grounds – the following recreation grounds lie within or adjacent to the Scheme boundary:
    - Oatlands Road Recreation Ground, which borders Ferry Hinksey Road and Willow Walk, lies within the Scheme boundary and will be crossed by a flood bund.
    - St Peter's College Recreation Ground, lies approximately 60m to the east of the Scheme boundary, on the southern edge of North Hinksey.
    - The University College Sports Ground, lies approximately 25m to the west of the Scheme boundary, where a new flood bund is proposed at New Hinksey.
    - Brasenose College Recreation Ground, lies on the northern side of the new flood bund proposed at New Hinksey.
    - Queen's College Recreation Ground, lies on the northern side of the new flood bund proposed at New Hinksey.
    - Bertie Place Recreation Ground lies to the east of the Scheme, between Old Abingdon Road and Abingdon Road
- Allotment gardens - There are several areas of allotments within or close to the study area. These include:
    - Bulstake Close, north of Botley Road, on the northern edge of a proposed flood bund and associated working area.
    - Osney Mead allotments, north of Botley Road, and bordering the eastern boundary of Botley Park.
    - Cowmead allotments lie on the western edge of the proposed flood bund and associated working area at New Hinksey.
    - South Ward, Redbridge, to the north of the A423 Roundabout, approximately 200m from the Scheme boundary.
    - Hinksey Park allotments, adjacent to Hinksey Park.
    - North Hinksey Lane allotments, to the west of Seacourt Stream, and east of the A34 and North Hinksey Lane.
- Oxford Canal, is located approximately 500m to the east of the closest part of the Scheme (proposed flood-gates), and joins the River Thames near Oxpens. Due to its distance from the Scheme, the canal is not considered further in this assessment.

There is also a community resource at Hogacre Common Eco Park (see Figure 6.1), which lies approximately 50m to the east of the Scheme boundary between North Hinksey and South Hinksey. The community eco-park comprises community allotments, a food garden, beekeeping, a forest school and pedestrian access to a combination of field, woodland and aquatic habitats. The site also hosts recreational events including camping, fire pits and orienteering courses.

6.1.3 Changes to recreation and public access in absence of Scheme

In the absence of the Scheme, recreational facilities and formal and informal areas of public access will continue to be vulnerable to flooding. These effects will be exacerbated by climate change, which will increase the extent, severity and frequency of flooding although flooding will still be only for a small proportion of the year. There may also be an increase in the numbers of members of the public using the Scheme area, and other areas of open space, following changes to recreation activities in the summer of 2020 when circumstances caused people to carry out recreational activities closer to home. Other than these, there is no reason to anticipate any significant change in public access to any part of the Scheme area.

6.2 Likely significant effects

6.2.1 During construction

Public Access

The construction of the Scheme will result in temporary disruption to and severance of existing access including parts of the currently accessible floodplain for recreational users. This will include the temporary closure and temporary (or permanent) re-routing of public footpaths and a bridleway/cyclepath along the length of affected river corridor (see Figures 6.2 and 6.3), as described in Table 6.1.

The area of land available for recreation will therefore be reduced in different areas, during construction. These impacts on access (and recreation) are considered to range from **minor** to **moderate adverse** in nature based on minor to moderate negative magnitude and low to medium value receptors i.e. rights of way that may have up to regional/county importance.

Additionally, the construction of the Scheme will result in temporary changes to walking/cycling routes for a duration of up to three years, depending on the location. This may increase walking/cycling distances to existing destinations. These impacts on pedestrians and cyclists (both commuters into Oxford from fringe communities and recreational users) are considered to be **moderate adverse** in nature based on major negative magnitude and medium value receptors i.e. routes of regional importance.

Table 6.1: Impacts on Public Rights of Way, informal paths and permissive access routes

Receptor	Potential Impacts		Significance of Impact
	Description of effects	Possible diversionary routes and associated effects	
Public Rights of Way (PRoW)			
311/1 North Hinksey footpath (Low to medium value receptor)	No known impacts during construction.	N/A	No significant impact
311/7 North Hinksey bridleway (Low to medium value receptor)	No known impacts during construction.	N/A	No significant impact
311/8 footpath (Low value receptor)	No known impacts during construction.	N/A	No significant impact
320/14 Willow Walk bridleway and cycleway (Low to medium value receptor)	Temporary closure of up to 279m of bridleway and cycleway for the construction of a new bridge. During periods of the Scheme construction when the bridleway at Willow Walk is open to walkers, horse-riders and cyclists (horse riders may wish to dismount), there is potential for elevated levels of noise and dust to affect recreational users. The construction works may also cause some loud unexpected noises that may panic horses, and therefore horse-riders may prefer to use the path outside of construction hours in summer months.	Our proposal is to temporarily divert a short section of the PRoW on a raised walkway, suitable for pedestrians, cyclists and horses running parallel to Willow Walk, which will increase walking riding and cycling distances by 12m during Scheme construction.	No significant impact on walkers and cyclists if the raised walkway forms the diversionary route. Minor to moderate adverse impact on horse riders (based on minor to moderate negative magnitude).

Receptor	Potential Impacts		Significance of Impact
	Description of effects	Possible diversionary routes and associated effects	
	Temporary closure of up to 117m of bridleway and Sustrans national cycleway for the construction of a new flood wall to the south of Oatlands Recreation Ground. During use of the diversion route, there is potential for elevated levels of noise and dust to affect recreational users.	Temporary diversion alongside working area at east end adjacent to Oatlands Recreation Ground.	No significant impact on walkers and cyclists as the diversionary route will be of a similar length. Minor to moderate adverse impact on equestrians (based on minor to moderate negative magnitude).
320/16 North Hinksey Causeway (Low to medium value receptor)	Temporary closure of up to 212m of public footpath to facilitate the installation of a new bridge. Permanent diversion as the new footpath will cross the new bridge on a slightly re-aligned route.	Our preferred solution pending approval would be to temporarily divert the footpath around Willow Walk (320/14) and its associated diversion as explained above. This will increase walking distances by 1,011m. This is a significantly longer route and runs along North Hinksey Lane for approximately 200m.	Minor to moderate adverse impact on walkers (based on minor to moderate negative magnitude)
	Permanent closure and diversion of 78m of this PRoW at the end of Ferry Hinksey Road due to the construction of the flood wall and flood gates adjacent to Osney Mead Industrial Estate.	The permanent diversion will follow a route 10m east at the southern corner of Osney Mead Industrial Estate.	
320/18 (Low value receptor)	Permanent closure and diversion of 14m of this PRoW at its northern end adjacent to the B4495 Weirs Lane.	The permanent diversion will follow a route running parallel and to the west of the existing PRoW, and following the road. This will increase walking distances by up to 14m.	Minor adverse impact on walkers (based on minor negative magnitude).
	Temporary closure of approximately 266m length of the northern end of the footpath.	Our preferred solution pending approval would be to temporarily divert the PRoW	Minor to moderate adverse impact on walkers

Receptor	Potential Impacts		Significance of Impact
	Description of effects	Possible diversionary routes and associated effects	
352/1 Devil's Backbone (which links to 320/17) (Low to medium value receptor)		along a route running close to Devil's Backbone using the existing National Grid track to the south, which would increase distances by approximately 606m. This is a significantly longer temporary diversion and runs through the adjacent field.	and cyclists (based on minor to moderate negative magnitude),
	Permanent closure and diversion of approximately 57m at the southern end of the footpath.	A temporary diversion will be in place during construction, which will increase walking distances by 513m. This is a significantly longer temporary diversion and runs along roads and through residential areas. The permanent diversion will follow a route slightly east of the existing footpath and will increase distances by approximately 4m.	Minor to moderate adverse impact on walkers (based on minor to moderate negative magnitude) during construction. No significant impact on walkers as the permanent route will be of a similar distance.
352/3 South Hinksey to Old Abingdon Road (Low to medium value receptor)	Permanent closure of 46m length of footpath (at the north-western end of the footpath).	A temporary diversion is proposed during construction around the temporary working area, linking to footpath 352/2. This will increase distances for walkers by up to 138m. The route of the permanent footpath will be moved further south of the existing and will link up with footpath 352/2. This will increase distances for walkers from the intersection of footpath 352/2 and 352/3 by 42m.	Minor adverse impact on walkers (based on minor negative magnitude).

Receptor	Potential Impacts		Significance of Impact
	Description of effects	Possible diversionary routes and associated effects	
	Permanent realignment of up to 141m length of footpath at the southern end, adjoining Old Abingdon Road.	A temporary diversion is proposed during construction around the temporary working area, adjacent to Redbridge Hollow residential site. This will increase distances for walkers by up to 95m The permanent diversion will follow the new channel as it curves north of Old Abingdon Road, with an increase in walking distance of up to 34m.	Minor adverse impact on walkers and cyclists (based on minor negative magnitude),
352/2 South Hinksey Village to A34 (Low to medium value receptor)	Temporary closure of approximately 22m length of footpath.	Temporary diversion around the edge of the temporary working area in the field, with an increase in walking distance of approximately 13m.	No significant impact on walkers as the diversionary route will be of a similar distance.
352/5 South Hinksey footpath (Low to medium value receptor)	No known impacts during construction (other than elevated noise and dust levels already identified in Chapter 5 'Local Community' of the ES).	N/A	No significant impact
352/6 footpath (Low to medium value receptor)	No known impacts during construction (other than elevated noise and dust levels already identified in Chapter 5 'Local Community' of the ES).	N/A	No significant impact
Thames Path National Trail	Loss of permissive access into the adjacent fields for a short period during planting.	No mitigation proposed, as the closure will be short and of similar duration to closures which the farmer would normally carry out.	No significant impact

Receptor	Potential Impacts		Significance of Impact
	Description of effects	Possible diversionary routes and associated effects	
(High value receptor)			
Public paths (footways)			
Old Abingdon Road and Kennington Road (Low value receptor)	Some disruption while the temporary road layout is connected. The road will remain open for both vehicles and pedestrians throughout.	No diversion required; walkers will be able to follow the temporary carriageway.	Minor adverse impact on walkers (based on minor negative magnitude)
Footpath along Johnsons Garage and Seacourt Park and Ride, (Low value receptor)	Temporary closure of 130m of footpath running south from Botley Road to Seacourt Park and Ride bus pick-up and drop-off point.	The diversionary route will be via the footway on the opposite side of the road during the installation of flood defence kerbs.	Minor adverse impact on walkers (based on minor negative magnitude)
Cycleway along north of Oatlands Recreation Ground (Low value receptor)	Temporary narrowing of a 74m length of cycleway during the construction of a new flood embankment, which will be blended in with the existing high ground on the cycleway.	Potential for short minor diversion if this cannot be managed on-site.	Minor adverse impact on walkers and cyclists (based on minor negative magnitude)
Informal or permissive access routes (excluding routes through public open space)			
Westway cycleway / footbridge over Seacourt Stream (Low value receptor)	Temporary closure of up to 63m of the cycleway to facilitate construction of a new bridge.	Diversion across Botley Bridge and down the northern section of Seacourt Nature Park.	Minor adverse impact on walkers and cyclists (based on minor negative magnitude)
Path from the Fishes Public House in North	Temporary closure of informal path during the installation of a new bridge, excavation of the new channel and establishment of grass cover in the	Temporary diversion in fields adjacent to area or via North Hinksey Causeway and Electric Road. This could create a diversion of up to 1.8km for pedestrians.	Minor adverse impact on walkers (based on minor negative magnitude)

Receptor	Potential Impacts		Significance of Impact
	Description of effects	Possible diversionary routes and associated effects	
Hinksey – Bulstake Stream (Low value receptor)	second stage of new channel each side of the bridge.		
Hinksey Meadow (Low value receptor)	Restricted access along the western edge of Hinksey Meadow during construction and during the grass establishment period.	Access will be retained along the western edge of the restricted area during construction and during the grass establishment period.	Minor adverse impact on walkers and cyclists (based on minor negative magnitude)
Path from Abingdon Road to the Thames alongside the northern edge of the Oxford Spires Hotel (Low value receptor)	Temporary closure for short periods of the permissive footpath during construction of the new flood defences at New Hinksey.	Possible diversion via Folly Bridge creating a diversion of up to 1.3km for pedestrians.	Minor adverse impact on walkers and cyclists (based on minor negative magnitude)
Track to railway from Whitehouse Lane (Low value receptor)	Possible closure or narrowing of access track to railway from Whitehouse Lane for installation of power cable.	No alternative diversion available.	Minor adverse impact on users of track (based on minor negative magnitude)

The Scheme will result in approximately 8ha of public open space being unusable during construction of the Scheme. This is because it will be within the footprint of the temporary working areas of the Scheme or the Scheme footprint itself. This will affect the following sites:

- Seacourt Nature Park – a 2.2ha area will be affected during construction with temporary closure of this nature reserve required during the construction works at the northern end of Seacourt Nature Park. A diversion of the footpath through the nature park is proposed along the edge of the construction working area;
- Oatlands Recreation Ground – a 2.0ha area of this recreation ground will be affected during construction of the new flood bund;
- Kendall Copse – a 2.4ha area of this community woodland will be closed for the duration of works with a reduced area for permissive access around the copse on the eastern side of Kennington Road upon completion of the Scheme;
- Kennington Pond – a 0.5ha area of Kennington Pool LWS will be affected with temporary closure of the dead-end footpath around the pond for the duration of the construction works; and
- Botley Park – a 0.7ha area of park will be affected during construction of the proposed flood-gates. Access for the construction works will also be from the West Oxford Community Centre entrance.

(Some permanent loss will also occur – see Section 6.2.2.). These impacts are considered to have a **minor adverse impact** on recreational users, based on a low value receptor (i.e. public open spaces of district/parish importance) and a moderate negative magnitude due to the availability of other similar areas of open space in the local area.

Recreational use of Scheme area

The impacts of the construction works on horse-riding, notably disruption to the bridleway at Willow Walk are discussed in other sections (socio-economic section in Chapter 5 'Local community' and the previous section of this chapter respectively).

The Scheme is not considered to have any impacts on angling within the River Thames, a low to medium value receptor and a negligible magnitude of effect resulting in **no significant impact.** However**,** the construction phase of the Scheme may temporarily affect water quality and create changes in flow, which could impact the migrating behaviour of fish over two (or three) seasons, with associated impacts on informal fishing in some streams within the study area. Migration along Bulstake Stream will be stopped in the final year of construction; there will be an alternative route available shortly afterwards via Hinksey Stream due to the removal of Towles Mill Weir. Fish may not locate the new route immediately**.** As fish migration will be disrupted for a period but will not be prevented during any migration season, the temporary impact on anglers is considered to be a **minor adverse** to **no significant impact** (based on a low value/negligible receptor i.e. informal fisheries of parish/no listed importance, and a minor negative magnitude).

The Scheme will not affect navigation on the River Thames but there will be restricted access to small boats and canoes that may use the watercourses in the Scheme area during construction of the second stage channel. Parts of the Bulstake and Hinksey Streams will be closed even to small boats during the earthworks season during construction. This is considered to have a **minor adverse** impact based on a low value receptor (district value) and a moderate negative magnitude.

The proposed construction of flood gates at Helen Road and Henry Road over a duration of up to six months, is not considered to be a noisy operation and is anticipated to have **no significant impacts** on recreational users at Botley Park. There is potential for temporary **minor adverse impacts** on recreational users at Hinksey Park resulting from

elevated noise and potentially dust from the construction of the flood wall at New Hinksey.

In addition to construction impacts on Oatlands Road Recreation Ground (discussed under 'Public access' above), Bertie Place Recreation Ground will also be affected during construction through the temporary storage and drying of material excavated from the channel – **minor adverse impact**. No other recreational grounds will be directly impacted by the construction of the Scheme. There is however potential for some temporary noise, access and dust disturbance to other recreation grounds adjacent to the Scheme area (Figure 6.1) – considered to be **minor adverse impacts.**

During construction, there will be a permanent loss of three allotment gardens at Bulstake Close, adjacent to the new flood defence to the north of Botley Road, and a further loss of two allotment gardens (currently abandoned) at Osney Mead in the footprint of the works. This is considered to be a **minor adverse impact**, based on a low value receptor (i.e. allotments of district/parish importance) and minor to moderate negative magnitude.

The impact on Hogacre Common Eco Park is discussed in Chapter 8 'Flora and fauna'.

6.2.2 During operation

Public Access

Once operational, the Scheme will provide a long-term reduction in the risk of flooding to many recreational assets (including PRoW, public access land, parks and recreation grounds) in Oxford. This represents a **moderate beneficial impact** (based on a major positive magnitude and medium value receptor i.e. receptors that have up to regional/county value), with associated health and well-being benefits to recreational users as considered in Chapter 5 'Local Community'.

A number of comments were received from the public during consultation events for the Scheme asking about the possible provision of a more formal public footpath and cycleway in a north-south direction. However, having consulted landowners it was clear that there was no wish to formalise any additional routes through their land for a number of understandable reasons including the fact much of it is productive farmland. As a result, we will provide permissive access for pedestrians and cyclists along the maintenance track beside the second stage channel (see Figure 6.4), from Osney Mead to Devil's Backbone, connecting to the existing footpath to Old Abingdon Road. In order to allow safe grazing and to protect wildlife, the track will be fenced off from the channel and from the surrounding farmland for much of its length, although access to the main existing informal paths that cross the area will be retained. The surface of the track will be grass. We will retain any existing permissive or informal footpaths on land we will own following construction, except where diversions are shown on Figure 6.3.

The construction of a new shared use bridge south of the A420 Botley Road/West Way will effectively make the existing foot/cycle bridge longer with some gentle slopes introduced into what were previously flat routes. This will not affect the quality of cycling provision and safety along this corridor. The other new bridges in the Scheme area will incorporate enhancements to surfaces, fencing, railings and signage, which will benefit those using the affected PRoW (e.g. at Willow Walk bridleway and North Hinksey Causeway footpath). We have also re-designed the parapet height on Devil's Backbone bridge to cycleway standards (height of 1.4m), to provide an opportunity for the Devil's Backbone footpath to be upgraded to a cycleway in the future by a third party. Such a shared use route could increase access for more people to this area. These are considered to be **minor beneficial impacts** (based on a medium value receptor and minor positive magnitude).

However, upon completion of the Scheme, there will be a permanent loss of public access land comprising a loss of 2.4ha at Seacourt Nature Park (although the 50% of the nature park which will be within the second stage channel will be available for the public to use, it will be unsuitable for walking for part of the year and so will not be fully accessible in practice), 1.47ha at Kendall Copse (11% of the eastern part of Kendall Copse) and 0.94ha at Kennington Pond (44% of the existing pond area). There will also be a permanent loss of 0.25ha of level open space at Oatlands Recreation Ground in the footprint of the proposed bund (6% of the total area of recreation ground), but the new sloping area can continue to be used by the public. These changes are considered to have a **minor adverse impact** on the physical activity (and potentially the mental well-being) of those recreational users, based on a low value receptor (i.e. sites of district/parish importance) and a moderate negative magnitude.

There will also be an increase in the number of new obstructions (e.g. ramps, flood gates etc) across some PRoW and public open space within the Scheme area, as well as alterations to access/entrances, and changes in elevations to some of these publicly accessible areas. These are considered to have **minor adverse impacts** on all users of these areas (based on medium value receptor and minor negative magnitude). All ramps are designed with the needs of less mobile users in mind, with either shallow slopes or alternative accesses available. Of particular note are the following changes:

- Oatlands Recreation Ground – The current access to the recreation ground will be affected by the presence of the new bund, which will have a 1 in 3 slope. The new access to the public open space for less mobile users or pushchair users will be via the footpath/cycleway along the northern boundary of the field. For more mobile pedestrians, an additional access ramp will be provided onto the recreation ground from the car park.
- Bridleway (320/14 Willow Walk) and cycle route – new floodgates will need to be installed across the public right of way adjacent to Osney Mead Industrial Estate, however these will be kept open except during floods and therefore will not affect public access.

During operation of the Scheme, a proportion of the land in the floodplain will be lower and is likely to be wetter, which may reduce its accessibility in some areas at certain times of the year, particularly Area 3 where the second stage channel may flood for at least four months of the year. In addition, the new stream will have water flowing all year and will split fields, over which some members of the public currently gain informal access. However, we will be providing a new footbridge over the new stream on the informal path behind the Fishes Public House in North Hinksey to ensure that informal access is not restricted in this area. The new wetland habitats and channel will create interest within the meadows for recreational users, which is considered to offset any potentially negative impacts associated with the wetter floodplain. There are therefore likely to be **no significant impacts** (medium value receptor and negligible magnitude).

We will need to make minor permanent diversions of some public footpaths (see Section 6.3), particularly around South Hinksey, and several paths will be routed over new flood embankments via ramps that are Disability Discrimination Act 2005 (DDA) compliant.

Recreational use of Scheme area

The long-term reduction in flood risk to recreational assets has been assessed under 'Public access' and is therefore not repeated in this sub-section.

The recreational value of some parts of the Scheme area, particularly in Area 3, will be improved in the long-term, through the creation of a more attractive and diverse landscape, which is discussed further in Chapter 7 'Landscape and visual amenity'.

The Scheme requires a fixed-crest weir across Bulstake Stream, to divert its flow into Hinksey Stream and eventually into the new channel. This would have a minor adverse

to no significant impact on anglers, if it were the only effect of the Scheme on the available fish migration routes. However, the Scheme also removes the obstruction of the Hinksey Stream at Towles Mill Weir, which creates an alternative migration route for fish. Once flow is diverted into the new channel, the migration route will use the lower part of Hinksey Stream, then the new channel, then Bulstake Stream above the new channel, with access to the upper part of Seacourt Stream. This is considered to be a minor beneficial (district level) impact as fish migration will be disrupted for a period but will not be prevented during any migration season and will subsequently be able to reach all the channels, which fish can currently reach. Overall, **no significant impacts** on angling within the study area are anticipated upon completion of the Scheme.

The Scheme will not affect navigation on the River Thames. Access for canoes and small boats to much of the lengths of the existing streams will re-open once construction is complete, however there will be permanent fixed-crest weirs including one on the Bulstake Stream which will reduce how far upstream boats can travel after accessing Bulstake Stream from its downstream end. The new channel is not designed for navigation, however small boats such as canoe and kayaks will be free to use it when flow conditions make access possible. Overall there is a **minor adverse** impact based on a low value receptor (district value) and a moderate negative magnitude.

6.3 Mitigation

We have developed a construction methodology which is designed to minimise the disturbance to recreational users caused by the effects of the main construction works. The methodology includes the following measures:

- The public, landowners, businesses and water corridor users affected by the Scheme will continue to be kept informed during the construction of the Scheme.
- We will keep access to the River Thames for recreation and business open at all times and will maintain access to the other streams outside the main construction working areas. We will take care to ensure that phasing of the works will not affect all access points simultaneously. Any alternative access will be signed.
- Mitigation measures relating to the PRoW will be detailed in a Construction Traffic Management Plan (CTMP) in consultation with the County Council. We will include the following measures in the CTMP:
    - We will continue to liaise with Oxfordshire County Council PRoW officer to pre-agree appropriate closure/diversion routes for footpaths, the bridleway and cycle paths with the identification of appropriate alternative routes to accommodate users of the footpaths and strategic cycling corridor. We will provide signage prior to closures/diversions. We will re-open footpaths, bridleways and cycle paths as soon as there is no longer any safety risk to the public. Due to the importance of Willow Walk and Devil's Backbone, as busy routes to and from the city of Oxford, we are seeking to keep these routes open for as long as possible. We anticipate that Willow Walk will remain open to pedestrians, horse riders and cyclists during the majority of the earthworks. However, due to safety risks if horses are frightened by construction noise, riders may prefer to avoid using it or dismount and walk through the diversion during working hours when construction is taking place, as described in Section 6.2.1.
    - Where diversions are required (see Table 6.1), these will be within acceptable distance thresholds for users and aligned with desire lines. Where interfacing with routes, hoardings will enclose the work area to contain construction activities. Where hoarding will need to encroach onto the existing footpath to provide working space for construction activities, a general minimum footpath width of 2m will be maintained.
    - We will inform the local community of the nature and duration of the temporary and permanent footpath/cycleway closures (and diversions)

and alternative provisions of access through signage and webpage updates. The diversion routes are shown on Figure 6.2 and described in Table 6.1. Where temporary diversions involve shared use paths, some routes will be coordinated to avoid conflicts for pedestrians.
    - We will ensure that construction materials and loose soil are swept off any affected footpaths, the bridleway and cycleways.
- Signage will be maintained adjacent to the open spaces with formal or informal public access throughout the Scheme, and on navigable watercourses when they are closed, to inform the local community of the works taking place and access restrictions.
- We will fence off areas of land within and adjacent to our working area to ensure the safety of recreational users but will seek to maintain existing public access to as much land as possible. We will also seek to open areas in winter, where practical, if this can be done safely.
- Creation of new areas to offset the permanent loss of allotment gardens that will occur during construction of the Scheme.
- Any maintenance work which affects fish spawning areas or migration routes (and thus angling) will avoid the key period from March to July, except in emergency, in line with our normal practice.

6.4 Residual effects

The residual impacts on recreation and public access are presented in Table 6.2.

Table 6.2: Residual impacts on recreation and public access

Receptor	Description of Potential Impact	Significance of Predicted Impact	Mitigation Measures	Significance of Residual Impact
Recreational users (equestrians, pedestrians and cyclists)	Temporary and partial severance of accessible floodplain as well as temporary and permanent closure and re-routing of public footpaths, a bridleway/ cyclepath, footways, and informal and permissive paths during construction.	Minor to minor to moderate adverse	Measures detailed in a CTMP will include: o Informing (and pre-agreeing) local community of closures/diversions o re-open paths as soon as there is no longer a safety risk o Any diversions will be within acceptable distance thresholds and aligned with desire lines, and hoardings to enclose works area. o Ensuring construction materials are swept off affected paths. o Continued liaison with affected landowners, tenants, businesses and recreational users	Minor adverse
Recreational users of public access land	Approximately 8ha of public access land/open space will be unusable during construction	Minor adverse	Signage will be maintained adjacent to open spaces with formal or informal public access throughout the	Minor adverse

Receptor	Description of Potential Impact	Significance of Predicted Impact	Mitigation Measures	Significance of Residual Impact
	Permanent loss of heavily-used public access land / open space at Seacourt Nature Park upon completion of the Scheme ("loss" meaning that the land will no longer be available 365 days a year). Also loss of parts of Kendall Copse and Kennington Pit.	Minor adverse	Scheme, to inform the local community of the works taking place, access restrictions and alternative routes.	Minor adverse
Water-based recreational users	Restricted access for small boats and canoes on watercourses in Scheme area during construction. Hinksey Stream and part of Bulstake Stream will be closed to navigation during earthworks for up to three years of construction. Bulstake Stream will be permanently obstructed by a fixed-crest weir during operation. While the Scheme has not been designed for kayaking, during some flow conditions parts of the new stream will be accessible to small boats, canoes and kayaks.	Minor adverse	Channels will be closed using warning signs and navigation markers. We will consult with water-based recreational groups / societies and landowners with riparian interests to explain the closures.	Minor adverse
Users of Hinksey Park and recreation grounds	Elevated noise and potentially dust at Hinksey Park from the construction of the flood wall at New Hinksey, and other recreation grounds adjacent to the Scheme area	Minor adverse	The public, businesses and water corridor users affected by the Scheme will continue to be consulted during the construction of the Scheme. Working in accordance with the EAP.	Minor adverse
Users of allotment gardens	Loss of three allotments at Bulstake Close and two allotments at Osney Mead.	Minor adverse	The loss of allotment gardens will be mitigated through the provision of a larger area of allotments to the west of the existing allotments at Bulstake Close.	No significant impact

Receptor	Description of Potential Impact	Significance of Predicted Impact	Mitigation Measures	Significance of Residual Impact
Recreational users	Reduced flood risk to recreational assets (including PRoW, public access land, parks, recreation grounds) in Oxford.	Moderate beneficial	Not applicable	Moderate beneficial
Recreational users	Improved quality of cycling provision and safety and improvements to PRoW.	Minor beneficial	Not applicable	Minor beneficial
Users of publicly accessible areas	Permanent increase in the number of new obstructions across PRoW and open spaces.	Minor adverse	We will ensure that any new flood-gates installed as part of the Scheme are set back from PRoW or do not open outwards from the site across the PRoW.	Minor adverse
Walkers and cyclists	New path along the maintenance track, providing an alternative to the Electric Road.	Minor beneficial	Not applicable	Minor beneficial

7 Landscape and visual amenity

7.1 Existing environment

The study area for this chapter comprises the Scheme area and the wider surrounding landscape that the proposed development may influence in a significant manner (the wider landscape).

In order to determine a study area for the baseline it is necessary to understand the likely visibility of the Scheme. The extent of the study area for the visual assessment has been identified through a review of maps of the Scheme area and surrounding area alongside a Zone of Theoretical Visibility (ZTV), generated using ArcGIS software. The ZTV was developed using a 3D model of the proposed Scheme and topography within 4km of the Scheme (beyond this distance significant adverse effects on views and visual amenity are considered unlikely). Fieldwork has been used to refine the results of the ZTV by establishing the influence of existing landform, buildings and vegetation.

The wider landscape with the potential to be affected by landscape and visual effects from the proposed development was identified, through desk top analysis and fieldwork, as 2km from the Scheme area. The extent of the study area for the LVIA is shown on Figure 7.1 and the ZTV on Figure 7.2.

The Scheme area is shown on Figure 1.3.

As set out in Chapter 4 'EIA methodology', the methodology used for the assessment of landscape and visual impacts is based on the principles set out in the Guidelines for Landscape and Visual Assessment (GLVIA3) (Landscape Institute and Institute of Environmental Management Assessment (IEMA) (2013) and guidance from Natural England on landscape character assessment (2014). The assessment considers the effects of the Scheme upon completion and after 15 years, when planting will have become established, as well as temporary effects during construction. The visual assessment also considers seasonality, assessing impacts over both winter and summer.

The landscape proposals are described in Section 3.6 and illustrated on Landscape Plans in Appendix I-6. The Scheme area has been subdivided into four areas; Area 1: north of Botley Road, Area 2: Botley Road to Willow Walk north, Area 3: Willow Walk to Devil's Backbone and Area 4: Devil's Backbone to the junction with Hinksey Stream and River Thames, as detailed in Chapter 3 'Scheme description'.

7.1.1 Scheme overview

The Scheme area is located to the west of the main conurbation of Oxford and is an intrinsic element of the landscape that forms the setting for the internationally recognisable Oxford skyline. The northern boundary of the Scheme includes Seacourt Park and Ride, and stream systems to the north of Botley Road bridge. The southern boundary extends to the south of the A423 Southern By-Pass Road at Kennington.

The Scheme is orientated north-west to south-east through Oxford's flood meadows, located west of Oxford city centre between the A34 to the west and the Oxford to London/Birmingham railway to the east (with the exception of some new defences proposed at New Hinksey). The land floods during normal winter flooding, from various channels of the Thames. This winter flooding is part of the normal functioning of the river.

The Scheme follows the routing of electricity pylons that span the rural landscape. The alignment of the southern extent of the Scheme closely follows the Oxford to London/Birmingham railway as it passes beneath the A423.

Topographically, the area is relatively flat, with elevations of between 60m AOD at Botley Road, falling to 55m AOD at Kennington. The historic city centre of Oxford is situated on a gravel terrace to the east of the Scheme at approximately 58m AOD. The land rises steeply beyond the study area boundary to form prominent limestone hills that provide a backdrop to Oxford, to the west - Cumnor and Boars Hill (144m AOD) and to the east at Shotover Hill (171m AOD).

The development pattern of the surrounding area follows the alignment of ancient roads into the city of Oxford, for example along Botley, Kennington and Abingdon Roads.

There are significant areas of public open space of varying character in the study area from recreational spaces such as parks, sports grounds and playgrounds (with a concentration south of Botley Road at North Hinksey, Grandpont and New Hinksey) to an extensive public right of way network, as well as other footpaths, cycleways and allotment gardens. A description of recreational activities within the vicinity of the Scheme is included in Chapter 6 'Recreation and public access.'

A number of key transport routes bisect the Scheme, including Botley Road that serves Oxford city centre and the A423 Southern bypass Road that links to the A40 to the east of the city (see Section 11.1). Oxford railway station provides links to Worcester and Hereford, Banbury, Bicester and Birmingham to the north, whilst links to the south connect with Bristol, South Wales, Southampton, Basingstoke, Reading and London.

The railway line in the study area runs from the south, dividing in Oxford to continue north-east and north-west. The routing of the railway severs east-west walking and cycling routes across the Scheme area.

7.1.2 Designated sites

International and national designated sites

There are no international, national or local landscape designations in the study area.

Locally designated sites

Although not designated for their landscape, the following sites are relevant to the landscape assessment as they are important for their amenity contribution to the local area and in their provision of Green Infrastructure (GI), as identified in the GI Study (see Appendix I-5).

- Seacourt Nature Park - located to the south of Botley Road, it is locally designated by Oxford City. The Nature Park forms part of the network of wildlife corridors that span the City, providing important linkages for wildlife between habitats.
- Osney Mead (Botley Meadow) LWS – this site includes Hinksey Meadow; a species-rich meadow with a nationally-scarce grassland community (National Vegetation Classification (NVC) MG4a) supporting the nationally-scarce snakeshead fritillary.
- Oatlands Road Recreation Ground – a green open space bounded by Willow Walk to the south, and Osney Mead Industrial Estate and Ferry Hinksey Road to the east. The local primary school is located to the north-east and residential streets to the north. The area is used for informal recreation and includes a marked-out football pitch and children's play area run by Oxford City Council, providing a range of play equipment.
- Kendall Copse Community Woodland – located to the south of Old Abingdon Road, it is a community woodland within Oxford City.
- Kennington Pool Local Wildlife Site (LWS) – located to the west of Oxford to London/Birmingham railway and the south of the Southern bypass road, it is locally designated by the VoWH District Council.

This list does not cover all nature conservation assets in the Scheme area; only those which contain landscape elements or receptors, which contribute to the landscape character of the

area. A comprehensive description of nature conservation assets within the vicinity of the Scheme is included in Chapter 8 'Flora and fauna'.

- **Green Belt** – The proposed Scheme is located within Green Belt to the west of Oxford; this is an area protected by planning policy (see Appendix N). Paragraph 133 of the NPPF states that *'the fundamental aim of Green Belt policy is to prevent urban sprawl by keeping land permanently open; the essential characteristics of Green Belts are their openness and their permanence'.*

A Green Belt Statement (Environment Agency 2021) has been prepared to support the planning application for the Scheme. It describes the compliance of the Scheme with Green Belt planning policies and the LVIA reviews the visual impact of the development on the openness of the Green Belt later in this chapter.

7.1.3 Historic landscape

Between 2012 and 2017 Oxfordshire County Council, funded by Historic England, undertook the Oxfordshire Historic Landscape Characterisation (HLC) project. The aim of the project was to characterise the historic dimension of the current landscape of Oxfordshire to inform its management, conservation and understanding at a local, regional and national level.

HLC projects use a broad-brush approach to the landscape, with shared current and previous characteristics and assigning them to a higher level Broad Type and a narrower HLC Type. In Oxfordshire, 15 Broad Types were identified, these were subdivided into 109 HLC Types.

Whilst impacts on historic landscapes are dealt with in more detail in Chapter 10 'Cultural heritage', a summary of the historic influences on the present landscape is provided below. The majority of the Scheme is covered by the HLC Broad Type, Enclosure. To the north of the Scheme, close to Botley Road HLC Broad Types Rural Settlements (North Hinksey Village), Orchards and Horticulture (Botley Road allotments), Civic Provision (Seacourt Park and Ride) and Unenclosed Land (north of Botley Road and to the south of the A423) are also present in isolated areas. HLC Enclosure is described as being the predominant type in Oxfordshire, most commonly found in rural areas however some are found on the rural-urban fringe of Oxford.

Oxfordshire HLC places the Scheme within the following HLC Types**:**

- Ancient Enclosure - 'Areas of land enclosed prior to the 18th century'; the most common type of enclosure dating to the medieval or earlier post-medieval period surviving in Oxfordshire's current landscape. The distinct distribution of this type reflects, to different degrees, how the various parts of the county have been subjected to agricultural reorganisation and change, including settlement expansion.
- Planned Enclosure - 'Fields with a predominantly straight boundary morphology giving a geometric and regular appearance'. Planned Enclosures are amongst the most common landscape type identified in Oxfordshire. These fields enclosed the remaining Open Fields and heaths and reorganised many earlier fields. Whilst they brought extensive change to the landscape they have since also been subject to change and reorganisation.
- Prairie/Amalgamated Enclosure - 'Patterns of large fields in excess of 10 hectares'. This is one of the most frequently found types in Oxfordshire's 21st century landscape. It is widespread and most parts of the county have sites of this type. This type predominantly dates to the 20th century and post-war agricultural changes, but there are a significant number of examples from the late 19th century where older fields were amalgamated to allow more intensive farming.
- Piecemeal Enclosure - 'Field systems that have been created out of the medieval open fields by informal agreement'. This is one of the more abundant types in the county and represents some of the older enclosures created from the post-medieval period onwards, early enclosure tended to be on pastoral rather than arable land.

- Reorganised Enclosure - 'Fields showing signs of modern adaptation through large scale re-organisation of earlier field boundaries'. This is the most common type in Oxfordshire. This type shows the extent of change the agricultural landscape has experienced since originally being enclosed. Most parts of the county have been affected, leaving few surviving medieval and 17th to 18th century landscapes.
  Rough Ground - 'Areas which show no visible evidence of recent agricultural improvements'. Large areas of unenclosed land still survive in Oxfordshire's modern landscape and form discrete clusters, on the chalk downlands to the south and southwest of the County and within Oxford.
- Secondary Woodland - Woodland that has developed, usually by natural colonization, on land formerly used for other purposes. Secondary Woodland is found throughout Oxfordshire and is more common than Ancient Woodland.

A limited number of HLC Types, Village, Allotment and Park and Ride are also present in the area surrounding Botley Road.

Figure 7.3a/b illustrates the location and distribution of the HLC Types described above. Those HLC Types present within the study area but not located within the footprint of the Scheme have been omitted for the purposes of clarity. This is due to the high number of HLC Types present within the study area, especially within the adjoining city of Oxford.

7.1.4 Existing landscape character assessments

The baseline landscape and townscape character (Figures 7.4 – 7.6) of the study area has been assessed and classified through a number of landscape character assessments. The relevant features are summarised below, starting with the wider scale assessments followed by more local scale studies:

National Landscape Character (defined by Natural England (formerly the Countryside Agency)). The Scheme is located within the 108 Upper Thames Clay Vales and 109 Midvale Ridge National Character Areas (NCA) – see Figure 7.4. The landscape character descriptions of relevance to the study area are:

Upper Thames Clay Vales;

- Low-lying clay-based flood plains that encircle the Midvale Ridge;
- The large river system of the River Thames drains the Vales, their headwaters flowing off the Cotswolds to the north;
- Woodland cover is low but hedges, hedgerow trees and field trees are frequent. Watercourses are often marked by lines of willows;
- In the river corridors, grazed pasture dominates, with limited areas of historic wetland habitats including wet woodland, fen, reedbed and flood meadow.

Midvale Ridge;

- Contrast between the moderately elevated limestone hills and ridges and the surrounding low-lying clay vales.
- Drained mostly by small springs and streams which run into the Thames, Thame and Ock.
- Well wooded – a third of the woodland is designated ancient woodland.
- Fragmented but rare and important semi-natural habitats,
- Evidence of previous land use such as Iron-Age and Romano-British settlements and ridge and furrow through to old quarries still visible in the landscape.
- Recreational opportunities include the Thames Path National Trail.

Regional Landscape Character - the Oxfordshire Wildlife & Landscape Study (OWLS) (Oxfordshire County Council, Natural England and The Earth Trust 2004) is the current landscape character assessment for Oxfordshire. The OWLS places the Scheme within two character areas; the Midvale Ridge and Upper Thames Vale – see Figure 7.5.

The **Upper Thames Vale** is described as being a linear riverine landscape with a flat, well-defined alluvial floodplain. It has a pastoral character with meadows and wet and semi-improved pasture. The key characteristics are;

- Flat, low-lying topography with seasonally flooded alluvial floodplains.
- Meandering river channels.
- Grazing meadows and small fields of permanent pasture.
- Riparian character with a strong pattern of riverside willows and tree-lined ditches.
- Sparsely settled with a few roads.

The **Midvale Ridge** is described as being a wooded estate landscape characterised by arable farming and small villages with a strong vernacular character. The key characteristics being:

- Rolling topography with localised steep slopes.
- Large blocks of ancient woodland and mixed plantations of variable sizes.
- Large parklands and mansion houses.
- A regularly-shaped field pattern dominated by arable fields.
- Small villages with strong vernacular character.

Local Landscape Character - At the local level, a Landscape Character Report (Enplan 2009) was produced to support our Oxford Flood Risk Management Strategy, developed to manage flood risk in Oxford over the next 100 years. The purpose of the landscape character report was to provide a detailed understanding of the area of landscape associated with the Oxford Flood Risk Management Strategy (OFRMS), the forces that have shaped it, those that continue to influence it today and threats or opportunities it may face in the future – see Figure 7.6.

As a result of there already being a number of existing and overlapping Landscape Character Assessments (LCA) across the OFRMS study area, this report forms an overarching and comprehensive review, gap analysis, and, where appropriate, a validation of the already published landscape character types and areas. The OFRMS landscape character map is an amalgamation of the landscape character types taken from two character reports: the 2002 LUC study, A Character Assessment of Oxford in its Landscape Setting and the 2004 OWLS report.

The Scheme lies across the following local landscape types:

Landscape Type 4. Pastoral Flood Plains (derived from 2002 LUC study): comprising flat, wide alluvial floodplains of the rivers flowing between the prominent hills. These have long been used for pasture and hay crops and are part of the classic image of Oxford. The tranquil pastoral scene of open meadows with cattle grazing amongst the silhouettes of mature floodplain trees contrasts with the busy urban scenes, which often lie adjacent. Boathouses, locks and pubs along the river are landmarks. Historic buildings and ancient groves are features. Allotments and land uses such as playing fields and large-scale business / retail parks are often found in the floodplain landscapes. The simple open green meadow expanses and open water allow long views and provide a dramatic contrast, both in colour and form, to the built core of Oxford.

Key Characteristics:

- Historic commons and meadowlands
- Tranquil and pastoral landscape
- Areas of ancient wooded groves
- Expanses of open water allowing long views
- Proximity of meadow landscape to cityscape provides dramatic contrast.

The Scheme lies across the following local areas:

4A: Thames (Isis) North.

Evaluation of Character and Quality
This area is highly distinctive as a result of its flat topography, expansive open space, riverside and canalside walks and species rich, traditionally managed, grasslands. Its character is strongly influenced by the history of land management and the richness of wildlife. The long management history and survival of historic features result in a landscape of exceptional quality illustrating a high survival of floodplain features. The area has a strong visual and cultural unity and a high functional integrity.

Sensitivity to Change
This area is highly sensitive to change as a result of its flat, open character allowing long views and the role it plays in the rural setting of Oxford. It is particularly sensitive as a result of its impressive historic remains, international ecological importance and open character.

Although Port Meadow is a landscape that has changed little since prehistoric times, pressures on other parts of the area are high as a result of the proximity of the city - built development, communication routes and industry have all had their place in the history of the floodplain. The flat nature of the floodplain has allowed westwards expansion of the city, bringing with it industrial estates, housing estates and retail parks, which have influenced its open and rural character.

The flat topography, expansive open spaces, riverside and canalside walks and species rich, traditionally managed, grasslands are crucial to the character of the Thames (Isis) - North and threats to this local character could arise as a result of:

- new built development that does not respect the spatial qualities and local vernacular of this distinctive area;
- intensive grassland management for recreation rather than nature conservation; and
- abstraction or flood defence work upstream, or drainage associated with building works, resulting in changes in the river flooding regime.

Objectives, policy development and enhancement opportunities:
The overall strategy should be to conserve the open expansive nature of the floodplain, the rural character, historic depth and ecological habitats as a setting to central Oxford.

4D: Thames (Isis) South.

Evaluation of Character and Quality
This character area has an extremely important role in the setting to Oxford. It is one of the major floodplains that defined the historic growth of the city and provided the unique juxtaposition of urban and rural environments at the centre of the city. The area is highly distinctive for its rural character, historic meadows, rowing culture and views to the historic core. The intact survival of historic features, rich ecological habitats and functional integrity results in a landscape of exceptionally high quality.

Sensitivity to Change
This area is highly sensitive to change as a result of its historic integrity, tranquil character, rich biodiversity and the role it plays in the rural setting of Oxford. Since the 18th century enclosures this area has seen very little change, although conversion of floodplain meadows into close-mown amenity playing fields has had an impact on the landscape and ecological character of the floodplain. Threats to local character could arise as a result of:

- new built development that does not respect the spatial qualities and local vernacular of this distinctive area;
- intensive grassland management for recreation rather than nature conservation; and
- abstraction or flood defence work upstream, or drainage associated with building works, resulting in changes in the river flooding regime.

Objectives, policy development and enhancement opportunities:
The overall strategy should be to conserve the area's historic integrity, tranquil character, rich biodiversity and the role it plays in the rural setting of Oxford.

4E: Hinksey and Bulstake Streams

Evaluation of Character and Quality
This area has a strength of character by virtue of its good survival of floodplain features. It has an important role in the setting to the city of Oxford, providing the sense of a rural landscape in close proximity to the urban area. It is also critical in the iconography of Oxford – part of a much-painted view from Boar's Hill and North Hinksey forming the rural setting to the historic core and celebrated in the poetry of Matthew Arnold. Detracting features include the pylons and transmission lines, encroachment of built development, extension of sports facilities and intrusion of traffic noise, which has eroded the peaceful\rural character. Despite this, the area retains a strong visual and cultural unity and a high functional integrity that conveys a perception of exceptionally high landscape quality.

Sensitivity to Change
Its distinctiveness, historic interest, high ecological value and open character make this area particularly sensitive to change. Since the 18th century enclosures this area has seen progressive changes resulting from expansion of close-mown amenity playing fields, introduction of pylons and transmission lines and gravel extraction. Building of the railway line has fragmented the area. Threats to local character could arise as a result of:

- new built development that does not respect the local vernacular of this distinctive area; and
- abstraction or flood defence work upstream resulting in changes in the river flooding regime

Objectives, policy development and enhancement opportunities:
The overall strategy should be to conserve the area's historic integrity, tranquil character, rich biodiversity and the role it plays in the rural setting of Oxford.

Landscape Type 5. River Meadowlands (2004 OWLS study) comprising flood plains and valley floors of the rivers Cherwell, Thames, Evenlode and Windrush. This is a linear riverine landscape with a flat, well defined alluvial floodplain. It has a pastoral character with meadows, wet and semi-improved pasture.

Key characteristics

- Flat, low lying topography with seasonally flooded alluvial floodplain
- Meandering river channels
- Grazing meadow and small fields of permanent pasture
- Riparian character with strong pattern of riverside willows and tree lined ditches.

The Scheme lies across the following local area:

5O: Lower Cherwell

The Lower Cherwell is characterised by small semi-improved grass fields, wet grassland, some unimproved neutral grassland and flood meadows at Marston and Iffley Lock. Hedges are generally overgrown and gappy but, in some places, tall and thick. Around Hinksey, the main field boundaries are ditches bordered by dense pollarded willows. A dense corridor of crack willow, hawthorn, ash and poplar borders the river, although trees are much sparser around Islip. There are poplar plantations alongside Hinksey stream and scattered hedgerow trees including ash, willow and some oak, add to the tree cover.

Landscape Type 8. Settled and Open River Terraces (derived from 2002 LUC study) comprising River terraces (and their proximity to pastures), which have been the prime locational factor for settlement in the Thames Valley from prehistoric times providing minor

undulations in topography and separating the Thames and Cherwell floodplains. These domed deposits of river terrace gravels overlying clay support the historic core of Oxford as well as much newer built development providing contrast to the open floodplains. The landscape type therefore tends to have a busy, urban character. Buildings are typically of limestone with red brick detailing. Roads are a feature of the landscape today. Those river terraces that remain undeveloped, typically support a rural, agricultural landscape of medium to large 'enclosed' fields of arable crops and pasture.

Key characteristics:

- Domed landform of river gravel deposits
- Historic core to villages
- Provides platform for development
- Contrast with floodplains

The Scheme lies across the following local area:

8B: River Terrace Outliers
Small islands of first level river terrace deposits within the Thames floodplain. Typically support settlement, including Wolvercote, Osney, Grandpont and New Hinksey - all areas vulnerable to flooding.

Built development is typical of river terraces, but should not extend onto the floodplain beyond.

Landscape Type 12. Wooded Estate lands (derived from 2004 OWLS study) comprising a wooded estate landscape characterised by arable farming and small villages with a strong vernacular character which covers the majority of the wooded and parkland areas in the undulating landscape of the Corallian Ridge and on the southern extremities of the Cotswolds.

Key characteristics:

- Rolling topography with localised steep slopes
- Large blocks of ancient woodland with mixed plantations of variable sizes
- Large parklands and country houses
- A regularly shaped field pattern dominated by arable fields
- Small villages with strong vernacular character.

The Scheme lies across the following local area:

12L. Cumnor Hill
The area has a mix of land uses including medium-sized, semi-improved grass fields and larger arable fields. Woodland dominates the landscape, particularly towards the east where there are very large blocks of ancient woodland including Kennington and Radley woods. The minor valleys and small streams, bordered by belts of dense scrub and wet woodland, are distinctive features that add diversity to the landscape. Fields are enclosed by thorn and elm hedges, but there are also some species-rich hedges with shrubs such dogwood, spindle and wayfaring tree close to the ancient woodland. Hedgerow trees of oak, ash and dead elm are also more prominent in the vicinity of ancient woodland. Hedges are generally taller and in better condition in the eastern part of the area and are very low, fragmented or replaced by fences in the west.

Figures 7.6a and 7.6b illustrate the Local Character Areas within the study area.

7.1.5 Site appraisal

Landscape Receptors

In general, the landscape character of the Scheme area is one of floodplain meadow allowing access to rural open space close to Oxford city centre. This rural meadow and watery setting with the backdrop of the Oxford skyline, has been much celebrated in art and literature such as the paintings by J.M.W. Turner (1775-1851) and William Turner (1789-1862), and the poet Matthew Arnold (1822-1888) who coined the phrase 'dreaming spires'.

Within this landscape setting are the following landscape receptors (Table 7.1), which have been considered during the design and development of the Scheme.

Table 7.1: Landscape receptors

Landscape Receptor	Description
Specimen trees, tree groups and hedgerows	Trees in native woodland blocks, as individual mature willows or as mixed tree and shrub riparian vegetation follow the streams and ditches and are important elements in the landscape character of the Scheme area. A pre-development arboricultural survey was carried out in May 2017 with an Arboricultural Impact Assessment (AIA) completed in November 2017 then both survey and AIA were updated and extended in 2020 and 2021 (see Appendix F). The AIA details the impact of the Scheme in the site's existing tree stock and sets out recommendations for the subsequent mitigation or avoidance of impact. Both the pre-application arboricultural survey and AIA were undertaken in accordance with guidance contained within British Standard BS5837:2012 'Trees in relation to design, demolition and construction – Recommendations'. Each tree was assessed and assigned to one of the following categories: • Category A: Those trees of high quality and value with an estimated remaining life expectancy of at least 40 years. • Category B: Those trees of moderate quality and value with an estimated remaining life expectancy of at least 20 years. • Category C: Those trees of low quality and value with an estimated remaining life expectancy of at least 10 years or young trees with a stem diameter below 150mm. • Category U: Trees in such a condition that they cannot realistically be retained as living trees in the context of the current land use for longer than 10 years. The predominant category of tree and tree group identified within Area 1 of the Scheme is Category C and of low quality. Category B and moderate quality tree groups were also identified at relic field boundaries and close to Seacourt Stream. Area 2 of the Scheme is largely comprised of individual trees located along the banks of Seacourt Stream. The categories of tree are variable but Categories C and U (low quality and unsuitable for retention respectively) are most frequent. A notable Category A, high quality tree group was identified to the north of Willow Walk. Throughout Area 3, Category B moderate quality, trees and tree groups were recorded. The distribution of the trees and tree groups reflect the extant field boundaries and alignment of watercourse present within this area of the Scheme.

Landscape Receptor	Description
	Within Area 4 of the Scheme the identified trees are largely Category C and U (low quality and unsuitable for retention respectively) whilst the tree groups located at field boundaries are generally of higher (Category B) quality. Woodlands of particular importance to the landscape character and/or for their contribution to amenity use are Seacourt Nature Park, Kendall Copse Community Woodland and Kennington Pit. Linear tree features such as the line of mature willows sitting on the east bank of the Seacourt Stream leading down from Botley Bridge to the avenue of trees lining both sides of Willow Walk are definitive elevated features crossing the floodplain landscape. The braided pattern of riparian hedgerows and groups of trees which follow the existing streams and ditches down the floodplain are typical of this landscape.
Watercourses	Watercourses are a key component of the landscape character of the Scheme area. From north of the Seacourt Park and Ride under Botley Road to Willow Walk, Seacourt Stream is a distinctive water feature approximately 8m wide. It then becomes the Hinksey Stream, with a seasonal connection also to the Bulstake Stream. Hinksey Stream and other channels, notably Hinksey Drain, are braided watercourses within the floodplain and flow in a southerly direction towards Old Abingdon Road where they enter culverts beneath the road.
Field drains and ditches including Jubilee Scrape	A number of field drains and ditches including the Jubilee Scrape criss-cross the alluvial landscape of the Scheme area. The field drains and ditches present within the Scheme area are generally rectilinear in form but significant variance in appearance and level of vegetation does exist. The field drains and ditches are a notable feature of the floodplain landscape. The Jubilee Scrape, a wetland feature, was created in 2002 as one of several wildlife spaces to mark the Queen's Golden Jubilee within the county of Oxfordshire. The scrape marks the medieval boundary of Oxford's franchise or liberty and until 1991 was also the local authority boundary.
Willow Walk	Willow Walk is a bridleway that links North Hinksey with New Botley and is the most notable pedestrian route linking the two settlements. Willow Walk was originally constructed between the years 1876-77 for the private use of the Harcourt family and their estate; a major local landowner. Willow Walk was made public in 1922. The walk is defined by its elevated pathway flanked on either side by mature willow trees, generally in poor condition (See AIA Appendix F). It is a prominent feature of the local landscape. At the western end on North Hinksey Lane, there is an existing stone bridge (approximately 5.4m wide and 29.6m long) spanning the current course of the Seacourt Stream. Beneath the walkway further to the east, a number of culverts have been installed to facilitate the flow of floodwater downstream. Their position is represented at the walkway level by two sets of black metal railings either side of the path.
Semi-improved grassland	Semi-improved grassland is the predominant landscape feature, present almost throughout the Scheme area. The grassland makes a valuable contribution to the character and setting of Oxford and other conurbations.
Public Rights of Way	Given the proximity of the Scheme to Oxford city centre there is a surprisingly limited network of PRoW within the Scheme area. This is especially true for those wishing to move through the landscape of the Scheme along its north-west – south-east alignment. The Electric Road, an informal path, provides the only access. Those PRoW present within the Scheme area follow a general east–west alignment and illustrate a continuity of use of the historic elevated crossing points of the floodplain landscape. To the north of the Scheme area,

Landscape Receptor	Description
	Willow Walk, a bridleway and North Hinksey Causeway, a footpath, link the village of North Hinksey with Osney; both are elevated routes across the landscape and tree lined with filtered views over the landscape. Further south within the Scheme area, the Devil's Backbone, a footpath, links New Hinksey with the village of South Hinksey; this is also an elevated and tree lined route. A number of footpaths also extend from South Hinksey in a southerly direction before passing through the Scheme area and meeting Old Abingdon Road. The Thames Path National Trail whilst not within the Scheme area is an important and well used route located to the east of the Scheme.
Landform	The landform of the Scheme area is extremely important in its role in the setting of Oxford. It is one of the major floodplains that defined the growth of the city and provides the contrast between the conurbations urban and rural character. Located within the lower reaches of the alluvial floodplain the Scheme contains relatively few areas of higher ground, exceptions being the historic east - west crossing points at Willow Walk, North Hinksey Causeway and Devil's Backbone.
Seacourt Nature Park	Seacourt Nature Park is managed by Oxford City Council and includes floodplain habitats adjacent to Seacourt Stream; it is a wildlife haven surrounded by development land. In addition to its ecological value the habitats the nature park supports, namely riparian woodland, scrub and grassland make an important contribution to the character and setting of Botley Road and Oxford itself.
Oatlands Road Recreation Ground	A green open space bounded by Willow Walk to the south, Osney Mead Industrial Estate and Ferry Hinksey Road to the east. The local primary school is to the north east and residential streets to the north. The area is part of a well-used east–west link and is used for informal recreation and includes a marked-out football pitch and children's play area run by Oxford City Council providing a range of play equipment.
Kendall Copse	Kendall Copse occupies the site of a former landfill formerly operated by Oxford City Council. In 2008, the local residents of Kennington helped to create a community woodland on the site. Until recently, the site was supported by the community group, Friends of Kendall Copse. In addition to the community significance and value associated with the copse, the semi-mature woodland and grassland make a valuable contribution to the character and setting to the urban fringe of the city.
Kennington Pool LWS	Created as a borrow pit when soil/sand was removed for the construction of the adjoining railway in the 19th Century, Kennington Pit now provides a variety of habitats for flora and fauna that is surrounded by a rare example of UK wet woodland habitat. In addition to the ecological value associated with the ponds, the wet woodland and series of ponds have in the past been valued for their contribution to the character of the urban fringe of the city. The area is currently overgrown and relatively inaccessible and is therefore not valued highly as a community asset.

7.1.6 Visual baseline

Visual context

A Zone of Theoretical Visibility (ZTV), a computer-generated tool, was analysed to identify the likely (or theoretical) extent of visibility of the proposed Scheme. This was further refined through analysis of Ordnance Survey mapping at a range of scales, and through field surveys. The ZTV is shown on Figure 7.2a/b.

The Scheme is visually enclosed to the west by the A34 in Areas 1 and 2. There are views from Areas 3 and 4 of the Scheme, towards the rising ground to the west of the A34 that includes Cumnor, Boars Hill and Hurst Hill. Clear views towards Wytham Hill are possible within Area 2. The Oxford to Birmingham and London railway defines the visual boundary to the east, industrial development at Botley Road and Osney Mead to the north and the Southern By-pass Road to the south. The majority of views of the Scheme area are within the immediate vicinity of the Scheme although many of these are filtered by the extensive network of hedgerows and tree cover present around the Scheme area.

Long distance viewpoints are possible from higher ground to the west and from taller buildings located within Oxford city centre such as those identified in Part 2 of the Assessment of the Oxford View Cone document and assessed in this chapter.

Within the VOWH District Council's Local Plan (2011, Saved Policies), the Oxford City Council's Local Plan (2001-2016) and the Oxford Core Strategy 2026, there are an agreed series of protected views or 'Oxford View Cones' around Oxford; some of which are from the high ground to the west of the city across from Wytham, Cumnor and Boar's Hill to the historic skyline of the city.

An 'Assessment of the Oxford View Cones' was produced in 2015 by Oxford City Council, Oxford Preservation Trust and English Heritage, to assess the key characteristics and heritage values of the ten views defined as the 'Oxford View Cones' the views are protected through the Local Plan. The ten viewpoints are examples of places from which Oxford can be appreciated in its landscape. The three viewpoints, which have views across the study area for the Scheme, are named 'Views from the Western Hills - Raleigh Park, Boars Hill and the A34 Interchange at Hinksey Hill'. As shown on Figure 7.7a/b, these viewpoints all look directly over the study area, and therefore any potential changes in the view may significantly affect the appreciation of Oxford's landscape. As well as looking at the characteristics of the existing view including detractors, potential opportunities for enhancements through the removal or screening of intrusive features have been considered in this assessment.

Although not protected, there are clear views of the hills to the north of the Scheme and towards the historic city core from Hinksey Meadows. However, high voltage electricity transmission lines detract from views in many locations in the study area, as they cross the site from Hinksey Meadows in the north, to North and South Hinksey villages, and from the meadows between Kennington and the River Thames in the south. In general, the overhead lines disrupt otherwise unspoilt views and introduce a sense of urbanity across the area. They are at their most intrusive within the protected view cones to Oxford such as from Hinksey Heights, Raleigh Park. Between Seacourt and Oxford city centre (across the southern most area of Port Meadow), the electricity lines have been buried underground.

Visual Receptors

Key visual receptors have been identified as:

- Local residents of Oxford, Botley and South Hinksey;
- Users of the Thames Path, PRoW and other informal routes;
- People engaged in outdoor recreational activities such as allotment holders and those occupied in sports;
- Agricultural workers;
- Visitors to Oxford city centre;
- Users of the strategic and local road and rail network; and
- Visitors to the Oxford view cone locations, to the west of Oxford.

The visual assessment appraises identified viewpoints where the Scheme may result in changes to the existing visual amenity and considers the degree of change that will be experienced by the visual receptors. The viewpoints are intended to be representative. The location of the assessed viewpoints is shown on Figure 7.7a/b and the viewpoints themselves are shown on Figures 7.8 – 7.45. The viewpoint locations represent the extent of the visual

influence of the development i.e. the extent to which the Scheme will be visible from public locations.

It includes an assessment of changes to visual amenity during construction and during operation. The assessment of effects after 15 years considers whether proposed planting screens or frames views and how appropriate the Scheme will appear in its local context.

Assessed Viewpoints

The selected viewpoints to assess the impacts of the Scheme on visual amenity are presented in Table 7.2, together with the reasons for the viewpoint selection. Of the 28 viewpoints selected for assessment a total of twelve locations were chosen for the creation of illustrative visualisations of the Scheme. The visualisations illustrate how the Scheme will appear after three years. The viewpoints and visualisations themselves are provided in Appendix I-8. Reference has been made to the viewpoints identified in Part 2: Views from the Western Hills of the Assessment of the Oxford View Cones (Oxford City Council et al 2015) document. The viewpoints and visualisations in Table 7.2 have been discussed and agreed with Oxfordshire County Council.

Table 7.2: Viewpoint and visualisation selection

Viewpoint and Visualisations	Visual Receptors	Reasons for Selection
Viewpoint 1: Land west of Seacourt Park & Ride. (Appendix I-8, Figure 7.8)	Agricultural workers	Illustrative of changes to visual character of the Scheme
Viewpoint 2: Land east of Botley Road Allotments. (Appendix I-8, Figure 7.9)	Local residents and users of the allotment site	Representative of views from residential properties to the north of Botley Road
Viewpoint 3: Botley Road / West Way bridge over the Seacourt Stream. (Appendix I-8, Figure 7.10)	Motorists with some cyclists and pedestrians	Representative of views towards northern extent of Scheme from Botley Road / West Way
Viewpoint and Visualisation 4: Seacourt Nature Park. (Appendix I-8, Figures 7.11 and 7.12)	Users of Seacourt Nature Park	Representative of the changes to the visual character of the Scheme
Viewpoint 5: South of Westway Cycle Route. (Appendix I-8, Figure 7.13)	Users of Nature Park	Illustrative of changes to visual character of the Scheme
Viewpoint 6: Hinksey Meadow, south of Botley Road Retail Park. (Appendix I-8, Figure 7.14)	Users of Hinksey Meadow	Representative of views from the northwest of Hinksey Meadow
Viewpoint and Visualisation 7: Hinksey Meadow. (Appendix I-8, Figures 7.15 and 7.16)	Users of Hinksey Meadow	Representative of changes to the visual character of the Scheme
Viewpoint 8: North Hinksey Lane. (Appendix I-8, Figure 7.17)	Local residents, cyclists and pedestrians	Representative of changes to the visual character of the Scheme
Viewpoint 9: North Hinksey Lane adjacent to North Hinksey C of E Primary School. (Appendix I-8, Figure 7.18)	Local residents, cyclists and pedestrians	Representative of changes to the visual character of the Scheme
Viewpoint 10: Hinksey Meadow north of Willow Walk. (Appendix I-8, Figure 7.19)	Users of the meadow	Illustrative of changes to views along Hinksey Meadow
Viewpoint and Visualisation 11: Willow Walk PRoW. (Appendix I-8, Figures 7.20 and 7.21)	Users of the PRoW	Illustrative of changes to views along Willow Walk
Viewpoint and Visualisation 12: North Hinksey Causeway PRoW.	Users of PRoW 320/16/10	Illustrative of changes to views along North Hinksey Causeway

Viewpoint and Visualisations	Visual Receptors	Reasons for Selection
(Appendix I-8, Figures 7.22 and 7.23)		
Viewpoint and Visualisation 13: Raleigh Park, Oxford protected viewcone. (Appendix I-8, Figure 7.24 and 7.25)	Users of the public open space and visitors to the viewcone location	Recognised viewpoint of Oxford's historic core from the western hills
Viewpoint 14: Castle Mound, Oxford. (Appendix I-8, Figure 7.26)	Visitors to Oxford Castle	Representative of views from tall, historic buildings within Oxford
Viewpoint 15: Carfax Tower, Queen Street, Oxford. (Appendix I-8, Figure 7.27)	Visitors to St Martin's Church	Representative of views from tall, historic buildings within Oxford
Viewpoint 16: Electric Road south of the Hogacre Ditch. (Appendix I-8, Figure 7.28)	Recreational users of Electric Road	Representative of changes to the visual character of the Scheme
Viewpoint and Visualisation 17: Land south of Hinksey Heights Golf Club. (Appendix I-8, Figure 7.29 and 7.30)	Local residents, visitors to the golf club	Representative of changes to the visual character of the Scheme in views from the west
Viewpoint 18: South Hinksey junction, A34. (Appendix I-8, Figure 7.31)	Motorists	Representative of changes to the visual character of the Scheme from the west
Viewpoint and Visualisation 19: Electric Road. (Appendix I-8, Figures 7.32 and 7.33)	Recreational users of the flood meadows	Representative of changes to the visual character of the Scheme
Viewpoint and Visualisation 20: Devil's Backbone PRoW, east of South Hinksey village. (Appendix I-8, Figures 7.34 and 7.35)	Users of the PRoW	Illustrates the change in the visual character along the PRoW
Viewpoint 21: Thames Path National Trail. (Appendix I-8, Figure 7.36)	Users of the PRoW	Representative of changes to the visual character of the Scheme in views from the east
Viewpoint and Visualisation 22: Hinksey Hill Roundabout, Oxford protected viewcone. (Appendix I-8, Figure 7.37 and 7.38)	Motorists and visitors to the viewcone location	Recognised viewpoint of Oxford's historic core from the western hills
Viewpoint and Visualisation 23: Kendall Copse. (Appendix I-8, Figures 7.39 and 7.40)	Users of the community woodland	Illustrate the changes to the visual character of the Scheme
Viewpoint 24: Old Abingdon Road. (Appendix I-8, Figure 7.41)	Motorists with some cyclists and pedestrians.	Illustrate the changes to the visual character of the Scheme
Viewpoint 25: Kennington Pool Local Wildlife Site. (Appendix I-8, Figure 7.42)	Users of the Nature Reserve	Illustrate the changes to the visual character of the Scheme
Viewpoint 26: Boars Hill, Oxford protected viewcone. (Appendix I-8, Figure 7.43)	Visitors to the viewcone location	Recognised viewpoint of Oxford's historic core from the western hills
Viewpoint and Visualisation 27: North Hinksey Lane. (Appendix I-8, Figure 7.44)	Motorists with some cyclists and pedestrians and users of the allotment site.	Illustrative of changes to views from North Hinksey Lane
Viewpoint and Visualisation 28: Hinksey Meadow and Seacourt	Users of Hinksey Meadow.	Representative of changes to the visual character of the Scheme.

Viewpoint and Visualisations	Visual Receptors	Reasons for Selection
Nature Park. (Appendix I-8, Figure 7.45)		

7.1.7 Landscape Design and Mitigation

The Scheme sits within a landscape with an internationally recognised skyline as its backdrop, and we have therefore designed the Scheme to reflect this quality and opportunity. The landscape strategy for the Scheme area has been developed to retain a green floodplain corridor. It has been designed to provide green links to join up existing key habitats and create enhanced ecological/habitat connectivity whilst retaining the landscape character of the floodplain. The Green Infrastructure (GI) Study (Gillespies 2016) considered the existing and potential GI Assets along the Scheme area corridor such as Seacourt Nature Park, Kendall Copse and Kennington Pit and how these could be linked north-south to create a continuous green floodplain corridor. Interconnection with existing east-west links including the Willow Walk route into Oxford and the Devil's Backbone link between South Hinksey village and Hinksey Park formed a GI Framework. GI identified within the corridor was to be designed to reflect the qualities of their setting and the character of the city of Oxford and the landscape of the floodplain.

In the GI Study, aside from habitat creation, key considerations/targets in the design were to:

- Increase the length and extent of blue infrastructure;
- Improve cycleway/pedestrian routes - connecting north to south and east to west,
- Improve setting of Heritage Assets - including Old Abingdon Road Scheduled Monument; and
- Preserve existing protected viewcones across the study area as well as potential enhancements through the removal or screening of intrusive features.

The GIS Concept Plan formed the template for the development of a more detailed Landscape Masterplan and the General Arrangement Landscape Plans (Appendix I-6) dividing the corridor into areas. Our Landscape Masterplan has been designed to compensate for the loss of valued landscape resources, changes in landscape character and adverse effects on visual amenity within the Scheme area (through the creation of new woodland areas, additional planting and wildlife areas). Care has also been taken to ensure that new locations for tree planting will not obscure the Oxford View Cones. Our landscape strategy includes the detailed interventions set out in the following paragraphs, which are illustrated on the Landscape Plans contained in Appendix I-6.

Area 1: North of Botley Road

Once excavated the second stage channel will be seeded up to the banks of the first stage stream with a wetland meadow grass mix. Locally sourced wetland plants will be utilised as pioneer planting and assist in the regeneration of native riparian vegetation species along the first stage stream. This will reduce the area available for invasive non-natives species to grow. Backwater features and riffles within and adjacent to the watercourse will be created as part of the Scheme. Three areas are allocated for the creation of woodland to replace those areas lost through the construction of proposed flood channels. The first is located west of Bullstake Close allotments and north of residential properties fronting Botley Road (0.30ha), the second north of Botley Road and east of the A420, behind Boundary House (2.17ha) and the third area of woodland is proposed north of Area 1, at the bifurcation of Seacourt Stream (1.1ha).

Flood bunds situated to the west of Seacourt Stream and north of properties on Botley Road will be seeded with native grassland species to integrate the features quickly with the landscape. To reduce the footprint and land take of the flood defences sheet pile flood walls, clad in concrete will be used along the south edge of the Bullstake Close allotments area. This will be located just in front of the existing boundary wall to reduce the visual impact experienced from residential properties. The existing stone wall on the eastern side of the

Bullstake allotments will be retained and repaired and flap valves added to prevent flow through the drains in the wall to the residential gardens behind the wall.

Concrete flood walls and kerbs will also be used at the Seacourt Park and Ride and the proposed car park extension area. This wall will be extended east alongside the copse area to minimise the footprint of the defences and construction work on the existing copse and associated habitat. Flood walls to the east of the Seacourt Stream north of Botley Road behind Boundary House will be similar in design to those behind the residential properties along Botley Road. This wall ties into high ground on the A34 sliproad to prevent water bypassing the defences and getting onto Botley Road. This wall is set back to enable a number of the trees along the edge of the road to be retained. Floodgates will be installed at the footbridges at the ends of Helen Road and Henry Road with some brick infill. The appearance of the flood wall, embankment and gate will be designed to minimise visual impact and blend with materials in the local area.

Area 2: Botley Road to Willow Walk
The West Way Cycle Bridge will be increased in length and an overspill weir will be installed to divert the second stage channel around an electricity pylon and a group of trees. The appearance of the weir structure will be carefully designed to minimise visual impact as discussed below. Within Area 2 of the Scheme, two areas are allocated for the creation of woodland to replace those trees lost through the creation of the second stage channel. The first is located between Seacourt Stream and North Hinksey Lane (0.74ha), the second is located south of Botley Road Retail Park north of Hinksey Meadow (0.03ha). The alignment of the second stage channel at this location has been designed to reduce, to the greatest extents possible, the impacts on the species-rich floodplain meadow (MG4a grassland) located within this area. Locally sourced wetland plants will be utilised as pioneer planting and assist in the regeneration of native riparian grassland species throughout the second stage channel. The sensitively designed Willow Walk Bridge will be appropriate for its semi-rural location in terms of the scale and massing of the structure, and the selection of high quality material finishes to the bridge and abutments as set out in more detail below.

Area 3: Willow Walk to Devil's Backbone
Once excavated, locally sourced wetland plants will be utilised as pioneer planting and assist in the regeneration of native riparian vegetation species along the first stage stream. The second stage channel will be sown with a native wet meadow mixture. Four areas of woodland creation are proposed; located to the east of North Hinksey (2.04ha), north-west of South Hinksey (1.53ha), north-east of Hogacre Common (3.69ha) and to the south of Osney Mead Industrial Estate (0.61ha). 15.7ha of MG4a grassland will be established on land located between Osney Mead Industrial Estate and Hogacre Common using a green hay method or over-seeding. A further 2.1ha of MG4a grassland will be translocated or sown to the north of the Devil's Backbone. Throughout the Scheme's second stage channel will be frequent backwater and wetland scrape features whose margins will be left to regenerate naturally, with surveillance and management to ensure non-native species do not become established. We anticipate reeds and other tall, non-woody plants will dominate a proportion of the ponds, which we will encourage for biodiversity reasons. The flood bund located to the west of Osney Industrial Estate at Ferry Hinksey Road will be seeded with native grassland species to integrate the features quickly with the landscape. A length of flood wall and floodgates will tie into the embankment. A further flood embankment will be located at South Hinksey. Five areas located at the periphery of the flood channels will be utilised in the establishment of 3.95km of new hedgerows with trees. The creation of woodland and hedgerows with trees across Area 3 will help to mitigate for those lost during the excavation of the second stage channel. The sensitively designed crossings at North Hinksey Causeway and Devil's Backbone will be appropriate for their semi-rural location in terms of the scale and massing of the structure and the selection of high quality material finishes of the bridge and abutments as described below.

Area 4: Devil's Backbone to the junction with Hinksey Stream and River Thames
To the north of Old Abingdon Road (0.35ha), at Kendall Copse (0.75ha) and to the south of the A423 and to the east of the railway (0.38ha), replanting of native tree species will be undertaken to replace those lost through the construction of flood channels and bridges. The sensitively designed bridges at Old Abingdon and Kennington Roads will be appropriate for the semi-urban location in terms of the scale and massing of the structures and the selection of high quality material finishes to the bridge and abutments. The flood bund situated at New Hinksey will be seeded with native grassland species to integrate the features quickly within the landscape. Backwater features and riffles within and adjacent to the watercourse created as part of the Scheme will provide opportunities for enhanced habitat creation, specifically lowland fen and reedbeds.

Bridge and Structure Design Summary
Six new bridges will be constructed as part of the Scheme and one bridge will be replaced to ensure that essential east–west access to Oxford City is maintained. Westway Cycle Bridge will be replaced in the same timber style as present but with an increased span over the second stage channel. Further detail is provided below with regard to the design of the bridges.

Footbridges
We have designed the new footbridges primarily with wood decking to ensure they remain low key in the pastoral landscape. They comprise a bespoke composite parapet constructed of Corten steel uprights with a hardwood timber handrail in neutral colours, which will help to soften their appearance and integrate the bridge into the landscape. As detailed on the drawings, the abutments of the North Hinksey Causeway and Westway cycle path bridges will be clad in a buff coloured limestone laid in a coursed rubble bond as will the pier of the cycle path in order to soften the appearance of the wingwalls.

Vehicular Bridges
The new bridges at Willow Walk and Devil's Backbone (see Plates 8 and 9) will be more substantial and have been designed to accommodate infrequent use by maintenance and farm vehicles along with regular use by cyclists, horse riders and pedestrians. These requirements dictate the width and approach ramp angles for the bridges. The span of the bridges is dictated by the need to convey the flood flows below the bridges . However, the width of the proposed Willow Walk Bridge will remain similar to the existing stone bridge.

Willow Walk is a sensitive location, where a raised walkway follows an historic route defined by an avenue of mature willow trees visible from the north through the whole of Hinksey Meadow. It is also a key east-west link for pedestrians and cyclists into Oxford City. We will plant new trees to replace those removed from working areas and alongside the new ramps for the bridges along Willow Walk. We consulted with the public on alternative design options for the new bridge and used the responses to develop a design that met the aesthetic aspirations of the local community both in terms of material selection and functionality. Of the options available during the consultative process was the inclusion of a public art element to the design of the parapets. However, due to a lack of public support for this intervention, this concept was discontinued with the final parapet taking a more contemporary form.

Following public consultation, from a choice of options using timber, metal and a combination of materials and a range of designs from formal upright balustrades to more organic curved designs, the public chose an option that comprises a Corten steel railing with a wooden handrail and arm rest. Abutments will be clad with either buff limestone laid in a coursed rubble bond, or a similar-looking, low-carbon alternative, if this can be sourced. The curved profile of the uprights and the organic shape of the hardwood handrail has been designed to be less urbanising and reflect the rural area in which it is set. The railings have been designed to allow pedestrians to view the surrounding riparian landscape. Asphalt with cobbles will be used on the verges of the bridge to soften the edges but allow safe and easy cycling.

Both bridges will have to take maintenance vehicles including excavators in order to clear the proposed channel and maintain the bridge structures in the future. In the case of the Devil's Backbone, farm vehicles and National Grid traffic will also be carried. The bridges require parapets 1.4m in height to protect pedestrians and cyclists as directed by Highway Authority standards for footpaths, cycleways and bridleways.

Similar to the footbridges, the parapets will be a bespoke composite construction of Corten steel uprights and hardwood handrails. The footways of the bridges will be surfaced with setts to provide a clear delineation between cyclist, pedestrian and equestrian usages, in addition to being more in keeping with the semi-rural locations of the bridges. The chosen finish will be in keeping with its location on the suburban fringe of Oxford. We will use pre-stressed concrete for the main beams as it allows a slim deck profile to minimise the overall height of the bridge.

Similarly, the freeboard (air space above flood levels to the underside of the bridge) has been assessed individually for each bridge to reduce this down as far as possible based on the risk of debris and blockages during a flood. This has helped to reduce the vertical height of the bridges by up to 400mm over the standard approach. The abutments are constructed from steel sheet piles to support the bridges but will be faced with stone.

Plates 8 and 9 illustrate the design intent for the parapets used for the proposed Willow Walk and Devil's Backbone bridges.

Plates 8 and 9: Design parapets for Willow Walk and Devil's Backbone bridges

Additionally, two new bridges will be constructed at Old Abingdon Road and Kennington Road with a span of 20m each with a central pier. The abutments will be constructed from reinforced concrete with a textured/stone effect appearance.

Aside from bridges, there are a number of other structures including flood defences, flood gates and small control structures.

Control Structures

The control structures have been appropriately sited to minimise impacts on openness. They will not be large; the crest will typically be less than 1m wide and will be located within streams and ditches below surrounding land levels. These include control structures in the Bulstake Stream and the Hinksey Stream. There are also hydrometric stations, which will be located at Botley Bridge and Bulstake Bridge on Botley Road, Old Abingdon Road Bridge, and Mayweed Bridge on Old Abingdon Road. These will be used for monitoring the flow in the various watercourses and will comprise permanent moss green coloured steel cabinets with a 1.8m palisade fence around them and an access track. The Eastwyke Ditch Control Structure will be located adjacent to the railway line and away from public areas. It will be set at a level similar to the railway embankment to reduce the visual aspect. The tree belt which screens the railway from the residential properties to the east will be retained to screen the structure.

Floodwalls

The new flood embankments, walls and floodgates, are all located on the fringes of the urban area, mainly to the north of Botley Road and the east of Abingdon Road. The floodwalls will be constructed of a clad steel sheet pile while the embankments are of an earthen construction, with a small steel key below to reduce seepage during floods. Their finishes have been carefully considered in order to integrate these structures quickly and sympathetically to their setting, and to minimise the Scheme's carbon footprint. As such, the grass species to seed the earthen embankments have been chosen to ensure they blend with other established grasslands in the semi-urban environment they are located. Similarly, we have selected materials for the flood walls to reflect the vernacular architectural style that predominates in the area where they are situated. For example, we are proposing red engineering brick cladding panels with a contrasting blue coping laid in an English garden wall bond for flood walls at Botley Road and Kennington village, and a buff limestone coursed rubble construction or low-carbon alternative with similar visual properties (if this can be sourced), for South Hinksey village to help these structures blend into their semi-urban setting.

Fencing
The new and replacement fencing required for residential properties abutting parts of the Scheme, or agricultural holdings within the footprint of the Scheme, will reflect its setting and purpose. In all instances, the selection of materials will match existing boundary styles and materiality. For example, at residential properties in Kennington village, we will install close boarded fencing panels as they are more compatible with existing fence lines, while wooden palisade fences will be more appropriate for properties in South Hinksey village given the style of boundary treatments found at this location. Agricultural boundaries requiring fencing will be predominately post-and-wire, reflective of the enclosure methods commonly encountered in Oxford's flood meadows.

Fixed Crest Riffles
Within the Bulstake Stream, a number of fixed crest riffles will be installed to manage the flow level of the watercourse and maintain groundwater levels below the sensitive MG4 grassland at Hinksey Meadow during periods of low flows in the channel. This is necessary because the diversion of the Bulstake Stream to become a combined channel with the Hinksey Stream risks local lowering of groundwater unless this mitigation is put in place. To reduce the visibility of these features the central steel pile core will be overlain with stone and topped with gravel, and the features designed to look like natural riffle features on the bed of the channel. This will allow them to perform a valuable function for the river while appearing as natural features in the river landscape, as well as safeguarding the groundwater levels for the sensitive grassland to the north.

An assessment of the impact of the proposed structures on the openness of the Green Belt is set out at the end of the visual impact section and is further considered in the Green Belt Statement (Environment Agency 2021) and Planning Policy Statement section on Compliance with Policy.

7.1.8 Changes to landscape and visual amenity in absence of Scheme

In the absence of the Scheme, the effects of climate change on the future baseline landscape of the Scheme area may include:

- Increased frequency of heavy rainfall during winter months resulting in widespread flooding of the Scheme area;
- Reduced rainfall and increased evapotranspiration during summer months, affecting the vitality of vegetation within the site;
- Changes in biodiversity and the balance of species, as a consequence of new climatic conditions with subtle changes in vegetation; and
- Changes to the constituent elements that define the character of the landscape.

Overall it is considered that the future baseline landscape and visual amenity of the Scheme has a low vulnerability to current climate change predictions. Although the nature of the site has the potential to change in the future as vegetation communities continue to develop (e.g. where vegetation cover has not reached its successional climax and where existing trees are already showing signs of decline), its flood meadow character would remain broadly intact. Some of the mature trees in the Scheme area, including the willows beside Seacourt Stream and those on Willow Walk, have been assessed in the AIA (Appendix F) to have limited predicted lifespan. Some of these should be replaced, otherwise elements of the historic character will be lost and there will be fewer distinctive landscape features.

Should the flood alleviation Scheme not be implemented and the Scheme area remain undeveloped and subject to a similar management regime to that which currently exists, the landscape character of the Scheme area is likely to remain relatively unchanged, as the existing land cover would not alter materially.

7.2 Likely significant effects

7.2.1 During construction

Landscape Character

Table 7.3 assesses the impacts of the Scheme on landscape character during construction.

Designations

Table 7.4 assesses the impacts of the Scheme on designations during construction.

Historic landscape

The Scheme will impact on the historic landscape through the erosion and/or loss of a number of the key characteristics of the existing HLC Types currently recorded within the Scheme boundary and the creation of new HLC Types. This is especially applicable with Area 3 of the Scheme. The changes in the defining characteristics of the HLC Types will primarily be the result of the removal and re-alignment of extant field boundaries and the introduction of new delineating and enclosure features altering the current grain and appearance of the landscape. To a lesser degree, changes in management practices and agricultural use of the floodplain landscape may also result in a localised shift in perception and character of the Scheme area. Overall, the changes to the historic landscape during construction will result in a **minor adverse** effect.

Landscape receptors

Table 7.5 sets out the overall significance of landscape effects on each of the landscape receptors identified. It is based on consideration of the value, susceptibility to change and sensitivity of the landscape receptors and the magnitude of change (as set out in Section 4.3.3).

Table 7.3: Impacts on landscape character during construction

Receptor	Value	Susceptibility	Sensitivity	Potential impacts	Magnitude of Change	Significance of Effects
Scheme Area landscape character	Local	**Medium / high**, as the proposals will require the removal of a substantial number of trees, tree groups and hedgerows. This will be in addition to losses of MG4a and semi-improved grassland within the proposed footprint of flood channels, flood defences and new infrastructure.	**Medium/ high**, based on having a local value and medium/high susceptibility.	Loss of landscape features and vegetation, including hedgerows and hedgerow trees; Changes to the existing topography; Impacts on landscape character due to the loss of landscape features; Impacts on landscape character due to the presence of cranes and scaffolding, movement of construction vehicles and fenced construction works and compounds, soil storage areas and other effects associated with a construction site.	Medium/ high	Major/ moderate adverse
Wider Landscape Character	Local	**Medium**, as the proposals will require the removal of features such as linear tree groups and grassland habitats that are typical of the wider landscape.	**Medium**, based on having a local value and medium susceptibility.	Loss of landscape features and vegetation, including hedgerows and hedgerow trees; Changes to the existing topography; Impacts on landscape character due to the loss of landscape features; Impacts on landscape character due to the presence of cranes and scaffolding, movement of construction vehicles and fenced construction works and compounds, soil storage areas and other effects associated with a construction site. Impacts on the landscape character of the North Vale Corallian Ridge, Kennington Pit, Kendall Copse and Seacourt Stream Nature Park.	Medium	Moderate adverse

Table 7.4: Impacts on designations during construction

Receptor	Value	Susceptibility	Sensitivity	Potential impacts	Magnitude of Change	Significance of Effects
Seacourt Nature Park	Local	**High**, as the Scheme will require the removal of stands of mature trees, the re-profiling of and alterations to the alignment of Seacourt Stream, installation of a new spillway and cycle bridge spanning the proposed flood channel.	**Medium/ high**, based on having a local value and high susceptibility.	The loss of mature trees within the nature park, and alterations to the cross-section of the Seacourt Stream. Loss of local character affecting setting of Botley Road / Oxford.	High	Major/ moderate adverse
Hinksey Meadow (part of Osney Mead (Botley Meadow) LWS)	Local	**High**, as the Scheme will require the removal of a section of the nationally scarce MG4a grassland habitat the meadow supports.	**High**, based on having a local value and high susceptibility.	The partial loss of this habitat due to the creation of the second stage channel flowing through Hinksey Meadow before passing beneath Willow Walk.	Medium	Major/ moderate adverse
Oatlands Road Recreation Ground	Local	**High,** as the Scheme will require the removal of mature trees and amenity grassland for the creation of a flood bund and flood wall within the recreation ground.	**Medium/ low,** based on having a local value and high susceptibility.	There will be a loss of amenity grassland located within the footprint of the proposed flood bund adjacent to Ferry Hinksey Lane. Mature tree cover located to the south-west of Osney Mead Industrial Estate will also have to be removed for the inclusion of a new flood wall.	Medium	Minor adverse
Kendall Copse	Local	**High**, as the Scheme will necessitate the removal of in total 2.3ha of woodland from both the western and eastern sections of the copse, representing a large proportion of the woodland. The Scheme	**Medium/ high**, based on having a local value and high susceptibility.	The loss of a large proportion of the community woodland and re-profiling of existing topography to create a canalised flood channel.	High	Major / moderate adverse

Receptor	Value	Susceptibility	Sensitivity	Potential impacts	Magnitude of Change	Significance of Effects
		will require the partial removal of a Category B and Category C tree group in addition to the complete removal of a further Category B tree group and individual Category B tree as they are located within the footprint of the Scheme proposals. A construction compound and temporary carriageway will be located in the western copse whilst the culvert passing beneath Old Abingdon Road and canalised flood channel through the eastern copse are also proposed as part of the Scheme				
Kennington Pit (within Kennington Pool LWS)	Local	**High**, as the Scheme will require the removal of three tree groups, one category B (mixed species) and two category C (mixed species / Sycamore) in addition to three category U and a single category C tree. The widening of the Hinksey drain will result in the reduction in size of the existing pond	**Medium/ high**, based on having a local value and high susceptibility.	The loss of riparian woodland and partial loss of Kennington Pit.	High.	Major/ moderate adverse

Table 7.5: Significance of effects on landscape receptors during construction

Receptor	Value	Susceptibility	Sensitivity	Potential impacts	Magnitude of Change	Significance of Effects
Specimen trees and tree groups	Local	**High**, as the Scheme will require the removal of mature trees and tree groups throughout the Scheme area.	**High**, based on having a local value and high susceptibility.	Removal of up to 361 individual trees and 79 groups of trees and the partial removal of a further 57 tree groups (approximately 2000 trees in total) will be required to facilitate the construction of the first and second stage channels and new flood defence structures. [*It should be noted that these tree losses are based on a worst-case scenario and following further discussion with the appointed contractor, it is anticipated that some of these trees can be retained following further design modifications*].	Medium/ high	Major/ moderate adverse
Watercourses	Local	**Medium / high**, as the Scheme will necessitate the re-profiling of stream beds, insertion of new riffle features, the creation of new and diversion of existing water channels and through Kendall Copse and Kennington Pit the creation of a canalised flood channel.	**High**, based on having a local value and high susceptibility.	Watercourses will undergo various alterations including the re-profiling of stream beds, creation of new water channels, the addition of new spillways and other flow control structures and the creation of new ponds and backwater features adjacent to their course.	High	Major/ moderate adverse
Field and drainage ditches	Local	**Medium / high**, as the Scheme will require the removal of field drains and ditches located in the footprint of the Scheme.	**Medium**, based on having a local value and medium / high susceptibility.	The field drains and drainage ditches located within the footprint of the first and second stage channels will be lost due to the re-grading of the landform necessary for creation of the flood channels. This will result in the loss of 182m of field drains and ditches.	Medium/ high	Major/ moderate adverse
Jubilee Scrape	Local	**Medium / high**, as the Scheme will require the removal of part of this wetland feature.	**High**, based on having a local value and	A proportion of the scrape will be lost as it is located within the footprint of the second stage channel associated with the Seacourt Stream. The loss will be due to the re-grading of the	Medium/ high	Moderate adverse

Receptor	Value	Susceptibility	Sensitivity	Potential impacts	Magnitude of Change	Significance of Effects
			medium / high susceptibility.	landform necessary for creation of the flood channel.		
Willow Walk	Local	**High**, as the Scheme requires the removal of mature trees flanking Willow Walk and the installation of a new bridge.	**High**, based on having a local value and high susceptibility.	It will be necessary to remove eleven category B White Willow trees, a single category C White Willow and a category U Ash in addition to the partial removal of a category A and category B tree group of mixed species. The removal of trees is necessitated by the installation of the proposed cycleway standard bridge and second stage channel.	High	Major/ moderate adverse
Semi-improved grassland	Local	**High**, as the Scheme will require the removal of the grassland within the footprint of the Scheme's flood channels.	**Low**, based on having a local value and low / medium susceptibility.	There will be a loss of the semi-improved grassland located within the footprint of the proposed first and second stage channels due to the re-grading of existing landform profiles this will total approximately 18.2ha of semi-improved grassland	Medium/ high	Minor adverse
Public Rights of Way	Local	**Medium / high**, as the Scheme will necessitate the removal of mature vegetation surrounding the PRoW and installation of new bridges spanning the first and second stage channels at North Hinksey Causeway and Devil's Backbone.	**High**, based on having a local value and medium / high susceptibility.	The potential impacts of the Scheme will be associated with the change to the character of the landscape through the introduction of flood defences and channels, loss of mature vegetation and new bridges.	Medium	Moderate adverse
Landform	Local	**Medium**, as the Scheme will necessitate the creation of new wetland features and ponds, re-grading of existing topography to create the first and second stage flood channels and raised flood bunds.	**Medium**, based on having a local value and medium / high susceptibility.	There will be substantial re-profiling of the existing landform throughout the Scheme area in order to create the new first and second stage channels, ponds and other wetland features, soil storage areas and flood defence bunds.	Medium/ high	Moderate adverse

Receptor	Value	Susceptibility	Sensitivity	Potential impacts	Magnitude of Change	Significance of Effects
The impacts on the following landscape receptors have already been discussed in Table 7.4 and are therefore not duplicated in this table: Seacourt Nature Park, Oatland Road Recreation ground, Kendall Copse and Kennington Pool LWS.						

Visual amenity
During the construction of the Scheme, the works that will affect the visual amenity of the identified receptors are:

- plant and vehicular movements within the Scheme area and adjoining road network and presence of construction personnel;
- earthworks, excavation of flood channels, re-profiling of watercourses, construction of flood bunds and walls;
- erection of construction compounds and storage stockpiles of stripped soils and construction materials;
- introduction of temporary and permanent fencing through a phased programme in a currently flat, rural landscape – this will reduce the potential for views of construction activities within the Scheme area for motorists, pedestrians and cyclists, although the fencing itself will be visible;
- views of cranes in the Scheme area will be possible during the construction period;
- lighting of the proposed development during operating hours in winter is also likely to be visible; and
- permanent clearance of landscape features including mature trees, both within the Scheme area and around the boundary – this will be noticeable to motorists, pedestrians, cyclists and equestrians in the vicinity of the Scheme.

Effects on visual amenity during the construction phase were considered for each viewpoint described in Table 7.9. The assessment concluded that effects on visual amenity during the construction phase will be **major adverse** at three of the viewpoints, **major/moderate adverse** at five and **moderate adverse** at ten viewpoints. The remaining eight viewpoints were assessed as minor/moderate or less. A separate assessment is provided for each viewpoint.

7.2.2 During operation

Landscape Character
The potential landscape impacts from operational activities have been identified as:

- impacts on the existing landscape character from the introduction of the proposed Scheme;
- impacts on existing landscape character from the proposed landscape proposals; and
- impacts on the existing character of the Seacourt Nature Park and Kennington Pit

Table 7.6 assesses the impacts of the Scheme on landscape character during operation.

Designations
Table 7.7 assesses the impacts of the Scheme on designations during construction.

Historic landscape
The Scheme will impact on the historic landscape through the erosion and/or loss of a number of the key characteristics of the existing HLC Types currently recorded within the Scheme boundary and the creation of new HLC Types. This is especially applicable with Area 3 of the Scheme. The changes in the defining characteristics of the HLC Types will primarily be the result of the removal and re-alignment of extant field boundaries and the introduction of new delineating and enclosure features altering the current grain and appearance of the landscape. To a lesser degree, changes in management practices and agricultural utilisation of the floodplain landscape may also result in a localised, shift

in perception and character of the Scheme area. Overall, the changes to the historic landscape during operation will result in a **negligible** effect.

Landscape receptors

Table 7.8 sets out the overall significance of landscape effects on each of the landscape receptors identified.

Table 7.6: Significance of effects on landscape character during operation

Receptor	Value	Susceptibility	Sensitivity	Potential impacts	Magnitude of Change during operation. Year 1	Significance of Effects during operation Year 1	Magnitude of Change during operation. Year 3	Significance of Effects during operation Year 3	Magnitude of Change during operation. Year 15	Significance of Effects during operation Year 15
Scheme Area landscape character	Local	Medium/ high	Medium/ high	Impacts on the existing landscape character from the introduction of the proposed Scheme, and impacts on existing landscape character from the proposed landscape proposals.	Medium/ high	Moderate adverse	Medium/ low	Minor adverse	Negligible	Minor beneficial
Wider Landscape Character	Local	Medium	Medium	Impacts on the existing landscape character from the introduction of the proposed Scheme, and impacts on existing landscape character from the proposed landscape proposals.	Medium	Minor adverse	Low	Minor adverse/ negligible	Negligible	Minor beneficial

Table 7.7: Significance of effects on local designations during operation

Receptor	Value	Susceptibility	Sensitivity	Potential impacts	Magnitude of Change during operation. Year 1	Significance of Effects during operation Year 1	Magnitude of Change during operation. Year 3	Significance of Effects during operation Year 3	Magnitude of Change during operation. Year 15	Significance of Effects during operation Year 15
Seacourt Nature Park	Local	High.	Medium/ high	There will be notable changes to the Nature Park on completion of the Scheme due to the changes in landform, loss of mature tree cover and new bridge. However, the Scheme is appropriate to its flood meadow context and will respond positively to the urban fringe of Oxford and the semi-rural Hinksey Meadow. After three years the seeded grasslands will have become established, blending the Scheme with the wider landscape. After 15 years, the proposed planting will have reached semi-maturity and will consist of a sensitively designed landscape appropriate to the purposes of the Scheme and an appropriate setting to Botley Road.	Medium/ high	Moderate adverse	Medium/ low	Minor adverse	Low	Minor beneficial
Hinksey Meadow ((part of Osney Mead	Local	High	High	There will be notable changes to Hinksey Meadow on completion of the Scheme due to the inclusion of the second stage channel, loss of grassland habitat and new bridge.	Medium	Major/ moderate adverse	Medium/ low	Moderate/ minor adverse	Low	Negligible

Receptor	Value	Susceptibility	Sensitivity	Potential impacts	Magnitude of Change during operation. Year 1	Significance of Effects during operation Year 1	Magnitude of Change during operation. Year 3	Significance of Effects during operation Year 3	Magnitude of Change during operation. Year 15	Significance of Effects during operation Year 15
(Botley Meadow) LWS)				However, the Scheme has been designed to minimise the loss of valued landscape features such as MG4a grassland and includes a sympathetically designed bridge and the evolution of flood channels to minimise the effects on local character. After three years the seeded grasslands will have become established, blending the Scheme with the wider landscape. Woodland planting adjacent to the meadow on North Hinksey Lane, although evident will not yet be advanced enough to contribute significantly to the landscape character. After 15 years the proposed planting will have reached semi-maturity and will consist of a sensitively designed landscape appropriate to the purposes of the Scheme and an appropriate setting to Oxford and North Hinksey.						
Oatlands Road	Local	High	Medium / low	There will be a notable change to the character of Oatlands Road with the changes to landform, the loss of	Medium	Minor adverse	Low	Minor adverse/ negligible	Low	Negligible

Receptor	Value	Susceptibility	Sensitivity	Potential impacts	Magnitude of Change during operation. Year 1	Significance of Effects during operation Year 1	Magnitude of Change during operation. Year 3	Significance of Effects during operation Year 3	Magnitude of Change during operation. Year 15	Significance of Effects during operation Year 15
Recreation Ground				amenity grassland and mature tree cover to the south also removed and opening views towards the industrial estate eroding its enclosed feel. After three years the seeded grassland will have become established, blending the Scheme with the wider landscape. After 15 years the grassed flood bund will be fully integrated with the recreation ground and the impacts of the development will be reduced as the planting matures.						
Kendall Copse	Local	High	Medium / high	There will be major changes to the character of Kendall Copse on completion of the Scheme. A large proportion of the eastern copse will be replaced by a maintenance access track and bridge and a new channel, part rock lined, downstream of the new Kennington Road Bridge. The western copse will be reseeded and replanted with native trees and shrubs upon removal of the temporary road and the construction compound. The new channel, with a less natural	High	Major/ moderate adverse	Medium/ high	Moderate adverse	Medium	Moderate adverse

Receptor	Value	Susceptibility	Sensitivity	Potential impacts	Magnitude of Change during operation. Year 1	Significance of Effects during operation Year 1	Magnitude of Change during operation. Year 3	Significance of Effects during operation Year 3	Magnitude of Change during operation. Year 15	Significance of Effects during operation Year 15
				appearance than in other areas, together with new tracks and bridges will be different to the reclaimed landscape currently experienced and the replanted trees will take a number of years to establish. After three years the seeded grasslands will have become established, blending the Scheme with the wider landscape. Woodland planting, although evident will not yet be advanced enough to contribute to the landscape character. After 15 years the vegetation within the copse will be reaching semi-maturity, helping to integrate the new bridges and channel into the semi-urban landscape.						
Kennington Pit (within Kennington Pool LWS)	Local	High	Medium/ high	There will be large changes to the character of Kennington Pond on completion of the Scheme as the existing pond and riparian vegetation is reinstated in conjunction with the new flood channel flowing from Kendall Copse. After three years the seeded grasslands will have become	High	Major/ moderate adverse	Medium	Minor adverse	Medium	Minor beneficial

Receptor	Value	Susceptibility	Sensitivity	Potential impacts	Magnitude of Change during operation. Year 1	Significance of Effects during operation Year 1	Magnitude of Change during operation. Year 3	Significance of Effects during operation Year 3	Magnitude of Change during operation. Year 15	Significance of Effects during operation Year 15
				established, blending the Scheme with the wider landscape. Woodland planting, although evident will not yet be advanced enough to contribute to the landscape character. After 15 years the replanted vegetation at the periphery of the ponds will be reaching semi-maturity and the impacts of the Scheme will reduce as the landscape matures.						

Table 7.8: Significance of effects on landscape receptors during operation

Receptor	Value	Susceptibility	Sensitivity	Potential impacts	Magnitude of Change during operation. Year 1	Significance of Effects during operation Year 1	Magnitude of Change during operation. Year 3	Significance of Effects during operation Year 3	Magnitude of Change during operation. Year 15	Significance of Effects during operation Year 15
Specimen trees and tree groups	Local	High	High	The proposed areas of native woodlands will become established, the larger specimen plantings will provide a framework around which the woodlands will develop, but nonetheless the loss of specimen trees and tree groups will remain. After three years, the woodland plantings although evident within the landscape will not yet contribute materially to the overall character. After 15 years, once the proposed woodland planting has reached semi-maturity the impacts of the Scheme will be reduced.	Medium/ high	Major/ moderate adverse	Medium	Moderate/ minor adverse	Low/ negligible	Negligible
Water-courses	Local	Medium/ High	High	The existing streams and other water courses will be retained and in some instances modified to improve their flow characteristics. This will be in conjunction with the creation of new stream / flood channels, ponds and backwater features. After three years the	High	Major/ moderate adverse	Medium/ low	Minor adverse	Negligible	Minor beneficial

Receptor	Value	Susceptibility	Sensitivity	Potential impacts	Magnitude of Change during operation. Year 1	Significance of Effects during operation Year 1	Magnitude of Change during operation. Year 3	Significance of Effects during operation Year 3	Magnitude of Change during operation. Year 15	Significance of Effects during operation Year 15
				seeded grasslands and marginal wetland habitats will have become established, blending the Scheme with the wider landscape. Tree planting adjacent to watercourses, although evident will not yet be advanced enough to contribute significantly to the landscape character. After 15 years planted and regenerated riparian vegetation will be established and the visual character of the water courses will be sympathetic to the local character.						
Field and drainage ditches	Local	Medium/ high	Medium	Those field and drainage ditches modified within the footprint of the first and second stage channel will be reinstated to reflect the character of existing ditches within the floodplain. After three years the seeded and planted marginal wetland habitats will have become established, blending the Scheme with the wider landscape. After 15 years planted and regenerated	Medium/ high	Major/ moderate adverse	Low/ negligible	Negligible	Low/ negligible	Negligible

Receptor	Value	Susceptibility	Sensitivity	Potential impacts	Magnitude of Change during operation. Year 1	Significance of Effects during operation Year 1	Magnitude of Change during operation. Year 3	Significance of Effects during operation Year 3	Magnitude of Change during operation. Year 15	Significance of Effects during operation Year 15
				riparian vegetation will be established and the visual character of the field and drainage ditches will be sympathetic to the local character.						
Jubilee Scrape	Local	Medium/ High	High.	The Jubilee Scrape will be reinstated to reflect the existing alignment of the feature where located within the re-graded footprint of the second stage channel. After three years the seeded wetland meadow within the scrape will have become established, blending the Scheme with the wider landscape. After 15 years the wetland planting in and around the scrape will be fully established and the visual character will be sympathetic to its setting within Hinksey Meadow.	Medium/ high	Moderate adverse	Low/ Negligible	Negligible	Low/ Negligible	Negligible
Willow Walk	Local	High	High	The potential impacts of the Scheme will be the presence of the new bridge and loss of mature trees either side of the walkway within the largely rural landscape setting	High	Major/ moderate adverse	Medium	Moderate adverse	Low	Negligible

Receptor	Value	Susceptibility	Sensitivity	Potential impacts	Magnitude of Change during operation. Year 1	Significance of Effects during operation Year 1	Magnitude of Change during operation. Year 3	Significance of Effects during operation Year 3	Magnitude of Change during operation. Year 15	Significance of Effects during operation Year 15
				of Hinksey Meadow. After three years, woodland planting to the south-west of Willow Walk and the specimen willow trees on either side of the walk, although evident, will not yet be advanced enough to contribute to the landscape character. After 15 years, the willow trees flanking the walk will be reaching semi-maturity, and the sympathetically designed bridge will be viewed as an appropriate addition to the landscape in its wooded setting.						
Semi-improved grassland	Local	High	Low	Semi-improved grassland will have begun to re-establish but the loss of grassland vegetation within the first and second stage channel will remain. After three years the seeded grassland will have become established, blending the Scheme with the wider landscape. After 15 years the grasslands located within the first and second stage channels will be fully revegetated, creating a	Medium/ high	Minor adverse	Negligible	Negligible	Negligible	Minor beneficial

Receptor	Value	Susceptibility	Sensitivity	Potential impacts	Magnitude of Change during operation. Year 1	Significance of Effects during operation Year 1	Magnitude of Change during operation. Year 3	Significance of Effects during operation Year 3	Magnitude of Change during operation. Year 15	Significance of Effects during operation Year 15
				more diverse floodplain grazing marsh and blending with the landscape beyond the Scheme boundary.						
Public Rights of Way	Local	Medium / High	High	The impacts of the Scheme will be associated with the change to the character of the landscape through the introduction of flood defences and channels, loss of mature vegetation and new bridges. After three years the seeded grasslands atop flood defences and marginal wetland habitats will have become established, blending the Scheme with the wider landscape. Tree planting adjacent to watercourses and bridges, although evident will not yet be advanced enough to contribute to the landscape character. After 15 years once proposed planting has become established and the floodplain grazing marsh and wetland features have matured, the Scheme will	Medium	Moderate adverse	Low	Minor adverse/ negligible	Low	Minor beneficial

Receptor	Value	Susceptibility	Sensitivity	Potential impacts	Magnitude of Change during operation. Year 1	Significance of Effects during operation Year 1	Magnitude of Change during operation. Year 3	Significance of Effects during operation Year 3	Magnitude of Change during operation. Year 15	Significance of Effects during operation Year 15
				contribute to the character of the floodplain landscape.						
Landform	Local	Medium	Medium	There will be no further change to landform within the development boundary although the new channels and flood bunds will be evident. After three years the seeded grasslands and marginal wetland habitats will have become established, blending the Scheme with the wider landscape. After 15 years, as the grasslands mature within the channels and atop the bunds, the changes in level will become more difficult to discern, blending with the landscape beyond the Scheme boundary.	Medium/ high	Moderate adverse	Low	Negligible	Low	Negligible
The impacts on the following landscape receptors during operation have already been discussed in Table 7.7 and are therefore not duplicated in this table: Seacourt Nature Park, Oatland Road Recreation ground, Kendall Copse and Kennington Pool LWS.										

Visual assessment
The assessment of visual impacts during operation has considered the impacts of the proposed development in the opening year and after 15 years when the landscape proposals will be established. Where there is a difference in the assessment between impacts in the summer and winter, it has also been noted.

Viewpoint Assessment
A detailed assessment from each viewpoint is provided in Table 7.9. The sensitivity of potential receptors at each of the identified viewpoints is considered, followed by a description of the changes to visual amenity and an assessment of effects.

Green Belt
The changes to the above-ground flood protection elements (flood embankments, flood walls bridges and hydrometric stations) will have a localised visual effect but will not have an adverse effect on wider views from the river corridor or from the Protected Viewcone locations to the west of Oxford. Mitigation in the form of sensitive bridge design and choice of materials, design of the earthworks and planting scheme sympathetic to the existing landscape character will be effective in minimising the visual impact on the Green Belt and maintaining its openness.

Table 7.9: Magnitude of change and significance of effects for visual receptors

Receptor	Sensitivity	Distance (m)	Changes as a result of Scheme	Magnitude of Change during construction	Significance of effects during construction	Magnitude of Change during operation, Year 1	Significance of effects during operation, Year 1	Magnitude of Change during operation, Year 3	Significance of effects during operation, Year 3	Magnitude of Change during operation, Year 15	Significance of effects during operation, Year 15
Viewpoint 1 Land west of Seacourt Park & Ride (car park users). (Appendix I-8, Figure 7.8)	**Low**, based on the viewpoint location being of local value and a receptor of low susceptibility to change	Within the Scheme boundary	There will be clear views of the newly created backwater feature and second stage channel. Loss of some existing mature tree cover will open views to wider landscape but the majority of the mature trees will be retained, maintaining the character of the local landscape. The creation of new wetland habitat adjacent to Seacourt Stream will be a positive addition to the landscape. After three years the grassland will have become established blending with the surrounding landscape. After 15 years the backwater feature and associated wetland habitat will be fully established and contribute positively to the setting of Seacourt Stream.	High	Moderate adverse	High	Moderate adverse	Medium / low	Minor adverse	Medium / low	Minor beneficial
Viewpoint 2 Land west of Bullstake Close Allotments (local residents and users of Bullstake Close Allotment site). (Appendix I-8, Figure 7.9)	**Low / medium**, based on the viewpoint location being of local value and a receptor of medium	25	From this location there will be clear views of the newly constructed clad flood wall and bund with its associated fence line. Views will be possible from the upper storeys of residential properties and the allotment site. Brick cladding panels will be used on the flood wall in order to integrate with the local vernacular building style and the flood bund sown with local grass species. An area of newly planted mitigation woodland extending westwards will also be evident north of the flood defences that assist in the integration of the defences over time. After three years the proposed grassland atop the flood bund and grassland will have become established, blending with the surrounding landscape. The mitigation woodland will not have a major presence within the view but will still be evident as a positive addition to the setting of the view. After 15 years the proposed mitigation woodland will be reaching semi-maturity and screening views of the flood wall in views from the north. The sown grasslands on the flood bunds will be fully established and blending with the surrounding landscape reducing their presence further.	Medium	Moderate adverse	Medium	Moderate adverse	Medium / low	Moderate / minor adverse	Medium	Negligible
Viewpoint 3 Botley Road / West Way bridge over Seacourt Stream (Motorists with some cyclists and pedestrians). (Appendix I-	**Low / medium**, based on the viewpoint location being of local value and a receptor of medium	Within the Scheme boundary	There will be partial, transient views of the newly constructed flood wall to the north of the carriageway, second stage river channel extending to the west of Seacourt Stream and area of mitigation woodland. The removal of some existing tree cover located within the second stage channel will open the currently visually congested Seacourt Stream and encourage the development of new riparian habitats. After three years the proposed grass atop the flood bund and grassland will have become established blending with the surrounding landscape. The mitigation woodland will not have a major presence within the view but will still be evident as a positive addition to the setting of the view.	Medium	Moderate adverse	Medium	Moderate adverse	Medium	Moderate / minor adverse	Low	Negligible

Receptor	Sensitivity	Distance (m)	Changes as a result of Scheme	Magnitude of Change during construction	Significance of effects during construction	Magnitude of Change during operation, Year 1	Significance of effects during operation, Year 1	Magnitude of Change during operation, Year 3	Significance of effects during operation, Year 3	Magnitude of Change during operation, Year 15	Significance of effects during operation, Year 15
8, Figure 7.10)	susceptibility to change.		After 15 years the magnitude of change will be reduced due to the proposed mitigation woodland reaching semi-maturity and contributing positively to the setting and character of Botley Road and Oxford. Grassland species used for the flood bund and second stage channel will already be established providing an improved visual setting for the stream.								
Viewpoint 4 Seacourt Nature Park (users of Nature Park). (Appendix I-8, Figures 7.11 and 7.12)	**Low / medium**, based on the viewpoint location being of local value and a receptor of medium susceptibility to change.	Within the Scheme boundary	The existing access track will be widened to facilitate construction and maintenance activities. In order to reduce the visual intrusion and promote its integration into the landscape as a 'farm track', the surface will be very lightly sown with the same meadow grass seed mix as the land on either side of the track. The removal of low value tree cover abutting Seacourt Stream will be undertaken and landform excavated to a typical depth of 1.5m to 2m in this location to create the second stage channel. Due to the operational requirements of the flood channel, replanting trees is not possible at this location; mitigation planting for the loss of these trees will be undertaken north of Botley Road. An upgraded, sensitively designed West Way cycle bridge, spanning the first and second stage channels of the Scheme will also be visible from this location. The above ground elements of the bridge will be finished to a high standard appropriate to its semi-rural setting. After three years the access track will be partially vegetated and the grassland will have become established blending with the surrounding landscape. After 15 years the access track will be fully integrated with its local setting. Although the loss of tree cover will remain due to the operational requirements of the flood channel, the opened views of the stream will be a positive addition to the character of the nature park.	High	Major / moderate adverse	High	Major / moderate adverse	Medium	Minor adverse	Medium / low	Minor beneficial
Viewpoint 5 South of Westway Cycle Route (users of Nature Park). (Appendix I-8, Figure 7.13)	**Low**, based on the viewpoint location being of local value and receptor of low susceptibility to change.	Within the Scheme boundary	From this location there will be clear views of the new West Way crossing as it spans the re-profiled Seacourt Stream and second stage flood channel. A new access track leading from Botley Road to the proposed spillway will also be evident as it passes east of the West Way crossing. Views towards Minns Business Park will be opened up due to the loss of tree cover along the banks of Seacourt Stream reducing the rural feel of the nature park at this location. After three years the proposed grass seeded on the access track and grassland will have become established, blending with the surrounding landscape. After 15 years the access track will be fully vegetated after reseeding of its surface, merging with its local setting. Although the loss of tree cover	High	Major / moderate adverse	High	Major / moderate adverse	Medium	Minor adverse	Medium / low	Minor beneficial

Receptor	Sensitivity	Distance (m)	Changes as a result of Scheme	Magnitude of Change during construction	Significance of effects during construction	Magnitude of Change during operation, Year 1	Significance of effects during operation, Year 1	Magnitude of Change during operation, Year 3	Significance of effects during operation, Year 3	Magnitude of Change during operation, Year 15	Significance of effects during operation, Year 15
			will remain due to the operational requirements of the flood channel, existing vegetation will continue to develop enclosing some wider views. The high quality materials utilised in the sympathetically designed bridge will be viewed as appropriate to its setting. The opened views of the stream will be a positive addition to the character of the nature park.								
Viewpoint 6 Hinksey Meadow, south of Botley Road Retail Park. (Appendix I-8, Figure 7.14)	**Low / medium**, based on the viewpoint location being of local value and a receptor of medium	Within the Scheme boundary	There will be views of the second stage channel as it sweeps in a south easterly direction towards Seacourt Stream. At the confluence of Seacourt Stream and the second stage channel, mature tree cover located on the northern bank of the watercourse separating the Scheme from North Hinksey Lane will be removed in order to construct the channel. After three years the proposed grassland will have become established, blending with the surrounding landscape. The mitigation woodland will not have a major presence within the view but will still be evident as a positive addition to the setting of the view. After 15 years the vegetation within the second stage channel will be fully established, blending this feature with the wider meadow landscape. Although the loss of trees to the north of Seacourt Stream will remain, mitigation planting to the south-east of the meadow will be reaching semi-maturity and tree cover located on the streams northern bank will have thickened to close any gaps in the surrounding tree cover.	Medium	Moderate adverse	Medium	Moderate adverse	Low	Minor adverse / negligible	Low	Negligible
Viewpoint 7 Hinksey Meadow (users of the meadow). (Appendix I-8, Figures 7.15 and 7.16)	**High**, based on the viewpoint location being of local value and a receptor of high susceptibility to change.	Within the Scheme boundary	There will be views of the second stage channel, discernible only as a shallow depression within the meadow. Tree cover located on the northern bank of Seacourt Stream will be removed to facilitate the construction of the second stage channel where adjoining the stream. The construction of the proposed Willow Walk bridge will necessitate the removal of mature trees located either side of the PRoW and introduce a break in this tree lined avenue After three years the proposed grassland will have become established, blending with the surrounding landscape. After 15 years the vegetation within the second stage channel will be fully established, blending this feature with the wider meadow landscape. Although the loss of trees to the north of Seacourt Stream will remain, mitigation planting to the south-east of the meadow and on parts of Willow Walk will be reaching semi-maturity and tree cover located on the streams northern bank will have thickened to close any gaps in the surrounding tree cover.	Medium	Moderate adverse	Medium	Moderate adverse	Medium	Minor adverse	Low	Negligible

Receptor	Sensitivity	Distance (m)	Changes as a result of Scheme	Magnitude of Change during construction	Significance of effects during construction	Magnitude of Change during operation, Year 1	Significance of effects during operation, Year 1	Magnitude of Change during operation, Year 3	Significance of effects during operation, Year 3	Magnitude of Change during operation, Year 15	Significance of effects during operation, Year 15
Viewpoint 8 North Hinksey Lane (local residents and road users). (Appendix I-8, Figure 7.17)	**High**, based on the viewpoint location being of local value and a receptor of high susceptibility to change.	17	The second stage channel will extend from Seacourt Stream north eastwards, away from receptors. The channel will be viewed over the pollarded willows located on the southern bank of the stream. The excavation of the channel will necessitate tree cover situated on the northern bank to be removed. After three years the proposed priority habitat of MG4a grassland and other grassland will have become established, blending with the surrounding landscape. After 15 years the vegetation within the second stage channel will be fully established blending this feature with the wider meadow landscape. Although the loss of trees to the north of Seacourt Stream will remain.	Medium	Moderate adverse	Low	Moderate adverse	Low	Minor adverse	Negligible	Negligible
Viewpoint 9 North Hinksey Lane adjacent to North Hinksey C of E Primary School (local residents and road users). (Appendix I-8, Figure 7.18)	**High**, based on the viewpoint location being of local value and a receptor of high susceptibility to change.	14	There will be filtered views of the second stage channel as its alignment deviates from Seacourt Stream to pass beneath Willow Walk to the north-east. Whilst tree cover located on the northern bank of Seacourt Stream will largely be removed to construct the second stage channel, mature tree cover on the southern bank will be retained. An area of rough grassland situated between North Hinksey Lane and Seacourt Stream will be planted to create an area of woodland and scrub opposite the school entrance, compensating for the loss of some of the existing tree cover. After three years the proposed priority habitat of MG4a and other grassland will have become established, blending with the surrounding landscape. The mitigation woodland and scrub will not have a major presence within the view but will still be evident as a positive addition to the setting of the view. After 15 years the vegetation within the second stage channel will be fully established blending this feature with the wider meadow landscape. Although the loss of trees to the north of Seacourt Stream will remain, mitigation planting to the south-east of the meadow will be reaching semi-maturity to close any gaps in the surrounding tree cover.	Medium	Moderate adverse	Low	Moderate adverse	Low	Minor adverse	Negligible	Negligible
Viewpoint 10 Hinksey Meadow (users of the meadow). (Appendix I-8, Figure 7.19)	**High**, based on the viewpoint location being of local value and a receptor of high susceptibility to change.	Within the Scheme boundary	Views from the meadow towards North Hinksey Lane and elevated residential properties will be opened up due to the removal of the majority of the willows on the northern bank of Seacourt Stream. There will be a notable change to the landform from this location as the proposed second stage channel, as its course deviates from Seacourt Stream, will extend northwards before passing beneath Willow Walk. To the south, an area of woodland and scrub will be created located between the stream and north Hinksey Lane. After three years the proposed priority habitat of MG4a and other grassland, will have become established blending with the surrounding landscape. The mitigation woodland and scrub will not have a major	Medium	Moderate adverse	Medium	Moderate adverse	Low	Minor adverse / negligible	Medium	Negligible

Receptor	Sensitivity	Distance (m)	Changes as a result of Scheme	Magnitude of Change during construction	Significance of effects during construction	Magnitude of Change during operation, Year 1	Significance of effects during operation, Year 1	Magnitude of Change during operation, Year 3	Significance of effects during operation, Year 3	Magnitude of Change during operation, Year 15	Significance of effects during operation, Year 15
			presence within the view but will still be evident as a positive addition to the setting of the view. After 15 years the vegetation within the second stage channel will be fully established, blending this feature with the wider meadow landscape. Although the loss of trees to the north of Seacourt Stream will remain, mitigation planting to the south-east of the meadow will be reaching semi-maturity and will have thickened to close any gaps in the surrounding tree cover.								
Viewpoint 11 Willow Walk Public Rights of Way (users of the PRoW). (Appendix I-8, Figures 7.20 and 7.21)	**High**, based on the viewpoint location being of local value and a receptor of high susceptibility to change.	Within the Scheme boundary	There will be views of the second stage channel, discernible as a shallow depression within the meadow. Tree cover located on the northern bank of Seacourt Stream will be removed to facilitate the construction of the second stage channel where adjoining the stream. An area of native woodland in the old paddock between Seacourt Stream and North Hinksey Lane will be planted in order to compensate for this loss. A new, sensitively designed bridge will take Willow Walk over the new flood channel. The bridge will require the removal of the existing culverts, trash screens and black railings but also necessitate the removal of several mature trees, creating a break in the tree lined avenue. New willows will be planted on either side of the bridge to replace those that require to be removed. After three years, grassland will have become established, blending with the surrounding landscape. The compensation woodland between Seacourt Stream and North Hinksey Lane will not have a major presence within the view but will still be evident as a positive addition to the setting of the view. After 15 years the grassland will be fully established within the dished profile of the second stage channel, blending with the wider meadow landscape. The loss of mature trees will remain due to the operational requirements of the flood channel and maintenance of the structure. However, the opening of views north and south of Willow Walk from the new bridge will bring an opportunity for the appreciation of the significance of the walk and its relationship with the surrounding meadow landscape. The loss of trees on the northern bank of Seacourt Stream will be compensated in an area of native woodland planting in the old paddock between Seacourt Stream and North Hinksey Lane.	High	Major / moderate adverse	Medium / high	Major / moderate adverse	Medium	Moderate adverse	Medium	Negligible
Viewpoint 12 North Hinksey Causeway Public Rights of Way (users of the PRoW).	**High**, based on the viewpoint location being of local value and a receptor of	Within the Scheme boundary	There will be clear views towards a newly constructed bridge following the alignment of North Hinksey Causeway that spans the second stage channel of the Scheme. The channel will flow north-west – south-east bisecting the current field structure. To the north-east of the channel and closest to receptors, an access track and hardstanding required for the maintenance of this and the bridge at Willow Walk will be evident. There will also be a loss of mature tree cover along a limited section of North	High	Major / moderate adverse	Medium	Moderate adverse	Medium	Moderate / minor adverse	Medium	Negligible

Receptor	Sensitivity	Distance (m)	Changes as a result of Scheme	Magnitude of Change during construction	Significance of effects during construction	Magnitude of Change during operation, Year 1	Significance of effects during operation, Year 1	Magnitude of Change during operation, Year 3	Significance of effects during operation, Year 3	Magnitude of Change during operation, Year 15	Significance of effects during operation, Year 15
(Appendix I-8, Figures 7.22 and 7.23)	high susceptibility to change.		Hinksey Causeway to permit the construction of the bridge crossing the newly excavated channel visible from this viewpoint. After three years the access track and hardstanding will have merged with the surrounding landscape due to the re-seeding with native grasses and grassland will have become established, blending with the surrounding landscape. The loss of trees will be mitigated through the planting of trees groups adjacent to the flood channels further downstream of this location but this planting will not contribute materially to the view. After 15 years the access track and hardstanding will have merged with the surrounding landscape due to the re-seeding with endemic grasses of their surfaces. The second stage channel will be difficult to discern within the landscape as the grassland habitat will be fully established. The high quality materials used in the sympathetically designed bridge will be appropriate to its setting. The loss of trees along North Hinksey Causeway will be mitigated through the planting of trees groups adjacent to the flood channels further downstream of this location.								
Viewpoint 13 Raleigh Park (visitors to Oxford protected viewcone viewpoint). (Appendix I-8, Figures 7.24 and 7.25)	**High**, based on the viewpoint location being of local value and a receptor of high susceptibility to change.	475	There will be glimpsed views towards the Scheme, evident above a break in vegetation within the boundary of Raleigh Park. Views of a small section of the second stage channel, access track and hardstanding associated with the new bridge at North Hinksey Causeway will be possible. The loss of a small number of mature trees for the construction of a new bridge on North Hinksey Causeway and flood wall to the south of Osney Mead Industrial Estate will also be evident. The visibility of the Osney Mead Industrial Estate will be increased slightly from this location due to the loss of tree cover. The remainder of the proposals will be screened by vegetation within the park or properties in North Hinksey Village. After three years, the grassland will have become established, blending with the surrounding landscape. After 15 years, the landscape proposals will be largely established across the Scheme area and integrated with the wider landscape, further reducing visibility of the Scheme.	Medium	Moderate adverse	Medium	Moderate adverse	Low	Minor adverse	Low	Negligible
Viewpoint 14 Castle Mound, Oxford (visitors to Oxford Castle Mound). (Appendix I-	**High**, based on the viewpoint location being of local value and a receptor of high	809	From this location views towards the Scheme are largely screened by the mature field maples on the slopes of the motte. Where views towards the Scheme are possible, intervening built form will effectively contain views of the Scheme. After three years, the landscape proposals will be semi-established across the Scheme area and integrated with the wider landscape, further reducing visibility of the Scheme.	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible

Receptor	Sensitivity	Distance (m)	Changes as a result of Scheme	Magnitude of Change during construction	Significance of effects during construction	Magnitude of Change during operation, Year 1	Significance of effects during operation, Year 1	Magnitude of Change during operation, Year 3	Significance of effects during operation, Year 3	Magnitude of Change during operation, Year 15	Significance of effects during operation, Year 15
8, Figure 7.26)	susceptibility to change.		After 15 years, the landscape proposals will be largely established across the Scheme area and integrated with the wider landscape, further reducing visibility of the Scheme.								
Viewpoint 15 Carfax Tower, Queen Street, Oxford (visitors to Carfax Tower). (Appendix I-8, Figure 7.27)	**High**, based on the viewpoint location being of local value and a receptor of high susceptibility to change.	970	Given that the height of much of the Scheme is relatively modest, from this viewpoint the intervening built form of Oxford will effectively contain views of the Scheme. After three years, the landscape proposals will be semi-established across the Scheme area and integrated with the wider landscape, further reducing visibility of the Scheme. After 15 years, the landscape proposals will be largely established across the Scheme area and integrated with the wider landscape, further reducing visibility of the Scheme.	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Viewpoint 16 Electric Road south of the Hogacre Ditch (recreational users of Electric Road. (Appendix I-8, Figure 7.28)	**High**, based on the viewpoint location being of local value and a receptor of high susceptibility to change.	Within the Scheme boundary	The most notable change to views at this location will be the proposed maintenance track as it leaves the Electric Road and sweeps south of the pylons and re-joins the second stage channel. In order to promote its integration into the landscape as a 'farm track', the surface will be very lightly sown with the same meadow grass seed mix as the land on either side of it, except for the short connection point with the Electric Road which has to incorporate a steel protection plate over the trenches which contain the high voltage cables that run along each side the track to ensure no damage occurs to the cables from maintenance vehicles. A new hedgerow, emerging from the south of the tree lined Hinksey Stream will continue across the view before joining and following the path of the maintenance track. A number of tree groups will be removed opening views across the landscape as they are located in the footprint of the second stage channel. Glimpsed views of created wetland features and ponds will also be possible. After three years, the prominence of the access track will be reduced as the stone surface weathers and it becomes partially vegetated. The proposed floodplain grazing marsh and wetland habitats will have become established, blending with the surrounding landscape. The mitigation woodland will not have a major presence within the view but will still be evident as a positive addition to the setting of the view. After 15 years, the prominence of the access track will be reduced as it vegetates and merges with the wider landscape. The floodplain grazing	Medium	Minor / moderate adverse	Medium	Minor adverse	Low	Minor adverse / negligible	Low	Minor beneficial

Receptor	Sensitivity	Distance (m)	Changes as a result of Scheme	Magnitude of Change during construction	Significance of effects during construction	Magnitude of Change during operation, Year 1	Significance of effects during operation, Year 1	Magnitude of Change during operation, Year 3	Significance of effects during operation, Year 3	Magnitude of Change during operation, Year 15	Significance of effects during operation, Year 15
			marsh sown within the second stage channel will fully establish as will the new wetland features such as ponds and backwaters. The proposed mitigation tree groups located close to the flood channels will be reaching semi-maturity and provide a positive addition to the landscape. Combined, these features will conserve and enhance the character of the local landscape and wider setting of the city.								
Viewpoint 17 Land south of Hinksey Heights Golf Club (visitors to Hinksey Heights Golf Club). (Appendix I-8, Figures 7.29 and 7.30)	**High**, based on the viewpoint location being of local value and a receptor of high susceptibility to change.	296	There will be notable changes to views from this location as the proposed first and second stage channels will be evident flowing north-west – south-east through the floodplain pastures at the foot of Hinksey Heights. A new access track and extensive hedgerow planting will follow the alignment of the proposed second stage channel in addition to scattered tree groups close to the channel. As existing ground levels are lowered during the construction of the channels, a number of existing hedgerows and individual trees will be lost to the Scheme, altering the perceived field structures. A series of new ponds and wetland scrapes located within the second stage channel will introduce a new feature to the landscape. As will the extensive area of mitigation woodland, which will be evident following an existing field boundary running north-west from South Hinksey village. After three years, the proposed floodplain grazing marsh and wetland features will have become established, blending with the surrounding landscape. The mitigation woodland will not have a major presence within the view but will still be evident as a positive addition to the setting of the view. After 15 years, the floodplain grazing marsh sown within the second stage channel will be fully established as will the new wetland features such as ponds and backwaters. The prominence of the access track will be reduced as the native grasses sown on its surface are fully established and merge with the wider landscape. The proposed mitigation tree groups planted close to the flood channels and those that extend north-west from South Hinksey will be reaching semi-maturity. Combined, these features will conserve and enhance the local landscape character and wider setting of the city.	Medium	Minor adverse	Medium	Minor adverse	Low	Minor adverse	Low / neutral	Negligible
Viewpoint 18 South Hinksey junction, A34 (motorists with infrequent pedestrians and cyclists). (Appendix I-	**Low**, based on the viewpoint location being of local value and receptor of low	29	Transient views over the Scheme from the bridge will be possible as receptors travel towards South Hinksey Village. The sinuous course of the first and second stage channels will be visible within the even flood meadow landscape that forms the middle distance of the view. Located within the second stage channel, a number of ponds and scrapes will be created. The lowering of the existing landform to create the flood channels will result in the loss of a limited number of semi-mature trees and hedgerows from this vista. Compensation and hedgerow planting to	Low	Minor adverse	Low	Minor adverse	Negligible	Negligible	Negligible	Negligible

Receptor	Sensitivity	Distance (m)	Changes as a result of Scheme	Magnitude of Change during construction	Significance of effects during construction	Magnitude of Change during operation, Year 1	Significance of effects during operation, Year 1	Magnitude of Change during operation, Year 3	Significance of effects during operation, Year 3	Magnitude of Change during operation, Year 15	Significance of effects during operation, Year 15
8, Figure 7.31)	susceptibility to change.		the north and south of the second stage channel will be evident; these features will define the extent of proposals within the landscape. After three years, the proposed floodplain grazing marsh will have become established, blending with the surrounding landscape. The mitigation woodland and hedgerows will not have a major presence within the view but will still be evident as a positive addition to the setting of the view. After 15 years, the floodplain grazing marsh sown within the second stage channel will fully establish as will the new wetland features such as ponds and backwaters. The proposed planting of tree groups as compensation close to the flood channels will be reaching semi-maturity, visually integrating the Scheme within the landscape. Combined, these features will conserve and enhance the local landscape character and wider setting of the city.								
Viewpoint 19 Electric Road (recreational users of Electric Road). (Appendix I-8, Figures 7.32 and 7.33)	**High**, based on the viewpoint location being of local value and a receptor of high susceptibility to change.	Within the Scheme boundary	Filtered views towards the first and second stage channels of the proposals will be possible. The channels will be largely evident as shallow depressions within the landscape. The excavation of the proposed channels will necessitate the removal of a limited number of mature hedgerows and trees. Retained hedgerows in the intervening landscape will contain some views especially to the south-east. After three years, the proposed floodplain grazing marsh and wetland habitats will have become established, blending with the surrounding landscape. The mitigation woodland will not have a major presence within the view but will still be evident as a positive addition to the setting of the view. After 15 years, the floodplain grazing marsh sown within the second stage channel will fully establish as will the new wetland features such as ponds and backwaters. The proposed tree groups planted as compensation close to the second stage channel will be reaching semi-maturity and contributing positively to the view. Combined, these features will conserve and enhance the local landscape and wider setting of the city.	Medium	Minor / moderate adverse	Medium	Minor adverse	Low	Minor adverse / negligible	Low	Minor beneficial
Viewpoint 20 Devil's Backbone Public Rights of Way, east of South Hinksey village (users of the PRoW).	**High**, based on the viewpoint location being of local value and a receptor of high	Within the Scheme boundary	There will be views towards a newly constructed bridge following the current alignment of the PRoW; the bridge spanning the first and second stage channels of the proposals. The construction of the bridge will necessitate the removal of several mature trees and section of hedgerow that enclose the PRoW opening a gap in this feature. The channels will pass to the east of receptors within the open fields, an access track following the sinuous route of the channel will also be visible from this location.	high	Major / moderate adverse	High	Major / moderate adverse	Medium	Moderate adverse	Low	Negligible

Receptor	Sensitivity	Distance (m)	Changes as a result of Scheme	Magnitude of Change during construction	Significance of effects during construction	Magnitude of Change during operation, Year 1	Significance of effects during operation, Year 1	Magnitude of Change during operation, Year 3	Significance of effects during operation, Year 3	Magnitude of Change during operation, Year 15	Significance of effects during operation, Year 15
(Appendix I-8, Figures 7.34 and 7.35)	susceptibility to change.		After three years, the access track and hardstanding will have merged with the surrounding landscape due to weathering and partial revegetation of its surfaces, additionally the floodplain grazing marsh habitat will have become established, blending with the surrounding landscape. The loss of trees along Devil's Backbone will be mitigated through the planting of woodland to the north-west of South Hinksey village but at this stage will not contribute significantly to the view. After 15 years, the access track and hardstanding will have merged with the surrounding landscape. The second stage channel will be difficult to discern within the landscape as the floodplain grazing marsh habitat will be fully established. The high quality materials used in the sympathetically designed bridge will be appropriate to its setting linking the rural and urban environments. The loss of trees along Devil's Backbone will be compensated through the planting of woodland to the northwest of South Hinksey village.								
Viewpoint 21 Thames Path National Trail (users of the Thames Path). (Appendix I-8, Figure 7.36)	**High**, based on the viewpoint location being of local value and a receptor of high susceptibility to change.	77	There will be oblique views of the proposed flood bund and associated fence line located east of the existing field boundary. Views will be slightly filtered by the hedgerow and hedgerow trees that define this section of the Thames Path. The flood bund will extend the full width of views from this location. The introduction of the fencing either side of the flood bund will foreshorten views slightly and introduce a new element to the view. Towards the south of the view, the flood bund will turn landwards through the existing field boundary, this change in direction will necessitate the removal of several mature trees and a section of hedgerow. After three years, the proposed grassland atop the flood bund will have become established, blending with the surrounding landscape. After 15 years, the native grasses sown on the flood bund will be fully established, blending with the wider landscape and further reducing their prominence.	Medium	Moderate adverse	Medium	Moderate adverse	Low	Minor adverse	Low / negligible	Negligible
Viewpoint 22 Hinksey Hill Roundabout Viewpoint (visitors to Oxford protected viewcone viewpoint). (Appendix I-8, Figures	**High**, based on the viewpoint location being of local value and a receptor of high susceptibility to change.	183	Transient and oblique views towards the Scheme will be possible for road users, and visitors to this location will be able to experience narrow, filtered views across the Scheme proposals. The proposed first and second channels of the Scheme will be visible from this location as shallow depressions as they pass between an existing water course and railway line; both defined by well vegetated boundaries. There will be a loss of several mature trees close to the railway as the ground level within the flood channels are lowered. This will result in a slight increase in the visibility of the railway embankment.	Low	Neutral / minor adverse	Low	Minor adverse	Negligible	Negligible	Negligible	Negligible

Receptor	Sensitivity	Distance (m)	Changes as a result of Scheme	Magnitude of Change during construction	Significance of effects during construction	Magnitude of Change during operation, Year 1	Significance of effects during operation, Year 1	Magnitude of Change during operation, Year 3	Significance of effects during operation, Year 3	Magnitude of Change during operation, Year 15	Significance of effects during operation, Year 15
7.37 and 7.38)			After three years, the landscape proposals will be semi-established across the Scheme area and integrated with the wider landscape, further reducing visibility of the Scheme. After 15 years, the landscape proposals will be largely established across the Scheme area and integrated with the wider landscape, further reducing visibility of the Scheme.								
Viewpoint 23 Kendall Copse (recreational users of the woodland). (Appendix I-8, Figures 7.39 and 7.40)	**High**, based on the viewpoint location being of local value and a receptor of high susceptibility to change.	Within the Scheme boundary	Views will be of the new bridge abutments and retaining wall on Old Abingdon Road. A new excavated channel will extend eastwards before turning to the south, passing close to a pylon and exiting Kendall copse. The removal of the majority of the existing vegetation within the copse will be necessary for the construction of the culverts and channel. After three years, the proposed grasslands will have become established, blending with the surrounding landscape. The mitigation woodland will not have a major presence within the view but will still be evident as a positive addition to the setting of the view. After 15 years, the replanted woodland close to Kennington Road will be reaching semi-maturity and re-establishing the character of the copse. The new bridges and channels will remain as prominent features of the local landscape but through natural regeneration, and colonisation at their fringes will have softened slightly in appearance.	High	Major adverse	High	Major adverse	Medium / high	Major / moderate adverse	Medium	Moderate adverse
Viewpoint 24 Old Abingdon Road (Motorists with some cyclists and pedestrians). (Appendix I-8, Figure 7.41)	**Low / medium**, based on the viewpoint location being of local value and a receptor of medium susceptibility to change.	Within the Scheme boundary	The new channel beneath the A423 will have been built by the County Council. There will already have been notable changes in the view from this location as the semi-mature native woodland currently experienced will be removed as part of the bridge works along with the mature tree cover located to the southern end of the Copse. This loss of vegetation will open views towards the elevated A423. The Scheme will introduce a channel, part rock lined, to carry normal and floodwater events through the Copse. The main channel will emerge from beneath Kennington Road, the watercourse flowing over an area of rip rap before connecting to a channel built by the County Council beneath the A423. We will replant part of the Copse to the east of Kennington Road. After three years, the proposed grasslands will have become established, blending with the surrounding landscape. The mitigation woodland will not have a major presence within the view but will still be evident as a positive addition to the setting of the view. After 15 years, the replanted woodland close to Kennington Road will be reaching semi-maturity and re-establishing the character of the copse. The bridges and channels will remain as prominent features of the local landscape but through natural regeneration, and colonisation at their fringes will have softened slightly in appearance.	High	Major adverse	High	Major adverse	Medium / high	Major / moderate adverse	Medium	Minor adverse

Receptor	Sensitivity	Distance (m)	Changes as a result of Scheme	Magnitude of Change during construction	Significance of effects during construction	Magnitude of Change during operation, Year 1	Significance of effects during operation, Year 1	Magnitude of Change during operation, Year 3	Significance of effects during operation, Year 3	Magnitude of Change during operation, Year 15	Significance of effects during operation, Year 15
Viewpoint 25 Kennington Pool Local Wildlife Site (recreational users of the wildlife site). (Appendix I-8, Figure 7.42)	**High**, based on the viewpoint location being of local value and a receptor of high susceptibility to change.	Within the Scheme boundary	The existing pond will be reduced in size to facilitate the widening of the Hinksey Drain running north – south. New scrub and tree planting will take place at the periphery of the realigned pond. After three years, the proposed grassland will have become established, blending with the surrounding landscape. The mitigation woodland will not have a major presence within the view but will still be evident as a positive addition to the setting of the view. After 15 years, the riparian woodland habitats created along the margins of the retained and enhanced ponds will have reached semi-maturity. The establishment of vegetation within Kennington Pond will contribute positively to the landscape setting of Oxford and contribute towards its ecological value.	High	Major adverse	High	Major adverse	Medium	Moderate adverse	Medium	Minor beneficial
Viewpoint 26 Boars Hill Viewpoint (visitors to Oxford protected viewcone viewpoint). (Appendix I-8, Figure 7.43)	**High**, based on the viewpoint location being of local value and a receptor of high susceptibility to change.	2692	Given the distance between the viewpoint and the Scheme, the proposed Scheme will be difficult to discern within the landscape. The hill crest at Hinksey Heights and mature woodlands at Chilswell Copse will screen many views towards proposals from this location. Successive vegetated field boundaries present in the intervening landscape will further obscure views, where visible the Scheme will appear as coarser visual texture within the vista. After three years, the landscape proposals will be semi-established across the Scheme area and integrated with the wider landscape, further reducing visibility of the Scheme. After 15 years, the landscape proposals will be largely established across the Scheme area and integrated with the wider landscape, further reducing visibility of the Scheme.	Low	Neutral	Low	Neutral	Negligible	Negligible	Negligible	Negligible
Viewpoint 27 North Hinksey Lane. (Appendix I-8, Figure 7.44)	**Low** / medium, based on the viewpoint location being of local value and a receptor of medium susceptibility to change.	34	There will be filtered, glimpsed views across hedgerows and allotment planting towards the Scheme as vehicle users and pedestrians travel south-east along North Hinksey Lane. Views from the North Hinksey Lane allotment are likely to be similarly constrained. The removal of trees at the interface of the allotment site and Hinksey Meadow and from the northern bank of Seacourt Stream will open views from this location. Partial views of the second stage channel and modified Jubilee Scrape (lowered banks and extended) will be possible close to the allotment site, evident as a shallow depression within the meadow. After three years, the proposed grasslands will have become established, blending with the surrounding landscape. A new belt of trees to be planted on the northern boundary of the land to the south of Botley Retail Park (to the south of the builder's yard at Lamarsh Road) will not have a major presence within the view but will still be a positive addition to the setting of the view.	Medium	Minor / moderate adverse	Medium	Minor / moderate adverse	Low	Minor adverse	Negligible	Negligible

Receptor	Sensitivity	Distance (m)	Changes as a result of Scheme	Magnitude of Change during construction	Significance of effects during construction	Magnitude of Change during operation, Year 1	Significance of effects during operation, Year 1	Magnitude of Change during operation, Year 3	Significance of effects during operation, Year 3	Magnitude of Change during operation, Year 15	Significance of effects during operation, Year 15
			After 15 years, the landscape proposals will be largely established across the Scheme area and integrated with the wider landscape, further reducing visibility of the Scheme. The trees planted on the northern boundary of the land adjacent to the industrial estate will screen the lower elevation of buildings and provide a green backdrop to the meadow.								
Viewpoint 28 Hinksey Meadow and Seacourt Nature Reserve. (Appendix I-8, Figure 7.45)	High, based on the viewpoint location being of local value and a receptor of high susceptibility to change.	Within the Scheme boundary	There will be notable changes to the view from this location as the construction of the second stage channel will necessitate the removal of an area of MG4a grassland in Hinksey Meadow and trees in Seacourt Nature Park. Views will be opened up towards Minns Business Park and residential properties located on North Hinksey Lane although all the trees on the west bank of the channel will remain to form a screen. At the interface of Hinksey Meadow and North Hinksey allotments, the removal of trees on the east bank will also partially open views but to a lesser degree as trees on the west bank will all be retained. The second stage channel will be evident as it emerges from beneath the new West Way cycle bridge located within Seacourt Nature Park, passing between the pylon and the re-cut Jubilee Scrape. These new elements will bring a greater degree of visual diversity to this meadow. After three years, the proposed replacement grasslands will be becoming more established, blending with the surrounding landscape. After 15 years, the landscape proposals will be largely established across the Scheme area and integrated with the wider landscape, further reducing visibility of the Scheme. Views through to Seacourt Nature Park will remain largely open.	High	Major / moderate adverse	High	Major / moderate adverse	Medium	Moderate Adverse	Low	Negligible

7.3 Mitigation

Construction Phase

The mitigation measures outlined will reduce the risk of likely significant adverse effects on sensitive landscape receptors (such as existing trees) and visual receptors (such as residents and pedestrians) as a result of construction activities.

Mitigation measures during construction will include:

- Protection of landscape features adjacent to the construction compounds from damage by movement of construction vehicles and machinery, in particular screening the visual impact of the South Hinksey Compound on the residents of Manor Road;
- Protecting existing trees on site. All trees on site have been subject to an Arboricultural Impact Assessment (AIA in Appendix F). A number of trees will be directly impacted by the works. Where trees are to be retained, tree protection areas will be fenced using an approved fencing system. Protective fences are to comply with BS 5837 2012 – Trees in relation to design, demolition and construction;
- Adherence to best practices to minimise adverse landscape effects, including sensitive location of construction equipment and site compound areas to minimise potential adverse visual effects. The locations of site compounds, adjacent to existing roads, will reduce their visual prominence, and minimise physical disturbance;
- The construction of the temporary haul road throughout the site will help to reduce disruption by minimising the area of construction activity;
- Positioning of structures, such as lighting columns and signage associated with compounds, and construction activities to minimise effects on properties, skylines and vistas;
- Ensuring that the perimeters of working areas are well maintained and clearly signed as 'Construction Site' hoardings to screen views of low level construction activities, materials stockpiles and associated visual clutter;
- Working areas and compounds will be kept as compact and tidy as practicable throughout construction to reduce the potential for intrusion on the surrounding landscape and reduce their visual prominence;
- Bunds used for the temporary storage of topsoil and subsoil will be positioned to provide some screening of construction activity with height limits applied (see Figure 3.2);
- The implementation of all soft and hard landscape proposals will be in accordance with the approved contract documentation and landscape plans (Appendix I-6);
- Procuring all plants and trees with no confirmed plant diseases from suppliers who are members of the Horticultural Trades Association to ensure no transmission of plant diseases result from the works;
- Implementing the seeding and planting of the Scheme as soon as practicable in order to achieve the successful development of plant materials after the completion of construction activity; and
- Appropriate maintenance of planting and seeding works and implementation of management measures, to continue through the construction period as landscape works are completed.

Operational Phase

Where new flood defences are required, these have been sensitively designed to minimise impacts on landscape and visual receptors and to integrate proposals with the baseline landscape.

The Scheme has been designed through an iterative process to minimise the loss of landscape features of high value such as MG4a grassland, mature trees and the land take required to fulfil its objectives. Wherever possible existing vegetation within the boundary of the Scheme will be retained in order to integrate proposals to the greatest extent possible with that of baseline conditions.

In addition, the Scheme will involve creating a range of habitats including 8.9ha of native woodland (losing 5.5ha), and shrub planting (1.3ha) in the second stage channel replacing 2.5ha of riparian woodland lost along the existing watercourses. 20.2ha of MG4 floodplain meadow will be created to compensate for the loss of 1.33ha MG4 grassland, together with 6.0ha gain of freshwater habitat in the form of backwaters and ponds with pond edge and marginal planting. Wetland meadow grass and wildflowers will be sown in the second stage channel with the ultimate aim to create 17.2ha of floodplain grazing marsh.

Approximately 2,000 individual trees will need to be felled as a result of the Scheme. As mitigation for this loss, we will be planting 3,632 trees within areas of proposed mixed, deciduous woodland and 239 individual trees. Approximately 15,000 smaller tree species (e.g. hawthorn, hazel and elder) will also be planted within the proposed woodland areas and on the woodland edges, along with many more native shrubs.

The aim of the landscape proposals is to reflect the surrounding flood meadow landscape in terms of species and character and increase the value of habitats for both landscape amenity and wildlife.

Typical native tree species proposed for planting include alder, downy birch, white willow and crack willow with lower level shrub species such as elder, hawthorn and guelder rose.

The layout of the different habitats proposed is shown on the Landscape General Arrangement Plans in Appendix I-6. More detailed Planting Plans showing species, location and number of plants will be submitted separately as part of the planning application.

Specific mitigation within the Scheme area and forming part of the flood risk management proposals will be as follows.

Area 1: North of Botley Road. Creation of freshwater habitat features such as backwaters and scrapes within the second stage channel avoiding the loss of mature willow trees to the north and west of the scrape, which contribute to the landscape character of the area. In-channel improvements, including riffle construction with gravels excavated during construction. The remaining wetter land will be used for creation of lowland fen or marsh.

Three areas of native woodland creation are proposed for this area. The first located to the west of Bulstake Close Allotments and the second to the east of the A420 on its approach to the Western By-Pass Road to the west of the Scheme and the third to the north of Seacourt Park and Ride. It is anticipated that these areas will deliver 3.57ha of mitigation woodland (0.3ha west of Bulstake Close Allotments, 2.17ha to the north of Botley Road and 1.1ha at the confluence of Botley and Seacourt Stream).

The appearance of all flood embankment, flood wall, gates and footbridges will be carefully designed to minimise visual impact.

Area 2: Botley Road to Willow Walk north. The shape of the second stage channel itself through this section is constrained by the need to minimise the area of floodplain meadow lost. The open aspect of Hinksey Meadow will be retained, with its views towards the historic city core and the hills to the north.

An additional area of 0.74ha adjacent to North Hinksey Lane will be planted with native woodland plus specimen Heavy Standard trees along the banks of Seacourt Stream to close gaps in vegetation, and mitigate in part, the loss of the mature willows on the eastern bank of Seacourt Stream. The planting will reduce any available views towards Osney Mead Industrial Estate opened up by the loss of the existing trees.

The area of MG4a grassland lost will be minimised as far as possible by the careful alignment of the second stage channel.

Part of the avenue of willow trees along Willow Walk will need to be removed to accommodate the bridge. The new bridge will be sensitively designed to meet the landscape objectives of the Scheme and minimise the loss of willow trees. A total of twenty willow trees will be replanted along Willow Walk to replace those removed. The choice of materials and appearance of the bridge parapets aims to lighten the bridge structure and be more organic in its choice of wooden materials, bronze colour and curved parapet design with the abutments reflecting the local stone bridge.

Area 3: Willow Walk to Devil's Backbone. A mosaic of scrapes, ponds and marginal berms/bays have been incorporated within the second stage channel and existing reaches of streams, that will no longer receive water in low flows, have been retained as backwaters. Small groups of trees will be planted along the channel close to the first stage to reflect the existing landscape character.

MG4 grassland will be located to the south of Osney Mead Industrial Estate, on land largely defined by the Bulstake Stream to the north and Hogacre Ditch to the south, with a further area adjacent to the Electric Road, just north of the Devil's Backbone. It is proposed that the native woodland will abut the MG4 grassland, being situated at the confluence of the Hogacre Ditch and Hinksey Stream, border Osney Mead Industrial Estate and abut the second stage channel to the north-west of South Hinksey. It is anticipated that these areas will deliver 7.86ha of mitigation woodland and 15.7ha of MG4 grassland.

Hedgerows will be retained where possible and further planting of hedgerows with trees across Area 3 will help to mitigate for those lost during the excavation of the second stage channel.

In the long-term, the landscape and ecological design of the new channel will aim to enhance the experience of walking, cycling, riding or boating in the area by making the landscape more attractive.

Area 4: Devil's Backbone to the junction Hinksey Stream and River Thames. The new bridge at Devil's Backbone will be longer and higher than existing and has been designed it to integrate into the surrounding landscape.

Further areas of freshwater habitat features will be incorporated in the second stage channel in this section. This area will deliver 0.14ha of pond habitat and 0.35ha of native woodland.

It is envisaged that 0.35ha of woodland will be created to the north of Old Abingdon Road, between Old Abingdon Road and the Oxford to London/Birmingham railway.

Kendall Copse will be re-planted as far as possible, to create an area of approximately 1.13ha of woodland.

Kennington Pit will lose 52% of its surface area as a result of works within the pond to establish a barrier between the remainder of the pond and the new channel. Part of the existing pond will be retained and enhanced through localised expansion and re-profiling with tree and scrub vegetation established at its margins.

An area of native tree planting located to the south of Old Abingdon Road (east of the railway) will provide 0.18ha of woodland.

7.4 Residual effects

The residual effects on landscape and visual amenity are described below. For all receptors, the residual effects are assessed on the assumption that mitigation measures set out in Section 7.3 are fully implemented and planting has established sufficiently so as to become fully effective (assumed to be Year 15 following completion of the works). Mitigation planting measures will be subject to establishment maintenance and management for a period of 25 years following implementation (and dependent on landowner agreement where located on private land).

The only residual adverse effects identified as a result of the Scheme for either a landscape or visual receptor are those related to Kendall Copse. The changes the copse will undergo as a landscape element and the impact on views experienced from within the copse and from Old Abingdon Road through the introduction of a new bridge over and a culvert beneath Kennington Road, the canalised flood channel and the removal of trees, will be significant. Due to the scale of change there is little opportunity to mitigate these effects further. Therefore, the residual effect after 15 years will remain as moderate adverse for the copse as a landscape element and on views within the copse and minor adverse from Old Abingdon Road.

No further mitigation measures beyond those described in Section 7.3 have been identified with regard to the landscape and visual effects of the Scheme, therefore the significance of effects as set out in Tables 7.6 to 7.8 for landscape receptors and Table 7.9 for Visual Receptors remain.

All mitigation measures identified as having beneficial long-term landscape and visual effects are part of the Scheme design and therefore design interventions. It is in the nature of planting proposals that their beneficial effects increase as the planting becomes established. This is particularly the case with tree planting meaning that landscape and visual impacts will further reduce over time.

8 Flora and fauna

As set out in Chapter 4 ‘EIA Methodology’ the methodology used for the assessment of flora and fauna (also referred to as ‘ecology’ in this report) is based on the principles set out in the Chartered Institute for Ecology and Environmental Management (CIEEM) Guidelines for Ecological Impact Assessment in the UK and Ireland – Terrestrial, Freshwater and Marine (CIEEM, 2019).

An updated scoping exercise was undertaken, provided in Chapter 4, in light of baseline and Scheme design updates. This chapter assesses those ecological features and potential impacts scoped into the assessment, as summarised in Table 4.2.

A range of supplementary information is provided as appendices to this report. In addition to factual reports that detail specific ecological results and provide the baseline for this assessment, reports to demonstrate compliance with nature conservation legislation and policy are provided:

- Appendix R - Controlled and protected species legislation compliance report. This report provides a summary of the protected and controlled species present in the vicinity of the Scheme and reviews the legal offences that the Scheme could be at risk of breaching and the measures needed to avoid any offence being committed. Protected species relevant to the Scheme are: badger *Meles meles*; bats; water vole *Arvicola amphibius*; otter *Lutra lutra*; great crested newt (GCN); reptiles; birds; and freshwater fish. Controlled species relevant to the Scheme include Japanese knotweed *Fallopia japonica* and Himalayan balsam *Impatiens glandulifera*. The mitigation measures that are included in Appendix R are in addition to those outlined in this report chapter. The impact assessment in this chapter assumes that measures necessary for legal compliance will be carried out, so that environmental impacts which would constitute legal offences will not occur.
- Appendix K - Habitats Regulations assessment – Screening. This report provides an assessment of the likely significant effects of the Scheme on the Oxford Meadows Special Area of Conservation (SAC).
- Appendix S - Biodiversity Net Gain report.

8.1 Existing environment

The Scheme’s main purpose is to reduce the frequency of floods affecting properties and infrastructure in Oxford, as well as to maximise opportunities for biodiversity, to deliver a net gain in habitats, enhance existing meadow landscapes and river habitat and provide some new amenity features for the local community, as well as:

- Protecting rare habitats and mitigating or compensating ones that are unavoidably impacted, with creation and restoration of priority habitats; and
- Protecting rare and notable flora and fauna by avoidance, translocation and monitoring, creating and improving habitat for flora, fauna and fisheries, and in some cases specific species.

A full and comprehensive list of ecology surveys has informed different aspects of the design and future management of the Scheme area.

The construction of a new channel to carry flood water, has provided opportunities to create a wetland corridor of valuable habitats, incorporating a variety of profiles and gradients, to include marginal shelves, steep banks and undulating bed profiles to maximise wetland habitat diversity. We have designed new backwaters, ponds and scrapes forming a mosaic of wetland habitats within the second stage channel and riffles

in watercourses to create more diverse habitats, channel substate and varied profiles, again maximising biodiversity and opportunities for rare and notable species. In addition, we will plant woodland, lowland grassland, hedgerows, shrubs and individual trees as mitigation or as additional habitat creation.

The study area is based on the Scheme area, which is shown on Figure 1.2. The study area varies for the different ecological features. In summary the study areas are:

- International (Special Area of Conservation (SAC)) and national (Sites of Special Scientific Interest (SSSI)) designated sites - 2km around the Scheme boundary;
- local designated sites (Local Wildlife Sites (LWS), Sites of Local Importance for Nature Conservation (SLINC) and Nature Parks designated by Oxford City Council or the Vale of White Horse (VoWH) District Council) - 1km around the Scheme boundary; and
- other ecological features (Priority habitat, ancient woodland and protected and notable species) - 1km around the Scheme boundary.
- Field survey areas are as defined in Table 4.9.

8.1.1 Nature conservation sites

International, national, local designated nature conservation and local non-designated sites are shown on Figure 8.1.

The international and national designated sites within 2km of the Scheme, and LWS, SLINC and Nature Parks within 1km of the Scheme, are described in Appendix C-1. However, a number of these designations have been scoped out of this report as they were outside the zone of influence. Designated sites which may be directly or indirectly impacted by the Scheme that may result in a possible likely significant effect are shown in Table 8.1.

Table 8.1: International, national, local designated sites and Eco Park

Designated site	Location	Baseline description	Value
International and national designated sites			
Oxford Meadows SAC	Lies approximately 0.8km to the north of the Scheme Connectivity to the RLB by the River Thames / Isis	Comprises several SSSIs: Port Meadow with Wolvercote Common and Green; Pixey and Yarnton Meads; Wolvercote Meadows; and Cassington Meadows. This site qualifies by supporting the Annex I habitat[1] lowland hay meadows with meadow foxtail *Alopecurus pratensis* and great burnet *Sanguisorba officinalis,* and Annex II species[1] creeping marshwort *Helosciadium repens* (previously *Apium repens*). Port Meadow with Wolvercote Common and Green SSSI is the closest SSSI to the Scheme area (0.8km) and contains creeping marshwort, where it is present in one specific area.	International

Designated site	Location	Baseline description	Value
Iffley Meadows SSSI	Lies immediately adjacent to the Scheme boundary in the south	A group of alluvial flood meadows comprising rich grassland flora including snake's-head fritillary *Fritillaria meleagris*. Berkshire, Buckinghamshire and Oxfordshire Wildlife Trust (BBOWT) manages the site, as Iffley Meadows Nature Reserve.	National
Local designated sites			
Egrove Park Meadow LWS	Lies a short distance from the Scheme boundary in the south	Located within the grounds of Egrove Park conference centre, on a north-facing slope, this site has unimproved species-rich neutral grassland, which includes wet seepages that have damp-requiring plants.	County
Kennington Pool LWS	The majority of this site is within the Scheme boundary	A site that encompasses Kennington Pit, a priority habitat for its pond plant community, originally dug as a borrow pit for the construction of the railway. It is one of the richest ponds in Oxfordshire for plant life. The very rare glutinous snail *Myxas glutinosa* has been recorded here but is now believed to be extinct at this location. Notable plant species whorled water-milfoil *Myriophyllum verticillatum* is found at this site (ES Appendix D-3).	County
Osney Mead (Botley Meadow) LWS	Partially within the Scheme boundary	The site comprises lowland floodplain meadow bounded by Hinksey and Seacourt Streams and supports a good plant assemblage. This site includes Hinksey Meadow, which supports a species-rich meadow (National Vegetation Classification (NVC) MG4a *Alopecurus pratensis-Sanguisorba officinalis* grassland, *Dactylis glomerata* sub-community (Wallace, *et al.*, 2017) supporting snake's head fritillary.	National
Willow Walk Meadow LWS	Partially within the Scheme boundary	The site of a successful translocation of creeping marshwort (see 'Protected and notable plants' under Section 8.1.4).	County

Designated site	Location	Baseline description	Value
Bulstake Stream, Botley Park SLINC	Partially within the Scheme boundary	Bulstake stream is a wooded watercourse with some open sections to the north.	County
Field North of Osney Mead SLINC	Wholly within the scheme boundary	This site contains a similar mix of species to Osney Mead (Botley Meadow) LWS, comprising lowland meadow with scrub. It is currently not managed.	County
Hinksey Pools SLINC	Partially within the Scheme boundary at its northern end	A narrow artificial pool which includes a section of the Hinksey Stream, having been dug out for ballast sometime between the two World Wars.	County
Wytham Stream / Seacourt Stream SLINC	Partially within the Scheme boundary at its northern end.	Most of this site consists of the watercourse known as Wytham or Seacourt Stream and its tributaries. The banks are varied including both open sections with emergent vegetation and densely shaded areas.	County
Iffley Meadow Nature Reserve	Lies immediately adjacent to the Scheme boundary at its northern end.	The SSSI name for the reserve is Iffley Meadows. The SSSI is slightly larger than the reserve, therefore it will be assessed on the Iffley Meadows SSSI only.	
Seacourt Nature Park	Majority of this site lies within the Scheme boundary.	A local nature reserve managed by Oxford City Council providing grassland floodplain habitat adjacent to Seacourt Stream.	County
Local non-designated sites			
Hogacre Common Eco Park	This site lies adjacent to the Hogacre Ditch which lies adjacent to the Scheme boundary.	Developed in 2010 to diversify wildlife and habitats in Oxford.	County

1 - Annex I and II habitats and species are those that occur in the United Kingdom for which one or more Special Area of Conservation (SAC) is designated https://sac.jncc.gov.uk/

8.1.2 Conservation Target Areas

Conservation Target Areas (CTA) have been identified by Oxfordshire County Council and the Thames Valley Environmental Records Centre (TVERC) as some of the most important areas for wildlife conservation in Oxfordshire, where conservation action can be targeted and their strategic importance for nature's recovery recognised during the planning process. These are shown on Figure 8.1. Each CTA supports one or more of the 20 priority habitats found in Oxfordshire. CTAs within 1km of the Scheme are:

- **Thames and Cherwell at Oxford CTA** - covers the majority of the Scheme area. It includes riverside land along the Thames and Cherwell at Oxford and extends along the Thames from Kennington in the south to Botley in the west

and along the Cherwell, as far the A40 at Marston in the east. Habitats include lowland meadows, wet grassland, fen/ swamp and reedbed.

- **Oxford Heights West CTA** - the majority of this site lies to the south-west of the A34, outside of the Scheme boundary, apart from an area to the south of the A423 which encompasses Egrove Business Park, which is within the Scheme boundary. This CTA encompasses Oxford Heights from west of the city to Appleton in the west and Frilford in the south-west. Includes Cumnor Hill, Boars Hill and the woodlands to the south. Habitats include fen, wet woodland, lowland mixed deciduous woodland, acid grassland, heathland, limestone grassland and lowland meadow.
- **Oxford Meadows and Farmoor CTA** - This CTA includes a small part of the Scheme area at its northern end and includes the Thames Valley to the west of Oxford as far as Farmoor. Sites within the CTA are Oxford Meadows SAC, Farmoor Reservoir and gravel workings between Yarnton and Cassington. Habitats include lowland meadows, floodplain grazing marsh, eutrophic standing water, fen/swamp, reedbeds and wet woodland.
- **Wytham Hill CTA** - lies approximately 270m to the north-west of the Scheme area, adjacent to the A34/A420 junction, and is dominated by Wytham Hill SSSI, with a number of smaller wooded areas. Other habitats include wood pasture, parkland, limestone grassland and fen.

These CTAs are valued at local/county to national level due to the priority habitats they support. As such, the assessment is focused on the priority habitats present, more than the CTA designation. Any potential effect or mitigation on the Thames and Cherwell at Oxford CTA, which is the CTA to which the Scheme is most relevant, have been mainly incorporated by the assessment on the priority habitats. Therefore, while there is a part of section 8.2.2 specific to the CTA, the whole of this chapter is relevant to the designation.

8.1.3 Habitats

The baseline and value of habitats within the Scheme are described in the habitat and botanical survey report for the Scheme, fieldwork for which was carried out in 2020 (Appendix C-3). This baseline is summarised below. Figure 8.2 shows the diversity of habitat types recorded during the survey, classified using the UK Habitat Classification.

There are six priority habitats considered as having local/county to national ecological value that could be affected by the Scheme. Figure 8.3 shows priority habitats present in the Scheme area. These are:

- Hedgerows;
- Lowland Calcareous Grassland;
- Lowland Fens;
- Lowland Meadows;
- Ponds; and
- Wet Woodland.

In addition, three habitats listed on Annex I of the Habitats Directive were recorded:

- H6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*);
- H6510 Lowland hay meadows (*Alopecurus pratensis*, *Sanguisorba officinalis*); and
- H91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*).

Priority and other habitats recorded of local/county to international ecological value within the Scheme area are listed in Table 8.2, with summary baseline descriptions and an assessment of whether the habitat can be recreated or is "irreplaceable" as defined by the NPPF. Irreplaceable habitats are defined (NPPF, 2021) as those "*which would be technically very difficult (or take a very significant time) to restore, recreate or replace once destroyed, taking into account their age, uniqueness, species diversity or rarity. They include ancient woodland, ancient and veteran trees, blanket bog, limestone pavement, sand dunes, salt marsh and lowland fen*".

Other habitats with a value of "local" and below are not considered further.

Table 8.2: Priority and non-priority habitats with above local value

Ecological feature	Quantity within the Scheme area	Baseline description	Replaceable / Irreplaceable habitat	Value of habitats
Priority Habitats				
Hedgerows, including lines of trees	Length: 11.3km / 45 features Area 1.93ha	Extensive network of hedgerows and lines of trees, including 15 important and 16 species-rich. See Figure 8.3 Priority Habitats for locations. 534 trees were recorded within shrubby hedgerows and 250 trees from lines of trees.	Species poor or recent hedgerows can be recreated. Species rich hedgerows along ancient boundaries are irreplaceable. Hedgerows containing old trees and ancient boundaries are irreplaceable	County
Lowland Calcareous Grassland	0.35ha	Grassland of type CG3 *Bromus erectus* grassland in an undesignated field within Egrove Park.	Irreplaceable	County
Lowland Fen	0.57ha	Jubilee Scrape through Osney Mead (Botley Meadow) LWS. This habitat was created relatively recently and is not Fen habitat as normally defined.	Can be recreated in this specific case (long-established true lowland fen would be irreplaceable)	County
Lowland Meadows	2.62ha	Grassland within Osney Mead (Botley Meadow) LWS and Seacourt Nature Park, including grassland of type MG4 *Alopecurus pratensis-Sanguisorba officinalis* grassland. Seacourt Nature Park degraded from and restorable to MG4. Due to its species-richness, soil properties and exacting hydrological requirements, this habitat is difficult to recreate.	Irreplaceable	National
	0.51ha	Field north of Osney Mead SLINC.	Can be recreated	County

Ecological feature	Quantity within the Scheme area	Baseline description	Replaceable / Irreplaceable habitat	Value of habitats
		Not currently managed as meadow but contains a similar mix of species to the meadows.		
	0.05ha	Small area of grassland located to the south-east of North Hinksey. MG5b *Cynosurus cristatus-Centaurea nigra* grassland, *Galium verum* sub community. Not currently managed as meadow but contains a similar mix of species to the meadows.	Can be recreated	County
Ponds	0.21ha	Kennington Pool LWS includes a wide range of invertebrates and varied wetland plants, including whorled water-milfoil.	Can be recreated	Local to county
Wet Woodland	South of Kennington roundabout 0.34ha Kennington Pool LWS 0.57ha	Stands of woodland of type W2 *Salix cinerea-Betula pubescens-Phragmites australis* woodland, to the south of Kennington roundabout and within Kennington Pool LWS. Diverse ground flora. Habitat is considered difficult to recreate.	Irreplaceable (as recreation will take a very long time)	County
Non-priority Habitats				
Grassland with restoration / enhancement potential	25.35ha	Semi-improved and abandoned grassland with greater plant diversity compared to other areas within the Scheme area: - fields north and east of Seacourt Park and Ride; - meadows south-east of Osney Mead Industrial Estate which are managed as hay meadow; - parts of pasture south-east of North Hinksey; - meadows between Hinksey Stream and Hinksey Pools SLINC. These have likely been derived from or are relicts of species-rich floodplain meadows and could be restored given favourable circumstances.	Can be recreated	Local to county
Rivers and	3.11ha	Numerous watercourses are present within the Scheme area,	Can be recreated	Local to

Ecological feature	Quantity within the Scheme area	Baseline description	Replaceable / Irreplaceable habitat	Value of habitats
streams		including Bulstake Stream, Eastwyke Ditch, Hinksey Stream, Seacourt Stream and the River Thames.		county
Standing open waters and canals	Two flooded culverts along Willow Walk 0.24ha Hinksey Pool SLINC (south) 0.57ha	Standing waterbodies recorded as part of the flood culvert along Willow Walk and within Hinksey Pools SLINC.	Can be recreated	Local to county

8.1.4 Protected and notable species

A summary of the protected and notable species scoped into the assessment is provided below.

Amphibians. No evidence of GCN has been found. The nearest records are approximately 225m to the west of the Scheme boundary in Hinksey Heights. Three ponds (two along Willow Walk in North Hinksey and one adjacent to the Oxford Spires Hotel on Abingdon Road) were to be surveyed for the presence/absence of GCN by eDNA analysis during the 2020 season. These were found to be dry before eDNA analysis was conducted (Appendix D-15). A precautionary assumption has to be made that a low population of GCNs may be present in these ponds until surveys can be carried out, which we will do before construction commences. GCN are considered to be of **county** ecological value.

Birds. No records of protected or notable birds were received from TVERC in 2020, from within the Scheme boundary. An adapted common bird census for breeding birds (Appendix D-5) and an over-wintering bird survey (Appendix D-6) for species listed as either red or amber on the Birds of Conservation Concern list 4 (Eaton *et al*., 2015), were conducted throughout the previous Scheme area. The species present within an area will remain relatively constant as long as factors, such as habitats, food resources, levels of disturbance and what is causing the disturbance remains relatively unchanged, notwithstanding larger scale changes in distribution of certain species due to wider environmental factors.

During the breeding season (May-July 2017), 65 species were noted. Of these, 12 were red and 17 amber listed on the BoCC 4. From these 29, there was sufficient data to approximate breeding frequency and territories for ten species within the Scheme area. The remaining nineteen species recorded were discounted as breeding species as they were migratory, only recorded once or breed in habitats absent within the Scheme area. Under Fuller (1980) the level of importance of the breeding bird assemblage would be considered to be negligible. Of the breeding species recorded, dunnock *Prunella modularis*, song thrush *Turdus philomelos*, house sparrow *Passer domesticus*, reed bunting *Emberiza schoeniclus*, bullfinch *Pyrrhula pyrrhula* and starling *Sturnus vulgaris* are priority species and so of **local** ecological value.

Two Schedule 1 (Wildlife and Countryside Act, 1981) species were recorded during the breeding bird surveys, kingfisher *Alcedo atthis* and red kite *Milvus milvus*. These species of breeding birds are of **county** ecological value for this Scheme.

During the over-wintering bird survey (December-March) (Appendix D-5), records of 56 species were noted. Of these, 10 were red and 11 amber listed on the BoCC 4. Four Schedule 1 species; Kingfisher, red kite, fieldfares *Turdus pilaris* and redwings *Turdus iliacus* were also recorded during the wintering bird surveys. These species are of **county** ecological value for this Scheme.

Bats. The updated TVERC data search provided records of common pipistrelle *Pipistrellus pipistrellus*, Nathusius' pipistrelle *Pipistrellus nathusii*, soprano pipistrelle *Pipistrellus pygmaeus*, Daubenton's bat *Myotis daubentonii*, lesser horseshoe bat *Rhinolophus hipposideros*, brown long-eared bat *Plecotus auritus*, Natterer's bat *Myotis nattereri* and noctule *Nyctalus noctula*. There were no records of a bat roost or evidence of bat activity within the Scheme boundary.

Bat surveys were undertaken between 2016 to 2018 within the Scheme boundary to identify trees, bridges and buildings with potential to serve as roosting sites (Appendix D-9, D-10 and D-11). Further surveys in 2020 (Appendix D-12) repeated inspections and activity surveys to identify changes in the intervening period and surveyed trees occurring within the amended Scheme boundary.

The Scheme area was proven to be utilised by bats on a regular basis from surveys including static monitoring, emergence surveys and transects. Surveys recorded eight confirmed and one possible bat roost. Four confirmed small bat roosts were in structures (see Figure 8.4 below): A423 Railway Bridge, with evidence of two common pipistrelle bats; Botley Road Bridge, with evidence of common pipistrelle; Willow Walk Bridge, with evidence of an individual medium myotis or long eared bat species; and Kennington Road Bridge, evidence of one Soprano pipistrelle bat. Four confirmed and one possible roosts were in trees with evidence of common pipistrelle plus an individual medium myotis or long eared bat species (See appendix D-12).

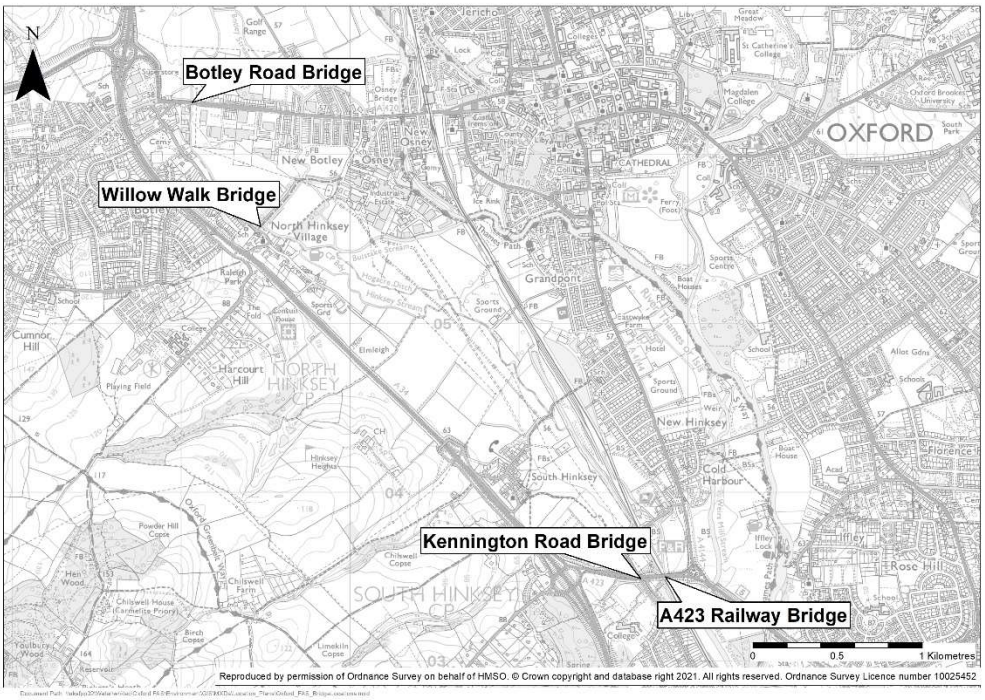


Figure 8.4: Bridges where bat roosts have been confirmed

Species recorded within the Scheme area during activity surveys comprised: common pipistrelle, soprano pipistrelle, long-eared bat, bats of *Myotis* species (Daubenton's bat, Natterer's bat, whiskered bat *Myotis mystacinus*, Brandt's bat *Myotis brandtii*, and Alcathoe bat *Myotis alcathoe*), lesser horseshoe bat, noctule and serotine *Eptesicus serotinus*.

Survey data showed that common pipistrelle was the most abundant bat species utilising the Scheme area for commuting or foraging, more or less equally throughout the Scheme area. Soprano pipistrelle and Myotis bat species were also represented in high numbers. Other bat species utilised tree lines and hedgerows as well as sheltered areas for foraging and commuting. Bats are of **county** ecological value.

Otter. Otter, *Lutra lutra*, is present throughout the River Thames and its tributaries. It is assumed that all streams and ditches within the Scheme area are used for feeding and/or travelling. An otter survey (Appendix D-16) in 2016 found a small number of possible holt sites within the Scheme area, that were later confirmed as not holts. A survey was undertaken in September 2018 (Appendix D-19) of previously unsurveyed areas, found a potential couch and hover. In 2020 a repeat otter survey (Appendix D-20) of the Scheme area was undertaken. Evidence of otter feeding was found on Bulstake Stream, with potential above-ground resting sites. There was no evidence that these had been in use by otters. Otter is considered to be of **county** ecological value.

Water vole. Surveys for this Scheme for water vole *Arvicola amphibius* found no signs of this species. However, they are known to be periodically present in low numbers in the southern part of the site, through sightings made during other species surveys and through historic records. All sightings were south of Old Abingdon Road. In the event that a population of water voles moves into the Scheme area prior to construction, the measures needed to comply with the law protecting this species would be adopted and would be enough to ensure no adverse effects on water voles. The Scheme has already scoped potential mitigation and potential receptor sites for translocated water voles should they be needed. This species is therefore not considered further in this chapter.

Fish. A fish survey was undertaken for the Scheme (see Appendix D-21). No fish with special protection or notable status were found to be present, therefore fish are considered to be of value **within the zone of influence only**. Although they will not be considered further in this chapter, it is anticipated that the scheme design will benefit local fish communities, including the removal of Towles Mill benefiting both truly migratory fish and also resident fish, which undertake shorter migratory movements in the breeding season. The value of the streams for angling is covered in Chapter 6 Recreation and public access.

Protected and notable plants. Plant populations of international to county ecological value within the zone of influence are listed in Table 8.3. Their location is shown in Figure 8.2.

Table 8.3: Protected and notable vascular plants of County to International value within the Zone of Influence

Ecological feature	Quantity within the Scheme area	Baseline description	Value of plants
Adder's-tongue *Ophioglossum vulgatum*	1,000s of plants	Large population spread over several meadows south-east of Osney.	County
Alder buckthorn *Frangula alnus*	1 plant	One small wild plant at the edge of Osney Mead (Botley Meadow) LWS. Planted in hedgerows in South Hinksey.	County
Creeping marshwort *Helosciadium repens*	NA	Population within Willow Walk Meadow LWS, outside the Scheme area.	International
Hybrid bedstraw *Galium x pomeranicum*	1 plant	A small population in an unmanaged field south of Osney Mead Industrial Estate.	County
Strawberry clover	1 population	A population in Oatlands Road	County

Ecological feature	Quantity within the Scheme area	Baseline description	Value of plants
Trifolium fragiferum		Recreation Ground population which was difficult to quantify due to clonal growth form and small size but covered several square metres. Two other populations have been recorded just outside of the scheme boundary at Willow Walk Meadow LWS and horse pasture by the Thames in New Hinksey.	
Whorled water-milfoil *Myriophyllum verticillatum*	1 population	Population in Kennington Pools LWS.	County

8.2 Likely significant effects

8.2.1 General potential impacts

Significant effects on ecological features must be assessed in the context of their baseline conditions within the zone of influence of the project. Such baseline conditions include noise, vibration and artificial lighting, and therefore input from different assessment disciplines has been required. Relevant impacts and effects are discussed in detail in other chapters of this EIA, and are summarised below:

- **Changes in noise and vibration** during construction as a result of construction plant, other construction-related vehicles and construction related activities (including piling and general earthworks) have been discussed in terms of their effects on people in Chapter 5 'Local Community'. An increase in noise and vibration may disturb protected and notable species.
- **Artificial lighting** as it affects local residents is discussed in Chapter 7 'Landscape and visual amenity'. No night-time working is anticipated. However, it is likely that construction of the Scheme will be undertaken in winter, so artificial lighting may be required during operating hours and for security purposes. There may be potential disturbance to protected and notable fauna species from artificial lighting.
- **Indirect effects on water-dependent features**, water resources, water bodies and water quality, as well as surface and groundwater related flood risk implications of the Scheme have been assessed in Chapter 9 'Water and hydromorphology'. There may be impacts on nature conservation designations and habitats that are dependent upon groundwater and/or flooding/inundation and watercourses.
- **Vehicle emissions** during the construction phase of the Scheme, which may change the concentrations of NOx and the rate of nitrogen deposition on sites designated for nature conservation, have been discussed in Chapter 13 'Air quality'. The change in concentrations of pollutants at designated sites is considered to be imperceptible and no adverse effects are anticipated, therefore impacts related to vehicle emissions on ecological designated sites have been scoped out.

Effects on ecological receptors caused by the above have been included in this chapter, along with direct effects such as those caused by vegetation clearance, earthworks and vehicle movements.

A summary of the potential impacts being assessed for the Scheme are:

- Impacts on international sites - Habitat Regulations Assessment;
- Temporary and permanent impacts on designated nature conservation sites, and the Eco Park which may lead to habitat loss, changes in quality and quantity of surface and groundwater;
- Impacts on groundwater sensitive habitats and MG4a grassland, from direct habitat loss and changes in groundwater levels, which may lead to a loss of a particular type of species community through a change in species composition;
- Impacts on priority habitats, important hedgerows and community woodland, such as permanent, temporary loss and habitat gain (habitat creation) from the construction of the Scheme;
- Impacts on wetland habitats during the construction works including severing of watercourses and loss of parts of ponds, leading to a habitat loss, disturbance and habitat gain (habitat creation) from the construction of the Scheme. Indirect impacts from changes in water quality and ground water levels; and
- Impacts on protected and notable species including aquatic invertebrates, bats, birds, GCN, otter, and plant species, such as mortality and injury during the removal/disturbance of vegetation and aquatic habitats, indirect impacts from a reduction in foraging and hibernating habitat, and severance of commuting routes; and disturbance from noise and vibration, visual and lighting stimuli.
- Impacts from air quality on Seacourt Nature Park.

8.2.2 During construction

Nature conservation sites

An HRA Screening Assessment has been prepared to fulfil the requirements of the Habitats and Species Conservation Regulations 2017 (as amended) and is provided in Appendix K. The HRA considered the following potential likely significant effects on the **Oxford Meadows SAC**:

- Habitat loss/damage and change in species/habitat distribution due to changes in hydrological regime;
- Nutrient enrichment from NOx deposition from construction including temporary changes in traffic flows and volumes;
- Loss of population and change in distribution of creeping marshwort and other sensitive species due to water pollution during construction; and
- Habitat loss due to increased recreational pressure as areas previously used by members of the public are no longer available and other areas such as Oxford Meadows SAC is used instead.

It was concluded that there were no likely significant effects alone and/or in combination on designated habitat due to changes in groundwater, air quality, water pollution, recreation or trampling.

Table 8.4 details the assessment for other designated nature conservation sites. The criteria used to define ‘level of impact’ and ‘significance of effect’ are given in Chapter 4, Table 4.11 and Table 4.12 respectively.

Table 8.4: Impacts on national and local designated sites during construction

Designated site	Value	Potential impacts	Level of Impact	Significance of Effect (before mitigation)
National designated sites				
Iffley Meadows SSSI	National	Indirect impacts from construction of proposed flood walls at New Hinksey near the upstream end of the SSSI may increase the risk of silt and pollutants entering the water from this part of the Scheme. This may smother and pollute aquatic flora and fauna. Standard site procedures, including adherence to regulatory requirements and good practice advice, similar to that provided in the former Pollution Prevention Guidelines (PPG), will be adopted for any works near or in water to ensure there is no contamination of surface water bodies. Minor vegetation clearance on the banks of the SSSI may be undertaken for approximately 10m upstream of the A423, dependant on whether the channel will be used for access only as a last resort if other options become unviable. Vegetation clearance will not affect any of the SSSI's designated features (alluvial flood meadows and species-rich grassland flora), as these are located upstream of where the works are proposed. Impacts to lowland meadow are discussed in section 8.2.4 Habitats.	Negligible	No likely significant effects
Local designated sites				
Kennington Pools LWS	County	There will be a loss of pond habitat as Kennington Pit will be partially under the footprint of a new earth embankment, which will separate the remaining pond from Hinksey Drain. This will significantly reduce the area of the pond by 62%, from approximately 4563 m^2 to 1752 m^2, as well as severing Kennington Pit from Hinksey Drain. Kennington Pit is assessed under section 8.2.4 Habitats. In addition there will be a loss of wet woodland habitat around the pond. Beneficial impacts are expected from the removal of trees and scrub vegetation from the banks of the pool, reducing shade which will open up the pond and make it more suitable for flora and fauna.	Minor negative	Minor adverse

Designated site	Value	Potential impacts	Level of Impact	Significance of Effect (before mitigation)
		Separation from the Hinksey Drain may benefit water quality as the pond will not be subject to periodic inundation of nutrient-rich surface water.		
Osney Mead (Botley Meadow) LWS	National	Impacts to lowland meadow and fen are discussed in section 8.2.4 Habitats.		
Willow Walk Meadow LWS	County	The north-western corner of this site lies within the construction footprint so approximately 0.1ha of wet woodland will be permanently lost. The impacts to wet woodland are discussed in section 8.2.4 Habitats. The impacts on the site's qualifying species, creeping marshwort, are assessed under Notable Species below. In addition, a number of trees will be lost to the construction. Impacts on trees which will be felled or otherwise affected are covered in Chapter 7 'Landscape and visual amenity'. Impacts relating to their value as habitat for protected and notable species are in the section below.		
Bulstake Stream, Botley Park SLINC	County	Construction of new in-channel flood gates on a footbridge and access bridge within this site may increase the risk of silt and pollutants entering the water, which may potentially smother and pollute aquatic flora and fauna. However, standard site procedures, including adherence to regulatory requirements and good practice advice, will be adopted for any works near or in water to ensure no pollutants, including silt, enter aquatic environments.	Negligible	No likely significant effects
Field north of Osney Mead SLINC	County	Impacts to lowland meadow are discussed in section 8.2.4 Habitats.		
Hinksey Pools SLINC	County	Construction of a low broad crested weir to maintain upstream water levels and groundworks to install the second stage channel will cut into the southernmost section of this SLINC. This will lead to a direct loss of habitat from ground lowering, with potential indirect impacts from an increase in silt and pollutants entering the water, which may potentially smother and pollute aquatic flora and fauna.	Minor negative	Minor adverse

Designated site	Value	Potential impacts	Level of Impact	Significance of Effect (before mitigation)
Wytham Stream/ Seacourt Stream SLINC	County	In-channel improvements and ground lowering for the creation of wetland habitat will lead to a loss of habitat, with potential indirect impacts from an increase in silt and pollutants entering the water, which may potentially smother and pollute aquatic flora and fauna. However, standard site procedures, including adherence to regulatory requirements and good practice advice, will be adopted for any works near or in water to ensure no pollutants, including silt, enter aquatic environments. Beneficial impacts at the site are also expected resulting from in-channel improvements and land lowering for the creation of wetland habitat, which will include the removal of trees and scrub vegetation which will result in a reduction of shading, which should have some ecological benefits.	Minor / moderate positive	Minor beneficial in the long term
Seacourt Nature Park	County	The construction of a second stage channel and access track will lead to the permanent loss of habitats. However, the majority of these habitats have relatively low ecological value. Beneficial impacts at the site are also expected resulting from in-channel improvements and ground lowering for the creation of wetland habitat, which will include the removal of trees and scrub vegetation, which will result in a reduction of shading, which should have some ecological benefits. This site already exceeds threshold levels of NOx, so an increase in traffic generated nitrogen deposition (See Chapter 13 'Air quality') from construction vehicles is unlikely to produce a significant effect, especially as habitats present are likely to be already fairly tolerant.		
Local non-designated sites				
Hogacre Eco Park	County	Hinksey Stream flows through the south-west corner of this site, having already flowed through the Scheme area. There may be silt and pollutants having entered upstream of this site, which may potentially smother and pollute aquatic flora and fauna. However, standard site procedures, including adherence to regulatory requirements and good practice advice, will be adopted for any works near or in water to ensure no pollutants, including silt, enter aquatic environments.	Negligible	No likely significant effects

Conservation Target Areas

The Thames and Cherwell at Oxford CTA covers the majority of the Scheme area. Where modified grassland and species-poor *Lolium-Cynosurus* neutral grassland dominates large area of the floodplain between North and South Hinksey, priority habitats that will be created within this CTA are:

- Lowland meadows;
- Other neutral grassland;
- Wet woodland;
- Standing open water; and
- Rivers and streams.

As one of the main benefits of the scheme is to create more diverse habitats, this will meet the overall objectives of the Thames and Cherwell at Oxford CTA, by increasing the area and connectivity of species-rich habitats and particularly priority habitats.

Protected and notable species

Figure 3.1 shows the Scheme overview. The potential impacts on protected and notable species during the construction phase before protective measures, such as avoidance, reduction or minimisation are considered, are presented in Table 8.5. Legal compliance, where relevant, is addressed separately in Appendix R.

Table 8.5: Impacts on protected and notable species during construction

Species	Locations affected	Value of species	Potential impacts	Level of Impact	Significance of Effect (before mitigation)
Amphibians: GCN and common toad	North Hinksey along Willow Walk	County	A low population of amphibians are assumed to be present. Mortality and injury of individuals during the removal of vegetation and groundworks is possible. Permanent loss of two ponds in the flood culverts under Willow Walk and the majority of scrub, ruderal and wooded terrestrial habitat (approximately 1ha) within 250m of the two ponds, will reduce availability of potential breeding, foraging and hibernating habitat, although other, larger ponds are available in the wider area.	Moderate negative	No likely significant effects to minor adverse
Bats	Area of woodland south of the A423 and to the east of the railway. Mainly in the south-east corner of the Scheme area.	County	The removal of five trees as confirmed or possible bat roosts, and the disturbance of Botley Road Bridge and Munday's Bridge may potentially cause the permanent loss of summer roosting sites. All records were of individual bat use in trees and structures with one structure found to be occupied by two individuals. As part of the Scheme 361 individual semi-mature and mature trees and 78 groups of trees will be removed. The partial removal of a further 57 groups will also be required. This will potentially reduce alternative potential roosting locations within the area. A lekking roost at Willow Walk will likely be indirectly impacted short term (one season) from the noise and vibration of construction activities.	Moderate negative	Minor adverse

Species	Locations affected	Value of species	Potential impacts	Level of Impact	Significance of Effect (before mitigation)
			The loss of hedgerows in the South Hinksey area, part of the line of trees at Willow Walk and trees next to river channels may have a negative impact on the local bat population, severing commuting routes and the loss of foraging areas, although no significant commuting routes have been identified. Artificial lighting during operating hours in winter and for security purposes at night may also impact foraging behaviour. This would potentially be an indirect adverse or favourable impact on bats, as slower broad-winged species (long-eared bat, barbastelle, greater and lesser horseshoe and Myotis sp. bats) will tend to avoid artificially lit up areas. This may impact bats through a reduction of foraging areas. However, other bat species (noctule, serotine and pipistrelle bats) will exploit artificial light sources due to the increased insect concentrations. Impacts are considered low due to the amount of lighting that may be required in relation to the foraging areas available for bats in the area, and the hours of use for construction work.		
Birds – Breeding	Throughout the Scheme area	County	Vegetation removal, including tree/scrub removal will be undertaken before the start of the breeding bird season. However, this will potentially still result in direct negative impacts to birds from mortality and injury. Impacts are considered to be minor. The loss of foraging and perching habitat may indirectly impact breeding birds, as well as increased noise, from the	Minor negative	Minor adverse

Species	Locations affected	Value of species	Potential impacts	Level of Impact	Significance of Effect (before mitigation)
			construction of the Scheme, human disturbance and artificially lighting. As there are no protected or notable birds breeding species present within the Scheme, impacts are considered to be minor.		
			Beneficial impacts are also expected resulting from the creation of wetland habitat, hedgerows and woodland, which in the long run will provide nesting opportunities and improved habitat for foraging and feeding birds/waterbirds/ waders.	Minor positive	Minor beneficial
Birds – Wintering	Throughout the Scheme area	County	Kingfisher, red kite, fieldfare and redwing: Vegetation removal, including tree/scrub removal, will result in direct physical damage and loss of habitats within the Scheme boundary that may support wintering birds. Indirect impacts are likely from construction activities, such as noise and artificial lighting from the construction of the Scheme, and human disturbance. However, there will be beneficial impacts resulting from the creation of wetland habitats that may provide suitable over-wintering locations for birds.	Moderate negative	Minor adverse
Otter	Throughout the Scheme area	County	Indirect negative impacts from construction activities on the river channels, banks and water courses could potentially destroy or cause damage to resting sites. This may cause disturbance to otters, so impacts are considered to be moderate negative. Surveys have not found evidence of holts (breeding or non-breeding). Holts may be discovered during pre-construction surveys. In the event that holts are found	Moderate negative	Minor adverse

Species	Locations affected	Value of species	Potential impacts	Level of Impact	Significance of Effect (before mitigation)
			during pre-construction surveys there would be additional impacts, requiring a specific mitigation plan, which would be addressed at the time. In addition, noise, vibration and artificial security lighting during construction may cause disturbance. Fish numbers may also be indirectly impacted by the works through pollution, silt and vibration, which may impact the otters' food resource. These additional impacts are considered to be low, as otters are a mobile species and can avoid the Scheme area during disturbing activities and best practice safeguards should minimise any adverse impacts on availability of fish.		
Creeping marshwort	One paddock south of Willow Walk	International	There will be no direct impacts on creeping marshwort in this field as no works will be undertaken where it grows. However, there may be indirect impacts to this population from changes in groundwater as a result of the earthworks and any associated dewatering.	Moderate negative	Moderate adverse
Whorled water-milfoil	Kennington Pit, within Kennington Pools LWS	County	Direct negative impacts from the construction of the Scheme which will reduce the size of Kennington Pit by over half, could result in plants being destroyed. Indirect impacts are from a loss of potential habitat. Changes in water movement and flow within Kennington Pit might result in unsuitable conditions for this species, along with a potential for pollution, sediment and silt from construction leading to suspended particles and smothering of plants. Direct and indirect negative impacts are considered to be high, as this plant species may disappear entirely.	Major negative	Moderate adverse

Species	Locations affected	Value of species	Potential impacts	Level of Impact	Significance of Effect (before mitigation)
Adder's-tongue	Within the Scheme area, large population spread in two meadows south-east of Osney	County	One of the fields and a section of a second field are proposed new floodplain meadow to mitigate for loss of MG4 grassland. The location for MG4 mitigation is shown on Landscape drawing number IMSE500177-CH2-L00-A3-VS-L-0605-13. Since the enhancement proposed is to use "green hay" or "over-seeding", both techniques not involving removal of existing vegetation, followed by management as meadow, the effect on populations of adder's tongue on the floodplain meadow supporting this species is expected to be negligible.	Negligible	No significant effects
			The remaining part of the second field is proposed as new woodland planting. The population of adder's-tongue it supports would therefore be lost to the woodland. The loss of this proportion of the population is not anticipated to affect the viability of the population overall.	Moderate negative	Minor adverse
Alder buckthorn	One small bush at edge of Osney Mead (Botley Meadow) LWS.	County	This single bush is likely to be disturbed by works during the construction phase of the Scheme which could result in its loss. The species is listed in the Rare Plant Register for Berkshire. However in the Online Atlas of the British and Irish Flora it is described as having an 'overall stable' distribution. Given this species is locally scarce, but that its loss is potentially short term and reversible, the magnitude of impact without mitigation can be regarded as minor negative and the significance of the effect therefore as minor adverse.	Minor negative	Minor adverse
Hybrid bedstraw	One plant in an unmanaged field south of Osney Mead	County	This species will be directly lost under the Scheme footprint as it lies beneath a proposed compound. The species is of county importance due to it being a rare hybrid in Oxfordshire, with only four other populations recorded since 2000 (BSBI, 2020). The Online Atlas of the	Minor negative	Minor adverse

Species	Locations affected	Value of species	Potential impacts	Level of Impact	Significance of Effect (before mitigation)
			British and Irish Flora states that it is probably still under-recorded. The individual plant will be lost if there is no mitigation. Given there is one plant, the magnitude of the impact is considered to be minor negative		
Strawberry clover	Oatlands Road Recreation Ground	County	The population in Oatlands Road Recreation Ground is close to a proposed flood defence raised embankment and is likely to be lost under the footprint of the development. As this species is of county importance and the level of impact to the Oatlands Road population is likely to be major negative, the significance of the effect on this population without mitigation is considered to be moderate adverse.	Major negative	Moderate adverse

8.2.3 During operation

The Scheme will provide a significantly improved environment for wildlife during operation. The incorporation of new and enhanced watercourses and wetland habitats as an integral part of the design will benefit the overall ecology of the Scheme area. It is important to note however, that long-term biodiversity benefits rely on a sustainable and sensitive maintenance programme of works being developed that includes mitigation for the loss of existing habitat. New habitats such as woodland and hedges are designed to be species-rich and it will be important that these are managed to maintain their species-diversity and value for wildlife. The new river channel must be allowed to develop naturally, including a degree of natural change of planform for the first stage stream within the second stage channel. Critically, the new meadow areas must be managed as meadow, with late-summer mowing for hay and no grazing until later in the year.

A summary of the general potential operation impacts and the resulting likely significant effects relevant to the Scheme are:

- Assessing impacts on international sites - Habitat Regulations Assessment;
- Impacts on MG4a grassland, from potential changes in groundwater levels and flooding frequency, which may lead to a loss of a particular type of species community through a change in species composition; and
- Impacts on wetland and terrestrial habitats, such as creation of ponds, watercourses, meadow, woodland and hedgerows, leading to a habitat gain.

Nature conservation sites

Oxford Meadows SAC. The HRA (Appendix K) Screening Report considered possible operation impacts on Oxford Meadows SAC. The potential for a fall in groundwater level beneath the SAC during both a dry year and an average year was investigated. The results found:

- There could be a slight lowering of peak groundwater levels in the vicinity of the new channel and within the Scheme area, however, there will be relatively little change in the frequency of groundwater flooding even within the Scheme area.
- During a dry year the model found a negligible difference in groundwater levels at Oxford Meadows SAC, which will not affect the hydrological conditions required to sustain the lowland hay meadows.
- Surface water modelling work shows that the Scheme will maintain the level of the stream further upstream, near Oxford meadows. As groundwater levels are maintained, the effect of ground lowering adjacent to the Seacourt Stream will not lead to an increase in discharge in the drainage of groundwater from Oxford Meadows.

The slight changes to groundwater levels in the immediate Scheme area will not extend to the SAC, and therefore no effects are anticipated on the lowland hay meadows or floodplain pasture at the SAC, see Chapter 9 ‘Water and hydromorphology’. Therefore, there are no likely significant effects on Oxford Meadows SAC designation due to changes in groundwater.

The meadows at Iffley Meadows SSSI will not be directly or indirectly impacted by operation impacts from the Scheme, as water levels are to remain unchanged. At the southern end of the SSSI, the vegetation clearance proposed during construction may need to be repeated every few years to keep the channel clear for flood flows. The effect of this clearance will be no greater than the initial clearance during construction. Therefore, **no likely significant effects** are envisaged. Table 8.6 details the assessment for national and local designated nature conservation sites.

Table 8.6: Impacts on national and local designated sites during operation

Designated site	Value	Potential impacts	Level of Impact	Significance of Effect (before mitigation)
National designated sites				
Iffley Meadows SSSI	National	Impacts to lowland meadow are discussed in section 8.2.4 Habitats.		
Local designated sites				
Osney Mead (Botley Meadow) LWS	National	This site could be indirectly impacted during the operational phase of the Scheme from lowering groundwater which, during dry summers, will change the species composition of this site. The groundwater modelling (see Chapter 9 'Water and Hydromorphology') suggests that with modifications to the channel of Bulstake Stream which were included in the Scheme design to raise groundwater levels during low flows, any change in groundwater will be minimal and may in practice be a very slight increase. If, despite these measures, groundwater levels we to be lower than anticipated, there could be an impact and if so, further intervention would be needed to ensure the meadow does not cease to be MG4a grassland. Impacts to lowland meadow and fen are discussed in section 8.2.4 Habitats.	Moderate negative	Moderate adverse
Willow Walk Meadow LWS	County	This site may be indirectly impacted from the operational phase of the Scheme from changes in water levels, which may change the plant species composition of this site. The impacts are considered under creeping marshwort below		
Field north of Osney Mead SLINC	County	Impacts to lowland meadow are discussed in section 8.2.4 Habitats.		
Hinksey Pools SLINC	County	The southernmost third section will be indirectly impacted from the operational phase of the Scheme from changes in water levels, which may change the plant species composition of this site. However, silt removal at the southern end of the pool will improve conditions for aquatic and terrestrial flora and fish species.	Minor negative	Minor adverse
Kennington Pool LWS	County	Habitat enhancement from the removal of trees and scrub around the pond during construction will potentially lead to indirect positive	Negligible	Negligible

Designated site	Value	Potential impacts	Level of Impact	Significance of Effect (before mitigation)
		impacts during operation from increased pond diversity, as there will be less shade and leaf litter leading to improved habitat. Shrub and occasional trees will be planted to the west of the pond, and grassland to the north and east. The margins of the pond will be left to regenerate naturally. The population of whorled water-milfoil is expected to be maintained or enhanced by this. See Section 8.3.2 for further details. Reduced connectivity with Hinksey Drain may potentially lead to improved water quality.		
Bulstake Stream, Botley Park SLINC	County	The new floodgates on a footbridge and access bridge are not expected to increase the risk of silt and pollutants entering the water, as good practice procedures will be followed.	Negligible	Negligible
Wytham Stream / Seacourt Stream SLINC	County	The habitat enhancements described in Table 8.4 will be in place. No impacts on this site are expected.	Negligible	Negligible
Egrove Park Meadow LWS	County	The boundary of the potential exchange land at Egrove Park has been drawn to exclude this site. Therefore there will be no increase in recreational use, whether or not exchange land is required.	Negligible	Negligible
Local non-designated sites				
Hogacre Common Eco Park	County	No impacts on this site are expected.	Negligible	Negligible

Protected and notable species

The potential impacts on protected and notable species during the operational phase are presented in Table 8.7.

Table 8.7: Impacts on protected and notable species during operation

Species	Locations affected	Value of species	Potential impacts	Level of Impact	Significance of Effect (before mitigation)
Amphibians: GCN and common toad	North Hinksey along Willow Walk	County	There may be indirect negative impacts from flowing water in the new channel and increased flowing water from flooding within the second stage channel, which may reduce connectivity in some areas. This may also impact foraging opportunities for amphibians. Impacts are considered to be low, as the Scheme area floods every few years. However, beneficial impacts resulting from the provision of wetland features throughout the Scheme will provide suitable foraging and possible breeding habitat for amphibian species which will considered to be a positive impact.	Negligible	No likely significant effects
Bats	Throughout the Scheme	County	Beneficial positive impacts resulting from increased hunting opportunities over a wider wetland area for specific species, with a likely increase in winged invertebrates, especially related to flooding periods. Positive impacts in the longer term (due to the length of time it will take for trees and hedgerows to become established sufficiently) will also come from newly planted woodland, which will eventually replace lost trees as roosting habitat; and new hedgerows to be planted throughout the Scheme area, once established, could provide assistance to bats in establishing commuting routes.	Negligible	No likely significant effects
Birds – Breeding	South of North Hinksey Causeway and in areas of new woodland	County	There may be beneficial positive impacts resulting from the creation of wetland habitat and an increase in flooding, which may improve foraging habitat.	Negligible	No likely significant effects

Species	Locations affected	Value of species	Potential impacts	Level of Impact	Significance of Effect (before mitigation)
	and scrub planting.				
Birds – Wintering	South of North Hinksey Causeway	County	Low beneficial impacts resulting from the increased duration of flooding within the secondary channel, which may increase the availability of areas to forage and hunt. The new channel and the numerous ponds in the second stage channel are likely to provide additional foraging opportunities for kingfisher in particular.	Minor positive	Minor beneficial
Otter	Throughout the Scheme area	County	New wetland areas and watercourses will provide new foraging habitats for otter.	Negligible	No likely significant effects
Fish - migratory	Downstream of the weir at Towles Mill	Local	Migratory fish will be able to reach Seacourt Stream via Hinksey Stream.	Minor positive	Minor beneficial
Creeping marshwort	One paddock south of Willow Walk	International	There may be indirect negative impacts from groundwater lowering, which could change the suitability of this species' current location. As this species is dependent on water levels in the old river channel where it grows, any lowering of groundwater could lead to loss of the species from this site. The groundwater modelling undertaken (ESI 2018) suggests that groundwater levels may be similar or fall marginally with the Scheme in place. Therefore, in the absence of mitigation, the impact is expected to be minor negative, resulting in a minor adverse effect. The provision of a new second stage will provide floodplain grazing habitat, may promote conditions favourable to creeping marshwort, and the scheme may	Minor negative	Minor adverse

Species	Locations affected	Value of species	Potential impacts	Level of Impact	Significance of Effect (before mitigation)
			therefore result in additional suitable habitat conditions for this species and encourage its spread.		
Whorled water-milfoil	Kennington Pit and further downstream	County	Habitat enhancement from the removal of trees and scrub during construction will potentially lead to indirect positive impacts during operation to this species as there will be less shade and leaf litter leading to improved habitat. In the absence of management (mitigation) during operation, the pond would likely become overgrown and shaded, resulting in a minor negative impact, having a minor adverse effect without mitigation. The improvement in light conditions is considered to compensate for the loss of total pond area.	Minor negative	Minor adverse
Strawberry clover	Willow Walk meadow LWS	County	In Willow Walk Meadow LWS this species lies in the same channel as creeping marshwort. It is an indicator of damp soils Groundwater modelling (ESI, 2018) suggests that groundwater levels may be similar or fall marginally with the Scheme in place. Therefore, in the absence of mitigation, there is expected to be minimal impact on the water level which the plant depends on, giving a minor negative impact.	Minor negative	Minor adverse
Adder's-tongue	Within the Scheme area, large population spread in one meadow south-east of Osney	County	During operation one of the fields where adder's-tongue will be present during operation is floodplain meadow where it is currently present. In the absence of mitigation, during operation this field is expected to be managed as it currently is, and the impact on it is therefore expected to be negligible.	Negligible	No likely significant effects

Species	Locations affected	Value of species	Potential impacts	Level of Impact	Significance of Effect (before mitigation)
Alder buckthorn	One small wild plant at edge of Osney Mead (Botley Meadow) LWS. Planted in hedgerows in South Hinksey.	County	In the absence of mitigation, this single plant is not expected to survive the construction and would therefore not be present during operation.	N/A Plant not present	N/A Plant not present
Hybrid bedstraw	One plant in an unmanaged field south of Osney Mead	County	In the absence of mitigation, this single plant would not survive, as it would be lost beneath a construction compound. It would therefore not be present during operation.	N/A Plant not present	N/A Plant not present

8.2.4 Habitats

Construction Impacts

The potential impacts on each of the priority habitats during the construction phase are presented in Table 8.8. Habitats, which are permanently removed or altered during construction are also considered in Table 8.8. Note that priority habitats of local ecological importance and below are not considered.

Table 8.8: Impacts on habitats during construction

Habitat type	Locations affected	Value of existing habitat	Potential impacts	Level of Impact	Significance of Effect (before mitigation)
Priority Habitats					
Hedgerows	Extensive network of hedgerows and lines of trees across site	County (important hedgerows)	Approximately 9km of hedgerow have been recorded in the Scheme area including 15 important hedgerows, of which eight will be affected by the Scheme and two of the eight will be wholly or largely removed. Important hedgerows have regional/ county value, and the impact on lost hedgerows will be permanent and irreversible.	Moderate/ major negative	Minor to moderate adverse
Lowland calcareous grassland	In an undesignated field within Egrove Park	County	Increase in recreational use (only if nearby public open space is acquired via compulsory purchase). Access to this field is currently only to people associated with the business school. If a CPO is applied and this land is made available to the public, impacts to the grassland are considered to be negligible as the field is used currently for occasional recreational purposes and there will be no change in management.	Negligible	Nil
Lowland fen	Jubilee Scrape through Osney Mead (Botley Meadow) LWS	County	Fen habitat will be lost under the footprint of the second stage channel (previously part of the old course of Seacourt Stream).	Moderate negative	Minor adverse
Lowland meadows	Iffley Meadow SSSI	National	No direct impact on Iffley Meadows SSSI is expected, as the SSSI lies outside the works area. However, this SSSI may be impacted indirectly from run-off, silt and pollutants from the upstream construction areas. Minor vegetation clearance from the Hinksey Stream adjacent to the SSSI will not affect its designated features. Due to the short duration and reversibility of the indirect impact,	Minor negative	Minor adverse

Habitat type	Locations affected	Value of existing habitat	Potential impacts	Level of Impact	Significance of Effect (before mitigation)
			the significance of effect before mitigation is minor negative.		
	Hinksey Meadow MG4a grassland - part of Osney Mead (Botley Meadow) LWS)	National	Approximate loss of 3.1ha of Hinksey Meadow in the Scheme footprint, of which approximately 1.33ha is MG4 unimproved meadow and the remainder is meadow of lower value but still qualifying as a priority habitat. Most of the permanently and irreversibly lost MG4 will be excavated as part of the permanent works. Reinstated grassland will be at a lower level than the existing level and therefore wetter due to increased frequency of inundation from water in the proposed channel, making it unlikely that MG4 can be reinstated in the same location.	Major negative	Major adverse
	Field north of Osney Mead SLINC	County	Towards the northern edge of the SLINC, tree planting will be undertaken. This will be within areas of scrub and bramble habitat, and not within areas of lowland meadow. If CPO is applied and public access is provided, management of the grassland and encroaching scrub would be undertaken which would benefit lowland meadow habitat. Otherwise, no change in management is expected.	Negligible	Nil
	Seacourt Nature Park	County	The northern and western parts of the nature park will largely be cleared during construction. Other than the new second stage channel, habitats will be replanted after construction similar to how they are now. A track will be maintained to allow continued public access to the eastern part of the nature park; these areas will therefore be likely to have an increased public presence/footfall, increasing the compaction of the soil and increased	Moderate negative	Minor adverse

Habitat type	Locations affected	Value of existing habitat	Potential impacts	Level of Impact	Significance of Effect (before mitigation)
			disturbance to the flora and fauna of the nature park meadow. Impacts are considered to be reversible.		
	Small area of grassland located to the south-east of North Hinksey	County	The northern part of this pasture lies within the Scheme area, under the footprint for the second stage channel and localised channel widening and some dry meadow creation. These impacts are permanent and irreversible over the lifetime of the Scheme and are high impacts. The southern part of this pasture lies outside the Scheme area and no impacts on it are predicted. As part of this grassland is being retained and part lost, the overall magnitude of the impact on it is moderate negative, giving a minor adverse effect.	Moderate negative	Minor adverse
Ponds	Priority habitat - Kennington Pit, within Kennington Pools LWS	County	Kennington Pit will be directly impacted as it will be under the footprint of a new earth embankment, which will separate the pond from Hinksey Drain. This will reduce the size of this water body by 62%, as well as severing Kennington Pit from Hinksey Drain. This may improve the water quality of the pond, without the periodic overtopping of nutrient-rich surface water from Hinksey Drain. Kennington Pit is well vegetated with native aquatic species, no evidence of poor water quality with whorled watermilfoil recorded. In the absence of protective measures, indirect impacts are highly likely from an increase in run-off and pollutants from works adjacent to this water body, leading to potential smothering and pollution of aquatic species.	Major negative	Moderate adverse

Habitat type	Locations affected	Value of existing habitat	Potential impacts	Level of Impact	Significance of Effect (before mitigation)
			Due to the county value of the Pit and the high impact due to the long term and irreversible change to its area, the significance before mitigation is moderate adverse.		
Wet woodland	Stands of W2 woodland to the south of Kennington roundabout and within Kennington Pool LWS	County	There will be the loss of wet woodland that surrounds Kennington pond and the wet woodland south of Kennington roundabout. The impact on woodland to be removed will be permanent and long term, and therefore high. The significance of a high impact on a feature of county value is moderate adverse.	Major negative	Moderate adverse
Non-priority Habitats					
Grassland with restoration/ enhancement potential.	Meadow south-east of Osney Mead Industrial Estate	County	The eastern side of this meadow is proposed to be planted with woodland and scrub as compensation for trees lost elsewhere on the Scheme. The remainder of this meadow is the proposed MG4a mitigation site. The woodland creation will be permanent and irreversible during the lifetime of the Scheme. As woodland creation is proposed on only a minority of the meadow, the impact without mitigation is overall moderate.	Moderate negative	Minor adverse

Operation impacts

During operation the Scheme will have little further effect on habitats beyond the effects resulting from construction and from the proposed landscape planting. The habitats created for the Scheme will be managed long-term with a view to maintaining their ecological value and meeting the ecological objectives of the scheme, including the achievements of biodiversity net gain. The Scheme's effects on surface water flows are not anticipated to result in any significant ecological changes and the Scheme is designed to provide a net improvement in river habitat quality.

There is a potential for ecological changes to result from changes in groundwater levels, particularly during summer when the soil is naturally at its driest. Ecological monitoring over a period of years after the Scheme is constructed (see Chapter 17) will identify if unanticipated ecological changes are resulting; if any significant negative changes are identified we will seek to rectify them. We have incorporated riffles into the works proposed at Bulstake Stream specifically to maintain water levels during low-flow periods, in order to avoid excessive lowering of groundwater levels in the sensitive meadow at Hinksey Meadow.

Our proposed management of the second stage channel will have ecological effects, which we expect to be beneficial. Additional trees and shrubs which attempt to grow in the second stage channel, will need to be removed or managed if they create a risk of blocking the flow during flood conditions. The main maintenance of the second stage channel will be by grazing. As described in section 3.7, cattle will graze the channel during those months of the year when it is sufficiently dry for this. This grazing, combined with the choice of grass species which will be planted, will lead to the development of habitat resembling floodplain grazing marsh. We will adjust the grazing as necessary to maximise the chance of achieving floodplain grazing marsh, a priority habitat. During the first few years, while the grass is establishing, it may be necessary to use mechanical mowing rather than grazing. Most tree and shrub growth will be kept in check by the grazing of the cattle, however our operations team will use powered tools to remove or manage trees and shrubs on occasion.

We will maintain the new first stage stream by removing any significant obstructions which develop but will otherwise allow it to develop as a natural channel.

Table 8.9: Impacts on habitats during operation

Habitat type	Locations affected	Value of existing habitat	Potential impacts	Level of Impact	Significance of Effect (before mitigation)
Priority Habitats					
Hedgerows	Extensive network of hedgerows and lines of trees across site	County (important hedgerows)	During operation, there will be no further gains or losses of hedgerow due to the Scheme. Hedgerows planted as part of the Scheme will be maintained.	Negligible	Nil
Lowland calcareous grassland	In an undesignated field within Egrove Park	County	Increase in recreational use (only if nearby public open space is acquired via compulsory purchase). Access to this field is currently only to people associated with the business school. If a CPO is applied and this land is made available to the public, impacts to the grassland are considered to be negligible as the field is used currently for occasional recreational purposes and there will be no change in habitat management.	Negligible	Nil
Lowland fen	Jubilee Scrape through Osney Mead (Botley Meadow) LWS (part to be lost in the footprint of the second stage channel)	County	During operation, new ponds and backwaters created in the second stage channel may develop into fen habitat, either as marginal/fringing habitat or covering all of individual features. The assumed worst-case scenario is that tall fen does not develop giving a negligible impact during operation (the loss of the fen having been already accounted for during construction) and nil significance of effect. In that case, additional off-site habitat creation would be needed to achieve biodiversity net gain targets.	Negligible	Nil
Lowland meadows	Iffley Meadow SSSI	National	Any operational impact on Iffley Meadow SSSI could only arise through changes to groundwater levels. As the Scheme is not predicted to affect groundwater this far from the new channel, no impact is anticipated.	Negligible	Nil

Habitat type	Locations affected	Value of existing habitat	Potential impacts	Level of Impact	Significance of Effect (before mitigation)
	Hinksey Meadow MG4a grassland - part of Osney Mead (Botley Meadow) LWS)	National	There is a potential for the Scheme to lower groundwater levels in this area during summer, when the soil is already at its driest. The MG4 habitat would be adversely affected by greater drying in summer and over time could change into a less-valuable habitat. If unmitigated, this would be a major adverse impact. The riffles in Bulstake Stream south of Hinksey Meadow were included in the design in order to raise water levels in the streams during the dry part of the summer and therefore reduce the extent to which groundwater levels are lowered.	Major negative	Major adverse
	Field north of Osney Mead SLINC	County	If CPO is applied and public access is provided, management of the grassland and encroaching scrub would be undertaken which would benefit lowland meadow habitat. Otherwise, no change in management is expected. This is assessed as Nil impact because the minor beneficial effect will only happen if compulsory purchase is needed at Seacourt Nature Park.	Negligible	Nil
	Seacourt Nature Park	County	Part of Seacourt Nature Park will be converted into second stage channel. It will still be accessible to the public, during drier parts of the year, but will be kept clear of trees and shrubs. The area immediately east of the nature park will remain open for public access and will be managed in a similar way to how the nature park is managed now. There will be little change in habitat and the overall effect will be negligible.	Negligible	Nil
	Floodplain Grazing Marsh	N/A	This habitat type is not currently present within the Scheme area. South of Willow Walk, the second stage channel is forecast to spend a proportion of each winter under water, making conditions suitable for this habitat to	Moderate positive	Minor beneficial

Habitat type	Locations affected	Value of existing habitat	Potential impacts	Level of Impact	Significance of Effect (before mitigation)
			develop. We will manage the grass by grazing cattle to encourage this habitat, although we cannot be certain that this will be fully successful in achieving the highest quality of grazing marsh habitat.		
Ponds	Priority habitat - Kennington Pit, within Kennington Pools LWS	County	During operation there will be species-rich grass at the northern end of the pond which is expected to increase the biodiversity of the area, preventing shading of the pond and encouraging other wildlife use. During operation this is expected to give rise to a minimum a minor positive impact.	Minor positive	Minor beneficial
Wet woodland	Stands of W2 woodland to the south of Kennington roundabout and in new planting locations	County	Most of the woodland planting is on wet ground and using species which are appropriate for wet woodland. While this woodland will continue to develop and improve ecologically during operation, none of the new planting areas have sufficiently wet ground to replace the wettest ("W2") woodland lost in other locations.	Negligible	Negligible

8.3 Mitigation

8.3.1 Generic mitigation measures

We will implement the following generic mitigation measures throughout the construction phase of the Scheme:

- Pre-construction surveys will be undertaken prior to the commencement of construction to confirm that protected species have not moved into an area, where previously they were recorded as likely to be absent.
- An Ecological Clerk of Works will supervise vegetation clearance works and the main construction works and will provide advice on specific ecological issues as and when they arise (for example, if new protected species or valued habitats are discovered during the works).
- Standard site procedures, including adherence to regulatory requirements and good practice advice, similar to that provided in the former Pollution Prevention Guidelines (PPG - e.g. the former Pollution Prevention Guidelines 5: Works and maintenance in or near water) and CIRIA guidance, will be used for any works near or in water to ensure no pollutants, including silt, enter aquatic environments. The contractor will be made aware of their responsibilities to comply with pollution prevention.
- Contractors will use existing access tracks, roads and haul roads as far as possible, and decompaction measures will be implemented, where appropriate.
- As soon as construction works are completed, disturbed habitats in temporary working areas will be returned to their original condition or better and enhanced where possible as quickly as possible to minimise loss of ecological function and colonisation by invasive plants.
- Tree protection measures (British Standard 5837:2012 guidelines) will be followed when working close to trees and shrubs, and appropriate root protection zones will be demarcated and protected with suitable vehicle barriers or other measures during construction.

8.3.2 Specific mitigation measures

Construction phase

Nature conservation sites

No mitigation for the international and national designated sites is proposed as the Scheme has been designed to avoid any significant impacts upon them. Specific measures for locally-designated sites, in addition to those proposed for habitats, are as follows.

Kennington Pool LWS: Part of the existing priority wet woodland will be retained. Selected overhanging tree limbs which are shading the pond will be cut back, so potentially enhancing its biodiversity. After construction is complete we will create a species-rich grass margin around the pond and/or a grass area to increase the biodiversity of the area, preventing shading of the pond and encouraging other wildlife use.

Hinksey Pools SLINC: Silt dredging at the southern end of the pool will improve conditions for aquatic and terrestrial flora, and fish species, which in turn will improve conditions for other species of wildlife.

Wytham Stream/Seacourt Stream SLINC: Contractors will use existing access tracks, roads and haul roads as far as possible, and decompaction measures will be implemented, where appropriate. As soon as construction works are completed, disturbed habitats in temporary working areas will be returned to their original condition or better as quickly as possible to minimise loss of key species.

Osney Mead (Botley Meadow) LWS: Specific mitigation for Hinksey Meadow is described in the lowland meadow (MG4) part of the habitats section below. We will monitor the experimental translocation of the 1.33ha of MG4a turf which has to be removed from the footprint of the second stage channel, in order to assess the success of the translocation and to provide information which may be of use to others attempting meadow translocations in future.

Habitats

New areas of habitat will be created to replace some of the most ecologically valuable habitat types. Figure 8.5 shows the areas after scheme construction and mitigation, which are likely to be valued as priority habitats once the Scheme is operational and newly planted habitats have established. Where possible, habitats will be recreated in the same location as they are currently located. However, due to landowner or other environmental/technical constraints, this may not always be possible. Comparing Figure 8.5 with the existing priority habitats in Figure 8.3 shows which habitats will be replaced in situ and which will be created in new areas. We will arrange for additional planting at an off-site location, to be identified, as part of a programme to develop new wetland habitat, new wet woodland, new or improved ditches and a number of new hedges, these being higher-value habitats which will experience net losses within the Scheme area due to the Scheme.

Woodland. Approximately 12.83ha of new woodland will be planted; north of Botley Road, along Bulstake Stream in North Hinksey and Osney, and to the west of Grandpont (Figure 3.1 Scheme overview), to replace approximately 9.6ha of woodland, which will need to felled. In addition, sufficient wet woodland will be created off-site to ensure delivery of a net gain overall in this habitat. Locations are to be confirmed.

Due to the need to restrict obstructions in the second stage channel, there will be fewer trees on riverbanks than there are at present, meaning less wet woodland.

Lowland meadow (MG4). Approximately 17.8ha of MG4 meadow will be created at fields in North Hinksey and South Hinksey, to mitigate for the potential loss of approximately 1.33ha of unimproved MG4a meadow and the loss of 1.1ha of other grassland at Hinksey Meadow.

Discussed in the MG4 Grassland Mitigation Strategy (Appendix D-23), subject to landowner permission, the 1.33ha of MG4a Hinksey Meadow turf will either be:

- Translocated to become part of the MG4 meadow which is being created near North and South Hinksey, this being our preferred approach if approved by the Hinksey Meadow landowners;
- Used in the second stage channel at Hinksey Meadow; or
- Used by the Hinksey Meadow landowners on another habitat creation scheme.

The success of habitat translocations is variable, therefore we are working on the basis that the MG4 may be lost and will be using seeds taken from existing MG4 meadows to create a much larger area of species-rich meadow as mitigation. This habitat will not fully replace the unimproved grassland lost, because part of its value comes from having been managed in the same way for hundreds of years. The Floodplain Meadows Partnership have advised on how best to manage this process and how to maximise the chances of success (see Appendix C-5).

Outlined in Chapter 17, a monitoring programme will be developed for the first five years after the works are complete, to assess whether the mitigation strategy for MG4 grassland has been successful. If key plant species are found to be declining, we will implement remedial actions. We cannot predict in advance what form remedial actions might take as this would depend on the nature of any problems identified. After the five years, ongoing monitoring at Hinksey Meadow will continue at five-year intervals for a further 20 years on species populations and trends.

The translocated area of MG4a grassland will be monitored long-term on a similar basis to Hinksey Meadow, as lessons learned from the success or failure of the translocation will be valuable for future schemes.

Species will be sown in the second stage channel, which are suitable to create floodplain grazing marsh (in those areas where the degree of annual flooding is appropriate, south of Willow Walk). This is a new habitat type for the Scheme area and will increase the ecological value of the area by increasing the diversity of habitat.

Protected and notable species

All elements of the Scheme will incorporate appropriate mitigation and legal compliance for protected and notable species. Measures are summarised below.

Amphibians. A low population of amphibians are precautionarily assumed in the three ponds which could not be surveyed in 2020. An eDNA survey will be undertaken at least two years prior to the start of construction. If Great Crested Newts are present a detailed mitigation strategy will be developed and agreed with Natural England in advance of the construction of the Scheme.

If required, the mitigation strategy will detail impacts to the pond and terrestrial habitats, pre-construction mitigation and compensation, as well as general mitigation measures to reduce the impacts of construction activities on Great Crested Newts. The mitigation strategy will inform a European Protected Species (EPS) licence application from Natural England and will be sought before any works commence which have the potential to impact newts. Ecological supervision will be undertaken where necessary as part of the mitigation strategy.

New areas of wetland habitats throughout the Scheme will provide potential breeding and foraging sites for amphibian species. All potentially suitable hibernacula, to be removed as part of the Scheme, will be dismantled by hand, by an experienced ecologist. These will be checked for amphibians which will then be moved off-site to a pre-determined ‘safe’ water body or hibernacula/refugia.

Bats. A mitigation plan for bats, which will be agreed with Natural England, will be developed on the basis of the bat survey and pre-construction surveys in advance of the construction of the Scheme. The basis of the mitigation plan is that trees with high-value features for bats will be retained where possible (which is only the case for a small proportion of such trees) and otherwise felled at a time of year when bats will not be present. Ecological supervision will be undertaken where necessary and in a way which does not harm bats. 117 bat boxes will be erected before the end of the Scheme. Post-construction monitoring to ensure that mitigation measures will deliver their target outcomes, are outlined in Chapter 17.

An EPS licence from Natural England will be sought before felling trees or removing bat boxes which were known to have hosted roosting bats, and before work at Botley Road bridge, which has the potential to disturb bats.

Where artificial security or construction lighting is necessary, lighting will be kept low or angled down to avoid spilling into key bat habitat and navigation areas, such as hedges and watercourses. Most trees will be felled during the winter, due to constraints of other

species; this timing is appropriate to reduce impact on bats as there is no evidence of any hibernation roost within the Scheme area.

Birds. All vegetation suitable for breeding birds will be removed before the start of the works, outside of the normal bird breeding season (March - August), with the exception of certain areas where removal needs to be delayed in order to protect other species. This reduction in vegetation should naturally encourage species to build nests outside of the Scheme area. If breeding birds, or nests (including the beginnings of a nest) are found during the works, these will be left intact until the young have fledged or the nest becomes disused. All work in the immediate vicinity will pause and an experienced ecologist will define a buffer zone to avoid disturbance. The nests of wild birds being used or being built, regardless of the species conservation status, are protected from damage or destruction.

Of the four species of Schedule 1 bird species recorded in the field surveys, two were present during the breeding season: kingfisher and red kite. A survey for kingfisher burrows and any early indications of nesting by red kites in the area, will be undertaken prior to the start of construction. If a burrow/nest is found, as Schedule 1 species, an increased exclusion zone will be required as it is illegal to disturb Schedule 1 bird species whilst breeding. A risk assessment will need to be conducted to determine the likelihood of the birds being disturbed by the construction activities and also to inform the size of the exclusion zone. The exclusion zone will need to be maintained until the end of the breeding activity.

Nest boxes will be placed during the first winter of Scheme construction, during vegetation clearance, before the nesting season has begun. Artificial nest box designs will be targeted for specific species being impacted by the works (see Appendix D-5) and their locations will be based on data collected through previous breeding bird surveys and availability of sites outside the Scheme area whose owners are willing to have nest boxes installed.

Post-construction monitoring will be undertaken to confirm that mitigation measures are delivering their target outcomes. These are outlined in Chapter 17 for breeding and wintering birds.

Otter. Pre-construction surveys will be undertaken to identify and confirm any new active holts and resting/lying up areas and confirm if previously identified potential resting sites subsequently become active. This will define the appropriate mitigation and allow for any licences required to be obtained.

During any vegetation clearance adjacent to suitable habitats, an Ecological Clerk of Works will be present. Works will stop immediately if any otters are disturbed and appropriate advice sought. Since breeding may occur at any time of year, active maternal holts can never be ruled out. In the event of a maternal holt being identified, an exclusion zone of up to 150m radius (CIEEM, 2011) or more will need to be established to prevent disturbance, depending upon location and works proposed in the area. Once mother and cubs are confirmed to have ceased using the holt, it will be removed under licence if required. If a repeat survey confirms that there will be damage to or removal of a holt, a Natural England licence will be required and a replacement artificial holt will be constructed.

During construction, monitoring will be undertaken periodically to identify any new holts established in locations subject to disturbance from the Scheme works and allow adjustments to working arrangements to be made to avoid disturbing otters, as outlined in Chapter 17.

Where night-time security lighting is necessary, lighting will be kept close to the ground or angled down to avoid spilling into key sensitive habitats. Bridge modifications at the

A420 will include a mammal ledge to allow continued passage for otters alongside the water body.

Protected and notable plants. A monitoring programme will be developed for the first five years after the works are complete, to assess whether mitigation plans for creeping marshwort and whorled water milfoil have been successful. See chapter 17 for further information. If they are found to be declining, we will identify and implement remedial actions. After the five years, ongoing monitoring will continue on species populations and trends.

Mitigation strategies have been developed for both species.

Creeping marshwort (see Appendix D-24). A mitigation strategy has been developed due to the risk that the species could be lost from a site that holds an important proportion of its UK population. During construction, when it will not be possible to maintain heavy grazing which ceased in 2017, the vegetation in which the plant grows will be mown. Grazing previously kept competitive grasses from smothering it and created patches of bare ground into which it could set seed and colonise vegetatively. The vegetation in the ditch will be mowed and patches of bare earth created using hand tools, and an appropriate grazing regime established if possible.

The ditch in which creeping marshwort grows is outside the Scheme area so we will not be carrying out works there. We will provide funds to a third party to allow translocation of some of the plants so they can be propagated off-site and available to re-colonise the paddock if the mowing were to fail to maintain the population. We will also fund deepening and widening of the ditch to provide the plant with sufficiently-wet ground if there is a minor reduction in groundwater levels due to the Scheme. This is considered to be a precautionary activity, as the predicted reduction in groundwater is between 50 and 100mm.

Whorled water-milfoil (see Appendix D-25). Prior to any construction work, the whorled water-milfoil plants at Kennington Pit will be identified and their location mapped. A coffer dam will be put across the pond to protect the part of the pond that is to remain undisturbed. This coffer dam will prevent changes in turbidity levels and silt accumulation and will protect whorled water milfoil plants that will remain during construction, before being removed once the earth bund is complete.

A number of plants will be temporarily translocated in spring to a suitable location to be 'grown on' as a precautionary measure. On completion of the works and when Kennington Pit is considered to be in the same condition or better than what it was prior to construction, the translocated whorled water-milfoil plants will be returned to the pit.

Operation phase

We added the riffles in Bulstake Stream near North Hinksey Causeway to the Scheme design to maintain water levels during the dry part of the summer, after initial modelling showed that groundwater levels in Hinksey Meadow would be slightly reduced and that the MG4 grassland in the meadow might be adversely affected once the Scheme is operating. If monitoring shows that this mitigation is not enough, we can raise the height of the riffles and therefore slightly increase the water level of Bulstake Stream further, without affecting the operation of the Scheme during flood conditions.

8.4 Residual effects

8.4.1 Flora and fauna

The residual impacts on flora and fauna are those impacts once measures to avoid and mitigate ecological impacts have been applied and are presented in Table 8.10. A breakdown of habitat losses and gains is provided in section 8.4.2.

Table 8.10: Residual impacts on flora and fauna

Feature	Description of Potential Impact	Significance of Predicted Impact	Mitigation Measures	Significance of Residual Impact
Designated Sites				
Kennington Pool LWS (County)	During construction, direct impacts from the loss of pond habitat in the footprint of a new earth embankment, which will separate the pond from Hinksey drain. Also loss of surrounding wet woodland within the site. See also whorled water-milfoil and pond habitat, below.	Minor adverse (construction)	Part of the existing priority wet woodland will be retained at Kennington Pool LWS. During operation indirect positive impacts will result from the loss of overhanging trees which are shading the pond, so potentially enhancing its biodiversity, and improving water quality due to less frequent inundation by the Hinksey Drain. Creation of species-rich grass at the northern end of the pond which will increase the biodiversity of the area, preventing shading of the pond and encouraging other wildlife use. Woodland planting and pond creation elsewhere in the Scheme area to replace trees and ponds lost here.	**Minor adverse**
Hinksey Pools SLINC (County)	Direct impacts from habitat loss from the construction of a weir and second stage channel. The southern-most third will be indirectly impacted from changes in water levels, which may change the plant species composition of this site.	Minor adverse (construction)	Silt dredging at the southern end of the pool will improve conditions for aquatic and terrestrial flora, and fish species, which in turn will improve conditions for other species of wildlife.	**No likely significant effects**
	Potential changes in water levels may change the species composition of this site.	Minor adverse (operation)		**No likely significant effects**

Feature	Description of Potential Impact	Significance of Predicted Impact	Mitigation Measures	Significance of Residual Impact
Wytham Stream/Seacourt Stream SLINC (County)	Direct impacts to habitat as in-channel improvements and land lowering within the footprint. With potential indirect impacts on flora and fauna. In-channel improvements and land lowering will create wetland habitat. Areas will be enhanced from removal of trees and scrub.	Minor beneficial (operation) in the long term	Contractors will use existing access tracks, roads and haul roads as far as possible, and decompaction measures will be implemented, where appropriate. As soon as construction works are completed, disturbed habitats in temporary working areas will be returned to their original condition or better as quickly as possible to minimise loss of key species.	**Minor beneficial**
Protected and Notable Species				
Amphibians (County)	Mortality and injury of individuals during the removal of vegetation and groundworks is possible. A low population of amphibians are assumed as a precaution. Permanent loss of two ponds and the majority of scrub, ruderal and wooded terrestrial habitat Possible indirect negative impacts from the flowing water in the new channel and increased flowing water from flooding within the second stage channel, may reduce connectivity. This may also impact foraging. New wetland features may provide suitable foraging and possible breeding habitat for amphibian species.	No likely significant effects to minor adverse (construction)	Three ponds could not be surveyed as they were dry at the time of an eDNA survey. An eDNA survey of these three ponds will be undertaken more than a year prior to the start of construction and a mitigation strategy will be developed if GCN are present. This will be developed and agreed with Natural England in advance of the construction of the Scheme. The mitigation strategy will inform an EPS licence application to Natural England. The licence will be obtained before any works which have the potential to impact GCN commence. All potentially suitable hibernacula to be removed as part of the Scheme will be dismantled by hand.	**No likely significant effects**

Feature	Description of Potential Impact	Significance of Predicted Impact	Mitigation Measures	Significance of Residual Impact
Bats (County)	Loss of five trees and works affecting two bridges with confirmed or possible summer roosting sites. Indirect impacts potentially from a loss of roosting locations, noise and vibration, offset by providing bat boxes before construction ends. Severance and reduced habitat for commuting/foraging, particularly in the Willow Walk area. Beneficial impacts resulting from increased hunting opportunities, roosting habitat and assistance to bats in establishing commuting routes from wetland and woodland creation, in the long-term.	Moderate adverse (construction)	A mitigation plan for bats will be developed on the basis of the bat survey and pre-construction surveys, which will be agreed with Natural England, in advance of the construction of the Scheme. An EPS licence from Natural England will be sought before felling trees or removing bat boxes which were known to have hosted roosting bats, and before work at Botley Road bridge, which has the potential to disturb bats. New bat boxes will be deployed before tree felling commenced. Where artificial security or construction lighting is necessary, lighting will be kept low or angled down to avoid spilling into key bat habitat and navigation areas. Most trees will be felled during the winter. Mitigation for the gap in the line of trees at Willow Walk created by the new bridge has not been identified.	**Minor adverse**
Birds – Kingfisher, red kite, fieldfares and redwings (County)	Direct impacts from the damage/loss of breeding habitat through the loss of vegetation (trees and hedgerows). Vegetation removal, including tree/scrub removal, will result in direct physical damage and loss of habitats within the Scheme boundary that may support wintering birds.	Minor adverse (construction)	All vegetation suitable for breeding birds will be removed in the winter months, before territories are established, outside the normal bird breeding season (March – August), with the exception of certain areas where removal needs to be delayed in order to protect other species. A survey for kingfisher burrows and any early indications of nesting by red kites in the area, will be	**No likely significant effects**

Feature	Description of Potential Impact	Significance of Predicted Impact	Mitigation Measures	Significance of Residual Impact
	Indirect impacts from increased noise, disturbance and security lighting during construction.		undertaken prior to the start of construction. If a burrow/nest is found, as Schedule 1 species, an increased exclusion zone will be required as it is illegal to disturb Schedule 1 bird species whilst breeding. A risk assessment will need to be conducted to determine the likelihood of the birds being disturbed by the construction activities and also to inform the size of the exclusion zone. The exclusion zone will need to be maintained until the end of the breeding bird season. If breeding birds, or nests (including the beginnings of a nest) are found during the works, all work in the vicinity must stop immediately and an experienced ecologist must be consulted. All breeding birds, regardless of their conservation status, are protected and nest disturbance is an offence. A programme of artificial nest box installation outside the Scheme will provide replacement nesting habitats for some species. We will develop this programme in conjunction with landowners who are willing to provide space for nest boxes to be fixed.	
	Beneficial impacts are expected resulting from the creation of wetland habitat, hedgerows and woodland, which will provide nesting opportunities and foraging habitat.	Minor beneficial (operation)	N/A	**Minor beneficial**

Feature	Description of Potential Impact	Significance of Predicted Impact	Mitigation Measures	Significance of Residual Impact
Otter (County)	Potential indirect impacts from construction, causing disturbance to otters and resting sites. Potential disturbance/destruction of non-active/active breeding and non-breeding holt sites to be confirmed by pre-construction surveys. Noise, vibration and artificial security lighting, may indirectly impact otters. Fish stocks impacted through the construction works may then impact food resources for otters.	Minor adverse (construction)	The Scheme area will be surveyed for otter holts, well before the beginning of any vegetation clearance and again as a pre-construction survey. In areas of dense vegetation, where areas cannot be physically checked thoroughly, activity surveys will be undertaken using camera trap surveys to identify any areas where an exclusion zone may be required. All known otter holts, and any found during surveys, will be removed under licence if necessary and if they are not in use for breeding. Since breeding may occur at any time of year, active maternal holts can never be ruled out. In the event of a maternal holt being identified, a minimum 150m exclusion zone will be established around the holt, to prevent disturbance until no longer in occupation. The holt will then be removed, under licence, once mother and cubs are confirmed to have left naturally.	**No likely significant effects**
	Increased habitat available for foraging/resting and breeding due to stream and wetland creation upon Scheme completion	No likely significant effects (operation)	N/A	**No likely significant effects**
Fish - migratory	Migratory and resident fish will be able to pass Towles Mill weir and reach Seacourt Stream via Hinksey Stream.	Minor beneficial	N/A	**Minor beneficial**
Creeping marshwort (International)	No direct impacts on this species. Indirect impacts potentially from a long-term change in groundwater and changes in management from grazing to mowing. There is a risk of losing the	Minor adverse	A mitigation strategy has been developed for creeping marshwort, due to the risk that the species could be lost from a site that holds an important proportion of its UK population. Before and during construction, when it will not be possible to maintain	**No likely significant effects**

Feature	Description of Potential Impact	Significance of Predicted Impact	Mitigation Measures	Significance of Residual Impact
	species from one of a handful of UK sites. There may be indirect negative impacts from groundwater lowering, which could change the suitability of the current location. As this species is dependent on water levels in the ditch where it grows, any lowering of groundwater could lead to loss of the species from this site.		heavy grazing, we will continue mowing of the vegetation in the ditch in which the plant grows, which we have already commenced. We will support others in the translocation of a number of the plants so they can be propagated off-site. If necessary, we will fund remedial actions including deepening and widening of the ditch to provide the plant with sufficiently-wet ground. We will support monitoring of the population to confirm the proposed measures are adequate.	
Whorled water-milfoil (County)	Direct negative impacts from the construction of the Scheme which will reduce the size of Kennington Pit by over half, could result in plants being destroyed. Indirect impacts from water pollution, sediment and silt from construction.	Moderate adverse (construction)	Plants will be removed from the pond and grown off-site while the works are ongoing, to ensure this species survives or can be restored at this location even if measures to protect it during the works are unsuccessful. Following completion of the works, these plants will be replaced back into Kennington Pit once the conditions are suitable.	**No likely significant effects**
	Habitat enhancement from the removal of trees and scrub around the edge of the pond, will potentially lead to indirect positive impacts to this species as there will be less shade and leaf litter.	Minor beneficial (operation)	N/A	**Minor beneficial**
Strawberry clover (County)	The population in Oatlands Road Recreation Ground is close to a proposed flood defence raised embankment and is likely to be lost under the footprint of the development.	Moderate adverse (construction)	Mitigation in this location is not practical. Two other populations have been recorded close to the scheme boundary in Willow Walk Meadow LWS and a horse pasture by the Thames in New Hinksey.	**Moderate adverse**

Feature	Description of Potential Impact	Significance of Predicted Impact	Mitigation Measures	Significance of Residual Impact
	As this species is of county importance and the level of impact to the Oatlands Road population is likely to be major negative, the significance of the effect on this population without mitigation is considered to be moderate adverse.			
Habitats				
Lowland Fen (County)	Tall herb fen and swamp along Jubilee Scrape through Osney Mead (Botley Meadow) LWS.	Minor to moderate adverse	As part of the Scheme, new ponds and backwaters in the second stage channel will be created, which may develop into lowland fen habitat. An area of fen near the proposed New Hinksey embankment has been excluded from the Scheme Area and will be retained.	**No likely significant effects**
Lowland meadows – Iffley Meadow SSSI (National)	Indirect impacts during construction from run-off, silt and pollutants	Minor adverse	We will follow regulatory requirements and good practice advice for all works near or in water to ensure no pollutants, including silt, enter aquatic environments. We will prepare a sediment management plan to support this.	**No likely significant effects**
Lowland meadows – Hinksey meadows (MG4a grassland) (part of Osney Mead (Botley Meadow) LWS) (National)	Approximate loss of 2ha of Hinksey Meadow in Scheme footprint, of which 1.33ha is the most valuable MG4a unimproved meadow and the remainder is meadow of lower value but still qualifying as a priority habitat.	Major adverse	To mitigate the loss of meadow at Hinksey Meadow, approximately 17.8ha of new meadow will be created in a nearby location. We will also carry out translocation of MG4 turf from Hinksey Meadow to the new location, using turf which will have to be dug up for the Scheme. The remainder of the new meadow will be planted with seeds of meadow grasses and wildflowers taken from MG4 meadows. We will retain ownership of the majority of this area once works are completed and we will enter into a management agreement with the owner of the	**Major adverse**

Feature	Description of Potential Impact	Significance of Predicted Impact	Mitigation Measures	Significance of Residual Impact
			remaining area to ensure it is managed as meadow and mown in late summer. Based on evidence of other translocation of species-rich floodplain grasslands, the MG4 translocation is likely not to be wholly successful. However the translocated turf will be managed as meadow in the same way as the new meadow areas and therefore over time will establish as meadow, even if the translocated plants are lost over the first few years.	
	Potential to change the species mix of the remaining MG4a grassland through changes to groundwater levels.	Major adverse	Riffles have been designed into the Scheme, in Bulstake Stream south of Hinksey Meadow. We will monitor the existing MG4a grassland via NVC surveys. This will track any change in species composition and identify any potential for the overall habitat type to change. Monitoring will allow adjustments to be made to its management regime to maintain the site as floodplain meadow during operation. Groundwater monitoring will take place to check whether the modelled outcome of minimal reduction in groundwater during a dry summer (or during a typical year) is borne out.	**No likely significant effects**
Lowland meadow - Small area of grassland located to the south-east of North Hinksey	The northern part of this pasture lies within the Scheme area, under the footprint for the second stage channel and localised channel widening and some dry meadow creation. These	Moderate adverse	Mitigation is not possible at this location, as this habitat lies within the footprint of the second stage channel. The loss of this meadow will have a moderate adverse significant effect.	**Moderate adverse**

Feature	Description of Potential Impact	Significance of Predicted Impact	Mitigation Measures	Significance of Residual Impact
	impacts are permanent and irreversible over the lifetime of the Scheme. The southern part of this pasture lies outside the Scheme area and no impacts on it are predicted.		Mitigation for the loss of this habitat will be the MG4a floodplain meadow creation site (the same site as for the loss of Hinksey Meadow).	
Ponds (County)	Loss of part of Kennington Pit pond habitat in footprint of a new earth embankment, which will separate the pond from Hinksey drain. See also whorled water-milfoil, above. Impact on Hinksey Pond at Devil's Backbone from construction of crested weir with minor loss of pond habitat.	Moderate adverse	Planting of riparian vegetation and/or wet woodland ground flora of local provenance around Kennington Pit to restore the biodiversity of the area. Selective overhanging branch cutting to reduce shading of the pond if appropriate. Management of the pond in a sensitive manner to allow rewilding. Creation of numerous new small ponds within the second stage channel and a larger pond, similar in area to the area lost from Kennington Pit, near the existing Hinksey Stream.	**Minor beneficial**
Wet woodland (County)	Loss of woodland during construction of second stage channel.	Moderate adverse	Woodland planting will be approximately the same area and species mix as woodland that is to be lost as part of the Scheme. Other than at Kendall Copse, where the woodland being lost is not wet woodland, we have chosen planting locations where the soil is sufficiently wet in winter to support the mixtures of willow and alder species typical of wet woodland in the Scheme area. It will be many years before the newly-planted woodland areas match the ecological value of the wet woodlands which will be removed.	**Moderate adverse**
Non-priority habitat grassland with	The eastern side of this meadow is proposed to be planted with woodland	Grassland proposed to be	Part of the western field is expected to be replaced by turf from the MG4a floodplain meadow and part	**Moderate beneficial**

Feature	Description of Potential Impact	Significance of Predicted Impact	Mitigation Measures	Significance of Residual Impact
restoration/ enhancement potential - Meadows south-east of Osney (County)	and scrub as compensation for trees lost elsewhere on the Scheme. The western side of this meadow is the proposed floodplain MG4a mitigation site. The woodland creation will be permanent during the lifetime of the Scheme. The grassland creation will be permanent but represents enhancement of an existing habitat rather than replacement of one habitat with another.	seeded: neutral effect	will be seeded using seeds harvested from the existing MG4a meadow and using green hay from Hinksey meadow, to enhance its diversity. The meadow will be cut in late summer and then grazed by cattle. The existing neutral grassland is very heterogenous, with patches of species poor and species rich vegetation. The proposed mitigation is likely to enhance the diversity of this grassland overall.	
		Grassland proposed to be planted with woodland: Moderate adverse	The woodland creation on the grassland will result in the loss of this habitat which is irreversible and has a moderate adverse significant effect.	**Moderate adverse**

8.4.2 Summary of habitat losses and gains

Explanation

A summary of Priority Habitats and other areas, which are lost through construction and gained through habitats creation or improvements are shown in Table 8.11.

Habitats which are cleared prior to construction but then re-instated in the same place afterwards are included in both the “Loss” and “Gain” columns.

Areas of improved and semi-improved grassland which are to be planted or over-seeded and managed to create habitats of higher conservation importance as part of the Scheme’s mitigation plans, are also included in the Loss column. The habitats that replace them are included in the Gain column.

Areas which will not be cleared but will be retained unaltered, including part of the woodland at Willow Walk, are not included in either column.

The figures in table 8.11 do not include off-site habitat creation, the areas of which will be fixed once the details of the receptor site(s) are firmed up. We anticipate off-site creation of additional wet woodland, reedbed and hedgerow, along with some ditch enhancement. This will be needed in order to comply with the biodiversity net gain requirements for these specific habitats as explained in Section 8.4.3.

Priority habitats

The main net increases in habitat areas relate to floodplain grazing marsh and the large area of new lowland meadow which replaces existing grazing land.

Floodplain grazing marsh is not currently present in the Scheme area. Within the second stage channel, there will be a significant increase in the depth, frequency and duration of winter flooding, which is expected to lead to the grazed fields becoming floodplain grazing marsh habitat. A net gain of 18.18 ha is expected.

Substantial new areas of lowland grasslands will be created totalling 20.25 ha, which will provide a net gain of 17.88 ha. Areas will include:

- Proposed new dry meadows along the proposed second stage channel but outside of the channel;
- New floodplain meadow (area of MG4 mitigation); and
- Area of reinstated MG4.

Although there is an overall increase in the area to be managed as meadow, the loss of an area of Hinksey Meadow which has been managed as meadow for a long time means that there is still an overall negative impact, as described in section 8.2 above.

Priority pond habitat is present at Kennington Pit, to the south of the Southern by-pass. After construction, a large number of ponds, scrapes and backwaters will be created in the second stage channel between North Hinksey and South Hinksey, which will create a mosaic of wetland habitats. This will lead to a 4.03ha net increase in priority pond habitat.

The area of woodland planted will be almost double that lost to the Scheme, reflecting the long time needed for newly-planted woodland to be of similar ecological value to mature woodland (a woodland does not become mature until the trees are over 150 years old). Replacement woodland planting will be carried out in various places outside the second stage channel (see Figure 3.1)l, with a net gain of 4.75 ha. In addition, sufficient wet woodland will be created off-site to ensure delivery of a biodiversity net

gain overall in this habitat, allowing for the lower biodiversity value of recently-planted woodland.

Wetland habitat, combining reedbed, fen and other swamp, will be lost in various places within the Scheme area. The area within Jubilee scrape will be recreated, elsewhere reeds will be encouraged to develop around the shallow edges of ponds and backwaters, and across the whole of some shallow ponds. This will lead to a net increase in lowland fen and reedbed habitats of 0.27ha. We will create additional off-site reedbed as part of delivering biodiversity net gain targets.

Just over 3 km of priority hedgerow will be lost to the Scheme. This length of hedgerow includes species-rich as well as species-poor hedges. Over 3.5km of hedge, consisting of a species-rich mix will be replaced. Although this will not fully compensate for the loss mature hedgerows, in the long-term this may provide a more diverse habitat. A net loss of 227m is expected. We will create a significant length of off-site hedge to compensate for the net loss on-site.

Table 8.11: Summary of potential habitat gains and losses

Habitat	Loss	Gain	Net loss/gain
Priority Habitats			
Lowland meadows	2.36 ha	20.25 ha ***	17.88 ha
Wet woodland	4.13 ha	8.88 ha	4.75 ha
Ponds	0.24 ha	4.27 ha	4.03 ha
Floodplain Grazing Marsh	0 ha	18.18 ha **	18.18 ha **
Lowland fen (incl reedbed)	1.02 ha *	1.29 ha *	0.27 ha *
Hedgerows	3812 m	3585 m	-227 m
Other habitats			
Scrub – dense / continuous (e.g. bramble)	2.53 ha	1.30 ha	-1.23 ha
Tall herb - ruderal	0.07 ha	0.00 ha	-0.07 ha
Neutral grassland (semi-improved, grazed)	48.81 ha	38.29 ha	-10.51 ha
Lowland mixed deciduous woodland	1.78 ha	0.81 ha	-0.97 ha
Rivers and streams	0.00	3.8 km	3.8 km
Improved or amenity grassland	38.73 ha	1.73 ha	-37.00 ha
Marsh / Swamp	0.67 ha	0.00 ha	-0.67 ha

* The created area of fen and reedbed is Jubilee Scrape (0.06ha) plus an estimated amount of reedbed habitat which will develop in some of the proposed pond areas (1.23ha).
** Floodplain grazing marsh has been counted as neutral grassland in the biodiversity net gain calculator (see Section 8.4.3).
*** The majority of the new meadow habitat is provided as mitigation for the loss of old meadow; the increase in habitat area therefore does not represent a net gain for biodiversity.

Other habitats

No river or stream habitats are to be lost as part of the Scheme. The creation of new watercourses i.e. a new first stage stream, which has an enlarged, second stage channel in some areas, has provided a large net gain in habitat area of 9.49 ha. The first stage stream will run for approximately 3km from north of south Hinksey to south of the Southern by-pass.

Improved or amenity grassland has a net loss of 37ha, as the majority of this habitat will be taken up by the two-stage channel; with ponds and floodplain grazing marsh. A large area of neutral grassland will be over seeded, using seeds taken from existing MG4

meadows to create a species-rich meadow. A neutral grassland seed mix with be used to reinstate grassland areas within the Scheme boundary. A net loss of -10.51 ha is expected.

8.4.3 Biodiversity Net Gain

The requirement for new developments to deliver a minimum of 10% Biodiversity Net Gain is being introduced to the development planning system under Part 6 of the Environment Act 2021. It is not yet a legal requirement, however we are assessing the Scheme as if it was, as discussed with Oxfordshire County Council. The Biodiversity Net Gain calculation is explained in Appendix S, which also includes the spreadsheet used to calculate the gains and losses. Certain habitats of very high distinctiveness are excluded from the calculation and any impacts on these habitats require bespoke mitigation, not simply avoiding net loss. For this Scheme, the loss of lowland meadow from the Hinksey Meadow site, the reinstatement of meadow grasses on that area and the creation of approximately 18ha of new meadow, as set out in Appendix D-23, are excluded from the metric.

The calculation is based around three separate elements of the metric, two relating to linear habitats – to rivers, streams and ditches and to hedges - and the other to ('terrestrial') habitats which includes ponds and wetlands. The linear habitats are measured by length of feature in kilometres, and terrestrial habitats by area in hectares. The requirement is that a score 10% higher than the baseline score should be achieved for each of the three metrics. In addition, there must not be a net loss of biodiversity value for certain higher-value habitats, even if the overall goal of +10% is achieved, and overall biodiversity gains should not be obtained by replacing habitats of medium or high value with habitats of lower value. The details of these requirements are provided in Appendix S.

We have calculated the baseline value of habitats using the habitat surveys carried out for the Scheme (see Appendix C) and have predicted the value of habitats post-Scheme on the basis of the planting plans and the landscape and habitat management plans submitted with the planning application.

The main net gains in biodiversity value identified by the calculator are the large areas of grassland which will be replaced by grassland of greater ecological value, in particular the grassland in the second stage channel which will be much wetter than the existing grassland it replaces, and the ponds and backwaters created throughout the second stage channel. There are also biodiversity gains from areas of grassland outside the channel which will be seeded with more diverse seed mixes than the species currently present, although a large proportion of the grassland outside the channel will be replaced with grassland similar to the existing grass, as preferred by the landowners. Although the area of wet woodland we will plant is almost twice the area to be felled, this is a net loss of biodiversity value, as newly-planted woodland supports less biodiversity than established woodland.

The biodiversity net gains in river habitat come from a mixture of enhancements to existing streams across the Scheme area and the creation of the new first stage stream.

The Scheme achieves a score above +10% for rivers, streams and ditches, and for habitats in general, through the on-site habitat creation plans. On-site hedge planting is not enough to achieve a net gain in biodiversity for hedges; despite including as much hedge planting as we can. To achieve the target of +10% we will partner with other organisations to arrange off-site habitat creation. We will also arrange off-site habitat creation for a significant area of new wet woodland, for a short length of ditch to be enhanced or created and, if needed, an area of reedbed. All other habitats of high value assessed in the metric will experience no net loss of biodiversity value due to the

combination of retaining habitat unchanged where possible and planting new habitat on site as part of the Scheme.

9 Water and hydromorphology

9.1 Existing environment

The study area for this chapter is taken to be the same as the Scheme boundary, plus a nominal buffer zone of approximately 250m. Although they are partially or completely outside of this zone, the Oxford Meadows SAC and Iffley Meadows SSSI are also included, due to their high sensitivity. This area is shown in Figure 9.1. A separate Water Environment Regulations assessment has been undertaken to cover specific impacts to water bodies within the Scheme under this legislation (see Section 9.1.5 and Appendix L).

This section considers the anticipated effects of the Scheme on water resources, water bodies and water quality and potential knock-on effects on water-dependent features. It also considers flood risk implications of the Scheme, including both surface and groundwater-related.

Related effects of the Scheme on navigation are discussed in Chapter 6 'Recreation and public access'.

Related effects of the Scheme on water-dependent ecology are discussed in Chapter 8 'Flora and Fauna'.

Related effects of the Scheme on archaeological remains are discussed in Chapter 9 'Cultural Heritage'.

9.1.1 Surface water features

The surface water channel network through the Scheme area broadly drains from north-west to south-east. Most of the Scheme works will take place in the floodplain grassland to the south-west of the city. In this area, there are a number of channels splitting from and re-joining the main Thames channel, including: the Seacourt Stream; Hinksey Stream; and the Bulstake Stream, as shown in Figure 9.1. The active floodplain area is also drained by a number of land/field drains.

A small number of permanent lakes and ponds separate to the surface water channels are present in the study area, these are:

- Hinksey Pools SLINC: a 700m-long pond occupying a flooded gravel pit (see Figure 8.1).
- Three small ponds adjacent to the railway line, centred at NGR 450770 205450 (Figure 9.1).
- A small pond near South Hinksey at NGR 451100 204050.
- Kennington Pit within Kennington Pool LWS at NGR 451800 203400 (see Figure 8.1).

There are no abstractions from surface water in the study area. There are several consented surface water discharges from the urban area; these are combined sewer overflows. There are also discharges from road drains, which do not require consent.

9.1.2 Groundwater

The most significant aquifer beneath the study area is the Floodplain Gravels/River Terrace Deposits, which occur beneath the contemporary floodplain, with Terraces capping the ground beneath the city centre. In most parts of the study area, this aquifer is capped by Alluvium, which due to its limited permeability, partially disconnects the aquifer from surface activities and vice versa. The gravels and the overlying alluvium

are designated as a Secondary 'A' aquifer. Beneath the River Terrace deposits is the Oxford Clay, which is designated 'unproductive' and is effectively impermeable.

Groundwater levels in the gravel aquifer have been both measured and modelled (ESI, 2018). The groundwater model has been calibrated against observed groundwater levels in the gravel aquifer at a number of observation wells across the study area (including two observation wells within the Oxford Meadows SAC). The model simulates the effect of recharge from surface waters and from rainfall and determines the influence these have on groundwater levels and flow in the underlying gravels. The aquifer is highly permeable, groundwater levels in the floodplain are typically shallow and beneath the Scheme groundwater flow is broadly south or south-eastwards, parallel to the Thames valley, with some local anomalies.

There are no source protection zones in the study area and no records of licensed groundwater abstractions are known. The key environmental relevance of groundwater in the study area is therefore to support surface water baseflow; and to provide resource to local water-dependent features and ecosystems.

9.1.3 Water dependent ecosystems

The most significant designated water-dependent ecosystems in the study area are the Oxford Meadows SAC and Iffley Meadows SSSI, to the north and east of the Scheme respectively. These are described in more detail in Chapter 8 'Flora and fauna'.

Groundwater beneath the SAC drains in a south-westerly direction, before discharging to the Seacourt Stream to the north of the proposed Scheme. Previous work and groundwater modelling suggests that maintenance of groundwater levels beneath the SAC is dictated by groundwater discharge to Seacourt Stream, north of Botley Road, and hence by the level of Seacourt Stream in the vicinity of this discharge.

There are also several local wildlife sites within the study area (shown on Figure 8.1 and described in more detail in Chapter 8 'Flora and Fauna'), that could have some connection to surface water (via periodic flood inundation) and/or groundwater dependence:

- Near North Hinksey/Botley Road:
    - Osney Mead (Botley Meadow) LWS;
    - Willow Walk Meadow LWS;
- Hinksey Pools SLINC;
- Kennington Pool LWS.

Several extended sections of the channels that pass through the route, in particular the Hinksey Stream, are designated as SLINCs. These habitats are dependent on surface water flow regimes and water quality; and potentially groundwater as well, where in good continuity with the underlying gravel aquifer. Groundwater modelling suggests a strong link between surface water levels in the channels and groundwater levels maintained in the gravel aquifer.

9.1.4 Water quality

The River Thames at Oxford has a predominantly rural catchment, although it does receive some component of urban runoff from the city area within its catchment. As mentioned above, there are a limited quantity of discharges from light industrial premises in the vicinity and the streams receive runoff from local roads. The principal Sewage Treatment Works for Oxford is downstream of the Scheme, although there are some local Combined Sewer Outfall discharges in the study area; and it must be assumed there may be foul misconnections into the storm drainage system.

Under the Water Environment Regulations 2017 (WER) classification, the WER surface water body in and adjacent to the Scheme (see Section 9.1.5) – the River Thames (Evenlode to Thame) - is classified as moderate. This is principally driven by unfavourable concentrations of phosphate and certain trace chemicals. Other water quality parameters (pH, ammonia, BOD and dissolved oxygen) are classified as 'high' (i.e. favourable) condition. Groundwater quality of the gravel aquifer has not been classified under WER, as it is not a designated water body.

Recent groundwater quality data beneath the Scheme area have been collected during the 2017 Ground Investigation and are collated in the Contaminated Land Assessment (CH2M 2018 plus addendum Jacobs 2021b) for the Scheme. In most areas, there are either negligible or very limited levels of groundwater pollutants that are likely deriving from current and historic activities in the nearby urban area. There are a few specific areas of more substantial groundwater contamination beneath the Scheme footprint, principally in and around the vicinity of Old Abingdon Road, where there are several closed landfills, a railway line, highways and embankment fill. All of these areas could act as contamination sources. The Redbridge and Kennington landfills will lie directly beneath the footprint of new sections of channel: trenches will be cut through them and profiled to create the new channels, with permanent impermeable lining installed to prevent direct leachate escape through the channel walls at this location.

Surface water sample data have also been collected and are collated in the same report. This indicates that many of the local streams have some low levels of trace pollutants (as per groundwater), likely deriving from the proximity to the urban area; and also elevated levels of phosphate deriving from the upstream catchment. There was no obvious indication to date of the local streams being impacted by the local contamination sources (e.g. the landfills), although it is expected that the closed landfills are likely to be leaching to the local surface water system, particularly under wet conditions.

Two other landfills (Coldharbour Lane and Rivermead Landfill) are within the Scheme works area. All these landfills may have poor groundwater (and surface water) quality in and around them; and bodies of leachate within the fill material itself.

9.1.5 Water Environment Regulations Assessment

The Water Environment (Water Framework Directive) England And Wales Regulations 2017 (WER) require every designated water body to be classified by the Environment Agency (in England) according to the condition of its biological, hydromorphological, physico-chemical and/or chemical quality elements and for it to be assigned an overall status. Where water bodies are not at 'high' or 'good' ecological status (GES) or 'good' ecological potential (GEP), we are required to identify and review the feasibility of improvement measures, and to set element objectives. This process is formalised via a River Basin Management Plan (RBMP). Under WER, new activities and schemes should therefore not cause a deterioration of water body status or prevent RBMP improvements being achieved.

We have assessed compliance of the Scheme with the WER (see Appendix L), using information from the Environment Agency's Catchment Data Explorer (Environment Agency, data updated 2020). This assessment considers both the water body within the Scheme boundary i.e. 'Thames (Evenlode to Thame)' (water body ID. GB106039030334) and the next upstream and downstream surface water bodies. Groundwater bodies were scoped out of the assessment, as no WER classified groundwater bodies are likely to be affected: the gravel aquifer beneath the Scheme area itself is not part of a WER groundwater body.

For each water body in scope, the following tasks have been completed:

- Collation of baseline information on the quality elements.
- Evaluation of potential impacts of the Scheme on quality elements.

- Evaluation of compliance of the Scheme with objectives (including mitigation of any potentially adverse impacts).
- Identification of opportunities to enhance the water body (and linked water bodies).

The WER assessment concluded that the Scheme will not cause or contribute to a deterioration in either overall status of any water body or elements, or prevent objectives from being achieved. The Scheme will in fact result in a net positive contribution to the water bodies in question, by contributing to WER measures assigned to the Thames (Evenlode to Thame) water body, including: removal of structures to improve connectivity and fish passage; improving channel flow; and a net increase in channel/riparian habitat.

9.1.6 Flooding

As would be expected, the bulk of the Scheme area sits within areas at high or medium risk of flooding, including parts of the functional floodplain (i.e. Flood Zones 2, 3a and 3b).

The Scheme is also in an area vulnerable to groundwater flooding from the gravel aquifer; and there have been incidences of groundwater flooding within the Grandpont area.

Further details of the baseline flood risk are provided in the Flood Risk Assessment (Jacobs 2021a).

9.1.7 Changes to water and hydromorphology in absence of Scheme

In the absence of the Scheme, it is predicted that in the medium to longer term there will be an increased flood risk from the main channel of the River Thames and floodplain north of Oxford, and from the Hinksey, Seacourt and Bulstake Streams as a result of climate change (see Figure 1.4, which shows predicted flood extents). Changes in flood frequency and duration would also lead to some changes in wildlife habitats and landscape.

9.2 Likely significant effects

9.2.1 During construction

Potentially significant impacts on water and river geomorphology during the construction phase are likely to relate to:

- Spills of polluting materials.
- Discharge of contaminated (including silty) water from construction dewatering.
- Temporary new pathways for contaminated groundwater to migrate into the aquifer or surface water features during excavations, piling and ground investigations.
- Temporary loss of in-channel and riparian habitat, during excavation of new channels, clearance of existing channels; and temporary channel diversions.
- Short-term compaction of landfill material (see Chapter 12 ‘Sustainable use of land’) beneath temporary stockpile areas, leading to higher than background leachate release rates into surrounding groundwater/surface water.
- Silt releases from exposed soils and stockpiles during heavy rainfall or flooding.
- Temporary water quality disturbance during in-channel works;
- Leaching from soil stockpiles (including from natural materials) into underlying groundwater and adjacent surface water, causing pollution.
- Construction groundwater control (dewatering) leading to localised changes to groundwater levels beneath local groundwater dependent eco-systems; and/or

abstraction of potentially contaminated water that will need to be stored and disposed of.

The risks associated with pre-existing ground contamination are more fully described in the Contaminated Land and Outline Remediation Strategy for the Scheme (CH2M, 2018 plus addendum Jacobs 2021b).

Since these would be localised effects of minor to moderate negative magnitude, and the receptors that could be affected are of medium sensitivity (the high sensitivity receptor of Iffley Meadows SSSI being unaffected), then the significance of impact is likely to be **minor to moderate adverse**.

9.2.2 During operation

Surface water features and groundwater

Changes to surface water resource and flows in the downstream River Thames

The Scheme is not anticipated to lead to a substantial change to the overall surface water flow regime downstream of the site (including both high and low flows), although there may be some redistribution of water resource between the various existing and new Scheme minor channels/water features within the Scheme area itself (as described below). We have modelled the behaviour of the river system with the proposed Scheme in place for low flows in addition to flood flows to ensure that the Scheme has been designed to ensure the flow in the River Thames through the area is not impacted outside of flood events and the existing low flow protocol for the area can be implemented to conserve water and maintain navigation levels. There will be no changes to the existing offtakes from the River Thames or the operation of the existing weirs on the River Thames.

Overall, it is expected the impact will be negligible magnitude on a medium sensitivity resource, leading to **no significant impact**.

Changes to hydrology and hydromorphology due to flow controls

Flow control structures are integrated into the Scheme to maintain levels within existing and new channels and ponds at low flows. For the majority of the current watercourses, new second stage channels / water features will not be operational until higher flows. Therefore, at low flows there will be no significant impact to the majority of existing watercourses. At higher flows the second stage channels will come into operation, resulting in more water flowing in channels which have new second stages and therefore less in other channels. For the lower section of Hinksey Stream and Bulstake Stream the new stream will be operational at all flows and sections of the existing watercourses will become backwaters of the Thames. New and old channels will adjust over time to changes in flow depth and width leading to new dynamic equilibrium under the new flow regime. There is the possibility of sedimentation in the new channel as flows decrease and sediment drops out, however the majority of the new channel will remain wet. Overall, it is expected that the direct and indirect impacts of flow control structures will be **neutral**.

The updated design (2021) has removed two large standalone culverts below the A423 bypass each side of the A423 bridge which were proposed in 2018. The County Council will have rebuilt the bridge over the railway with sufficiently large openings either side of the railway to provide the capacity required for the Scheme by using the existing

channels which will be enlarged. This removes the need for separate independent culverts under the A423.

Changes to water resources in minor channels from groundwater level changes

Our groundwater model predicts that dry year groundwater levels beneath the central part of Hinksey Stream and the associated Hinksey Ponds will rise slightly, resulting in a **neutral** or **minor beneficial** impact on the water resource in these features as lower groundwater levels lead indirectly to lower flows in the nearby channels.

However, our groundwater modelling predicts that there will be a slight drop in dry year groundwater level in the vicinity of the new channel, particularly to the west of it, increasing in scale (typically in the range of 10 to 40cm) in the area between South Hinksey and Old Abingdon Road. This could affect water resource in overlying ditches and small streams where they are in continuity with the underlying aquifer. This could result in a localised minor impact to these features, with some reaches of smaller streams and ditches potentially drying during dry weather (although it is noted that this might already happen under baseline dry weather conditions, as groundwater levels are already predicted to be below ground level in this area under dry conditions). These impacts could have a **minor adverse** impact overall (based on a moderate magnitude of impact on features of low sensitivity).

Changes to groundwater quality due to changes to groundwater flow directions

The Scheme will not lead to any changes in the groundwater quality in the section of the aquifer beneath the designated ecosystems in the study area (Oxford Meadows SAC and the Iffley Meadows SSSI), as they are too distant from the area of new assets.

It is possible that there may be minor changes in groundwater quality in the zone adjacent to the section of the new channel that runs through natural materials, due to changes in the degree of groundwater-surface water interaction and flow directions, although the net impact is likely to be **negligible** or **minor adverse**.

There is also the potential for diversion of pre-existing contaminated groundwater (e.g. from the closed landfills) to new receptors following installation of the presence of permanent below ground structures (e.g. short sections of sheet piles), or new/widened channel sections. This could result in some very localised deterioration of surface/groundwater quality. As the aquifer (and associated surface water receptors) are of low sensitivity, it appears likely at this stage that this could result in up to a **minor adverse impact** (based on a potential change of negligible to moderate magnitude).

Water dependent ecosystems

Changes to geomorphological value of riverine habitats

As detailed in the WER assessment (Appendix L), the Scheme will provide a net benefit to the collection of watercourses included in the Scheme area and will create substantial sections of new riparian and in-channel habitat (see Appendix S). This will be an improvement of moderate magnitude, to a receptor of low sensitivity, resulting in a **minor beneficial impact**.

Changes to groundwater level beneath designated water-dependent ecosystems

As described above, Scheme design is such that surface water levels in the Seacourt Stream north of Botley Road will not change from pre-Scheme levels under the dry year and typical year condition. The groundwater modelling demonstrates that groundwater levels adjacent to the Seacourt Stream are effectively controlled by the surface water levels in Seacourt Stream and by discharge (i.e. groundwater drainage) to the stream. In turn, the groundwater flow (and gradient) from the north-east remain unchanged and, as a result, groundwater levels beneath the Oxford Meadows SAC will also be subject to no change.

The Scheme will not lead to any material changes in the groundwater level in the section of the aquifer beneath the nationally important ecosystem of Iffley Meadows SSSI (ESI 2018).

Initial groundwater modelling suggested that, without mitigation, there may be more substantial changes in groundwater level (a reduction of circa 250mm) beneath the MG4 floodplain meadow at Hinksey Meadows, particularly during a “worst case” dry year. Groundwater levels beneath the area were especially sensitive to surface water levels in the Bulstake Stream. On the basis of the modelled impacts, the Scheme design was developed to include localised bed raising and riffles to increase water levels in the Bulstake Stream during the sensitive dry year condition. With this mitigation incorporated into the design, the modelled results show little change from the current groundwater levels under the dry year condition, with a slight fall (up to 20mm) in a small area beneath the meadow and a rise (of between 10-50mm) beneath the majority of the meadow. To set up the dry year model run, it was preceded by a model run for an “average” year, more representative of “typical” conditions within the aquifer. This average year model run also showed a similar level of response throughout the year (including during the growing season) – i.e. a negligible difference (and in some places a small rise) in groundwater levels between the baseline (without Scheme) and the ‘with Scheme’ model runs.

The impacts on these nature conservation designations are discussed in Chapter 8 ‘Flora and fauna’.

There may be slight changes in groundwater levels beneath other groundwater-fed pools and channels.

Changes to flooding frequency and surface water resource at water-dependent ecosystems

The Scheme will necessarily lead to changes in floodplain inundation frequency from the River Thames and existing channels. This has the potential to affect ecological habitats that are dependent on periodic flooding, which are considered in Chapter 8 ‘Flora and fauna’.

Water Quality

Seepage of contaminated groundwater into the new channel sections constructed through Kennington and Redbridge landfills

The new channel will be cut directly through old landfill material. These channel sections will be profiled and sheet piled, and this will limit direct seepage of leachate or contaminated groundwater into the new channel to small amounts, although sheet piles in the vicinity of the landfills may divert flows elsewhere (the impacts of which are

considered below). It is noted that any contaminated material excavated will be removed from the local area as part of the Scheme, reducing the overall potential for it to act as a source for water pollution in the long-term. The overall impact is likely to be **neutral.**

Seepage of contaminated groundwater into the new/existing channel sections

The Scheme will change local groundwater flow directions and discharge points for bodies of existing groundwater contamination in the southern part of the Scheme. This may increase the discharge of contaminants in some areas leading to a **minor adverse impact**.

Flooding (including groundwater flooding)

The Scheme is not likely to increase either groundwater or fluvial flood risk either within the Scheme area or wider study area; and as would be expected, will deliver a significant reduction in fluvial flood risk for a large number of residential properties and the environment. This beneficial impact has been assessed in Chapter 6 'Local Community'.

Groundwater modelling suggests that during flood flows of 10%, 5% or 1% probability of occurrence in any given year the proposed Scheme will generally result in a slight lowering (by up to about 600mm) of peak groundwater levels in the vicinity of the new channel and within the Scheme area. During these events, the river levels in most of the watercourses in the area are out of bank with inundation of the surrounding floodplain.

Further assessment of flood risk is provided in a revised Flood Risk Assessment, prepared after submission of the first ES (Jacobs 2021a).

9.3 Mitigation

The mitigation of construction impacts will be defined in the CEMP and surface water management plan for the Scheme, and will include:

- Implementation of standard spill/leak control measures (e.g. bunded fuel storage area, spill kits, interceptors).
- A Scheme-wide groundwater and surface water monitoring programme during the works, with control and trigger levels for level and quality.
- Development of a groundwater control strategy and working method for new channel construction or channel clearance to prevent significant changes to groundwater level, including appropriate recharge of any abstracted groundwater back to the environment where appropriate, e.g. through recharge trenches or boreholes where feasible.
- Following on from the above, any groundwater control measures that require the handling of contaminated groundwater will include measures to protect surface water features from any discharge of that water back to the environment.
- Development of a strategy for in-channel works and temporary stream diversions, to minimise both the disruption to ecological elements and the risk of siltation/scour during the construction phase.
- Appropriate design of temporary or permanent in-channel structures to reduce the potential for scour/channel migration.
- A developed methodology for excavations and piling in or adjacent to landfill/contaminated areas, to specify suitable design, construction techniques and monitoring strategy; and identification of disposal routes for any contaminated water that is abstracted.

- Definition of control and trigger levels for water quality and level to identify any significant changes that require corrective action; and to define a construction phase water monitoring programme. Installation of temporary drains and silt traps where required in temporary works areas.
- Consideration and mitigation of the risk of silt generation from temporary stockpile areas from rainfall/floods, and of leachate generation from excavated materials, e.g. by the use of impermeable bases, flood bunds, and temporary covering of exposed material: this will be included in the scope of a silt management plan for the Scheme.

Mitigation measures for the identified operational impacts will include monitoring after construction to determine any significant effects on water quality and level and any need for mitigation to be enhanced or otherwise amended.

The mitigation for groundwater and surface water level changes on biodiversity is described in Chapter 8 'Flora and fauna'.

9.4 Residual effects

Residual impacts for water and hydromorphology receptors are summarised in Table 9.1. These all correspond to the operational phase of the Scheme, unless stated.

Table 9.1: Residual impacts on Water and Hydromorphology Receptors

Receptor	Description of Potential Impact	Significance of Predicted Impact	Mitigation Measures	Significance of Residual Impact
Surface water bodies	Changes to riparian zone/ channel geomorphology during construction	Minor Adverse	n/a	Minor Adverse
	Improved riparian zone/ channel geomorphology during Scheme operation	Minor Beneficial	Improved riparian habitat built into Scheme design.	Minor Beneficial
Groundwater beneath sensitive ecosystems	Changes to groundwater level due to of permanent channel/below ground structures during operation	Assessed in Chapter 8 'Flora and fauna'		
Surface water dependent designated ecosystems	Changes to surface water flooding inundation frequency during operation.			
Local streams and ditches close to new channel	Depletion of groundwater baseflow during operation	Minor Adverse	None identified	Minor Adverse
Groundwater and associated surface water features	Seepage of contaminated groundwater into new or existing channels	Minor Adverse	There is the possibility that less contaminated material will leach into existing channels upon completion of Scheme.	No impact to Minor Adverse

10 Cultural heritage

10.1 Existing environment

Cultural heritage has been considered under the following three sub-topics:

- Archaeological remains
- Historic buildings (including Conservation Areas)
- Historic landscape (including the designated Oxford View Cones).

Impacts on cultural heritage value in recreational activities, such as opportunities to walk in historic meadows and the use of the River Thames for navigation, are considered in Chapters 5 'Local community', 6 'Recreation and public access' and 7 'Landscape and visual amenity'.

A cultural heritage asset is defined by the NPPF as "a building, monument, site, place or landscape identified as having a degree of significance meriting consideration in planning decisions, because of its heritage interest".

Cultural heritage assets include designated assets (World Heritage Sites, Scheduled Monuments, Listed Buildings, Conservation Areas, Registered Parks and Gardens, Registered Battlefields and Registered Historic Wrecks) and non-designated assets identified by the Local Planning Authority (for example: Locally Listed Buildings, archaeological sites and monuments and historic landscapes. Both designated and non-designated cultural heritage assets have been examined as part of this assessment.

The following assessments and investigations have been undertaken to support the Scheme and are provided at Appendices J-2 to J-8 respectively:

- A cultural heritage desk-based assessment.
- A consideration of designated assets and their settings (Heritage Statement).
- A geoarchaeological assessment.
- A geophysical survey.
- An archaeological evaluation at Old Abingdon Road.
- A trial trench evaluation of the Scheme.
- An additional trial trench evaluation undertaken in 2020 of an area being considered as an alternative location for part of the main construction compound.

In order to identify potential impacts on the setting of designated assets, data was gathered for a wider area than the Scheme footprint, i.e. a 500m buffer around the boundary of the Scheme. The same study area was used for historic landscapes and the designated Oxford View Cones. The study area for non-designated assets is shown in the desk-based assessment provided at Appendix J-2.

From the sources identified in Appendices J-2 to J-8, a total of 210 cultural heritage assets were identified with the potential to be impacted by the Scheme. These comprise 143 assets in the category of Archaeological Remains, 45 assets in the category of Historic Buildings and 22 assets in the category of Historic Landscape - see Table 10.1. There are no World Heritage Sites, Registered Parks and Gardens, Registered Battlefields or Registered Historic Wrecks within the study area.

More detailed information on all identified cultural heritage assets is presented in the gazetteer (Appendix J-1). An overview of baseline sites is provided below. For the purposes of this assessment the Scheme has been split into four geographically distinct areas (Area 1 – North of Botley Road; Area 2 – Botley Road to Willow Walk

North; Area 3 – Willow Walk to Devil's Backbone; and Area 4 – Devil's Backbone to the junction with Hinksey Stream).

Each asset discussed below is identified by a unique asset number that can be cross-referenced to the gazetteer (Appendix J-1). Trenches identified within the baseline below relate to the main programme of archaeological evaluation undertaken in 2017 (Appendix J-7) and the more recent investigation of one additional field (Appendix J-8).

Table 10.1: Summary of identified cultural heritage assets

Sub-topic	Value						
	Very High	High	Medium	Low	Negligible	Uncertain	TOTAL
Archaeological remains	0	2	11	108	22	0	143
Historic buildings	0	4	40	1	0	0	45
Historic landscapes	0	0	0	11	11	0	22
TOTAL	0	6	51	120	33	0	210

10.1.1 Cultural heritage baseline

In this section, the asset numbers used to refer to the items of cultural heritage interest refer to the numbering system in the Gazetteer (Appendix J-1). The locations of the assets are shown by their reference numbers on Figure 10.1 (archaeological remains) and Figure 10.2 (historic buildings). Asset numbers beginning with the letters CH, and trench numbers, refer to findings from the archaeological excavations carried out for this Environmental Statement.

Area 1 – North of Botley Road

Archaeological Remains

Bronze Age
Within Trench 7, a natural feature (CH20) was identified containing burnt material dated to the Early Bronze Age. Although no artefacts were recovered, it was suggested by the excavators that the asset could indicate prehistoric activity within the vicinity. This asset is of **negligible** resource value.

Medieval
Botley ('Bota's clearing' or possibly 'wood') was first recorded in the late 12th century. Historically it was a small secondary medieval settlement with a mill and farm.

Geoarchaeological Interest

Area 1 (CH33) is characterised by a deep channel system associated with the Seacourt Stream. The floodplain sequence at this location is relatively deep which overlies a channel complex. Radiocarbon dates obtained from organic deposits recovered from within the channels in this area yielded Early Bronze Age and Early to Middle Iron Age dates.

Further details on the geoarchaeological interest of the Scheme are provided in Appendix J-6.

Historic Buildings

Post-Medieval
Post-medieval assets include two Grade II Listed Buildings on the western periphery of the Scheme: South View (OA8), an early 19th century farmhouse; and 13 and 15 North Hinksey Lane (CH1), an early 17th century dwelling. These assets are both of **medium** resource value.

Further designated assets are noted in the Osney Town Conservation Area (OA35), to the east of the Scheme, which predominantly encompasses an area of 19th century terraced housing within a distinct island setting. This asset is of **medium** resource value.

Further discussion of the settings of designated assets is provided in the Heritage Statement (Appendix J-3).

Historic Landscape

This historic landscape of Area 1 comprises: an area of irregular enclosure (HLT1) in the west; an area of modern transport infrastructure (HLT2); an area of parliamentary enclosure (HLT3); an area of allotments (HLT4); a residential area (HLT5) in the east; rural-village (HLT14) and Seacourt Steam water feature (HLT16).

Area 2 – Botley Road to Willow Walk

Archaeological Remains

Prehistoric - Roman
There are no prehistoric or Roman assets within this area.

Medieval
Documentary sources record a mill at Botley during the medieval period. The Chronicle of Abingdon Abbey reported a lawsuit in the 11th century when the men of the neighbouring hamlet of Seacourt damaged a watercourse in Botley called the lake. The lake referred to may have been the later named Shirelake which became the Seacourt Stream, which remained unchanged until the 20th century. The "Oseney Abbey cartulary" documents the presence of a mill in Botley in the early 13th century in the record of a sale of two acres and four butts of meadow between Bulstake and Botley Mill (OA605).

The mill building was demolished in the early 20th century. Historic mapping shows that the mill complex contained associated water management features, including a weir and leat to the north and a pond to the south.

Trenches 9, 10 and 11 were excavated to investigate the mill water management features shown on historic mapping. Although none of the surviving evidence of the mill features (OA605) was identified, trenches could not be dug in some parts of the site due to environmental constraints and therefore some of the mill remains may survive outside of the excavated trenches. This asset is of **low** resource value.

Within Trench 15, the old county boundary ditch was identified (CH4). This feature was represented by three separate cuts, which spanned the Early Medieval to Post-medieval periods. This asset correlates with the modern 'Jubilee Scrape'. This asset is of **low** resource value.

Geoarchaeological Interest

Area 2 (CH34) is characterised by a relatively shallow alluvial clay over the surface of the underlying natural gravel and is marginal to a deep channel complex related to former courses of the Seacourt Stream.

Evaluation trenches excavated in the southern part of this area encountered channel deposits associated with the Seacourt Stream.

Historic Buildings

Post Medieval
The only post-medieval asset in the vicinity of this area is the Grade II listed Old Manor House (OA9), on the western periphery of the Scheme, dating to the late 16th to early 17th century. This asset if of **medium** resource value.

Historic Landscape

This historic landscape of Area 2 comprises an area of parliamentary enclosure (HLT3); rural-village (HLT14), industrial (HLT15) and the Seacourt Stream water feature (HLT16).

Area 3 – Willow Walk to Devil's Backbone

Archaeological Remains

Palaeolithic
Palaeolithic implements are recorded to have been found at South Hinksey near the rail line (OA154). These have been removed from the Scheme area and are of **negligible** resource value.

Mesolithic – Neolithic
Neolithic flint tools (OA124) are recorded to have been found at North Hinksey. These have been removed from the Scheme area and are of **negligible** resource value.

Along the lower slopes of Hinksey Hill, close to South Hinksey, evidence of Late Mesolithic or Early Neolithic activity was identified. Within Trench 142 and Trench 144, a mixed assemblage of flint was recovered from colluvial deposits (CH21). The fresh condition of the earlier flint, and the presence of fine chips recovered from sieved samples, suggested that flint working had occurred in the vicinity. However, it was acknowledged that as the finds were recovered from colluvium, and particularly within Trench 144 where prehistoric pottery was also found, they were unlikely to be *in situ*. This asset is of **medium** resource value.

An assemblage of burnt flint (CH12) recovered from a natural feature with Trench 61 was interpreted by the field archaeologists as being related to possible domestic waste that was dumped, or displaced, into a natural hollow. The assemblage was typologically dated to the Late Mesolithic. This asset is of **medium** resource value.

The remainder of the identified Mesolithic and Neolithic evidence comprised small quantities of, mostly residual, worked flint including: flint artefacts recovered from alluvium with Trenches 19, 20 and 22 (CH22); a small assemblage of worked flint recovered from two natural features within Trench 49 (CH8); and a single piece of worked flint recovered from a linear feature identified within Trench 46 (CH8). These assets are of **low** resource value.

Bronze Age
Bronze Age flint tools (OA129) are recorded to have been found at North Hinksey. In addition, an important group of metalwork is recorded to have been recovered from the River Thames near Osney Mead Industrial Estate, to the east of the Scheme, during dredging in the 19th century. This included three late Bronze Age spearheads, a socketed axe and an extremely fine Iron Age dagger sheath with engraved 'Celtic' decoration (OA125). These assets have been removed from the Scheme area and are of **negligible** resource value as there is no evidence that similar items remain on site.

A small number of excavations carried out on sites along the eastern periphery of the Scheme have recorded areas of prehistoric settlement. These include an Early to Middle

Bronze Age settlement site (OA122) located on Osney Mead Industrial Estate and a small Middle Iron Age settlement on a floodplain island at Whitehouse Road (OA638). These assets have been subject to archaeological investigation and will not be affected by the Scheme. As such, they are of **negligible** resource value.

Within Trench 51 an alignment of wooden posts was identified forming a slightly curved line approximately 6m in length (CH10). One of the posts was removed and dated to the Late Bronze Age. This asset is of **medium** resource value.

The remainder of the Bronze Age evidence identified comprised isolated features and unstratified finds including: a pit containing small fragments of pottery and charred hazelnut shells (CH23) within Trench 68; possible Bronze Age pottery and worked flint from Trench 142 (CH21); a possible Bronze Age ditch (CH21) within Trench 146; and a cremation burial (CH9) dated to the Middle Bronze Age within Trench 155. The cremation burial (CH9) is of **medium** resource value. The remainder of these assets are of **low** resource value.

Iron Age

A focus of Iron Age activity was identified to the north of South Hinksey on the lower slopes of Hinksey Hill. Three roundhouse drip gullies were identified within Trench 162 representing at least two phases of Iron Age occupation (CH16). The drip gullies were dated to the Middle to Late Iron Age and represent the only firm evidence of sustained domestic occupation within the Scheme. This asset is of **medium** resource value.

Further Iron Age evidence identified within this area included: pits within Trenches 142 and 149 (CH21) and a pit and ditch in Trench 161 (CH24) and clusters of postholes within Trenches 149 and 151 (CH21). These assets are of **low** resource value.

Investigation of the field immediately north of the proposed main compound in 2020 revealed a continuation of Iron Age activity to the north-west of CH16. A series of ditches, pits and postholes (CH37) identified in Trenches 220, 222 and 226-228 were interpreted to relate to former field boundaries and peripheral agricultural/pastoral activity dating to the Early or Middle Iron Age (Appendix J-8). This asset is of **low** resource value.

Isolated Iron Age pits were also identified within Trench 67 (CH23) and Trench 87 (CH25) and two small abraded pieces of Iron Age pottery recovered from a natural feature within Trench 61 (CH12). These assets are of **low** resource value.

Roman

Although there is no evidence for a Roman town at Oxford, the area was the focus for a major pottery industry, mostly located on the higher ground of Headington/East Oxford some 4.5km to the east of the Scheme. Other Roman activity, primarily small scale agricultural settlement, is known from the central Oxford area.

The Scheme contains areas of previously recorded cropmarks (OA644), interpreted as indicative of settlement activity, and areas of probable ring ditches (OA643 and OA647). The Scheme also contains a second area of cropmarks of possible enclosures (OA642).

Trenches 76 – 81 and 83 were excavated to investigate the settlement cropmarks (OA642). These identified a trackway, within Trenches 77 and 78, and ditches forming a square enclosure within Trenches 77, 79, 80, 81 and 83. No finds were recovered from either feature. However, twigs from the trackway ditch were radiocarbon dated to the middle Roman period leading the field archaeologists to suggest a Roman date for all the features within this area. No evidence of sustained domestic occupation was identified. These assets (CH13) are of **medium** resource value.

Investigation of the field immediately north of the proposed main compound in 2020, to the west of the above noted settlement cropmarks (OA642) revealed evidence of potential Roman domestic activity (CH38). Artefacts recovered from Trenches 224 and

226-228 were interpreted to indicate Roman settlement within or in close proximity to the Scheme. A continuation of the trackway (CH13) was also identified within Trenches 221, 230, 231, 236 and 237. This asset (CH38) is of **low** resource value.

A series of intercutting ditches were identified within Trench 160 (CH15) to the north of South Hinksey. The earliest of these ditches yielded Roman pottery. Further Roman pottery was also recovered from a colluvium deposit within Trench 142 (CH21). These assets are of **low** resource value.

Saxon – Medieval

A possible alignment for the route of the medieval western approach to Oxford was suggested to run through the Scheme (OA119). The identified alignment followed an existing footpath/causeway ('North Hinksey Causeway') running east-west across the line of the proposed channel.

The North Hinksey Causeway (OA119) lies between the modern village of North Hinksey and Osney Mead and formed part of the route from the Botley Road to Ferry Hinksey. The line of the North Hinksey Causeway was suggested to have followed part of a Roman road, possibly as part of the line between North Hinksey and Besels Leigh. There was also suggestion that the North Hinksey Causeway (OA119) may have been part of the western approach road to Oxford during the medieval period. People travelling west from Oxford may have crossed the river at Ferry Hinksey (the previous name of North Hinksey). This suggestion was based on two 14th century documents, one of which, a 1352 charter, details a property grant of a tract of land south of the meadow of the Prioress and Convent of Studley, where a ford, called Oxenforde, and a bridge could be crossed on the way to North Hinksey. The presence of a ferryman at the crossing of the Hinksey Stream is mentioned in several medieval documents and the presence of the ferry into the mid-19th century can be seen on the 1878 Ordnance Survey map. John Leland described reaching Ferry Hinksey by crossing a causeway from Osney in the first half of the 16th century. Other sources suggest that the main route for heavy traffic from Oxford to the south side of the River Thames crossed over the Grandpont.

Trench 25 was excavated across the line of the North Hinksey Causeway (OA119) to determine its date and value. The trench revealed the causeway to be of post-medieval date and therefore could not be part of an earlier Roman road, or the medieval western approach to Oxford. This asset is of **low** resource value.

However, to the north of North Hinksey Causeway (OA119), two concentrations of compacted limestone pebbles, identified within Trenches 19 and 20 (CH26), were interpreted as possible medieval causeways. Horseshoes dating to the medieval period were recovered from the surface of the deposit found within Trench 19 and from alluvial clay above the deposit within Trench 20. However, the exact nature of these deposits remains unproven. These assets are of **medium** resource value.

Further concentrations of stone (CH27), identified within Trench 113, were interpreted by the excavators as pads that may have supported a structure. A horseshoe dating to the medieval/post-medieval period was recovered from the surface of one of the deposits. This asset is of **low** resource value.

Two undated causeways were also identified within Trench 64 (CH28) and Trench 98 (CH29). Both features consisted of stone pressed into the underlying alluvium and were suggested by the excavators to represent *ad hoc* bridging of wet ground between gravel islands. A stake found within peat sealed beneath the alluvium into which the causeway (CH28) in Trench 64 had been pressed indicates that this feature is likely to be of medieval or later date. These assets are of **low** resource value.

Two Saxon iron spearheads and a bone draughtsman are recorded to have been found close to the Minster Ditch at the edge of Osney Mead (OA130), possibly indicating the

location of an early crossing point. These finds have been removed from the Scheme area and are of **negligible** resource value.

To the east of Minster Ditch, on the eastern periphery of the Scheme, lies the modern Abingdon Road, forming the main southern approach to Oxford and first mentioned by name in 911-912. Oxford developed as a fortified settlement around the turn of the 10th century and is recorded as such in the Burghal Hidage, an Anglo-Saxon document detailing fortified places (burhs or burgs). There is increasing evidence that Oxford was developed to guard the strategic crossing of the River Thames on the boundary between Wessex and Mercia. The area known as Grandpont to the south of the historic centre of Oxford is named after the Magnum Pons (Great Bridge), of which a fragment remains, protected as a Scheduled Monument (OA1). The first documentary evidence for the existence of a stone built causeway on the southern approach to the city occurs in the 12th century charters of Abingdon Abbey. However, recent excavations in St Aldates have shown that this monumental structure was the successor to several phases of man-made causeways and crossing points, which had begun to be constructed along the modern-day line of Abingdon Road and St Aldates at least as early as the 9th century.

The area to the east of South Hinksey is noted to contain evidence of ridge and furrow cultivation (OA646 and OA647). These assets are of **low** resource value.

Post-Medieval
Willow Walk (CH7) is a causeway that crosses the Scheme from North Hinksey to the Osney Mead and dates from the Victorian period. This asset is of **low** resource value.

Ruskin's Walk (CH32) was a road which lay between the villages of North Hinksey and South Hinksey and which was developed by John Ruskin, the leading art critic of the Victoria period, and some of his students and contemporaries, including Oscar Wilde. The project was abandoned after Ruskin suffered a personal tragedy. Ruskin's workforce appears to have followed the line of the 18th century road which may have been visible, if not in use, at the time. The current trackway abruptly ends in a field on its way to South Hinksey. This asset is of **low** resource value.

Undated
Trench 53 was extended to cut across an earthwork feature identified at its south-east end from the available Light Detection and Ranging (LiDAR) data. The trench section revealed two ditches cutting through alluvial deposits and into earlier ditches (CH11). This asset is of **low** resource value.

Various undated features were identified by the archaeological evaluation (CH14, CH17 and CH18). These assets are of **negligible** resource value. Further detail on these is provided in Appendix J-6.

Geoarchaeological Interest
The geoarchaeological interest of Area 3 (CH35) is complex and is summarised below by the zones identified within Appendix J-6.

Zone V (Bulstake Stream) is characterised by a complex underlying topography associated with waterside edge environments, meandering channels and drier areas where the surface of the natural gravel is relatively high beneath a shallow alluvial clay. Deep alluvial sequences of more than 1m were encountered in several of the evaluation trenches in this area. An Early Bronze Age date was obtained from peat recovered from a channel in Trench 24. This sequence was cut by a later channel containing organic deposits dated to the Middle Iron Age. Further peat dating to the Early Bronze Age was also identified within Trench 29.

Zone VI (The Long Meadow) is characterised by a deep complex channel system associated with the Seacourt-Hinksey Stream. The surface of the natural gravel is low-

lying throughout this Zone and was not generally exposed during the evaluation trenching,

Zone VII (South Hinksey) is characterised by relatively high elevations in the surface of the natural gravel. The thickness of deposits overlying the gravel ranges from approximately 0.40m to 0.80m, increasing locally to approximately 1.20m, particularly in the northern part of the zone approaching the Hinksey Stream. A peaty silt identified within Trench 72 yielded an Early Medieval radiocarbon date. This deposit was sealed by a sequence of alluvial clay.

Zone VIII (The Devil's Backbone) is characterised by increased thicknesses of alluvial clay compared to Zone VII, and a corresponding drop in the elevation of the underlying natural gravel. A peat deposit and piece of chopped branchwood recovered from Trench 127 were radiocarbon dated to the Early-Medieval period.

Zone XI (Lower Slopes of Hinksey Hill) deposits within this zone were dominated by colluvial ploughwash. The absence of bedding within the colluvium was suggested to indicate that it had built-up over a considerable time.

Historic Buildings

Saxon – Medieval
North and South Hinksey are recorded jointly as Hengestesie' ('Hengest's Island' or the 'Island of the Stallion') in late Saxon charters, and as separate places from the 13th century. Both villages lie on the slightly higher ground on the western periphery of the Scheme. Both contain medieval churches dedicated to St Lawrence. The Grade II* listed church at North Hinksey (OA3) is early 12th century with a 13th century tower. The churchyard also contains a Grade II* listed medieval churchyard cross (OA4). These assets are of **high** resource value. The Grade II* church at South Hinksey (OA5) is early to mid-13th century. This asset is of **high** resource value.

Post-Medieval
A cluster of nine Grade II Listed Buildings located within the North Hinksey Conservation Area to the west of the Scheme (OA10 – OA18) predominantly comprise 17th and 18th century cottages and farmhouses within the historic core of North Hinksey and are of **medium** resource value. The Scheduled Monument and Grade II* Listed Building North Hinksey Conduit House (OA300) is located on the north-east facing slope of Harcourt Hill to the west of the Scheme. This asset was built during the 17th century and represents one of the last surviving elements of a system for providing clean water to Oxford via Carfax Conduit. This asset is of **high** resource value. A group of nine Grade II Listed Buildings within South Hinksey (OA7, OA21-OA27 and CH2) to the west of the Scheme again mostly comprise 17th and 18th century dwellings within the historic core of South Hinksey and are of **medium** resource value. The Grade II listed Hinksey Hill Farm (OA301) and Grade II listed Hinksey Hill Farm Barn (OA302), located on Harcourt Hill to the west of the Scheme both date to the late 18th century and are of **medium** resource value.

Further designated assets are also noted within the Central (University and City) Conservation Area to the north-east of the Scheme. This asset encompasses the historic centre of Oxford which forms one of the masterpieces of European architectural heritage.

The Grade II Old Whitehouse Public House (CH3) is also recorded within the Grandpont area, to the east of the Scheme, and dates to the 19th century. This asset is of **medium** resource value.

Historic Landscape

This historic landscape of Area 3 comprises: an area of parliamentary enclosure (HLT3) and an area within civic use (HLT6) in the north; and an area of piecemeal enclosure (HLT7) to the east of North Hinksey; areas of prairie/amalgamated enclosure (HLT8) to

the south of the Osney Mead Industrial Estate and to the north of South Hinksey; an area of piecemeal enclosure (HLT7) surrounding South Hinksey itself; rural-village (HLT14); industrial (HLT15); the Hinksey Stream and Bulstake Stream water features (HLT16); and a major road junction (HLT17). The designated Raleigh Park and Boars Hill view cones cross this area.

Two hedgerows were identified within this area that may be considered important under the Hedgerows Regulations (1997). These hedgerows are located to the north-west of South Hinksey and are of **low** resource value.

Area 4 – Devil's Backbone to the junction with Hinksey Stream

Archaeological Remains

Palaeolithic
A large collection of Palaeolithic hand-axes was recovered from a gravel pit near New Iffley Lane to the west of Donnington Bridge (OA163). Further hand-axes are recorded from New Hinksey (OA171 and OA172). These assets have been removed from the Scheme area and are of **low** resource value.

Iron Age
Residual Iron Age pottery was recovered from a natural feature (CH30) identified within Trench 198. This asset is of **negligible** resource value.

Roman
Roman assets recorded within this area include: an inhumation burial at South Hinksey (OA169); a quernstone (OA162); and pottery (OA161, OA167 and OA179). These assets have been removed from the Scheme area and are of **negligible** resource value.

Saxon – Medieval
The Scheme crosses the line of the Devil's Backbone (OA170), a possible medieval causeway (now followed by a metalled track and footpath) running across the floodplain between South Hinksey and Oxford. This asset is of **medium** resource value.

The southern end of the Scheme crosses the Old Abingdon Road, which forms the southern end of the Grandpont Causeway, at the point at which the line of the road diverts to run roughly east-west to cross the originally braided streams of the Hinksey Stream.

The presence and survival of Norman and medieval culvert structures on Old Abingdon Road was demonstrated by a programme of archaeological recording and prospection carried out in 2006-7 and they were further investigated during a programme of archaeological recording during road repair works in 2008-9 (OA2). The culverts were scheduled in October 2012.

This Scheduled Monument (OA2) comprises six discreet scheduled areas identified from west to east as: Stanford Bridge Culverts, comprising two scheduled areas on either side of the Stamford Bridge; Redbridge Culvert 1 (West Culvert); Redbridge Culvert 2 (East Culvert); Mayweed Bridge Culverts, again comprising two culverts to the east of the main bridge unit but scheduled as one area; and the Mayweed Lesser Culvert. This asset is of **high** resource value.

The immediate setting of this asset predominantly comprises the route of the Old Abingdon Road. The road is oriented north-east to south-west and is bounded to the north by a traveller site at Red Bridge Hollow, a railway access road and low-lying ground forming part of the Scheme; to the east by the Abingdon Road and the Redbridge Park and Ride; and to the south and west by further low-lying ground forming part of the Scheme, the Kennington Road and the A423 southern by-pass road. The Old Abingdon

Road rises to pass over the Hinksey Stream and railway is bounded at its western end by dense vegetation and security fencing. The central Stamford Bridge part of the road passes over the low-lying area of the Scheme and allows for views of the floodplain, albeit these are framed by large electricity pylons. The eastern limit of the road passes over the railway, adjacent compounds and Hinksey Stream before joining Abingdon Road. The eastern limit of the road is again bounded by modern development and vegetation. Given the nature of the asset, there are no clear views of the culverts when traversing the Old Abingdon Road, nor are there any information boards to alert passers-by to their presence. As such the experience of this asset is limited. However, it is acknowledged that the historic alignment of the Old Abingdon Road and low-lying floodplain and associated channels of the Hinksey Stream allow for an appreciation of the historical value and functional relationship of the road and the asset. However, the low-lying floodplain setting, associated channels of the Hinksey Stream and the route of the Old Abingdon Road are considered to make a small positive contribution to the value of this asset, providing its historical and functional setting.

Further evaluation of the Old Abingdon Road was undertaken as part of the Scheme (Appendix J-5). The works revealed evidence for the truncated remains of 13th – 14th century medieval road surfaces. It also identified an associated, although earlier, roadside ditch, post-medieval road surfaces, plus the remains of a stone structure, which was probably a bridge/culvert abutment of medieval or post-medieval date. The evidence identified during the evaluation could be considered of equivalent resource value to the adjacent Scheduled Monument.

Towles Mill Sluice (OA614) lies adjacent to the site of a medieval mill variously documented as Langford Mill, Hinksey Mill, New Hinksey Mill and Towles Mill. Historic mapping dating from the 18th century onwards records the evolution of the mill with various ancillary buildings depicted including the presumed miller's residence located on the west bank of the Hinksey Stream. The mill ceased production in the early 20th century and was largely demolished by the mid-20th century. The only standing remains of the mill complex are ashlar stone retaining walls along the course of the main Hinksey Stream channel.

During December 2006 and March 2007, a programme of archaeological investigation was undertaken on the site of the mill during the remodelling of the flood by-pass channel (Oxford Archaeology 2007). The excavation revealed medieval alluvial deposits and vestigial remains of the mill dating to the 19th century. A subsequent watching brief on the site identified timber revetments at the mouth of the by-pass channel that were dated to the 15th century. A stone revetment and wheel pit dating to the 19th century were also recorded. This asset is of local historical and archaeological interest and is of **low** resource value.

The only other medieval assets within this area comprise extant ridge and furrow earthworks (CH19) at New Hinksey. While a number of trenches were excavated across these earthworks, no dating evidence was recovered. This asset is of **low** resource value.

Post-Medieval

Post-medieval artefacts were identified within a natural feature (CH31) within Trench 201 at New Hinksey. This asset is of **negligible** resource value.

Undated

Undated ditches were also identified within this area in Trenches 133, 139 and 141 (CH18). These assets are of **negligible** resource value.

Geoarchaeological Interest

To the north of the Old Abingdon Road, Area 4 (CH36) was characterised by thinner deposits of alluvial clay over the natural gravel.

At New Hinksey, near Eastwyke Farm (CH5), a thin alluvial clay was identified over the natural gravel. To the south of this, thicker deposits of alluvial clay were encountered adjacent to the channel of the River Thames. Basal channel deposits from this area yielded Middle to Late Iron Age radiocarbon dates.

Historic Buildings

Post-Medieval
Historic buildings dating from the post-medieval period comprise a number of Grade II Listed Buildings on the periphery of the Scheme including: Eastwyke Farmhouse (CH5), an early 17th century farmhouse, and an 18th century Stone on the Thames Tow Path at Long Bridges (OA19) within New Hinksey; an undated milestone (CH6), the Church of St John the Evangelist (OA31) dating to the turn of the 20th century, and associated New Hinksey Vicarage (OA20) along Abingdon Road; and the Grade II Roving Bridge upstream from Iffley Lock (OA28) to the south-east of the Scheme. These assets are of **medium** resource value.

Historic Landscape

The historic landscape of Area 4 comprises: enclosure pre 18th century irregular (HLT1); transport / infrastructure / links (HLT2); parliamentary enclosure (HLT3); allotments (HLT4); settlement post 1800 (HLT5); hospitals, schools and universities (HLT6); piecemeal enclosure (HLT7); an area of enclosed meadows (HLT9) and an area of post-parliamentary enclosure (HLT10) at New Hinksey; an area of piecemeal enclosure (HLT7) surrounding South Hinksey; an area of reorganised enclosure (HLT11) to the north of the A423; an area characterised as modern civil provision (HLT12) to the north-east of the A423; an area of unenclosed land to the south of the A423 (HLT13); a very small area characterised as a modern rural settlement (HLT14) at the southern extent of the Scheme; the Thames water feature (HLT16; communication – main road (HLT18); Weir Mill Stream (HLT19); the railway (HLT20); communication – car parks (HLT21) and caravan parks (HLT22). The designated A34 Interchange and Rose Hill view cones cross this area.

Three hedgerows were identified to the south-east of South Hinksey that may be considered important under the Hedgerows Regulations (1997). These assets are of **low** resource value.

View Cones

There are a number of view cones within Oxford which are designated through the Local Plan in order to protect the skyline of Oxford and the characteristics of the view cones. The “dreaming spires” of Oxford are a symbol of the City and the 10 Oxford View Cones are places from which Oxford can be appreciated. Four of these view cones were scoped into this assessment – Raleigh Park; Boars Hill; A34 Interchange; Rose Hill.

10.1.2 Changes to cultural heritage in absence of Scheme

The future baseline for cultural heritage is very much dependent on the actions of others to conserve and manage cultural heritage assets (both designated and non-designated). Current policies and laws are likely to continue to require the conservation and enhancement of cultural heritage assets. However, in the absence of action to maintain them or keep them in active use, the condition of cultural heritage assets will deteriorate.

Climate change will impact cultural heritage assets. Predicted climate extremes may affect both known and unknown cultural heritage assets (such as buried archaeological remains and deposits of palaeoenvironmental or geological interest). Prolonged dry periods, intense storms and wetter winters will affect cultural heritage assets in different ways. Changes in groundwater, for example, may affect waterlogged archaeological and palaeoenvironmental remains. A higher risk of flooding is more likely to cause

damage to historic buildings. Increased rainfall will cause rivers to flow faster in certain times of the year. Higher erosion rates may expose archaeological features or damage designated historic buildings.

10.2 Likely significant effects

Cultural heritage assets that will be affected by the Scheme, either during construction or operation, are identified below. Where no impact on an asset has been identified, or where the asset has been removed from the Scheme, such as previous finds, no further discussion of the asset is provided.

10.2.1 During construction

Potential impacts arising from construction include:

- Removal of archaeological remains during construction works for the Scheme, predominantly within the footprint of the channel but also including areas of temporary land-take such as construction compounds;
- Compression of archaeological remains (including deposits of geoarchaeological interest) resulting from plant movements or soil storage;
- Changes in groundwater conditions leading to dewatering and associated degradation of archaeological remains (including deposits of geoarchaeological interest);
- Temporary changes to historic landscape integrity; and
- Temporary impacts on the setting of cultural heritage assets resulting from construction compounds, the visual presence of construction machinery and activities and associated noise, dust and vibration.

Archaeological remains

Impacts on archaeological remains during construction are shown in Table 10.2 and range from **neutral/slight adverse** to **moderate/large adverse**.

Table 10.2: Construction Phase Impacts on Archaeological Remains

Asset	Sub-area	Description of Potential Impact	Sensitivity	Magnitude of Impact	Significance of Effect
CH4 Former county boundary incl Jubilee Scrape	Area 1 – North of Botley Road	Partial removal during construction of the channel	Low	Moderate	Slight adverse
CH20 Natural feature	Area 1 – North of Botley Road	Removal during construction	Negligible	Major	Slight adverse
CH33 Geoarchaeology Area 1	Area 1 – North of Botley Road	Partial removal during construction. Although channel deposits dating to the Mesolithic period have been identified below the depths of the design impact, the channel complex is complicated and it is probable that Mesolithic deposits are present at shallower depths. Some Bronze Age and Iron Age palaeochannel evidence is likely to be present within	Low	Minor	Slight adverse

Asset	Sub-area	Description of Potential Impact	Sensitivity	Magnitude of Impact	Significance of Effect
		impact depths. There is a reduction predicted on groundwater levels of 0.05-0.1m (ESI 2018) which should not have a significant impact on the archaeological deposits.			
OA605 Botley	Area 2 – Botley Road to Willow Walk	Partial removal during construction of the channel if mill remains survive	Low	Moderate	Slight adverse
CH34 Geoarchaeology Area 2	Area 2 – Botley Road to Willow Walk	Partial removal during construction. Although channel deposits dating to the Mesolithic period have been identified below the depths of the design impact, the channel complex is complicated and it is probable that Mesolithic deposits are present at shallower depths. Some Bronze Age palaeochannel evidence is likely to be present within impact depths. Palaeochannel deposits dated to the Saxon and Medieval periods were identified within impact depth. There is a reduction predicted on groundwater levels of 0.05-0.3m (ESI 2018), which should not have a significant impact on the archaeological deposits	Low	Minor	Slight adverse
CH7 Willow Walk	Area 3 – Willow Walk to Devil's Backbone	Changes to current routeway including newly designed Willow Walk Bridge and the removal of some trees	Low	Moderate	Slight adverse
CH26 Causeway	Area 3 – Willow Walk to Devil's Backbone	Partial removal during construction of the channel and during topsoil stripping for temporary construction compound	Medium	Moderate	Moderate adverse
OA119 Hinksey Causeway	Area 3 – Willow Walk to Devil's Backbone	Partial removal during construction of the channel	Low	Moderate	Slight adverse
CH8 Undated linear features	Area 3 – Willow Walk to Devil's Backbone	Partial removal during construction of the channel	Low	Moderate	Slight adverse

Asset	Sub-area	Description of Potential Impact	Sensitivity	Magnitude of Impact	Significance of Effect
CH9 Cremation burial	Area 3 – Willow Walk to Devil's Backbone	Potential removal during topsoil stripping for compound if there are more burials	Medium	Major	Large adverse
CH10 In situ prehistoric post alignment	Area 3 – Willow Walk to Devil's Backbone	Partial/complete removal during construction of the channel	Medium	Moderate	Moderate adverse
CH11 LiDAR feature comprising two post-medieval ditches	Area 3 – Willow Walk to Devil's Backbone	Partial removal during construction of the channel	Low	Moderate	Slight adverse
CH12 Cut features and worked flint assemblage	Area 3 – Willow Walk to Devil's Backbone	Partial/complete removal during construction of the channel	Medium	Moderate	Slight adverse
CH13 Undated trackway and square enclosure	Area 3 – Willow Walk to Devil's Backbone	Partial/complete removal during construction of the channel	Medium	Major	Large adverse
CH14 Undated ditches and pits.	Area 3 – Willow Walk to Devil's Backbone	Partial/complete removal during construction of the channel	Negligible	Moderate	Slight adverse
CH21 Prehistoric activity area	Area 3 – Willow Walk to Devil's Backbone	Potential compression due to soil storage	Medium	Minor	Slight adverse
CH22 Flint assemblage	Area 3 – Willow Walk to Devil's Backbone	Removal during construction of the channel and during topsoil stripping for temporary construction compound	Low	Major	Slight adverse
CH23 Prehistoric pits	Area 3 – Willow Walk to Devil's Backbone	Removal during construction of the channel	Low	Major	Moderate adverse
CH24 Prehistoric pit	Area 3 – Willow Walk to Devil's Backbone	Removal during topsoil stripping for temporary construction compound	Low	Major	Slight adverse
CH25 Prehistoric pit	Area 3 – Willow Walk to Devil's Backbone	Removal during construction of the channel	Low	Major	Slight adverse
CH28 Causeway	Area 3 – Willow Walk to Devil's Backbone	Partial/complete removal during construction of the channel	Low	Moderate	Slight adverse

Asset	Sub-area	Description of Potential Impact	Sensitivity	Magnitude of Impact	Significance of Effect
CH29 Causeway	Area 3 – Willow Walk to Devil's Backbone	Partial/complete removal during construction of the channel	Low	Moderate	Slight adverse
CH27 Stone concentrations	Area 3 – Willow Walk to Devil's Backbone	Partial/complete removal during construction of the channel	Low	Moderate	Slight adverse
CH15 Geophysical anomaly – intercutting ditches	Area 3 – Willow Walk to Devil's Backbone	Partial removal during topsoil stripping for temporary construction compounds	Low	Minor	Neutral/Slight
CH16 Prehistoric occupation	Area 3 – Willow Walk to Devil's Backbone	Removal during topsoil stripping for temporary construction compounds	Medium	Major	Large adverse
CH17 Undated ditches and pits	Area 3 – Willow Walk to Devil's Backbone	Partial removal during topsoil stripping for temporary construction compounds Compression of deposits from spoil storage	Low	Moderate	Slight adverse
CH35 Geoarchaeology Area 3	Area 3 – Willow Walk to Devil's Backbone	Partial removal during construction. Although channel deposits dating to the Mesolithic period have been identified below the depths of the design impact, the channel complex is complicated and it is probable that Mesolithic deposits are present at shallower depths. Some Bronze Age palaeochannel evidence is likely to be present within impact depths. Palaeochannel deposits dated to the Iron Age, Saxon and Medieval periods were identified within impact depth. There is a reduction predicted on groundwater levels of 0.05-0.1m (ESI 2018) which should not have a significant impact on the archaeological deposits	Low	Minor	Slight adverse
CH18 Undated ditches and pits	Area 4 – Devil's Backbone to the junction	Partial/complete removal during construction of the channel	Negligible	Moderate	Neutral/Slight adverse

Asset	Sub-area	Description of Potential Impact	Sensitivity	Magnitude of Impact	Significance of Effect
	with Hinksey Stream				
OA170 Line of the Devil's Backbone	Area 4 – Devil's Backbone to the junction with Hinksey Stream	Partial removal during construction of the channel	Medium	Moderate	Moderate adverse
OA2 Old Abingdon Road Culverts	Area 4 – Devil's Backbone to the junction with Hinksey Stream	Temporary impact on the setting of the asset due to construction machinery and noise	High	Minor	Slight adverse
OA2 Old Abingdon Road Culverts	Area 4 – Devil's Backbone to the junction with Hinksey Stream	Partial removal of the unscheduled areas adjacent to the Old Abingdon Road culverts during construction. Impact unavoidable due to infrastructure constraints (A34 and railway line) and minimum size required for correct movement of water.	High	Major	Large adverse
OA614 Towles Mill Sluice	Area 4 – Devil's Backbone to the junction with Hinksey Stream	Modification of the left bank of the Hinksey Stream could impact on further vestigial elements of this asset due to partial removal.	Low	Moderate	Slight adverse
CH19 Extant ridge and furrow earthworks at New Hinksey	Area 4 – Devil's Backbone to the junction with Hinksey Stream	Partial removal during construction of new flood defences	Low	Moderate	Slight adverse
CH30 Natural feature with Iron Age pottery	Area 4 – Devil's Backbone to the junction with Hinksey Stream	Removal during construction of new flood defences	Negligible	Major	Slight adverse
CH31 Natural feature with post medieval pottery	Area 4 – Devil's Backbone to the junction with Hinksey Stream	Removal during construction of new flood defences	Negligible	Major	Slight adverse
CH36 Geoarchaeology Area 4	Area 4 – Devil's Backbone to the junction with Hinksey Stream	Partial removal during construction. Some Bronze Age palaeochannel evidence is likely to be present within impact depths. There is a	Low	Minor	Slight adverse

Asset	Sub-area	Description of Potential Impact	Sensitivity	Magnitude of Impact	Significance of Effect
		reduction predicted on groundwater levels of 0.1-0.4m (ESI 2018), which will have an impact on the archaeological deposits.			

Historic buildings

There will be a temporary impact on the Grade II 21 and 23 Manor Road (OA23), Grade II Horseshoe House (OA25) and Grade II Hill House and Myrtle Cottage (OA26) within South Hinksey due to the presence of a proposed compound to the north-west of the village and the presence of construction machinery, noise, dust and vibration. The magnitude of impact will be minor adverse and the significance of effect will be **slight adverse** (based on a medium value receptor).

A small part of the North Hinksey Conservation Area (OA33) overlaps with Area 3. Works within the Conservation Area will be limited to the construction of a new weir structure. The magnitude of impact will be negligible and the significance of effect will be **no significant impact**.

No other physical impacts or impacts on the setting of any built heritage assets are anticipated as a result of the construction of the Scheme.

Historic landscape

There will be an impact on historic landscapes which may have existed since the medieval period, consisting of pre-18th century irregular enclosure (HLT1), meadows (HLT9), unenclosed – rough ground (HLT13), due to partial removal as a result of the Scheme although there will be no severance of the landscapes and they will still be understood. The magnitude of impact will be minor adverse and the significance of effect will be **slight adverse.**

There will be an impact on historic landscapes which may have existed since the post medieval period, consisting of parliamentary enclosure (HLT3), settlement post 1180 (HLT5), piecemeal enclosure (HLT7) prairie / amalgamated enclosure (HLT8) and subsequent parliamentary enclosure (HLT10). (HLT1), meadows (HLT9), unenclosed – rough ground (HLT13), due to partial removal as a result of the Scheme although there will be no severance of the landscapes and they will still be understood. The magnitude of impact will be minor adverse and the significance of effect will be **slight adverse.**

There will be an impact on historic landscapes from the modern period, consisting of allotments (HLT4), hospitals, schools and universities (the grounds of St. Ebbe's CE Primary School, (HLT6), reorganised enclosures (HLT11), and industrial (HLT15), communication – major road junction (HLT17) due to partial removal as a result of the Scheme although there will be no severance of the landscapes and they will still be understood. The magnitude of impact will be minor adverse and the significance of effect will be **neutral.**

There will be a temporary impact on historic landscapes from the modern period, consisting of transport infrastructure / link (HLT2), civil provision – park and ride (HLT12), communication – major road junction (HLT17), communication – main road (HLT18), communication – rail transport sites (HLT20), communication - car park (HLT21) and caravan parks (HLT22) due to access roads, compounds and construction traffic as a result of the Scheme although there will be no severance of the landscapes and they will

still be understood. The magnitude of impact will be neutral adverse and the significance of effect will be **no change.**

There will be an impact on water feature (HLT16) as the Hinksey Stream and the Bulstake Stream will be severed and will feed into the new channel as part of the new water system. However, their alignment will not be changed and their historical routes will still be understood. The magnitude of impact will be major adverse and the significance of effect will be **large adverse.**

There will be a temporary impact on rural village (HLT14), due to some new access roads and temporary working areas. However, these are on the fringes of the settlements at Botley, South Hinksey and Kennington along the historical routes into the City of Oxford. The magnitude of impact will be minor adverse and the significance of effect will be **slight adverse.**

There will be a temporary impact on the setting of the River Thames (water – river; HLT19), due to the introduction of new access roads, compounds and temporary working areas into its landscape. However, the surrounding landscape of the River Thames in the area of the Scheme is already modernised on the fringes of the City. The magnitude of impact will be neutral and the significance of effect will be **no change**.

A single north-east to south-west oriented hedgerow to the north of South Hinksey, that may be considered important under the Hedgerows Regulations (1997), will be impacted within Area 3. Two additional 'important' hedgerows under the Hedgerows Regulation (1997) will be impacted by the proposed new flood defences to the south-east of South Hinksey. The magnitude of impact will be minor adverse and the significance of effect will be **slight adverse**.

10.2.2 During operation

Archaeological remains

The Scheme will result in physical alteration to the setting of the Old Abingdon Road Culverts (OA2) through the introduction of a new channel feature and two bridges. The magnitude of impact will be minor and the significance of effect will be **moderate adverse**.

Upon completion of the Scheme, information boards will be installed at the Old Abingdon Roads Culverts (OA2) explaining their significance. Based on feedback from public exhibitions, the preferred design for these boards is sketch style illustrations with explanatory text. There will also be active public participation and public engagement through the media, online social media and flyers. The significance of this effect is considered to be **slight beneficial,** based on a high value receptor and a negligible to minor magnitude.

Historic buildings

North Hinksey

The following Listed Buildings within North Hinksey share some limited intervisibility with Area 3: 22 North Hinksey Village (OA16); 26 North Hinksey Village (OA17); and 27 North Hinksey Village (OA18). The Scheme will result in a slight visual alteration to the wider settings of these assets through the introduction of a new channel within views from these assets to the north-east. The magnitude of impact will be negligible and the significance of effect will be **neutral.**

The remainder of the Listed Buildings within North Hinksey, including the Grade II* Well House (OA300), will be screened from the Scheme by intervening buildings and vegetation. Consequently, it is considered there will be no direct impacts to these assets through changes to their wider settings. The magnitude of impact will be no change and the significance of effect will be **neutral**.

The Scheme will result in a visual alteration to the historic floodplain setting of the North Hinksey Conservation Area (OA33) through the introduction of a new channel which will further reinforce the island nature of the settlement due to its scale and physical proximity to the asset, particularly given the presence of the A34 to the south-west. The magnitude of impact will be minor adverse and the significance of effect will be **slight adverse**.

South Hinksey

The following Listed Buildings within South Hinksey share some limited intervisibility with Areas 3 and 4: 44 Manor Road (OA21); 32 Manor Road (OA22); and the Church of St Lawrence (OA5). The Scheme will result in a slight visual alteration to the wider settings of these assets through the introduction of permanent flood defences and a new channel within views to/from these assets. The magnitude of impact will be minor adverse (assets OA21 and OA22) and negligible (asset OA5) respectively. The significance of effect will be **slight adverse**.

The Scheme will provide additional flood protection to the Listed Buildings within South Hinksey. The magnitude of impact will be moderate beneficial and the significance of effect will be **moderate beneficial**.

Grandpont

No adverse physical impacts or impacts on the setting of any built heritage assets were predicted as a result of the operation of the Scheme.

The Scheme will provide additional flood protection to the Listed Buildings within Grandpont. The magnitude of impact will be moderate beneficial and the significance of effect will be **moderate beneficial**.

Hinksey Hill Farm

The Scheme will alter the wider landscape setting of Hinksey Hill Farmhouse (OA301) and the associated Hinksey Hill Farm Barn (OA302) which enjoy extensive views across Areas 3 towards Grandpont and Oxford. The Scheme will result in a visual alteration to the wider settings of these assets through the introduction of a new channel within views to/from these assets. The magnitude of impact will be minor adverse and the significance of effect will be **slight adverse**.

New Hinksey

The following Listed Buildings within New Hinksey share some limited intervisibility with Area 4: Eastwyke Farmhouse (CH5). The Scheme will result in a visual alteration to the wider setting of this asset through the introduction of new flood defences structures, both flood walls and embankments. The magnitude of impact will be minor adverse and the significance of effect will be **slight adverse**.

The Scheme will provide additional flood protection to the Listed Buildings within New Hinksey. The magnitude of impact will be moderate beneficial and the significance of effect will be **moderate beneficial**.

Abingdon Road

The Scheme will alter the wider landscape setting of the Church of St John the Evangelist (OA31) through the introduction of new channel within views towards the roof and bell tower from Areas 3 and 4. The magnitude of impact will be negligible and the significance of effect will be **neutral/slight adverse**.

The Scheme will provide additional flood protection to the Listed Buildings along Abingdon Road. The magnitude of impact will be moderate beneficial and the significance of effect will be **moderate beneficial**.

Iffley Lock

A small portion of the Iffley Conservation Area (OA34) overlaps with the eastern limit of the wider study area. Given the distance between the Scheme and the Conservation Area, the locations of the proposed works, and the lack of intervisibility between the two, there will be no impact on this asset. The magnitude of impact will be no change and the significance of effect will be **neutral**.

The Scheme will provide additional flood protection to this asset. The magnitude of impact will be moderate beneficial and the significance of effect will be **moderate beneficial.**

Historic landscape

There are no permanent impacts predicted on the historic landscape during operation of the Scheme as all planting and landscape mitigation will be matured in 15 years (see Chapter 7 'Landscape and Visual Amenity').

Raleigh Park

There are no views of the Scheme within the Raleigh Park view cone due to intervening vegetation along its north-eastern boundary bordering the A34. There will be glimpsed views of the Scheme from within Raleigh Park and the loss of mature trees will be evident. The magnitude of impact will be minor and the significance of effect will be **neutral/slight**.

Boars Hill

The Scheme is not visible within the designated Boars Hill view cone when viewed from the origin of the view cone. Similarly, from within the central area of the view cone, the Scheme is screened by the prevailing topography and intervening vegetation. There will be no change to this view from the upper reaches of Boars Hill. The magnitude of impact will be no change and the significance of effect will be **neutral**.

A34 Interchange

The Scheme is currently screened from the A34 Interchange view cone due to the dense vegetation present along the road. There will be no change to this view if the current level of vegetation remains. The magnitude of impact will be no change and the significance of effect will be **neutral**.

Rose Hill

There are no views of the Scheme from the Rose Hill view cone due to dense vegetation. There will be no change to this view if the current level of vegetation remains. The magnitude of impact will be no change and the significance of effect will be **neutral**.

10.3 Mitigation

Mitigation proposals to be implemented for individual cultural heritage assets are detailed in Table 10.3. Discussion of these proposals is provided in the following paragraphs.

Mitigation will be undertaken in accordance with national standards and guidance including but not limited to:

- Code of Conduct of the Chartered Institute for Archaeologists (CIfA 2019)
- Standard and guidance for archaeological field evaluation (CIfA 2020a);
- Standard and guidance for an archaeological watching brief (CIfA 2020b);
- Standard and guidance for archaeological excavation (CIfA 2020c);
- Understanding the Archaeology of Landscapes: A guide to good recording practice (Historic England 2017); and
- Preserving Archaeological Remains (Historic England 2016).

Archaeological remains

Mitigation works for the archaeological remains within the footprint of the Scheme will include:

- Archaeological excavation in advance of and during works adjacent to the scheduled OAR Norman and medieval culverts (OA2);
- A watching brief at the site of Botley Mill (OA605);
- Evaluation by archaeological trial trenching within the MG4a grassland (within the Scheme area only);
- Targeted areas of Strip, Map and Sample (SMS) excavation along the line of the proposed channel, for example assets OA1904, OA2006 and CH13;
- Preservation in situ of archaeological assets if possible (in particular, within temporary construction compounds, for example assets CH15, CH16, CH17, CH37 and CH38);
- A watching brief during the widening of the Hinksey Stream at the site of Towles Mill Sluice (OA614); and
- Publication and archiving of the archaeological investigations.

All mitigation in respect of archaeological remains will be agreed with the relevant Local Authority Archaeological Advisor in an approved Written Scheme of Investigation prepared by a suitably qualified and experienced archaeological organisation. This will include provision for the post-excavation analysis, publication, archiving and dissemination of the results of the mitigation.

All archaeological mitigation will be undertaken by an archaeological contractor, using only professional archaeologists, and who will preferably be a Registered Organisation of the CIfA.

It is not expected that further investigation or mitigation in relation to the geoarchaeological interest of the Scheme will be required. Any impacts to this resource will be mitigated through the research dividends gained from the works already undertaken and publication and dissemination of these studies.

Historic buildings

No significant adverse impacts on Listed Buildings and Conservation Areas requiring mitigation have been identified.

Historic landscape

All new features within the landscape have been sensitively designed and as part of the reinstatement of the Scheme, there will be substantial planting (see Chapter 7 'Landscape and Visual Amenity').

10.4 Residual effects

The residual impacts of the Scheme on cultural heritage assets are set out in Table 10.3.

Table 10.3: Residual effects on cultural heritage assets

Receptor	Description of Potential Impact	Significance of Predicted Impact	Mitigation Measures	Significance of Residual Impact
CH4 Former county boundary ditch (Jubilee Scrape)	Partial removal during construction of the channel.	Slight adverse	No further investigation. Publication of investigation results. This asset has been adequately characterised by the evaluation.	Slight adverse
CH20 Natural feature	Removal during construction	Slight adverse	No further investigation. Publication of trenching results. This asset has been adequately characterised by the evaluation.	Slight adverse
CH33 Geoarchaeology Area 1	Partial removal during construction	Slight adverse	No further investigation. Publication of geoarchaeological assessment results. This asset has been adequately characterised by the evaluation.	Slight adverse
OA605	Partial removal during construction of the channel if mill remains survive	Slight adverse	Watching brief	Neutral / Slight adverse
CH34 Geoarchaeology Area 2	Partial removal during construction	Slight adverse	No further investigation. Publication of geoarchaeological assessment results. This asset has been adequately characterised by the evaluation.	Slight adverse
CH7 Willow Walk	Changes to current routeway including newly designed Willow Walk Bridge and the removal of some trees	Slight adverse	Sympathetically designed new Willow Walk Bridge and planting (see Chapter 7 "Landscape and visual amenity"). This will include the retention of the historic alignment of the walkway.	Neutral
CH26 Causeway	Partial removal during construction of the channel. Truncation during topsoil stripping for temporary construction compounds.	Moderate adverse	Archaeological Strip, Map and Sample within the channel. Preservation in situ within the temporary works areas.	Slight adverse
OA119 Hinksey Causeway	Partial removal during construction of the channel.	Slight adverse	Trench through causeway at the location of the proposed new bridge.	Slight adverse

Receptor	Description of Potential Impact	Significance of Predicted Impact	Mitigation Measures	Significance of Residual Impact
CH8 Undated linear features	Partial removal during construction of the channel	Slight adverse	Archaeological Strip, Map and Sample	Neutral/ Slight adverse
CH9 Cremation burial	Potential removal during topsoil stripping for compound if there are more burials	Large adverse	Archaeological Strip, Map and Sample	Moderate adverse
CH10 In situ prehistoric post alignment	Partial/complete removal during construction of the channel.	Moderate adverse	Archaeological Strip, Map and Sample	Slight adverse
CH11 LiDAR feature comprising two post-medieval ditches	Partial removal during construction of the channel.	Slight adverse	Archaeological Strip, Map and Sample.	Neutral/ Slight Adverse
CH12 Cut features and worked flint assemblage	Partial/complete removal during construction of the channel.	Slight adverse	Archaeological Strip, Map and Sample	Neutral/ Slight adverse
CH13 Undated trackway and square enclosure	Partial/complete removal during construction of the channel.	Large adverse	Archaeological excavation	Slight adverse
CH14 Undated ditches and pits	Partial/complete removal during construction of the channel	Slight adverse	Archaeological Strip, Map and Sample	Neutral/ Slight adverse
CH21 Prehistoric activity area	Potential compression due to soil storage	Slight adverse	Preservation in situ	Neutral
CH22 Flint assemblage	Removal during construction of the channel. Truncation and during topsoil stripping for temporary construction compound	Slight adverse	Archaeological Strip, Map and Sample	Neutral/ Slight Adverse
CH23 Prehistoric pits	Removal during construction of the channel	Moderate adverse	Archaeological Strip, Map and Sample	Slight Adverse
CH24 Prehistoric pit	Removal during topsoil stripping for temporary construction compound	Slight adverse	No further investigation Publication of trenching results. This asset has been adequately characterised by the evaluation	Slight adverse
CH25 Prehistoric pit	Removal during topsoil stripping for temporary construction compound	Slight adverse	No further investigation Publication of trenching results. This asset has been adequately characterised by the evaluation	Slight adverse
CH28 Causeway	Partial/complete removal during construction of the channel	Slight adverse	Archaeological Strip, Map and Sample	Neutral/ Slight adverse

Receptor	Description of Potential Impact	Significance of Predicted Impact	Mitigation Measures	Significance of Residual Impact
CH29 Causeway	Partial/complete removal during construction of the channel	Slight adverse	No further investigation Publication of trenching results. This asset has been adequately characterised by the evaluation	Slight adverse
CH27 Stone concentrations	Partial/complete removal during construction of the channel	Slight adverse	Archaeological Strip, Map and Sample	Neutral/ Slight adverse
CH15 Three intercutting ditches	Partial removal during topsoil stripping for temporary construction compounds	Slight adverse	Preservation in situ	Neutral/ Slight
CH16 Prehistoric occupation	Removal during topsoil stripping for temporary construction compounds	Large adverse	Archaeological Strip, Map and Sample	Moderate adverse
CH17 Undated ditches and pits	Partial removal during topsoil stripping for temporary construction compounds Compression of deposits from spoil storage	Slight adverse	Preservation in situ	Neutral/ Slight
CH35 Geoarchaeology Area 3	Partial removal during construction	Slight adverse	No further investigation. Publication of geoarchaeological assessment results. This asset has been adequately characterised by the evaluation	Slight adverse
CH18 Undated ditches and pits	Partial/complete removal during construction of the channel	Neutral/ Slight adverse	No further investigation Publication of trenching results. This asset has been adequately characterised by the evaluation	Neutral/ Slight adverse
OA170 Line of the Devil's Backbone	Partial removal during construction of the channel	Moderate adverse	Archaeological excavation	Slight adverse
OA2 Old Abingdon Road Culverts	Partial removal of remains (of equivalent significance as a Scheduled Monument) during construction of the channel culverts	Large adverse	Archaeological excavation. Careful design of the channel route taking into consideration the importance of the Scheduled Monument. The chosen channel route is located on the part of the causeway that has already been impacted by post-medieval rebuilds. Alternative routes were discounted because they would impact the more valuable and intact sections of the causeway.	Moderate adverse

Receptor	Description of Potential Impact	Significance of Predicted Impact	Mitigation Measures	Significance of Residual Impact
	Enhanced setting of Scheduled Monument through the installation of information boards and active public participation and engagement.	Slight beneficial	No mitigation required. As above, the revised channel route has been carefully designed and located further away from the Scheduled Monument to minimise any impact to its setting.	Slight beneficial
OA614 Towles Mill Sluice	Modification of the left bank of the Hinksey Stream could impact on further vestigial elements of this asset due to partial removal.	Slight adverse	Watching brief	Neutral/slight adverse
CH19 Extant ridge and furrow earthworks at New Hinksey	Partial/complete removal during construction of new flood defences	Slight adverse	Earthwork survey shall be undertaken	Neutral
CH30 Natural feature with Iron Age pottery	Removal during construction of new flood defences	Slight adverse	No further investigation Publication of trenching results. This asset has been adequately characterised by the evaluation	Slight adverse
CH31 Natural feature with post medieval pottery	Removal during construction of new flood defences	Slight adverse	No further investigation Publication of trenching results. This asset has been adequately characterised by the evaluation	Slight adverse
CH36 Geoarchaeology Area 4	Partial removal during construction	Slight adverse	No further investigation. Publication of geoarchaeological assessment results. This asset has been adequately characterised by the evaluation	Slight adverse
OA23 21 and 23 Manor Road	Temporary change to asset's wider setting due to construction activities	Slight adverse	None required. Temporary	Slight adverse
OA25 Horseshoe House	Temporary change to asset's wider setting due to construction activities	Slight adverse	None required. Temporary	Slight adverse
OA26 View and Myrtle Cottage	Temporary change to asset's wider setting due to construction activities	Slight adverse	None required Temporary	Slight adverse
OA34 Iffley Lock Conservation Area	Reduced flood risk as a result of the Scheme	Moderate beneficial	None required	Moderate beneficial
OA3 North Hinksey Conservation Area	Construction works to a weir	Neutral/ Slight adverse	None required	Slight adverse

Receptor	Description of Potential Impact	Significance of Predicted Impact	Mitigation Measures	Significance of Residual Impact
CH5 Eastwyke Farmhouse	Temporary change to asset's wider setting due to construction activities	Slight adverse	None required Temporary	Slight adverse
OA16 22 North Hinksey Village	Slight change to wider setting upon Scheme completion	Neutral	None proposed	Neutral
OA17 26 North Hinksey Village				
OA18 27 North Hinksey Village				
OA33 North Hinksey Conservation Area	Change to wider setting upon Scheme completion	Slight adverse	None proposed	Slight adverse
OA21 44 Manor Road			New flood defences at South Hinksey will be sympathetically clad to reduce their visual impact.	
OA22 32 Manor Road				
OA5 Church of Saint Lawrence South Hinksey			None required	
OA301 Hinksey Hill Farmhouse				
OA302 Hinksey Hill Farm Barn				
N/A Boars Hill View Cone	Introduction of channel feature within the green floodplain foreground at the lower extent of this view	Slight adverse	After three years post-completion, the landscape proposals will be semi-established across the Scheme area and integrated with the wider landscape, further reducing visibility – see Viewpoint 12.6 in Table 7.9	Neutral
CH5 Eastwyke Farmhouse	Slight change to wider setting upon Scheme completion	Slight	None proposed	Slight adverse
OA31 Church of St John the Evangelist	Change to wider setting upon Scheme completion	Neutral/ Slight	None proposed	Slight adverse
Listed Buildings	Reduced flood risk to Listed Buildings as a result of the Scheme	Slight adverse	None proposed	Moderate beneficial
HLT1 Enclosure pre 18th century irregular	Partial removal	Slight adverse	Planting (see Chapter 7 "Landscape and Visual Amenity")	Neutral

Receptor	Description of Potential Impact	Significance of Predicted Impact	Mitigation Measures	Significance of Residual Impact
HLT2 Transport Infrastructure/ Links	Partial removal	Neutral	None proposed	Neutral
HLT3 Enclosure Parliamentary	Partial removal	Slight adverse	Planting (see Chapter 7 "Landscape and Visual Amenity")	Neutral
HLT4 Allotments	Partial removal	Neutral	None proposed	Neutral
HLT5 Settlement post 1880	Partial removal	Neutral	None proposed	Neutral
HLT6 Hospitals, Schools & Universities	Partial removal	Neutral	None proposed	Neutral
HLT7 Piecemeal Enclosure	Partial removal	Slight adverse	Planting (see Chapter 7 "Landscape and Visual Amenity")	Neutral
HLT8 Prairie / Amalgamated Enclosure	Partial removal	Slight adverse	Planting (see Chapter 7 "Landscape and Visual Amenity")	Neutral
HLT9 Meadows	Partial removal	Slight adverse	Planting (see Chapter 7 "Landscape and Visual Amenity")	Neutral
HLT10 Enclosure Subsequent Parliamentary	Partial removal	Slight adverse	Planting (see Chapter 7 "Landscape and Visual Amenity")	Neutral
HLT11 Reorganised Enclosures	Partial removal	Neutral	Planting (see Chapter 7 "Landscape and Visual Amenity")	Neutral
HLT12 Civil Provision - Park and Ride	Partial removal	Neutral	None proposed	Neutral
HLT13 Unenclosed - Rough Ground	Partial removal	Slight adverse	Planting (see Chapter 7 "Landscape and Visual Amenity")	Neutral
HLT14 Rural - Village	Partial removal	Neutral	None proposed	Neutral
HLT15 Industrial	Partial removal	Neutral	None proposed	Neutral
HLT16 Water feature	Partial removal	Slight adverse	None proposed	Neutral
HLT17 Communication - major road junction	Partial removal	Neutral	None proposed	Neutral
HLT18 Communication - main road	Partial removal	No change	None proposed	Neutral

Receptor	Description of Potential Impact	Significance of Predicted Impact	Mitigation Measures	Significance of Residual Impact
HLT19 Water - River (Weir Mill Stream)	Partial removal	Neutral	None proposed	Neutral
HLT20 Communication - rail transport sites	Partial removal	No change	None proposed	Neutral
HLT21 Communication - car park	Partial removal	No change	None proposed	Neutral
HLT22 Caravan Parks	Partial removal	Neutral	None proposed	Neutral

11 Traffic and transport

11.1 Existing environment

11.1.1 Traffic and transport characteristics

The geographical extent of the traffic and transport assessment ('study area') of the Scheme was agreed with Oxfordshire County Council and is shown on Figure 11.1.

The main features of the study area are:

Highway links

- The A34 is a major strategic highway route that runs between Winchester in Hampshire and the M40 at Bicester, with additional sections through the West Midlands to the North West. As well as a long-distance strategic function, the A34 also forms part of the western by-pass around Oxford. There are two major interchanges – the Botley Interchange, which provides access to the A420, Botley and Oxford City Centre and the Hinksey Hill Interchange with the A423 Southern and Eastern By-Pass. In the study area, the route is a dual carriageway.
- The A420 Botley Road/West Way is one of the principal access routes to and from Oxford City Centre to the A34. West of the A34, the A420 links Faringdon and Swindon to the South West. The road is largely a single carriageway with bus lanes and junction filter lanes at a number of locations.
- Parker Road is a local road that provides direct access from the A34 to the small village of South Hinksey. It is a single carriageway with limited provision for non-motorised users. It runs parallel with the A34 until it loops into the village.
- The A423 Southern By-Pass connects with the A423 Eastern By-Pass and is the principal route for accessing the eastern and southern parts of Oxford and also the A40 and M40. It is a dual carriageway with several roundabouts at junctions.
- The A4144 Abingdon Road is one of the major thoroughfares to and from Oxford City Centre. It connects with the A423 Southern and Eastern By-Pass and is the principal access route to the New Hinksey area of Oxford. It is a single carriageway that provides footways and cycle lanes and has adjacent development which is directly accessed from it.
- Old Abingdon Road connects Kennington with the A4144 Abingdon Road to Oxford City Centre. It also provides a short cut between the A423 Southern By-Pass and the A4144 Abingdon Road in an eastbound direction.
- Kennington Road is the major road through Kennington Village. The road provides a link to Radley and the eastern parts of Abingdon.

Highway junctions

- The A34/A420 Botley Interchange is a major junction on the A34 and provides a link between the Western By-Pass (the A34) and Oxford City Centre via the A420, Botley Road and West Way. It is a grade separated interchange which has a signalised gyratory. Each of the slip roads onto the A34 are single lane whilst both off-slips have two lanes.
- The A34 South Hinksey junction is an on/off slip junction that connects to the small village of South Hinksey. Connected by an overbridge across the A34, the junction has a small roundabout on the east side of the A34.
- The A34 Hinksey Hill Interchange connects with the A423 and the Southern and Eastern By-passes and also the village of Hinksey Hill. It is a grade separated

interchange which has a signalised gyratory. Capacity improvements are planned for the interchange in the forthcoming years.

- The A423 Southern By-Pass and A4144 Abingdon Road (Kennington Roundabout) is a three-arm 'through-about' roundabout. The roundabout was recently modified which takes the major through traffic from the A423 out of the circulatory carriageway.
- The A4144 Abingdon Road and Old Abingdon Road is a signalised priority junction with controlled pedestrian crossings across Old Abingdon Road and Abingdon Road (south arm).
- Old Abingdon Road with Kennington Road is an uncontrolled priority junction.

Footpaths, bridleways and cycle routes

The footpaths, bridleways and cycle routes within the study area are described in Section 6.1.1.

Park and Ride

- The Seacourt Park and Ride site off the A423 Botley Road/West Way has 794 parking spaces including six designated for disabled users. Served by four buses per hour during Monday to Friday daytime, the site was recently extended to include 1,389 parking spaces of which 10 will be designated for disabled users.
- The Redbridge Park and Ride site off the A4144 Abingdon Road has 1,412 spaces of which 19 are for disabled use. The Park and Ride is typically served by five buses per hour during Monday to Friday daytime. Occupancy data have been provided by the Transport Monitoring Team at Oxfordshire County Council, based upon traffic counters located at the public vehicular entrance and exit of the Park and Ride site. This data is provided in a technical note in Annex K of this ES.

11.1.2 Traffic and transport conditions

Traffic count and collision data have been obtained from National Highways and Oxfordshire County Council for those roads described in Section 11.1.1. These data are the most up to date, complete picture of the traffic conditions available pre Covid-19 pandemic. During the pandemic traffic flows have dropped considerably and thus any new surveys would not be an accurate representation of typical highway conditions.

Table 11.1 shows traffic count data based on the Average Daily Traffic (ADT) flows for a 24 hour period at identified locations in the study area.

Throughout this chapter, NB, SB, EB and WB are used as abbreviations for northbound, southbound, eastbound and westbound respectively.

Table 11.1: Summary of the Annual Average Daily Traffic (24 hour flow)

Location	Source and Date	Direction	Flow
A420 Botley Road (West of Seacourt Park and Ride)	Oxfordshire CC 2016	EB/WB Combined	24,400
A420 Botley Road (Osney Bridge)		EB/WB Combined	16,500
A34 South of Botley	National Highways 2016	NB/SB Combined	65,746
A34 Road to North Hinksey Lane		NB/SB Combined	70,256
Hinksey Hill		NB/SB Combined	9,064

Location	Source and Date	Direction	Flow
A34 Hinksey Hill Interchange	Oxfordshire CC January 2017	NB Slip Off	9,752
A34 Hinksey Hill Interchange		SB Slip off	10,563
A423 Southern By-Pass (East of junction with Old Abingdon Road)		EB/WB Combined	45,900
Old Abingdon Road (East of junction with Kennington Road)		NB/SB Combined	7,769
A4144 Abingdon Road (South of junction with Old Abingdon Road)		NB/SB Combined	14,799

The data reveal:

- The highest traffic flows along the strategic A34 corridor.
- The A423 Southern/Eastern By-Pass have the second highest flows.
- Similar volumes of traffic access Oxford City Centre along the A420 Botley Road and A4144 Abingdon Road.
- Land uses along the A420 Botley Road (Seacourt Park and Ride, retail parks) intercept some of the flows along this western corridor to Oxford City Centre.
- The lowest flows are recorded along Old Abingdon Road.

Collision and Personal Injuries

Collision and personal injury data have also been obtained for the study area from Oxfordshire County Council for a five-year period from January 2012 to the end of August 2017. Table 11.2 provides a breakdown of the total number of injuries. As with the traffic data the availability of more recent information is impacted by the Covid-19 pandemic.

Table 11.2: Total number of injuries by year and severity for each link including pedestrians and cyclists

Link	Severity	2012	2013	2014	2015	2016	2017	Total	Pedestrians and Cyclists
A34	Fatal	0	0	0	0	1	0	1	0 (0%)
	Serious	2	1	1	0	3	1	8	1 (13%)
	Slight	22	17	22	12	10	9	92	0 (0%)
A423 Southern Bypass	Fatal	0	0	0	0	0	0	0	0 (0%)
	Serious	0	0	1	0	0	1	2	1 (50%)
	Slight	1	2	7	1	2	7	20	0 (0%)
A420 Botley Road	Fatal	0	0	0	0	1	0	1	0 (0%)
	Serious	0	1	1	1	2	1	6	5 (83%)
	Slight	3	6	12	10	12	10	53	29 (55%)
	Fatal	0	0	0	0	0	0	0	0 (0%)
	Serious	0	0	0	0	1	0	1	1 (100%)

Link	Severity	2012	2013	2014	2015	2016	2017	Total	Pedestrians and Cyclists
A4144 Abingdon Road	Slight	0	0	1	1	5	1	8	5 (63%)
Old Abingdon Road	Fatal	0	0	0	0	0	0	0	0 (0%)
	Serious	0	0	0	0	1	0	1	1 (100%
	Slight	0	0	1	1	3	1	6	5 (83%)
Kennington Road	Fatal	0	0	0	0	0	0	0	0 (0%)
	Serious	0	0	0	0	0	0	0	0 (0%)
	Slight	0	0	1	1	1	1	4	2 (50%)

The data reveal the following trends:

- A total of two vehicle fatalities were recorded over the five-year period, one on the A34 and one on the A420 Botley Road/West Way.
- A higher level of collisions with cyclists and pedestrians occurred on links within the urban area (A420 Botley Road/ West Way, A4144 Abingdon Road, Old Abingdon Road and Kennington Road) compared to strategic and principal links (the A34 and the A423 Southern By-Pass).
- The numbers of cyclist incidents reflect that Oxford is currently the third highest ranking area of the UK where people cycle at least three times a week.
- Except for one pedestrian/cyclist incident each, all collisions on the A34 and the A423 involved vehicles only.

11.1.3 Changes to traffic and transport in absence of Scheme

Oxfordshire County Council's Local Transport Plan 4 (LTP4) covers the period between 2015 and 2031. It identifies the likely changes to traffic and transport in Oxfordshire and the measures that are needed to transport networks to support jobs, housing growth, protection and enhancement of the environment and improve public health, safety and individual wellbeing.

LTP4 identifies that an additional 31,000 dwellings are required in Oxford and Inner Oxfordshire over the period to 2031 and this is likely to lead to 15,400 additional commuter trips. The Local Highway Authority's Strategic Transport Model shows many main junctions over capacity in 2031 and severe delays on many routes including the A34.

Forming a part of the Oxfordshire LTP4, the Oxford Transport Strategy outlines the challenges and transport interventions required within the Oxford area. It identifies a total of eight challenges in Oxford, which include meeting the needs of a growing population, economic growth and new housing. The strategy notes Oxford's travel to work modal split with over 50% of people walking and cycling, representing a 30% increase in these modes between 2001 and 2011.

To accommodate growth, the LTP4 identifies the requirement for improvements to transport infrastructure and a change in modal shift from car to sustainable modes. This includes capacity improvements on the A34 including the Hinksey Hill Interchange with bus priority measures, expansion of the Seacourt Park and Ride site on the A423 Botley Road, and a new masterplan for Oxford Station, which will improve public transport integration and enhancements to walking and cycling provision.

In the absence of the Scheme, flooding will continue (with increasing frequency due to climate change) to cause transport disruption, with frequent closure of the railway line and main roads to the west (Botley Road) and the south (Abingdon Road) of the city.

11.2 Likely significant effects

11.2.1 During construction

During construction, the main traffic and transport related impacts will result from the movements of construction staff and the delivery and removal of material and equipment. A separate Transport Assessment has been prepared (see Appendix M), which identifies the following main temporary impacts:

- Requirement for new highway access points, and increased use of existing ones, to access construction sites and compounds
- Construction related traffic on the highway network
- The temporary change to the alignment of the junction of Old Abingdon Road with Kennington Road
- Diversion of existing pedestrian, cyclist and equestrian routes
- Loss of car parking spaces at Redbridge Park and Ride
- Shared access (i.e. the interaction of Scheme related construction traffic and bus services) at Seacourt Park and Ride with a loss of spaces within the car park.

Highway access routes to construction sites and compounds

Due to the large area covered by the Scheme, a large number of new access points will be required so that all plant necessary for the works can be delivered and set up away from the public highways. A total of 23 access points will be required, many of which will be temporary and short term in nature and the majority of which will be existing accesses which we will modify. Of these accesses, the four which form the major highway interfaces for the bulk of construction traffic, are:

- Shared use of the Seacourt Park and Ride site main access on Botley Road
- Continued use of existing field access on eastern side of Parker Road 30m south of the A34 slip road roundabout
- Upgraded path off eastern side of Abingdon Road opposite Hinksey Park
- Old Abingdon Road / Kendall Copse area, which will be accessed from the western end of Old Abingdon Road and included in the Construction Phase Traffic Management Plan covering the whole works in this location.

The shared access to Seacourt Park and Ride currently hosts large vehicles in the form of service buses and its present arrangement will enable its use by site traffic with little or no alteration, which will serve to limit some of the disruption caused by the construction works. However, the construction of the new access points, particularly those which form major highway interfaces, will result in some disruption to traffic flow and disturbance to business units with some potential conflicts with bus services at the Seacourt Park and Ride. These are considered to be **minor to moderate adverse** in nature (based on low to medium value receptors and moderate negative magnitude).

The remaining accesses will be temporary in nature and only used during critical construction periods when access is required to specific works areas and compounds.

The main access routes by all construction delivery vehicles will be from the A34 with Areas 1 and 2 being served along the A420 Botley Road/West Way, Area 3 from the South Hinksey Interchange on the A34 (between Willow Walk and Devil's Backbone), and Area 4 from Old Abingdon Road and the A4144 Abingdon Road. However, over 50% of the traffic (i.e. HGVs in Area 3 plus half of the HGVs in Area 2) will use the access

for Area 3 following the establishment of a haul road within the site. These access routes will have minor adverse impacts on the existing road network (see Table 11.4).

The Scheme's construction will work around the A423 bridge replacement project as outlined in section 3.2.1 as we try deliver the Scheme as quickly as possible and minimise local disruption. This could potentially alter the arrangements and status of compounds we use but at this time we are unable to provide detail on any arrangements beyond the main compound at South Hinksey, satellite compounds and access points. However, the most logical location for activity to focus would be Kendall Copse, as works will be focused on completion of all works south of Old Abingdon Road.

Construction-related traffic

Table 11.3 outlines the construction material that will be handled in each of the Scheme areas and the estimated traffic numbers during the Scheme. A total of 455,000m^3 material needs to be excavated during the construction of the Scheme, of which approximately 360,000m^3 will be moved onto the public highway. However, based on an earlier calculation of material to be transported in the transport scoping assessment (Appendix M), we have assumed as a worst case proxy, that 391,000m^3 will be moved onto the public highway to assess the construction related impacts. This estimate will provide a worst-case scenario of construction-related traffic numbers taking into account peaks and troughs in construction activity.

We estimate works to the north of Old Abingdon Road, which includes the main earthworks for the scheme will take 3 calendar years. Within the 3 years, the majority of the earthworks will be undertaken during a 15 month period due to the need for a winter break each year when the ground is too wet. With earthworks vehicles movements on the public highway restricted to off peak periods (10:00 to 16:00), it is estimated there will be a need to remove up to 900m^3 per day. Given a typical three axle HGV can transport 8m^3 of material per load – this equates to 111 HGV movements in each direction per day. It should be noted that the analysis considers that half of the HGV movements generated by Area 2 will enter from and exit onto Botley Road. This 50% estimate is highly unlikely to occur with the realistic value being considerably lower, the current intention is that all material from Area 2 leaves the site via the South Hinksey junction onto the A34. This methodology does however offer a robust analysis of Botley Road demonstrating the minimal impact of this traffic at this higher rate. Therefore, the realistic, and lower, portion of HGV movements along Botley Road will create a smaller impact still.

Table 11.3: Construction HGV movements

Location	% of overall HGV Trips	Estimated HGV Journeys per Day (access & egress)	Access & Egress (for distribution design)
Area 1 – North of Botley Road	8.2%	16	A420 Botley Rd
Area 2 – Botley Walk to Willow Walk	20.6%	40	A420 Botley Rd (50%, 20 journeys)
			Parker Rd, off the A34 (50%, 20 journeys)
Area 3 – Willow Walk to South Hinksey	36.1%	70	Parker Rd, off the A34

Location	% of overall HGV Trips	Estimated HGV Journeys per Day (access & egress)	Access & Egress (for distribution design)
Area 4 (part) – Devil's Backbone to Old Abingdon Road	12.4%	24	Parker Rd, off the A34
Area 4 (part)- Old Abingdon Road to Munday's Bridge	15.5%	30	Parker Rd, off the A34
Area 4 (part) – Works to existing channels	7.2%	14	A4144 Abingdon Rd

Table 11.4 examines the likely construction HGV movements on traffic flows. The analysis in the table is based on the likely traffic flows in the horizon year period of 2021, with traffic growth figures obtained from the widely used Department for Transport TEMPRO database for Vale of White Horse District (reflecting larger traffic growth that is expected to occur on the outskirts of Oxford).

The assessment reveals that the proportion of construction HGVs will be low against the total traffic flow and existing HGV flows. The HGV movements associated with the Scheme will therefore only have **minor adverse** impacts on existing traffic flows (based on medium value receptors and minor negative magnitude).

For staff movements, it is envisaged a total number of 100 construction workers will be deployed across all sites. Given the phasing of the Scheme and the location of the works and compounds, there will be a shifting of staff (construction site workers) movements through this period. Staff movements will be largely during off-peak periods on the network and involve shuttling workers to and from identified sites. It should be noted that during the day, most construction staff movements will be within the site and they will be using the haul route. Based on this, staff movements will likely have a magnitude that is minor negative with a significance that is **minor adverse.**

Table 11.4: Impact of construction HGV movements on existing highway links

Link	24 hour ADT (two way flows)	Existing proportion of HGVs/ numbers	Construction related daily HGVs (two way flows)	% Construction related daily HGVs against 24 hour ADT	Magnitude	Significance
A420 West Way (west of the Seacourt Park and Ride)	27,696	--	+36	+0.13%	Minor Negative	Minor Adverse
A420 West Way (Osney Bridge)	18,728	--	+0	0.00%	Minor Negative	Minor Adverse
A34 South of Botley	74,628	9.75%	+134	+0.18%	Minor Negative	Minor Adverse
A34 Road to North Hinksey Lane	79,748	8.56%	+134	+0.17%	Minor Negative	Minor Adverse
A34 Hinksey Interchange NB off slip	10,901	11.95%	+1	+0.01%	Minor Negative	Minor Adverse

Link	24 hour ADT (two way flows)	Existing proportion of HGVs/ numbers	Construction related daily HGVs (two way flows)	% Construction related daily HGVs against 24 hour ADT	Magnitude	Significance
A34 Hinksey Interchange SB off slip	11,807	10.04%	+6	+0.05%	Minor Negative	Minor Adverse
A423 Southern By-Pass	51,307	EB 11.82% WB 11.36%	+14	+0.03%	Minor Negative	Minor Adverse
Old Abingdon Road	8,684	NB 6.53% SB 7.41%	+0	0.00%	Minor Negative	Minor Adverse
A4144 Abingdon Road	16,542	NB 11.39% SB 9.13%	+14	+0.08%	Minor Negative	Minor Adverse

Management of Construction Traffic at South Hinksey

The main access for Areas 2 and 3 of the works will be taken at an existing, though modified, gated field entrance along Parker Road, 20m south of the small roundabout positioned immediately west of the A34 Southern By-pass Road near the village of South Hinksey. Access will be provided via the short slip lanes on both sides of the A34 Southern By-pass Road, whilst northbound traffic will be required to cross across the A34 road via an overbridge section of the South Hinksey Bridge carriageway. Access into the site will be controlled via a simple priority arrangement. HGV traffic within the compound will be controlled to make sure traffic movements into and out of the compound are not restricted in any way, so that local roads are not obstructed by HGVs queuing outside the compound. To ensure safety is maintained along the A34 itself we propose to request a temporary 40 mph speed limit between Botley Interchange and a point south of South Hinksey. There will be no access to the village for any construction traffic, including light vehicles; all traffic will be required to enter the construction compound direct from the A34 junction.

Temporary carriageway at Old Abingdon Road and Kennington Road

Construction works are required along sections of both Old Abingdon Road and Kennington Road near the junction between the two roads. From previous assessments it has been identified that the closure of these roads would result in unacceptable impacts on the surrounding local highway network. Therefore, a temporary carriageway will be provided to maintain flow along these routes during construction. This measure is designed to keep two-way traffic flowing, eliminate the need for any diversions of bus routes and limit any queuing which may occur onto the A423 and A34 roads as a result of diverting traffic away from Old Abingdon Road and Kennington Road. Section 6.4 of the Transport Assessment in Appendix M of this ES provides further detail on this aspect of the Scheme. A small compound will also be located in the west side of Kendall Copse to service these works, this will be accessed through the temporary working area and from the existing gated access off Kennington Road. As these works will act to mitigate the impacts of the Scheme on the highway in this area, albeit with a lower speed limit, they have been classed as **minor adverse**.

Pedestrians, cyclists and equestrians

Impacts on pedestrians, cyclists and equestrians are discussed in Section 6.1.1.

Redbridge Park and Ride

During construction of the Scheme, the southern section of Redbridge Park and Ride will be used as a site compound, which will result in a temporary loss of an estimated 306 parking spaces. A supplementary technical note has been prepared (Annex K of this addendum), which assesses the impacts of this temporary loss of car parking spaces and reviews the availability of space against occupancy. It is considered that even if the appointed Contractor uses the largest available area for a construction compound, there would still be 64 empty spaces remaining within the site during periods of maximum occupancy. The temporary loss of car parking spaces will potentially increase walking distances to the bus stop for some vehicle travellers and may reduce ease of parking and is therefore considered to result in a **minor adverse** temporary impact (based on a medium value receptor and minor negative magnitude i.e. a discernible negative impact from the reduction in spaces and ease of parking in a small locality).

Seacourt Park and Ride

During construction of the Scheme, there will also be a loss of parking spaces at Seacourt Park and Ride The temporary loss of 223 spaces occurs around the outer boundary of the car park. Likely impacts are potentially increased walking distances to the bus stop for some vehicle travellers should they need to park in another area of the car park and may reduce ease of parking. Therefore, construction of the Scheme is considered to result in a **minor adverse** temporary impact (based on a medium value receptor and minor negative magnitude i.e. a discernible negative impact from the reduction in spaces and ease of parking in a small locality).

Summary of construction impacts

Table 11.5 presents the temporary overall impacts on individual highways and the Park and Ride sites during the construction works.

Table 11.5: Summary of construction impacts on traffic and transport receptors

Receptor/Location	Transport Mode	Anticipated duration	Magnitude	Significance
Seacourt Park and Ride – medium value	Vehicle	12 months	Minor negative	Minor adverse
A420 Botley Road/West Way – medium value	Vehicle	12 months	Minor negative	Minor adverse
A34 South Hinksey Interchange – medium value	Vehicle	36 months	Minor negative	Minor adverse
A423 Southern By-Pass – medium value	Vehicle	36 months	Minor negative	Minor adverse
A4144 Abingdon Road - – medium value	Vehicle/Bus	12 months	Minor negative	Minor adverse
Old Abingdon Road – medium value due to adjacent affected A-roads and affected bus service	Vehicle/Bus	36 months	Minor negative	Minor adverse
Kennington Road – low value	Vehicle/Bus	36 months	Minor negative	Minor adverse
Redbridge Park and Ride	Vehicle	12 months	Minor negative	Minor adverse

11.2.2 During operation

The Scheme will bring benefits to the resilience of the transport network such as the local road network and the London to Birmingham railway line through reduced incidents of flooding and the reduced need for emergency closures of both the roads and railway.

The Scheme (and its associated maintenance requirements) will not generate a large number of additional trips on the local transport network and therefore the operational traffic impacts were scoped out of the assessment, in agreement with Oxfordshire County Council.

Car parking spaces at Redbridge Park and Ride

Upon completion of the Scheme, there will be a permanent reduction of 21 public car parking spaces at Redbridge Park and Ride. This is considered to result in a **minor to moderate adverse** impact (based on a medium value receptor and moderate negative magnitude).

Car parking spaces at Seacourt Park and Ride

Upon completion of the Scheme, there will be no permanent reduction of public car parking spaces at Seacourt Park and Ride. Therefore, there is no long-term impact.

11.3 Mitigation

An outline Construction Traffic Management Plan (CTMP) has been prepared as part of the Transport Assessment in Appendix M. This CTMP will be finalised before construction starts in consultation with the County Council and National Highways and will form a central part of the traffic mitigation for the Scheme.

Table 11.6 outlines the main elements of the CTMP together with the timing and its duration. The CTMP will be managed and monitored by a Traffic Management Working Group (TMWG) with whom the appointed contractors will consult and communicate. It is suggested that the TMWG should comprise representatives from:

- Contractor
- Local Highway Authority
- National Highways
- Public transport operators
- Parish councils
- Environment Agency.

The lead contractors will be required to ensure that these requirements are made clear to all their sub-contractors and suppliers.

Table 11.6: Component parts of the CTMP

CTMP Element	Short Description
Block plans	Block and layout plans of the sites which will include: • Access/egress arrangements including visibility splays onto the public highway and vehicle tracking; • Vehicle tracking within the site especially for articulated HGVs where appropriate so that vehicles enter and leave the site in forward gear; • Internal parking arrangements for staff and visitors; • Storage of materials and waste on site; • Pedestrian/circulation routes within the compound; • Rules and regulations for banksmen; • Site boundaries / hoardings / temporary structures on the public highway.
Access routes for construction traffic	Permitted access routes for construction traffic and roads which are not permitted or have restrictions.
Movements	Movement restrictions of HGVs delivering and removing plant and materials (expected to be outside peak periods on the highway network, usually considered to be 08:00-09:00 and 17:00-18:00). Abnormal load movements will be timed in consultation with Highway Authorities. Appropriate software and management systems will be used to manage the deliveries to site. This provides an efficient and effective means of controlling all deliveries. Its implementation will ensure that all deliveries arrive at the right time and ensure that the space available is used as effectively as possible.
Measures to reduce pollution and debris on the transport network	Measures to reduce dust, air pollution and other debris on the local highway network. Measures to ensure that the maintenance and condition of public roads, cycleways and rights of ways do not deteriorate due to the construction traffic, including monitoring arrangements with Local Highway Authorities. Outline of measures to reduce construction traffic noise near sensitive receptors.
Vehicle Types	HGVs will be low emission vehicles defined as Euro VI standard, where feasible, and regular fleet maintenance shall take place to reduce emissions. All vehicles will be required to comply with the current guidance with respect to visibility, audibility of reversing/turning warnings during manoeuvring and other controls when interfacing with the public. To address cycle safety, any large vehicle accessing the site will be fitted with side bar protection to avoid cyclists being pulled beneath the vehicle.
Traffic management measures	A programme of traffic management measures to be implemented: Measures to provide for the safety of traffic, the public and construction staff during traffic management works and temporary traffic control measures;

CTMP Element	Short Description
	Procedures to be followed for the temporary or permanent closure or diversion of roads or accesses including details of required notice periods; Drawings showing traffic management layouts, signing and apparatus to be implemented; Details of any delivery management procedures or software to ensure access to the site is clear for arrival.
Staff Travel	Sustainable travel for staff will be encouraged making use of the Park and Ride sites and other public transport locations from which staff will be shuttled to construction sites.
Temporary Closure of Old Abingdon Road and junction with Kennington Road	Construction of temporary carriageway to accommodate traffic during closures.
Diversion of footpaths and bridleways	Routes for non-motorised users around sites will be maintained throughout the construction programme as far as possible. Where diversions are required, these will be within acceptable distance thresholds for users and aligned with desire lines. Where interfacing with routes hoardings will enclose the work area to contain construction activities. In places, the hoarding will need to encroach onto the existing footpath to provide working space for construction activities and a general minimum footpath width of 2m will be maintained.

11.4 Residual effects

Table 11.7 summarises the residual effects of the Scheme after the implementation of the mitigation measures.

Table 11.7: Residual impacts on traffic and transport

Receptor/ Location	Description of Potential Impact	Significance of Predicted Impact	Mitigation Measures	Significance of Residual Impact
Seacourt Park and Ride	Increased HGV movements and increased risk of conflict with other users at construction stage	Minor adverse	CTMP	Minor adverse
A420 Botley Road/West Way	Increased HGV movements and increased risk of conflict with other users at construction stage	Minor adverse	CTMP	Minor adverse
A34 South Hinksey Interchange	Increased HGV movements at construction stage	Minor adverse	CTMP	Minor adverse

Receptor/ Location	Description of Potential Impact	Significance of Predicted Impact	Mitigation Measures	Significance of Residual Impact
A423 Southern By-Pass	Increased HGV movements and diverted traffic at construction stage	Minor adverse	CTMP	Minor adverse
A4144 Abingdon Road	Increased HGV movements and diverted traffic at construction stage	Minor adverse	CTMP	Minor adverse
Old Abingdon Road	Temporary closure (up to two years) during construction works. Temporary carriageway to be constructed to accommodate traffic during closures.	Minor adverse	CTMP and temporary carriageway	Minor adverse
Kennington Road junction with Old Abingdon Road	Temporary closure (up to two years) during construction works. Temporary carriageway to be constructed to accommodate traffic during closures.	Minor adverse	CTMP and temporary carriageway	Minor adverse
Redbridge Park and Ride	Loss of car parking spaces during construction	Minor adverse	Potential for contractor to reduce size of compound.	Minor adverse
Seacourt Park and Ride	Loss of car parking spaces upon completion of Scheme.	Minor adverse	Additional spaces generated by Seacourt Park and Ride expansion will help to offset losses (see Chapter 15 'Cumulative Effects'.	Minor adverse
Redbridge Park and Ride	Loss of car parking spaces upon completion of Scheme.	Minor adverse	Additional spaces generated by Seacourt Park and Ride will help to offset losses (see Chapter 15 'Cumulative Effects'.	Minor adverse

12 Sustainable use of land

12.1 Existing environment

12.1.1 Geological sites

There are no geological Sites of Special Scientific Interest or Local Geology Sites (formerly known as Regionally Important Geological or Geomorphological Sites, RIGGS) within the study area, which has been defined as the Scheme area (see Figure 1.3) plus a 1km buffer.

12.1.2 Soils and agricultural land

The National Planning Practice Guidance states that the planning system should protect and enhance valued soils and prevent the adverse effects of unacceptable levels of pollution. This is because soil is an essential finite resource that provides important ecosystem services, for example as a growing medium for food, timber and other crops, as a store for carbon and water, as a reservoir of biodiversity and as a buffer against pollution.

A detailed soil resource and agricultural quality survey was therefore carried out by Land Research Associates and is provided in Appendix P. A summary of the findings is incorporated into this chapter of the ES.

Agricultural use – Approximately 87% of the Scheme area is considered to be agricultural land (approximately 103ha), with the remaining 13% comprising farm tracks, watercourses, woodland/scrub habitat and domestic gardens/allotments.

Provisional Agricultural Land Classification (ALC) mapping by the former Ministry of Agriculture, Fisheries and Food (1988) shows the main body of the Scheme area to be lying within Grade 4 agricultural land, i.e. land of poor quality for crop production. However, the agricultural land quality survey showed that all of the agricultural land within the Scheme area (with the exception of the unsurveyed areas, which is unknown) falls within Grade 3b, i.e. land of moderate quality. This land is dominated by heavy, poorly-draining soils, which stand wet for long periods in winter and spring. Arable use would be limited, by wetness, to autumn-sown cereal-based rotation. At present the agricultural land is all under long-term pasture and sileage meadow. The land lies mainly on a floodplain and flooding is therefore a limiting factor for agricultural use within most of the Scheme area. The soil resource is considered to be of medium value.

The pasture land is also registered under an Environmental Stewardship Agreement as part of a wider holding, which will be affected by implementation of the Scheme. This is a land management scheme that provides funding to farmers to manage the land in a certain way that has been agreed with Natural England.

Soils and geology – British Geological Survey (BGS) 1:50,000 mapping identifies that the main area of the Scheme is underlain by river alluvium with occasional patches of Northmoor Member sands and gravels. The National Soil Map (published at 1:250,000 scale) shows the soils in the main body of the Scheme as belonging to the Thames Soil Association, comprising stoneless clayey soils formed in river alluvium.

The soil resource survey (LRA 2018) identified that the Scheme lies within a clayey floodplain alluvium over sands and gravels. The soils associated with this land have variably calcareous heavy silty clay loam or silty clay topsoil; with peaty deposits in wetter locations. The upper subsoils are clay-textured, poorly structured (dense) and slowly permeable. The depth to the underlying gravel varies, but it is mainly at depths of over 80cm below the land surface. The soils are mainly poorly-draining and have a low capacity to absorb excess winter rainfall.

The hydromorphology of the wider study area relevant to the Scheme is described in Chapter 9 'Water and hydromorphology'.

12.1.3 Ground contamination

The baseline conditions of potential ground contamination within the Scheme area has been derived from a Phase I desk study prepared for the Environment Agency along with ground investigation works in 2017. The findings of these have been incorporated into a Contaminated Land Risk Assessment and Outline Remediation Strategy (CH2M 2018, plus addendum Jacobs 2021b) for the Scheme.

A few key areas of higher contamination potential within the Scheme boundary are shown in Figure 12.1 and include:

- Three mixed waste lined shallow landfills now closed adjacent to Old Abingdon Road. These are directly beneath the footprint of the permanent Scheme works (Kennington West, Kennington East and Redbridge). Sections of these landfills will need to be excavated during construction of new channels/culverts;
- Two mixed waste landfills now closed, also in the Old Abingdon Road area (Coldharbour Campsite and Rivermead). These will lie within the footprint of the Scheme temporary works area, and the Coldharbour site may be used for storage of excavated soil stockpiles;
- A mixed waste landfill, now closed, at Grandpont. This lies beneath a temporary access route for installation of a new small stream control structure, which will be sited just to the south of the landfill.
- An infilled area beneath and adjacent to the of the A423 Southern bypass, as well as fill in the c. 5-10m-high road embankment itself.

The Old Abingdon Road area is the only area with residential properties close to any of the former areas of landfill.

The ground investigation and risk assessment has indicated that whilst contamination is present within these locations, the contamination, even if disturbed by construction, is not considered to present a risk to nearby receptors and the contamination does not present a risk to the environment.

Key known areas of potential historic soil contamination within 100m of the Scheme, but outside its footprint, are also shown on Figure 12.1 and include:

- The industrial estate at Osney Island, which borders the Scheme, currently comprised of commercial/light industrial buildings;
- Historical commercial properties/light industry around Botley Road;
- The railway line and sidings; and
- The overhead line transformer compound, to the east of South Hinksey.

The Ground Investigation has indicated that these areas are unlikely to be affected by or affect the Scheme.

12.1.4 Green Belt

The proposed Scheme is located within Green Belt to the west of Oxford; this is an area protected by planning policy to prevent urban sprawl by keeping land permanently open; the essential characteristics of Green Belts are their openness and their permanence. We have produced a Green Belt Statement to appraise the proposals against national and local policy on the protection of Green Belt land and to set out how our Scheme is suitable for location within it (see separate Planning Statement).

12.1.5 Changes to use of land in absence of Scheme

In the absence of the Scheme, the agricultural land within the study area will continue to flood and is expected to be subject to increased flooding due to climate change. Additionally, areas of potential soil contamination may be subject to increased flood risk, with potential for future migration of contaminants. Urban flooding could also transfer urban contamination across non-urban flooded areas.

12.2 Likely significant effects

12.2.1 During construction

Soils and agricultural land

There are likely to be localised **minor adverse impacts** on ground conditions as a result of land requirements for site compounds, storage areas and working areas during the construction phase. Due to the high clay content of the topsoils within the Scheme area, the proposed construction works have the potential to cause compaction of these soils when wet, particularly considering the difficulties in handling these soils with machinery. Additionally, the heavy subsoils are susceptible to compaction, which could result in restricted rooting depth, increased 'droughtiness' and an increased risk of localised flooding. Compaction of some topsoils and subsoils could affect land drainage and the creation of new habitats. However, much of the access for constructing the Scheme and on-site haulage will be undertaken within the footprint of the Scheme, particularly in Area 2 (between Botley Road and Willow Walk) where the footprint of the temporary works has been reduced to minimise impacts on Hinksey Meadows. Additionally, some of the newly constructed haul roads will be removed and the land reinstated upon completion of the Scheme, to reduce permanent damage to the soil resource.

There will also be temporary impacts on local farm businesses and associated tenancies from temporary land-take during the construction works and from severance effects, which will prevent the continuation of current farming practices in some areas for up to three years, with potential changes in day-to-day management and loss of farm income. Such impacts are considered to be **moderate adverse** in nature.

There will be temporary disturbance of up to 100ha of Grade 3b agricultural land which will be temporarily unavailable due to construction. Some of this land will be permanently in the footprint of the new Scheme, see section 12.2.2. This impact, which will be experienced for up to three years, is considered to be a **moderate adverse** impact (based on the assessment methodology in Section 4.3.7).

Ground contamination

There is potential for the construction works to expose contaminants and to open new pathways for contaminants, with the following impacts:

- Exposure of construction workers to direct contact with soil contamination and soil gas during excavation work.
- Exposure of local land-users (residents, commercial property users and recreational users) to contaminated material via dust and vapours from exposed soils and soil stockpiles.
- Exposure of local land-users to soil gas risk because of changes to existing gas migration pathways.
- Odour from exposed in situ or stockpiled organic soils.

All of these impacts are considered manageable and the Scheme will be designed to mitigate these impacts in line with both the legislative requirements and best practice (see Section 12.3).

12.2.2 During operation

Soils and agricultural land
The Scheme will provide an improved standard of protection against flooding for existing land uses (including agricultural land and some small areas of potential contamination) and soils within the floodplain, thereby helping to prevent pollution – a **moderate beneficial** impact.

Following completion of the Scheme, there will be a permanent change in wetness of Grade 3b agricultural land in the permanent footprint of the Scheme due to the increased frequency of flooding. The Grade 3b land within the second stage channel will become Grade 4 agricultural land, which will be managed as floodplain grazing marsh, due to being significantly wetter and to having its topsoil removed. There will also be some severance impacts, which will affect local farm businesses and associated tenancies, particularly between North and South Hinksey.

Up to 19.7ha of agricultural land will be used for mitigation planting upon completion of the Scheme. The 7.8ha direct land-take in the footprint of the new first stage stream, new flood defences and new habitat creation areas will be removed from agricultural use. There will also be effects on the land within the second stage channel, as described above, which will remain in agricultural use but will be less productive. Such impacts are considered to be **moderate adverse** in nature. Some of the agricultural landowners within the Scheme area, have indicated their preference for us to take ownership of the Scheme channel upon Scheme completion. Seasonal grazing of the second stage channel is the intended means for the management of vegetation growth. Temporary electric livestock fencing for seasonal grazing will be permitted across the new channel; responsibility for any such fencing will pass to the relevant grazier.

Ground contamination
Operational impacts associated with soil contamination have not been assessed as this was scoped out of the EIA. However, the former landfill areas are to be significantly engineered in the development of the Scheme and therefore a programme of monitoring during the construction phase and maintenance will be developed to ensure there are no breaches of leachate to the new channel or surrounding environment.

12.3 Mitigation

We will implement the following mitigation and management practices to minimise damage to soils:

- Ensure that our Contractors adhere to Defra's 'Safeguarding our Soils' Strategy and the Construction Code of Practice for Sustainable Use of Soils on Construction Sites (Defra, 2009), as well as our strategy document 'Soil a Precious Resource: Our strategy for protecting, managing and restoring soil (Environment Agency, 2007).
- Programme the majority of earth movements and soil handling for between April and October when the soils are likely to be drier.
- Loosen any subsoils that have been unavoidably compacted during the construction works, before any topsoil is spread on them.
- Ensure that any areas outside of the Scheme area (i.e. not within the footprint of the Scheme or adjacent working areas) which are not public highway are not used by construction vehicles.
- Store stripped topsoil in separate resource bunds to an approximate maximum height of 2-4m (but depending on soil wetness). These bunds will be kept grassed and free from construction traffic until required for re-use.

Mitigation for soil contamination risks during construction will follow standard practice appropriate to the risk level and will include:

- Employment of a health and safety plan for any workers likely to come into physical contact with contaminated soils, gases or vapours during the construction phase.
- Use of measures to mitigate dust migration risks from exposed soils and stockpile areas (e.g. tarpaulins, dust suppression sprays and/or siting of any contaminated/odorous stockpiles away from residential areas – see Chapter 13 'Air Quality').
- Storage of excavated soils on low permeability ground or pads with suitable temporary drainage/bunding to prevent risk of wash-off of stockpiled soils by rain or flood water; and/or leaching into the ground.
- Adoption of risk-based human health screening values to determine appropriate locations for the re-use of materials within the project boundary.
- Construction phase monitoring of soil gas levels where there is a significant risk of changing existing soil gas migration pathways e.g. in landfill areas. If required, gas migration breaks (clay bunds) or venting will be incorporated into the design.
- Appropriate design of a capping layer and/or seeding of any bare soils exposed at the end of the earthworks phase to reduce potential exposure pathways.

It is anticipated that employment of these measures during the construction phase will leave no additional residual health risk from the Scheme during the operational phase. We will provide further details of the mitigation strategy to be employed in the outline remediation strategy for the Scheme, which will be implemented via the Contractor's Construction Environmental Management Plan (CEMP) and EAP (Appendix G).

12.4 Residual effects

Table 12.1 presents the residual impacts on soils, agricultural land and ground contamination, as a result of the Scheme.

Table 12.1: Residual impacts on soils, agricultural land and ground contamination

Receptor	Description of Potential Impact	Significance of Predicted Impact	Mitigation Measures	Significance of Residual Impact
Existing land uses	Improved standard of protection against flooding for some existing land uses including Grade 3b agricultural land, soils and landfills within the floodplain, thereby helping to prevent pollution.	Moderate Beneficial	No mitigation required	Moderate beneficial
Grade 3b agricultural land	Disturbance during construction to 99.8ha of Grade 3b agricultural land.	Moderate Adverse	Compensation will be provided to affected landowners.	Moderate adverse
	Permanent loss of some Grade 3b agricultural land on completion of Scheme, together with severance effects, plus an additional 19.7ha in footprint of mitigation planting areas.	Moderate Adverse	No mitigation available for loss. Compensation will be provided to affected landowners.	Moderate adverse

Soils and ground conditions	Localised impacts on ground conditions and compaction damage to topsoil/subsoil during construction and storage of soil	Minor Adverse	Programme the majority of earth movements and soil handling during summer months. Loosen subsoils prior to topsoiling. Store stripped topsoil in separate bunds to a suitable maximum height depending on local conditions. Grass bunds and keep free from construction traffic.	Minor Adverse
Local farm businesses and associated tenancies	Temporary land-take and severance during construction, which will prevent the continuation of current farming practices in some areas for up to three years	Moderate Adverse	Continued liaison with affected landowners and tenants to include adjustments to farming systems during the construction period.	Moderate Adverse
	Permanent impact on viability of farm businesses from direct land-take in the footprint of the new channel, new flood defences, new habitat creation areas, changes in soil structure and changes in water table.	Moderate Adverse	Continued liaison with affected landowners and tenants	Moderate Adverse
Health of construction workers and local land-users	Exposure of soil contamination with potential for direct contact	Moderate to Major Adverse	Employment of a health and safety plan for any workers likely to come into physical contact with contaminated soils, gases or vapours during the construction phase. Use of measures to mitigate dust migration risks from exposed soils and stockpile areas (e.g. tarpaulins, dust suppression sprays and/or siting of any contaminated/ odorous stockpiles away from residential areas – see Chapter 13 'Air Quality'). Storage of potentially-contaminated excavated soils on low permeability ground or pads with suitable temporary drainage/bunding to prevent risk of wash-off of stockpiled soils by rain or flood water; and/or leaching into the ground. Adoption of risk-based screening values for human health/controlled waters to determine appropriate locations for the re-use of	No Significant Impact
	Exposure of soil gas/vapours with potential for inhalation	Moderate to Major Adverse		No Significant Impact

			materials within the project boundary. Construction phase monitoring of soil gas levels where there is a significant risk of changing existing soil gas migration pathways. Appropriate design of a capping layer and/or seeding of any bare soils exposed at the end of the earthworks phase to reduce potential exposure pathways.	

13 Air quality

13.1 Existing environment

13.1.1 Overview

The Scheme is located within the administrative boundaries of Oxford City Council and VoWH, within proximity to the A34 and B4044 (West Way) – see Figure 1.3. This assessment considers construction traffic impacts up to 200m from the proposed Scheme (hereafter referred to as the 'study area') and along the adjacent highway network that will be used by construction traffic, and impacts associated with the generation of dust up to 350m from the Scheme area.

The main pollutants of concern relevant to the construction phase of the Scheme are nitrogen dioxide (NO_2) and airborne particulate matter (PM). These pollutants are known to have detrimental cardiopulmonary (heart and lung) effects on the human body and can trigger increased hospital admissions and contribute to premature mortality. They can also have adverse impacts on sensitive ecological receptors, through dry deposition of dust which can alter photosynthetic processes and of nitrogen oxides which can acidify soils, affecting ecosystem health.

The Scheme will require a large amount of material to be moved off site, resulting in the generation of HGV traffic on the existing road network. A Transport Assessment was carried out in 2017 (CH2M 2017b) and updated in 2021 (see Appendix M for the current version), which identified the Affected Road Network (ARN). Figure 13.1 presents the ARN considered to assess the impacts from traffic generated by the Scheme during the construction phase and which has therefore been used to appraise the air quality impacts due to construction traffic.

As indicated in Figure 13-2 and detailed in Section 13.1.4, the Scheme area partially overlaps one Air Quality Management Area (AQMA) and is close to a second. During the pre-planning application phase of the Scheme, Oxford City Council and the VoWH District Council expressed concerns with the Scheme potentially worsening PM_{10} and NO_2 concentrations within or in proximity to existing AQMAs during construction.

13.1.2 Key sensitive human receptors

Human receptors in proximity to the ARN have been screened and 21 worst-case receptors were selected using professional judgement of where the highest change in pollutant concentrations would be likely to arise and where the greatest impacts would be expected as a result of the Scheme.

These locations include residential properties, schools, hospitals and care homes. Other receptors, such as shops and offices, where the NO_2 short term air quality objective (i.e. 200µg/m^3 not to be exceeded more than 18 times a year) would apply, have also been considered. However, Oxford City Council recorded no exceedances of this objective in the last five years (Oxford City Council 2020b) and changes in traffic flows associated with construction of the Scheme are unlikely to have perceptible impacts on NO_2 hourly average concentrations.

Figure 13.1 shows the human receptors selected for the air quality assessment.

13.1.3 Local air quality management

The European Union (EU) Framework Directives 96/62/EC and 2008/50/EC on ambient air quality and cleaner air for Europe provide regulations pertaining to the assessment of air quality as well as setting limit values for relevant pollutants, known as Air Quality Standards (AQS). Limit values are set for individual pollutants and are made up of a concentration value, an averaging time over which it is to be measured, the number of exceedances allowed per year, if any, and a date by which it must be achieved. Although

the UK is no longer a member of the EU these AQS have been adopted into UK regulations and remain in force.

According to Section 82 of the Environment Act (1995) (Part IV), Local Authorities are required to review and assess air quality within their area of jurisdiction annually under the system of Local Air Quality Management (LAQM). This review and assessment of air quality involves assessing present and likely future air quality against the AQS objectives.

If it is predicted that levels are exceeded or are likely to be exceeded at the façade of buildings where members of the public are regularly present, the Local Authority is required to declare an AQMA. For each AQMA, the Local Authority is required to produce an Air Quality Action Plan (AQAP), the objective of which is to reduce pollutant concentrations in pursuit of the AQS objectives.

The AQS of most relevance to the proposed Scheme are NO_2 and PM, shown in Table 13.1, as these have the potential to be exceeded within the study area.

Table 13.1: Air Quality Standard objectives for NOx, NO_2, PM_{10} and $PM_{2.5}$

Pollutant	Averaging Period	Limits (µg/m^3)
Nitrogen oxides (NO_X) (for the protection of vegetation and ecosystems)	Annual mean	30
Nitrogen dioxide (NO_2) (for human health)	Annual mean	40
	1-hour mean (not to be exceeded more than 18 times per year)	200
Particulate matter (PM_{10}) (for human health)	Annual mean	40
	24-hour mean (not to be exceeded more than 7 times per year)	50
Particulate matter ($PM_{2.5}$) (for human health)	Annual mean	25

13.1.4 Air Quality Management Areas

There are two designated AQMAs (one in Oxford City and one in the VoWH District) that are relevant to the Scheme, as presented in Figure 13.2:

- The City of Oxford AQMA – this includes the full area of the city of Oxford. Parts of the Scheme area fall within this AQMA.
- Botley AQMA – which encompasses a number of properties within Westminster Way, Coles Court, Stanley Close and along the Southern Bypass within Vale of White Horse District. The Scheme lies to the east of this AQMA but the affected road network lies within this AQMA.

Both AQMAs have been declared as a result of exceeding the annual mean AQS for NO_2. The most recent source apportionment study, aimed at determining the main sources contributing to air pollution in the region, indicated that road vehicle emissions are the main source of air pollution within the AQMAs, with buses playing a significant role in the city centre while private cars dominate emissions elsewhere (Ricardo, 2020).

13.1.5 Local Authority monitoring data

Available air quality data from Oxford City Council and the VoWH District Council have been collated and presented in this section. The locations of the monitoring sites within the study area are presented in Figure 13.2. Results from all monitoring networks in the

areas surrounding the Scheme are discussed in the sections below. We have not used data collected in 2020 as air pollution was lowered due to lockdowns and would not be representative.

13.1.6 Oxford City monitoring network

Oxford City Council monitor NO_2 concentrations from a network of diffusion tubes positioned at various locations throughout the city. Oxford City Council's data also include automatic monitoring data from three sites including Defra's urban background site at St. Ebbe's, which monitors PM_{10}, $PM_{2.5}$, NO_x and Ozone (O_3), Defra's Oxford Centre Roadside site (NO_x), and the City Council's Oxford High Street Roadside station (PM_{10} and NO_x).

Five exceedances of the annual mean NO_2 objective of 40µg/m³ were recorded in 2016. These exceedances were recorded at St Aldate's (Oxford Centre AURN) (CM1), High Street (CM2), Abbey Road Corner (DT35), Duke Street (DT39) and Speedwell Street/ St Aldate's (DT58). These locations are all within the existing City of Oxford's AQMA.

Monitoring locations have been reviewed for relevant exposure in terms of their proximity to the Scheme and the type of monitoring location. Five diffusion tube locations have been considered to be representative for this study. Annual mean NO_2 and PM_{10} concentration data for 2015-2019 obtained from Oxford City Council's '*2019 Air Quality Annual Status Report*' (Oxford City Council 2020b, reporting up to 2019 data), are shown in Table 13.2 and Table 13.3.

Table 13.2: Oxford City Council monitored annual mean NO_2 concentrations (µg/m^3)

Site ID	Location name	Site type	2015	2016	2017	2018	2019
DT2	Weirs Lane/Abingdon Road Lamp Post 1	Roadside	39	34	28	27	29
DT3	Lamp Post 52 Abingdon Road	Roadside	**42**	38	31	29	34
DT35	Botley Road / Hillview Road	Roadside	40	40	34	32	34
DT36	Botley Road North (Corner of Prestwich place)	Roadside	29	35	27	27	25
DT37	Botley Road South (Corner of Duke Street)	Roadside	34	22	25	23	NM
*Exceedances with the Annual mean NO_2 objective of 40 µg m^{-3} are shown in **bold**.*							

Table 13.3 indicates no exceedances of the annual mean PM_{10} objective since 2012, at the two automatic monitoring stations in Oxford City (CM2 and CM3).

Table 13.3: Oxford City Council monitored annual mean PM10 concentrations (µg/m3)

Site ID	Location name	Site type	2015	2016	2017	2018	2019
CM2	High Street	Roadside	21	20	18	18	19
CM3	St Ebbe's	Urban background	13	15	13	12	14
*Exceedances with the Annual mean PM_{10} objective of 40 µg m^{-3} are shown in **bold**.*							

Table 13.4 and Table 13.5 present the number of exceedances of the NO_2 and PM_{10} short-term AQS recorded by Oxford City's automatic monitoring stations.

The AQS objective for hourly mean NO_2 concentration is 200 µg/m^3, which may be exceeded up to 18 times per calendar year. During 2016 there were no recorded hourly mean NO_2 measurement exceeding 200 µg/m^3.

The AQS objective for PM_{10} is a maximum of 50 µg/m^3 for any 24-hours mean period, not to be exceeded more than 35 times a year. The results of PM_{10} measurements during the course of 2016 show four exceedances to the 50 µg/m^3 24-hours mean periods value recorded at Oxford High Street, thus well within the objective.

Table 13.4: Oxford City Council monitored number of exceedances per year of the 1-hour mean NO2 Objective

Site ID	Location name	Site type	2015	2016	2017	2018	2019
CM1	St Aldate's (Oxford Centre AURN)	Roadside	2	0	0	1	3
CM2	High Street	Roadside	0	0	0	0	2
CM3	St Ebbe's	Urban Background	0	0	0	0	0

*Exceedances of the NO_2 1-hour mean objective (200 µg/m^3 not to be exceeded more than 18 times per year) are shown in **bold**..*

Table 13.5: Oxford City Council monitored number of exceedances per year of the 24-hour mean PM10 Objective

Site ID	Location name	Site type	2015	2016	2017	2018	2019
CM2	High Street	Roadside	1	4	2	0	7
CM3	St Ebbe's	Urban Background	6	0	2	1	5

*Exceedances of the PM_{10} 24-hour mean objective (50 µg/m^3 not to be exceeded more than 7 times per year) are shown in **bold**.*

13.1.7 VoWH District Council monitoring network

The VoWH District Council monitor NO_2 concentrations from a network of diffusion tubes positioned at various locations throughout the district. The council does not undertake automatic monitoring.

The closest monitoring sites to the Scheme are two locations near the A34 in the Botley AQMA (Figure 13.2). All other monitoring sites in the district are distant from the Scheme and the affected road network and not relevant to this baseline review. The latest annual mean NO_2 concentration data for 2015-2019 obtained from the council's 2020 Air Quality Annual Status Report (VoWH District Council 2020), are shown in Table 13.6.

Exceedances of the annual mean NO_2 objective have been recorded every year between 2012 and 2019 at Stanley Close (S21). According to the council's Air Quality ASR, the exceedance is caused by heavy traffic along the A34. All other considered diffusion tube sites indicate compliance between 2012 and 2016 with the annual Mean NO_2 objective.

Table 13.6: Vale of White Horse District Council monitored annual mean NO2 concentrations (µg/m3)

Site ID	Location name	Site type	2015	2016	2017	2018	2019
S21	Stanley Close (AQMA)	Kerbside	**47.8**	**52.5**	**46.2**	**46.2**	**44.3**
S22	Westminster Way (AQMA)	Kerbside	32.0	38.8	31.7	38.5	30.9
*Exceedances with the Annual mean NO_2 objective of 40 µg m^{-3} are shown in **bold**.*							

13.1.8 Ecological receptors

The sensitive ecological receptors (e.g. designated sites) identified within the study area, as shown on Figure 13.1, include international conservation sites (Oxford Meadows SAC) and national conservation sites (Iffley Meadows SSSI, Wytham Woods SSSI and Port Meadow with Wolvercote Common & Green SSSI). In addition, there are local conservation sites such as the Seacourt Nature Park, located within the footprint of the proposed Scheme.

The pollutants of most concern in relation to vegetation and ecosystems near roads is NOx. Excessive exposure to NOx, can cause death in plants and roots and damage the leaves of many agricultural crops as a result of the lowering of pH of soil and surface and groundwater.

The identified ecological receptors that may potentially be impacted by the Scheme contain ecological features that could be sensitive to changes in nitrogen levels, which could have direct and indirect effects on vegetation affecting species composition and ecosystem health.

All habitats included within the designated nature conservation sites are sensitive to nitrogen deposition according to the Air Pollution Information System (APIS) website (http://www.apis.ac.uk/srcl). These habitats are listed in Table 13.7. The deposition of nitrogen from airborne pollutants contributes to eutrophication in sensitive habitats. The 'critical level' is the objective concentration of a pollutant in the air for the protection of vegetation and ecosystems, below which adverse effects are not as likely.

Table 13.7 provides data on the average nitrogen deposition within the international and national designated nature conservation sites and an empirical estimate of the critical load ranges. Critical loads are a quantitative estimate of an exposure of one or more pollutants below which significant harmful effects on specified sensitive environmental receptors do not occur. The locally designated Seacourt Nature Park is not listed under the APIS sites and is therefore not included in the table below.

Seacourt Nature Park is considered to represent the 'worst case' ecological receptor, as it lies within the footprint of the Scheme.

A transect (E1 – E6) has been defined that extends up to 200m from ARN within the study area. These receptors have been included into the model to calculate Nitrogen Oxides (NO_X) concentrations at the designated sites.

Table 13.7: Average nitrogen deposition (based on measured-interpolated data for 2013-2015) and critical loads for ecological designated sites

Designated site	Local Authority	Habitat Type or Species	Critical Load (kg N/ha/yr)	2013-2015 Average Baseline Nitrogen Deposition (kg N/ha/yr)
Oxford Meadows SAC	Oxford CC	Lowland hay meadows Creeping marshwort	20-30	17.1
Iffley Meadows SSSI	Oxford CC	Neutral grassland	20-30	15.4
Wytham Woods SSSI	VoWHDC	Broad-leaved, mixed and yew woodland Calcareous grassland Vascular Plant Assemblage	15-25	26.8
Port Meadow with Wolvercote Common & Green SSSI	Oxford CC	Creeping marshwort Neutral grassland	20-30	15.4

13.1.9 Background concentrations

The background concentration of a pollutant is determined by regional, national and international emissions and often represents a significant proportion of the total pollutant concentration. The local component is determined by local pollutant sources such as road traffic and chimney stacks. Data from the grid squares relevant to the Scheme (as defined in Appendix H-2) have been downloaded from the Defra website and are summarised in Table 13.8.

The background concentrations have been downloaded for the base year (2016). To prevent double counting of source contributions, background contributions from the traffic sector were subtracted from total background NOx concentrations using the Defra tool (NO_2 Adjustment for NOx Sector Removal Tool v6.0).

Background concentrations representative of future years have not been used. Instead, following a conservative approach, the 2016 concentrations were adopted to represent the background conditions at the time of the construction phase.

As indicated in Table 13.8, average and maximum background pollutant concentrations for 2016 were already well within the AQS objectives.

Table 13.8: Defra background pollutant concentrations in the study area

Pollutant	2016 Maximum Concentration (µg/m³)	2016 Average Concentration (µg/m³)	Short-Term AQS Objective (µg/m³)	Annual Average AQS Objective (µg/m³)
NOx	33.4	10.8	n/a	30
NO_2	22.1	8.1	200	40
PM_{10}	19.2	11.8	50	40
*Exceedances of the AQS Objectives are shown in **bold**.*				

13.1.10 Changes to air quality in absence of Scheme

In the absence of the Scheme, there will continue to be an increase in population within the area, resulting in an increased reliance on the road network and an increase in road vehicles. However, this will be countered in part by reduced emissions per vehicle as technology improves and we move towards more electric cars over the coming decades.

Air quality has been improving within Oxford City and the VoWH district and will continue to do so as new actions are taken, ensuring that air quality objectives within the city are met in the future.

13.2 Likely significant effects

This assessment primarily focuses on the potential air quality impacts associated with the construction phase of the proposed Scheme, resulting from the generation of dust from the construction sites and from traffic emissions associated with the movement of Heavy Goods Vehicles (HGV).

13.2.1 During construction

The Scheme's construction phase will consist of various activities that could potentially affect air quality in the local area. These activities include:

- Movement of earth via excavation, flood defence construction, demolition and channel re-alignment procedures;
- Increased use of site access roads by HGVs and other vehicles; and
- Additional HGVs traffic on the existing road network.

After consultation with Oxford City Council, six sensitive areas for air quality, which are located within or in close proximity to the existing AQMAs, have been identified. These are:

- Osney Mead via Botley Road – entrance/exit
- A34 Southern Bypass Road (South Hinksey) – entrance/exit
- Botley Road delivery and small vehicle entrance (Seacourt Stream)
- Haul route for materials removal via Seacourt Park and Ride
- Main entrance/exit for northern site
- Access to Area 4 – New Hinksey

Sensitive receptors within these areas are considered in the air quality assessment of the Scheme, including both human receptors and ecological designated sites.

On-site activities

The impacts on air quality resulting from the construction phase are through the generation and subsequent deposition of dust, and elevated local PM with an aerodynamic diameter less than 10 µm (PM_{10}) concentrations. Most construction dust consists of large particles (diameter >30 µm) that have a very short lifetime in the atmosphere (EP UK, 2017) and tend to be deposited close to the source.

Dust deposition onto properties can lead to complaints and may constitute a statutory nuisance. Deposition onto sensitive habitats can also affect photosynthetic and other biological functions that may cause permanent ecological damage. Elevated PM_{10} concentrations in an area of poor air quality will have additional adverse human health effects, such as increased risk of cardiopulmonary diseases for sensitive populations.

The potential impacts associated with dust generation resulting from the construction works is summarised for each construction area below. Following the IAQM Guidance (2014), human receptors within 350m of Area 4A have been considered in this

assessment. These receptors have varying sensitivities, including residential properties, schools, hospitals, care homes, and commercial and recreational areas.

Full details of the assessment are provided in Appendix H-1.

Area 1 – North of Botley Road

The main construction activities relevant to Area 1 are related to the modification of Seacourt Stream, modifications to Botley Bridge involving channel clearance beneath the bridge and the construction of a floodwall and embankment to the west of Seacourt Stream, additional flood defences including a floodwall to the east of Seacourt Stream, and floodgates by Helen Road and Henry Road.

One ecological site, Seacourt Nature Park, located within Area 1, has been considered as part of the assessment.

The overall risk of construction dust associated with Area 1, prior to mitigation, is considered to range from Low to High depending on the construction activity, as detailed in Appendix H-1 and Table 13.9.

Area 2 – Botley Road to Willow Walk North

The main construction activities relevant to Area 2 are related to the modifications of Seacourt Stream via further earth movement and water course diversions, the replacement of West Way Cycle Bridge, the creation of a new second stage channel north of Willow Walk, and the construction of the new Willow Walk Bridge.

The Seacourt Nature Park has been considered in the assessment of Area 2, as is located in close proximity to the Scheme.

The overall risk of construction dust associated with Area 2, prior to mitigation, is considered to range from Low to Medium depending on the construction activity, as detailed in Appendix H-1 and Table 13.9.

Area 3 – Willow Walk to Devil's Backbone

The main construction activities relevant to Area 3 are related to the creation of a new channel between Willow Walk and New Hinksey Causeway and the construction of a new footbridge at North Hinksey Causeway, a new weir, three ford crossings and additional flood defences at Ferry Hinksey which includes two new floodgates.

No ecological designated sites were identified within 50m of Area 3.

The overall risk of construction dust associated with Area 3, prior to mitigation, is considered to range from Negligible to High depending on the construction activity, as detailed in Appendix H-1 and Table 13.9.

Area 4A – Devil's Backbone to the junction with Hinksey Stream and River Thames (South Hinksey)

The main construction activities relevant to Area 4A are related to the raising of flood defences at South Hinksey, the creation of a new channel between Cold Harbour Bridge to Old Abingdon Road, the construction of two bridges at the Old Abingdon Road and Kennington Road junction and the demolition/removal of Towles Mill Weir.

One ecological designated site, Iffley Meadows SSSI, located within 20m of the Scheme, has been considered in assessment of Area 4A.

The overall risk of construction dust associated with Area 4A, prior to mitigation, is considered to range from Low to High depending on the construction activity, as detailed in Appendix H-1 and Table 13.9.

Area 4B - Devil's Backbone to the junction with Hinksey Stream and River Thames (New Hinksey)

The main construction activities relevant to Area 4B are related to the building of defences at New Hinksey, including the construction of a 1.5m high, 140m long flood wall.

One ecological designated site, Iffley Meadows SSSI, located within 50m of the Scheme, has been considered for Area 4B.

The overall risk of construction dust associated with Area 4B, prior to mitigation, is considered to range from Negligible to High depending on the construction activity, as detailed in Appendix H-1 and in Table 13.9 below.

Table 13.9 summarises the overall risk of dust impacts associated with each construction activity for all five areas.

Table 13.9: Overall risk of dust impacts from each construction activity

Potential Impact	Overall Risk of Dust Impacts			
	Demolition	Earthworks	Construction	Trackout
Area 1 – North of Botley Road				
Dust Soiling	Medium Risk	High Risk	Low Risk	Medium Risk
Human Health	Low Risk	Medium Risk	Low Risk	Low Risk
Ecological	Low Risk	Medium Risk	Low Risk	Low Risk
Area 2 – Botley Road to Willow Walk North				
Dust Soiling	Medium Risk	Low Risk	Low Risk	Medium Risk
Human Health	Low Risk	Medium Risk	Low Risk	Low Risk
Ecological	Low Risk	Medium Risk	Low Risk	Low Risk
Area 3 – Willow Walk to Devil's Backbone				
Dust Soiling	Medium Risk	High Risk	Low Risk	High Risk
Human Health	Low Risk	Medium Risk	Low Risk	Medium Risk
Ecological	Negligible	Negligible	Negligible	Negligible
Area 4A – Devil's Backbone to the junction with Hinksey Stream and River Thames (South Hinksey)				
Dust Soiling	Medium Risk	High Risk	Medium Risk	High Risk
Human Health	Low Risk	Medium Risk	Medium Risk	Medium Risk
Ecological	Low Risk	Medium Risk	Medium Risk	Medium Risk
Area 4B - Devil's Backbone to the junction with Hinksey Stream and River Thames (New Hinksey)				
Dust Soiling	Medium Risk	High Risk	Medium Risk	Medium Risk
Human Health	Low Risk	Medium Risk	Medium Risk	Low Risk
Ecological	Negligible	Low Risk	Low Risk	Low Risk

During construction (HGV traffic)

The assessment carried out for the Scheme for the 2018 Environmental Statement concluded that air quality effects caused by traffic will be **not significant**. The assessment included congestion due to a proposed closure of Old Abingdon Road for several months during construction, which is no longer required.

Appendix H-4 sets out the conclusions of the modelling study, with additional detail given in Appendix H-3 which is more technical. Modelled results at one receptor, in a similar location to the Vale of White Horse roadside monitoring point numbered S21, showed a slight increase in NO_2 levels at a site in the Botley AQMA which would be expected to be above the national objective level for NO_2. Further monitoring data collected by the council since 2016 show that levels at Botley AQMA are still above the objective levels but have reduced. Data for 2020 showed a significant reduction, but this was due to reduced traffic during the lockdown that year and is not representative of the long-term

trend for more gradual reductions. As this effect was not significant in the previous assessment, and subsequent changes to the Scheme and the timing of its construction will tend to reduce air pollutant levels rather than increase them, the modelling study has not been repeated and the effect is still not significant.

Changes in vehicle-derived PM_{10} levels were predicted to be imperceptible.

Changes in NOx levels at protected wildlife sites were found not to be potentially significant at any site except Seacourt Nature Park, where nitrogen deposition could be significant if continued over an extended period. Due to the relatively short period when the Scheme will cause increased traffic on Botley Road, and the fact that the affected area of Seacourt Nature Park will be heavily affected by vegetation clearance for construction, with trees, shrubs and grass being replanted on completion, there will be no discernible effect at this site beyond that identified in Chapter 8 due to the direct effect of vegetation clearance.

13.2.2 During operation

During operation, there will be very few traffic movements, related only to periodic inspection and maintenance. Operational impacts were therefore scoped out of this assessment.

13.3 Mitigation

On-site management

A Construction Environmental Management Plan (CEMP) will be prepared and implemented by the appointed construction contractor. The CEMP will include a range of best practice construction mitigation measures, as presented in Table 13.10.

Table 13.10: Construction phase mitigation measures

Site Planning	Construction Traffic	Site Activities
• Machinery and dust causing activities should be located away from sensitive receptors where feasible; • Visual inspections should be regularly undertaken to determine whether there are any significant dust episodes resulting of the construction activities; and • Ensure adequate water supply on site for dust suppression, as and when required.	• All vehicles to switch off engines when not in use (i.e. no idling of vehicles); • Effective vehicle cleaning and specific wheel-washing on leaving the site and damping down of haul routes (dust suppression measures), where there is a potential for carrying dust or mud off the site; • All loads entering and leaving the site to be covered; • On-road vehicles to comply to regulated emission standards; • Movement of construction traffic around the site should be reduced as far as practical;	• Ensure the disposal of any run-off water from dust suppression activities is in accordance with legal requirements; • Maintain all dust control equipment and record any maintenance activities; • Avoid double handling of materials where possible; • Use water as a dust suppressant where required; • Ensure the mixing of cement and other similar materials takes place in enclosed areas away from potential receptors; • Ensure slopes on any stockpiles are no

Site Planning	Construction Traffic	Site Activities
	• Impose and signpost maximum speed limits within the construction areas; and • Regularly inspect haul routes for integrity and undertake repairs as appropriate.	steeper than the natural angle of repose of and maintain a smooth profile; • Stockpiles should be covered and located away from sensitive receptors where possible.

Traffic mitigation

The contractor(s) will be required to operate EURO VI vehicles which compared to other construction vehicles are expected to have significantly lower emissions of NO_X, and to agree with the Highways Authorities, and implement, a Construction Traffic Management Plan.

The contractor(s) will be also be required to ensure that construction vehicles will not circulate during traffic peak hours to minimise the risk of congestion and reduce the impact on local air quality.

In our previous application we had proposed road closures and traffic management that would see more stationary vehicles on Old Abingdon Road, Kennington Road and likely additional queuing back onto the A423 and on the A34. This application includes a temporary carriageway that will maintain traffic flowing as it does currently along Old Abingdon Road and Kennington Road, as additional traffic mitigation.

All of the above traffic mitigation measures will reduce the impacts of traffic-derived air pollution due to the Scheme.

In addition, a six month air quality monitoring campaign will be performed at a number of locations, agreed with Oxford City Council and the VoWH District Council. The campaign will commence three months before the construction phase begins and will continue for the first three months of the construction phase. If the results of the monitoring survey highlight a significant increase in NO_2 concentrations, the campaign could be extended.

13.4 Residual effects

Table 13.11 presents the residual effects of the Scheme, together with appropriate mitigation that is expected to reduce any potential air quality impacts as a result of the Scheme.

Table 13.11: Residual effects on air quality

Receptor	Description of Potential Impact	Significance of Predicted Impact	Mitigation Measures	Significance of Residual Impact
Humans and ecological receptors	Fugitive dust as a result of the construction and earth moving activities	Moderate adverse	Mitigation measures as presented in Table 13.10, including: ○ Machinery and dust causing activities should be located away from sensitive receptors where feasible; ○ Ensure adequate water supply on site for dust suppression, as and when required. ○ All vehicles to switch off engines when not in use (i.e. no idling of vehicles); ○ All loads entering and leaving the site to be covered; ○ On-road vehicles to comply to regulated emission standards; ○ Movement of construction traffic around the site should be minimised; ○ Regularly inspect haul routes for integrity and undertake repairs as appropriate. ○ Avoid double handling of material where possible; ○ Use water as a dust suppressant where required; ○ Stockpiles should be covered and located away from sensitive receptors where possible ○ The successful contractor(s) will be required to operate EURO VI vehicles which are expected to have significantly lower emissions of NO_X.	Negligible
Humans and ecological receptors	Vehicle emissions resulting from the addition of HGVs to the road network around the Scheme	Minor adverse		Negligible

14 Carbon, sustainability and climatic factors

14.1 Climate change

Whilst there is some uncertainty around the likely impacts of climate change into the future, the Oxford Flood Risk Management Strategy which underpins the Scheme has taken into account the latest guidance and predictions with respect to climate change which was published in 2021. The Scheme is a major part of implementing the strategy.

The strategy identifies an adaptive pathway for dealing with climate change which can be tailored into the future, the strategy identified the opportunity for additional upstream storage to be built in the future but allows flexibility for other solutions. This is in line with current guidance and best practice for allowing flexibility to implement the next stages as the actual impacts of climate change and development in the area become known with more certainty.

As well as allowing for climate change in the design of the Scheme, we have used the IEMA Guidance on Climate Change Resilience and Adaptation (IEMA 2020) in carrying out the EIA of the Scheme.

14.2 Environmental sustainability

In line with Provision 4(1) of the Environment Act (1995) design for the Scheme has been developed to contribute towards achieving sustainable development, in that it will provide significant economic benefits through prevention of flooding with low carbon emissions and reflecting the principles for sustainable development throughout the Scheme.

The Scheme has been designed so that it will require little active management and maintenance over its design life of 100 years. The Scheme creates more space for water within the existing western floodplain of the city with a new channel that will operate with minimal intervention (a mainly passive Scheme) and that can be maintained largely through traditional land management techniques that are appropriate to the site.

The second stage will be managed through traditional agricultural practices including grazing by limited numbers of cattle to maximise the biodiversity interest of the area into the future. This will allow us to maintain the second stage in a condition which will accommodate flood flows when needed, while avoiding the need for regular mowing with the energy this would require. Although some interventions will be required, to remove any excess self-set woody growth within the second stage which cattle will not keep down, this likely to be only on an annual or bi-annual basis.

The design allows a tolerance in the length for grass growth in the second stage to accommodate varying lengths of vegetation likely to be encountered with grazing and will avoid the need to regularly mow the area to keep a short grass sward. This will also allow the new wetland features in the second stage channel to develop structured marginal and aquatic vegetation without interfering with design conveyance. This design will help to retain a rural feel and open landscape setting to the city of Oxford and, through habitat creation, help to reverse the national decline in ponds and wetland habitats.

The Scheme has been designed to ensure that long term maintenance can be undertaken in a sustainable manner. The passive nature of the Scheme, with the only moving part the control structure on the Eastwyke Ditch channel and five small flood gates which are manually closed, minimises the energy and carbon emissions

associated with the operation of the Scheme during a flood event. There are no other new gates or sluices or pumps as part of the Scheme which need power to operate during a flood, and this avoids the risk of failure or components operating incorrectly in the event of a power failure.

The main two stage section of the Scheme has been designed to work with natural processes, and the new first stage will be allowed to act and behave as an unconstrained natural watercourse so will mature and provide long term in-channel habitat features such as riffles, pools and vegetated side bars.

Where possible, the detailed design of the Scheme has incorporated environmentally sustainable techniques and materials (e.g. low carbon concrete, sustainable timber for use in new bridges and for formwork), to reduce the carbon footprint. We will re-use some of the excavated materials from ground lowering for landscaping, including the creation of varied profiles in addition to the material needed for new flood defence bunds. Some of the excavated material will also be used for the creation of an artificial badger sett, thus further reducing the need to transport materials away to restoration sites. We will re-use the majority of the gravels excavated within the Scheme area for channel improvements (although some of the gravels will be exported off site for the beneficial re-use in other environmental improvement projects).

In order to ensure that all habitat creation and environmental mitigation works are realised on site and that our long-term aims are met, we have made plans for management and monitoring of the Scheme once construction is complete (see Chapter 17), with remedial action to be taken if measures are found not to work.

14.3 Carbon

A Carbon Calculator Tool was applied to the option development stage, to provide an indication of the whole life carbon requirements of the options under consideration. Subsequently, the Carbon Calculator was applied to select and design a Scheme, which has as low an impact as possible on the environment, to help increase our resource efficiency and to estimate and target reduction of the carbon emissions associated with construction activities and maintenance activities during Scheme operation.

Throughout the development of the Scheme a number of workshops have been held to review opportunities to reduce the carbon emissions associated with the Scheme, these have reviewed the solution, materials and advances in technology which will help to reduce carbon. This process will continue through the delivery stage of the project to ensure that further carbon reduction improvements are incorporated as they become available through advances in technology and the development of sustainable practices.

As a result of these workshops a number of elements of the design have been refined to help reduce the carbon impacts of the Scheme; these include amongst others;

- Use of re-usable shutters for concrete casting
- Use of pre-formed brick cladding in place of tradition hand laid brick cladding
- Use of pre-cast concrete components where possible
- Avoiding complicated cladding details and using textured concrete in less high profile visual areas
- Use of sustainable nature-based solutions for creating headwalls for pipe outfalls, reducing the number of traditional concrete headwalls
- Use of nature-based solutions for erosion protection where possible to minimise the amount of rock scour protection.

Whilst the proposed two-stage channel is the main construction activity for the Scheme and the dimensions of this channel and its associated features have been optimised to reduce carbon emissions as far possible. The raised defences such as walls and

embankments create larger carbon emissions than the channel works due to the use of new materials brought to the site and the construction process. This has been minimised by use of lower carbon materials as noted above. The raised structures have been designed with a long design life to minimise maintenance and the need for replacement during the Scheme life, this has helped to reduce the long term maintenance carbon emissions.

In addition, we will continue monitor developments in construction materials and adopt new technologies to further reduce carbon emissions associated with the raised structures as opportunities arise, this includes the use of ultra low carbon concrete in a many of the proposed structures and the use of steel from suppliers using green energy for manufacturing.

The carbon emissions presented in the carbon calculator are based on currently available technology and plant, which is predominantly diesel powered. However, advances in alternative fuels, hydrogen powered and electric plant are developing quickly and are likely to be more widely available when construction commences, these advances in plant technology will be adopted as soon as they are commercially available to further reduce carbon emissions during construction.

We estimate a total volume of 455,000m^3 will be excavated. In order to minimise and reduce the associated carbon footprint, the soil requirement for new flood defence embankments and environmental enhancements, estimated at 96,000m^3 (about 21% of the total) will be met by reuse of materials generated by excavations on site.

As described in Section 2.3.3, we investigated a range of options for the re-use and disposal of materials to limit adverse environmental impacts generated by the Scheme. Section 16 of this document describes the rail opportunity which is being investigated to help reduce both road vehicle movements and carbon emissions. We are investigating options for lower-emission road vehicles and will continue to look for further ways to reduce these emissions during construction, as this technology is currently advancing rapidly.

A short-listed option to reduce carbon emissions from transportation of excess material involved the disposal of a quantity at a land raising area south of Hinksey Heights, but this area has since been rejected due to planning constraints.

The whole life carbon dioxide emissions over the project life is estimated at 19,558 tonnes and the operational carbon is 4.65% of this (i.e. 909 tonnes) based on the proposed maintenance regime. For comparison, a 2019 Oxford City Council report stated that direct and (selected) indirect carbon dioxide emissions from the city in 2017/18 were 718,362 tonnes per year. The emissions due to the Scheme including operation for 100 years would be equivalent to direct emissions from the city for ten days. This comparison is given for context; it is not an accurate comparison as the figure for Oxford only includes certain indirect emissions, not including the carbon emitted by bringing food and other goods from outside the city or by residents travelling to other cities, and the figure for the Scheme omits carbon saved by avoiding rebuilding work caused by flooding.

The Contractor will use well-maintained equipment, new technology low emission vehicles where feasible, and implement construction procedures (e.g. regular fleet maintenance) to minimise emissions, as will be detailed in the CEMP (see outline CEMP in Appendix M). We will also seek to operate a park and ride scheme to bring site workers onto site on a daily basis and reduce the numbers of vehicles on roads at start and finish times each day.

Additionally, the Contractor will ensure sustainable use and disposal of resources, as outlined in the materials management plan (see Appendix O). A Site Waste Management Plan (SWMP) will be prepared by the Contractor, which will consider

reduction, re-use and recycling of soils, timber and waste. Each of these sustainability requirements will also be extended to the wider sub-contractor and supply chain.

15 Cumulative effects and inter-relationships

15.1 Interactions between impacts of the Scheme

The cumulative impacts identified in this section are those multiple actions or combined impacts from various elements of the Scheme acting on a single environmental receptor or resource.

Any impacts identified in earlier sections to be 'negligible' are not considered in this section.

Table 15.1 presents a summary of where potential multiple impacts on a range of environmental resources or receptors may arise (mostly during the construction phase).

Table 15.1: In-combination Scheme impacts

	Change in Environmental Resource								
Receptor	Elevated noise and/or vibration	Impacts on public access and rights of way	Landscape change and visual impacts	Impacts on flora and fauna	Impacts on water and flood risk	Loss or damage to heritage assets	Changes in traffic and transport	Impacts on soils, geology and agricultural land	Elevated dust and traffic emissions
Human beings	✓	✓	✓	✓	✓	✓	✓	✓	✓
Flora and fauna	✓		✓	✓	✓		✓	✓	✓
Landscape		✓	✓	✓	✓	✓	✓	✓	✓
Water				✓	✓		✓	✓	
Historic assets	✓		✓		✓	✓	✓	✓	✓
Soils and geology		✓		✓	✓			✓	
Air							✓		✓

The table shows that all receptors will be affected to some degree by environmental impacts arising from the Scheme. Human beings may, in particular, be affected by temporary changes in many environmental features. Any adverse 'combined' impacts are likely to be localised to the Scheme boundary, affecting existing residents, businesses or workers, tourists, road users and recreational users in close proximity to the working areas. However, these receptors are likely to benefit significantly from the Scheme in terms of the reduced flood risk.

Ecological receptors will also be affected by a range of environmental impacts during construction including noise, change to landscape (e.g. tree loss), disturbance to wetland habitats etc but these factors have all been considered when determining the significance of impacts predicted in Chapter 8 'Flora and fauna'.

Gradual cumulative changes in visual amenity and landscape character for the local community are likely to be experienced within and around the Scheme area during the three years of construction and upon Scheme completion. The landscape will be affected by changes to public access and rights of way (particularly those involving new structures, barriers and elevation changes), changes to habitats and trees, the creation

of new channels and wetland habitats, changes to the historic landscape, re-routing of traffic and changes in the use of agricultural land. These factors have been considered in Chapter 7 'Landscape and visual amenity'.

Surface water bodies in the study area have the potential to be affected by impacts on flora and fauna (for example vegetation clearance releasing sediment and affecting water quality), changes in flood risk, the construction of new accesses and haul roads, changes in soils and land use change. These factors have all been considered in Chapter 9.

Cultural heritage can be affected by various environmental impacts including increased vibration from the movement of construction machinery (e.g. affecting built heritage assets), landscape changes (which often contribute to the setting of heritage features), changes in surface and groundwater levels/flows, the construction of new accesses and haul roads, changes in land use change resulting from the Scheme (e.g. loss of buried or unknown archaeology as a result of ground lowering for the new stream or second stage channel) and direct impacts on known areas of archaeological sensitivity (e.g. around Old Abingdon Road). These in-combination impacts have already been considered when determining the significance of impacts in Chapter 10.

Soils and geology can be affected by in-combination impacts on access (e.g. soil stripping for new accesses, haul roads and ground lowering), biodiversity (e.g. vegetation clearance), changes in flood risk (and erosion) and land use change (e.g. compaction of soils from soil storage/working machinery). These impacts have been assessed in Chapter 12 'Sustainable Use of Land' of the ES.

Additionally, air quality can be affected by in-combination impacts resulting from changes to traffic flows (e.g. from the closure of Old Abingdon Road and increased HGV movements), the construction of new accesses and haul roads, and general construction machinery.

No other significant cumulative impacts affecting specific receptors as a result of the Scheme are predicted over and above those already identified in the relevant chapters of this ES.

15.2 Cumulative impacts with other developments

Cumulative effects can also be considered as effects resulting from incremental changes caused by other past, present or reasonably foreseeable activities, developments or plans together with the Scheme i.e. multiple projects/plans acting in combination. 'Reasonably foreseeable' is interpreted to include other proposals that already have consent or are awaiting determination in the planning process with design information in the public domain.

The potential cumulative effects of the following projects or plans have been reviewed with regard to their relevance to the Scheme, in the following sub-sections:

15.2.1 Oxford Corridor Phase 2

The Oxford Corridor scheme aims to improve the current transport capacity, at Oxford Railway Station, to prepare for future projected demand. Phase 2 has planning application reference 21/02007/PA18.

The proposed 'Oxford Station Masterplan' works will include a replacement rail with accompanying platform and a new 'western entrance' to the platform, at Roger Dudman Way. The works will also include the replacement of Botley Bridge to include the footpath and cycle path routes and works at Cripley Road and Roger Dudman Way. The designs are intended to prioritise cyclists and pedestrians on Botley Road.

Construction is due to start in November 2022 and end in Nov 2024. Current known key dates are published as follows:

- Nov 2022 – commence highway works on Roger Dudman Way
- Dec 2022 – Botley road bridge, additional platform face and station buildings
- Apr 2023 – Botley road bridge highway works
- Nov 2023 – West end station entrance construction
- Dec 2024 – Entry into service

The Oxford Corridor scheme is unlikely to increase traffic flow on completion as no additional parking would be provided. During the two years' construction period it is estimated an average of six construction vehicles would pass per day. This is not considered a significant impact. Temporary lane closures and full diversion routes will be in place for the duration of construction of the rail scheme; these would not affect Scheme traffic.

A full closure of Botley road will be required whilst the main bridge decks are replaced which would take around 4 to 5 days, and a single lane traffic system would be implemented for a period during construction.

Given the current programme for these works it expected these will be completed or nearing completion when the Scheme commences and there will be no cumulative impacts. If there any delays to the Oxford Corridor scheme we will work with the local authorities and Network Rail to manage traffic accessing the site via Botley Road to minimise coincident working periods during the day. However the total number of movements (including those undertaken by HGVs) is expected to be low against the baseline and future traffic flows. The timing of the road closure of Botley Road is early enough that there is no risk of this coinciding with the construction of the Scheme. Together with the OFAS Scheme, it is therefore expected that any cumulative impacts would be avoided or **minor adverse**.

15.2.2 A423 Kennington Bridge Rail Bridge Replacement

Oxfordshire County Council is planning the replacement of the A423 Southern Bypass rail bridge to the east of Hinksey Interchange. We are working in partnership with the County Council to deliver an integrated solution for the bridge replacement and enhanced flood flow capacity at the site. The Scheme has been designed to take account of the works which the County Council will have carried out on and under the bridge.

The works to the bridge will require extensive traffic management for a long period which will have a negative impact on traffic flows in the area. Due to this, and to the need for works on the bridge to be complete before our contractors can work safely in the same area, it is proposed to delay the flood alleviation works in this area until the bridge replacement works are completed. We will continue to work with the County Council to ensure this is coordinated in an efficient manner.

However, it is proposed that the flood alleviation works to the north of Old Abingdon Road will commence whilst the A423 bridge works are in progress. The works north of Old Abingdon Road will be accessed via South Hinksey interchange on the A34 and from Botley Road and therefore will not interact with the works or traffic management associated with the bridge replacement works.

Given the above controls it is expected the cumulative additional impacts associated with this scheme will be **negligible**.

15.2.3 Osney Mead

Oxford City Council is drawing up a framework for future developments, the Oxford West End and Osney Mead Supplementary Planning Document, which covers future development plans for the Osney Mead industrial estate. In the long term this is anticipated to lead to a masterplan for future development at the site, along with other parts of Oxford. The document is currently at the stage of consultation about its scope,

so it will be some time before detailed proposals are published. It is unlikely that the timescale of development will coincide with the construction of the Scheme, and the Scheme proposals will result in improved flood protection for Osney Mead, therefore no cumulative impacts are anticipated.

15.2.4 Botley Road Development

Planning Permission has been granted for the redevelopment of the 'Pets at Home' site behind 215 Botley Road, application reference 21/02053/FUL. This is to convert a large retail unit to commercial /R&D premises. Construction is required to be commenced within 3 years from 15/12/2021 so could coincide with the construction period for the Scheme works and create some cumulative traffic impacts in the area.

This application will be monitored to identify any cumulative impacts and necessary mitigation.

16 Potential changes to impacts if the rail sidings are used

16.1 Purpose of this chapter

Up to this point, the ES has considered only the main planning application and has therefore assumed that all inert waste removed from the works area is taken away by road via the A34. A second planning application is proposed to be submitted to remove a significant proportion of the inert waste from site via rail. This would utilise the Hinksey Sidings which are located alongside the section of the Scheme just north of Old Abingdon Road and currently operated by DB Cargo. This chapter considers the changes to the environmental effects predicted if both planning applications are granted and the majority of the inert waste is removed by rail.

A separate planning application is being used for these works as there are a number of commercial agreements which need to be complete prior to confirming the use of rail as a transport option in addition to the planning permission. Therefore, the main application proposes the use of road vehicles to manage the risk of problems with the commercial agreements or train paths not being available on the rail network when required.

16.2 Potential changes to the Scheme description

16.2.1 Overview

If the planning application for the rail sidings is granted, the boundary of the Scheme's working area will be extended to include a temporary site haul road and access to the northern end of the existing sidings, operated by DB Cargo, as shown on Figure 16.1 'Haul roads and sidings boundary' and Figure 16.2 'Haul route to the rail sidings'. DB Cargo is a railway undertaker and has a licence to operate as a railway undertaker. The Hinksey Sidings is part of their operational land which they lease from Network Rail, and the use of the site for the storage, transfer and handling of materials between road and rail is long established. Handling the material and removing it by train is withing the range of activities which DB Cargo normally carry out at the sidings; handling this material will be in addition to their normal activities, which will continue.

Under this proposal the majority of the material to be removed from the Scheme will be taken to the rail sidings where it will be placed into temporary stockpiles using the existing stockpile locations during normal Scheme working hours. This will not include contaminated material, such as that from the former landfills, which will be removed by road as described in the rest of the ES.

No extension, changes or development of the sidings site will be required to facilitate the proposals. Up to two trains per day will be loaded with 1500 tonnes per train of material and will transport it away via the rail network, this will take place over the earthworks window between April to October during the first year of construction. During the second year of construction this will reduce to 1 train per day for a similar period.

Once the material is deposited into stockpiles within the siding, DB Cargo will load the wagons and coordinate the train movements with their other ongoing rail operations within the sidings. Activities to load trains and train movements may take place outside of normal working hours including overnight and at weekends. DB Cargo's activities will not be under our control.

16.2.2 Proposed haul route to the sidings

The proposed haul route is shown on Figure 16.2 'Haul route to the rail sidings'. There will be no change in any of the haul roads described in Chapter 3; this new haul road will

connect into the network of haul roads shown on Figure 3.1. This haul road will allow all material from the section between Botley Road and Old Abingdon Road to be transferred to the sidings without the need to use any of the local highway network. Material will be brought from the site to the sidings using off road dumpers. Material from north of Botley Road will be brought to the main site compound at South Hinksey by road and then transferred to the sidings. Any material not classified as inert will still need to be removed from the site by road to a licensed disposal site.

The haul road will be removed and the existing fields reinstated at the same time as the rest of the Scheme area is reinstated; once rail operations are complete it will be fenced off to prevent vehicles working on the Scheme from using it.

16.2.3 Proposed temporary material stockpiles

During normal Scheme working hours (see Section 3.2 above) material will be brought to the sidings and placed in stockpiles in three defined existing areas within the sidings. Vehicles will use existing routes within the sidings and no changes to the layout or use of areas in the sidings will be required.

16.2.4 Proposed rail operations

The estimated load capacity of each train is 1500 tonnes, which can be moved by a standard goods locomotive such as a Class 66. We assume that the locomotive will arrive with empty wagons and leave fully laden during a single 24 hour period. Due to the period needed to load wagons each day the locomotives are likely to be switched off or redeployed during the waiting period. Stockpiling of material removed from the Scheme working area will be during Scheme working hours only; loading of trains and train movements may be at any time of day or night, according to DB Cargo's operational requirements.

DB Cargo will manage the train movements to avoid any impacts on the regular passenger services and other commercial usage of the sidings. During some parts of the programme two trains per 24 hours will be used to minimise the need for road transport to supplement the rail disposal route. The trains will use the existing access from the sidings onto the main line and then proceed to a facility which has rail access and is licensed to accept inert waste for environmental purposes, for example restoration of a quarry.

16.3 Local community

16.3.1 Changes to the existing environment considered

Overview

The changes to the Scheme if the rail sidings are used are relevant to noise effects. As the nearest properties are approximately 170m from the sidings on the opposite side of the railway, other effects on the local community are not predicted to change.

Local population and community buildings

The receptors considered are unchanged.

Noise and vibration

DB Cargo already use the site for loading and unloading trains which sets an existing baseline of noise for these types of operations at the site, the work to load trains for the flood alleviation Scheme will be the same as current operations at the site and therefore no significant changes are expected to receptors.

The closest noise sensitive receptors to the work area have been identified for the Scheme using appropriate mapping. For the freight train loading operations, these closest sensitive receptors are residential properties to the west of the A4144 in New Hinksey, especially those on Lake Street. The closest of these receptors from the possible freight train loading operations is 170m.

Socio-economics

The receptors considered are unchanged.

Human health

The receptors considered are unchanged.

16.3.2 Potential changes to likely significant effects

During construction

Local population and community buildings

There will be no change in the effects on the local population or community buildings, other than those due to noise (see below).

Noise and vibration

The introduction of the loading and freight train operations at night and weekends has the potential to generate high levels of noise during a quiet period. Due to the distance to the closest sensitive receptors, there are not expected to be impacts from vibration.

Considering the activities associated with the loading of freight trains, the predicted noise level at the closest sensitive receptors is 53 dB(A). Considering receptors of very high value and a minor negative to negligible magnitude, this would be a **minor adverse** noise effect.

Socio-economics

There will be a minor reduction in the number of jobs created in comparison to using HGVs, partly offset by increased activity at the rail sidings site. This effect is considered to be of negligible magnitude and therefore **nil impact** in relation to the impacts of the Scheme overall.

Human health

Human health effects due to reductions in the additional HGV traffic on the A34 are considered in Section 16.11, Air Quality. There will be no other effect on human health if the rail sidings are used.

During operation

Local population and community buildings

There will be no change to the operation of the Scheme and therefore no change to operational impacts.

Noise and vibration

Potential effects from noise and vibration during the operation of the Scheme have been scoped out from this assessment.

Socio-economics

There will be no change to the operation of the Scheme and therefore no change to operational impacts.

Human health

There will be no change to the operation of the Scheme and therefore no change to operational impacts.

16.3.3 Additional mitigation

Local population and community buildings

No additional mitigation is proposed.

Noise and vibration

In addition to the already suggested mitigation measures, there are some that could be applied to the operation of the loading of the freight trains. The ability to use these would be dependent upon the operations and working practices within the yard, which are unknown at this time. While we will suggest these measures to the operators of the sidings, they will be working in accordance with their own procedures, not under our control, and therefore we cannot guarantee that mitigation will be applied.

- The positioning of any unused wagons on the track alongside the area where loading is in operation. This would provide some screening. Avoiding the idling of diesel locomotives during the loading operations.
- Positioning of the stockpile to limit or eliminate the need for dumpers to move the material to the excavators for loading into the wagons.
- If dumpers are used, the need for reversing should be limited as this will reduce the use of reversing alarms.

The material being loaded into the wagons will be soft alluvium and therefore make less noise than ballast or stone being loaded into wagons.

Socio-economics

No additional mitigation is proposed.

Human health

No additional mitigation is proposed.

16.3.4 Potential changes to residual effects

Local population and community buildings

The residual effects are likely to remain unchanged.

Noise and vibration

The residual effects are likely to remain unchanged.

Socio-economics

The residual effects are likely to remain unchanged.

Human health

The residual effects are likely to remain unchanged.

16.4 Recreation and public access

16.4.1 Changes to the existing environment considered

There is no public access to the sidings area or any recreational activities that would be affected by the operations within the sidings.

The haul road has been located to avoid any impacts on the recreational activities at the sports ground to the north of the route.

16.4.2 Potential changes to likely significant effects

During construction

The temporary haul road from the site working area to the sidings will cross the Electric Road with a temporary low bridge or protection works to the cable troughs to avoid imposing any loads from construction vehicles onto the National Grid infrastructure. Although the Electric Road is not a formal right of way it is informally used by pedestrians, cyclists and horse riders. The temporary bridge or protection works will block access along the Electric Road and a short diversion will be required.

There will be some visual and noise impact from the construction works for the public using the informal Electric Road route. Section 16.5 covers the visual impact.

There will be a **minor adverse** impact to recreation and public access during construction as the Electric Road will be slightly less attractive as a walking route than it would be if there was no haul road crossing.

During operation

There will be no change to the operation of the Scheme and therefore no change to operational impacts to the public or recreation activities.

16.4.3 Additional mitigation

We will provide a suitable short diversion route around the end of the temporary bridge suitable for use by pedestrians, cyclists and horse riders. During working hours when vehicles are using the haul road a banksman will ensure the safe passage of the public across the haul road.

16.4.4 Potential changes to residual effects

The residual effects will remain unchanged.

16.5 Landscape and visual amenity

16.5.1 Changes to the existing environment considered

The receptors identified in Table 7.1 (landscape) and Section 7.16 (visual) have been considered in relation to the proposed use of rail to remove the majority of the spoil from

the Site during its construction. The key changes to the existing environment are described below;

- Introduction of new temporary haul route;
- New temporary crossings over Electric Road and Hinksey Stream;
- The partial removal of up to 4 tree groups and grassland and subsequent replanting;
- Temporary vehicle movements between the main site and railway sidings
- Temporary stockpiling of materials within the railway sidings; and
- Temporary change in views from Electric Road, Pembroke College Sports Ground and Devils Backbone PRoW.

16.5.2 Potential changes to likely significant effects

During construction

Landscape Character

During construction there will be a localised loss of landscape features and vegetation, including areas of grassland and the partial removal of up to 4 tree groups to the south of Pembroke College Sports Ground. The proposed creation of a new temporary haul route to the rail sidings will necessitate the installation of two crossings, the first over Electric Road and the second spanning Hinksey Stream. Additionally, the movement of construction vehicles including excavators, fenced construction works and compounds and soil storage areas will also affect the character of the Site. Upon completion of the construction phase of the Scheme the crossings will be removed and affected grasslands and tree groups will be replanted with native woodland and local grassland species. Overall however, it is considered that these effects will not materially affect the conclusions drawn in Table 7.3 Impacts on landscape character during construction.

Specimen trees and tree groups

The proposed haul route will necessitate the partial removal of up to 4 groups of trees of moderate value (refer to AIA for further information) from the southern boundary of Pembroke College Sports Ground. Upon completion of the construction phase of the Scheme the affected tree groups would be replanted with native woodland species. Overall it is considered that these effects will not materially affect the conclusions drawn in Table 7.5 Significance of effects on landscape receptors during construction.

During operation

Landscape Character

During operation the temporary elements of the proposed access to the rail sidings would have been removed from the landscape. There will be localised impacts on existing landscape character from the proposed native woodland on the boundary of the sports ground and local grassland species as they mature, these effects reducing over time. Overall however, it is considered that these effects will not materially affect the conclusions drawn in Table 7.6 Significance of effects on landscape character during operation.

Specimen trees and tree groups

During operation the proposed areas of native woodlands replanted on the boundary of the sports ground would become established, reaching semi-maturity after 15 years, reducing the impacts of the Scheme. Overall it is considered that these effects will not materially affect the conclusions drawn in Table 7.8 Significance of effects on landscape receptors during operation.

16.5.3 Additional mitigation

No change to the mitigation identified in Section 7.3 of this ES.

16.5.4 Potential changes to residual effects

No change to the residual effects identified in Section 7.4 of this ES.

16.6 Flora and fauna

16.6.1 Changes to the existing environment considered

The introduction of an access track from the South Hinksey compound to the railway sidings will result in an extension to the existing red line boundary.

The extension of the Scheme boundary is located within the existing extents of the study area for designated sites, habitats and protected and notable species, as discussed in Chapter 8. Therefore, there are no additional ecological features to be included or assessed and additional ecological surveys were not conducted.

16.6.2 Potential changes to likely significant effects

Where other sections in this chapter have discussed factors that may impact designated sites, priority habitats, protected and notable species they have been identified below:

- **Changes in noise and vibration** during construction as a result of construction plant, other construction-related vehicles and construction related activities (including general earthworks) have been discussed in section 16.3 'Local Community'. The use of train movements at night has the potential to generate additional levels of noise, with potential impacts on protected and notable species. This may cause disturbance with changes in nocturnal foraging or movement within and around the area where the noise and vibration is being created.
- **Artificial lighting** is currently present on the site and is operated during the hours of darkness Monday to Saturday as part of the existing operation of the sidings. It is not expected that any additional lighting will be required for the site during these works and thus there are not considered to be any additional impacts or disturbance to foraging behaviour or movement around territories.
- **Water and hydromorphology** - This section (16.7) has concluded that the temporary crossing, to allow the temporary haul road between the main works area and the rail sidings to cross Hinksey Stream, will not result in a breach of the Water Environment Regulations. The significance of this impact is minor adverse; it will not materially change the magnitude or significant of construction effects on Hinksey Stream.

There will be no operational impacts from the track and the sidings as this area will be reinstated at the end of the construction period.

Note that only new impacts or where the significance of impact differs to what is stated in Chapter 8, are included in this section.

During Construction

Nature conservation sites

International and national designated sites

There will be no change in impacts upon international and national designated sites from these proposed additions to the Scheme.

Local designated sites

Additional potential impacts on the local designated sites are:

Hinksey Pools Sites of Local Importance for Nature Conservation (SLINC) – an access track will be constructed over Hinksey Stream and approximately 8m to the north of Hinksey Pools. This could lead to potential indirect impacts on aquatic flora and fauna from an increase in silt, pollutants and other materials entering the water from the construction and use of the access track. This impact may temporarily affect notable aquatic invertebrates. Rivers, and Standing open water within this designated site, are assessed under Habitats below in Table 16.6.2.

Protected and notable species

Only additional construction impacts on protected and notable species to those detailed in Chapter 8 have been included in this section. The potential impacts on protected and notable species during the construction phase are presented in Table 16.6.1.

Table 16.6.1: Impacts on species during construction

Species	Locations affected	Value	Potential impacts	Magnitude of Impact	Significance of Effect (before mitigation)
Amphibians - Common toad	At the north and north-eastern side of Hinksey Pools	District/ parish/ local	There may be direct negative impacts (mortality) on individuals during the removal of approximately 0.1ha of broadleaved woodland and indirect impacts on toads from a reduction in foraging and hibernating habitat, such as woodland, piles of loose earth and scrub habitat. Indirect negative impacts may also occur from the temporary access track being removed after nearly two years, if amphibian species have sought refuge underneath. However, the removal of suitable vegetation (scrub, woodland and	Low	No likely significant effect

Species	Locations affected	Value	Potential impacts	Magnitude of Impact	Significance of Effect (before mitigation)
			hedgerow) for amphibian species is approximately 0.1ha, with a large population of toads identified, approximately 60m to the east of the Scheme area, on the opposite side of a railway embankment, therefore impacts are considered to be low.		
Bats	Access track from the South Hinksey compound and railway sidings	Moderate	The removal of approximately 0.1ha of broadleaved woodland to the south of Pembroke College Sports Ground is proposed. No direct impacts to bats are expected, as no evidence of roosts were found. However, with the removal of trees and scrub habitat, there may be an indirect adverse impact from the loss of foraging habitat for bats. There is extensive existing artificial lighting at the site so there is unlikely to be an increase in the use of artificial lighting at night. Therefore, it is not anticipated there will be any adverse impact on bats. Slower broad-winged species will tend to avoid artificially lit up areas. However, bats will also exploit artificial light sources due to the increased insect concentrations. The impacts associated with lighting are considered to be low.	Low	Minor negative

Badger - The access track to the sidings passes adjacent, and then through woodland in New Hinksey, where signs of badger (scratching posts and fur) have previously been found during surveys.

There may be indirect negative impacts to badger from the noise, vibration and artificial lighting of the rail sidings during night work. This may disturb the badgers while they forage or move around their territory. In addition, pathways regularly used by badger may be blocked by construction fencing or earth works.

There will be potentiality a localised loss of food resources due to vegetation clearance (e.g. loss of foraging habitat such as grassland and woodland).

During Operation

Nature conservation sites

There will be no change in impacts to international, national and local designated sites from operational changes to the Scheme.

Protected and notable species

There will be no change in impacts on protected and notable species from operational changes to the Scheme.

Habitats

Construction

The potential impacts on priority and non-priority habitats during the construction phase of the potential Scheme changes are presented below in Table 16.6.2.

Priority habitats which are permanently removed or altered due to the Scheme are considered in Table 16.6.3, which gives a summary of potential habitat gains and losses for the rail sidings and haul road boundary.

Table 16.6.2: Impacts on Priority and non-Priority habitats during construction

Habitat Type	Locations affected	Value	Potential impacts	Magnitude of Impact	Significance of Effect (before mitigation)
Priority habitats					
Hedgerows (not Important under the Hedgerow Regs 1997 and species-poor)	To the north of South Hinksey	District/ parish/ local	An approximately 40m length hedgerow running alongside a proposed access track, may need to be trimmed back to allow construction vehicles to pass.	Negligible to Low	No likely significant effect to Minor negative
Non-priority habitats					
Broadleaved woodland	Hinksey Pools SLINC	District/ parish/ local	There will be a loss of approximately 0.1ha of non-priority woodland -at the northern end of Hinksey Pools as it is under the proposed construction footprint of an access track.	High	Moderate negative

Habitat Type	Locations affected	Value	Potential impacts	Magnitude of Impact	Significance of Effect (before mitigation)
Neutral grassland	Between Hinksey Pools SLINC and the electric road.	District/ parish/ local to Moderate	Approximately 0.3ha of this habitat will be under the footprint of an access track and working area for approximately 18 months. Impacts are considered low, as topsoil will be scraped off and stored alongside the track, for it then to be reinstated upon completion of the construction phase.	Low	Minor negative
Tall herb	Either side of Hinksey Stream	Within the zone of influence only/no listed importance	This habitat will be within the footprint of an access track and temporary bridge, which will be in place for approximately 18 months. There will be a direct loss of a 6m length of habitat on each side of Hinksey Stream. This habitat is easy to recreate and will likely re-establish within the 18 months whilst construction is ongoing.	Low	No likely significant effect
Standing open water and canals	Hinksey Pools SLINC	District/ parish/ local	A temporary stone access track will be constructed approximately 8m to the north of Hinksey Pools. This may have an indirect adverse effect as materials could get dislodged and fall into the water body if there is not sufficient bunding or other protection. This could lead to an increase in sediment and potential smothering of aquatic species. Pollutants from construction vehicles may negatively impact the water body if allowed to run into Hinksey Pools. Impacts are considered low as the access track to the north of Hinksey pools will be designed so an	Low .	Minor negative

Habitat Type	Locations affected	Value	Potential impacts	Magnitude of Impact	Significance of Effect (before mitigation)
			earth bank is constructed on its open water side, forming a barrier between the track and waterbody		
Rivers - Hinksey Stream	To the north of South Hinksey	District/ parish/ local	A temporary clear span bridge or other crossing will be placed across Hinksey Stream for 18 months. Indirect adverse impacts could occur as a result of shading from the bridge on stream bank habitat and aquatic vegetation. There may be a temporary increase of turbidity whilst the temporary bridge is placed and then removed, leading to potential temporary smothering of aquatic species. Dust coming from vehicles during the transportation of spoil and moving along haul roads may impact aquatic flora.	Low Stone is to be used for haul roads, which will keep dust levels down as vehicles will not be driving directly on earth.	Minor negative

Operation

Within the footprint of the access track and rail sidings, habitat will be restored as close as possible to the condition it was in before work started. The haul road will be reinstated to neutral and modified grassland. A selection of native trees and shrubs will be planted where woodland was removed, to provide a more diverse mix of species. Hedgerows (priority habitat) will be replanted and enhanced with the same or a more diverse range of species.

The overall gains and losses of habitat have been calculated for the main Scheme area and the additional access track and rail sidings area. This has been calculated in two ways.

- Hectares of habitat and metres of linear habitat, both for priority habitats and for other habitats, have been summarised to show gains and losses, see Table 16.6.3 (all losses are temporary since all habitats will be replanted with the same type of habitat as is currently present and the temporary bridge will be removed); and
- The Defra Biodiversity Metric v3.0 calculator will give an overall figure of biodiversity units in order to generate a biodiversity net gain. This will be reported separately alongside the planning application for the use of the sidings.

Table 16.6.3: Summary of habitat gains and losses for the additional rail sidings boundary

Habitat	Loss	Gain	Net loss/gain
Priority Habitats			
Hedgerows (not Important under the Hedgerow Regs 1997 and species-poor)	4 m	4 m	0
Other Habitats			
Broadleaved woodland	0.11 ha	0.11 ha	0
Improved grassland	0.01 ha	0.01 ha	0
Tall herb	0.38 ha	0.38 ha	0
Rivers - Hinksey Stream	0.03 ha`	0.03 ha	0

The existing habitat in the additional area will be reinstated and grassland areas reseeded. The temporary bridge in Hinksey Stream will be fully removed. We will not provide any additional on-site enhancements beyond those incorporated into the overall Scheme, but will create additional off-site habitat if required to meet the requirements for biodiversity net gain.

16.6.3 Mitigation

- **Hinksey Stream** and **Hinksey Pools SLINC** - Generic mitigation measures will be implemented within the footprint of the access track and rail sidings, along with more specific mitigation for Hinksey Pools SLINC. These are discussed in Section 8.3, Chapter 8 Fauna and Flora).
- **Bats** - Prior to works, a construction site lighting scheme will need to be agreed with an experienced ecologist if any additional lighting over the existing lights are needed to reduce impacts to bats. Any additional lighting scheme will need to ensure that sensitive features such as the river corridor are kept dark during works. Construction phase lighting will need to be directional and avoid light spill on to adjacent retained vegetation.

16.6.4 Potential changes to residual effects

Based on the current data, there are no changes to the residual effects for the construction or operation of rail sidings and an access track.

16.7 Water and hydromorphology

16.7.1 Changes to the existing environment considered

A part of the existing Hinksey Stream, which will be outside the works area of the Scheme as described in chapter 9, will be within the Red Line Boundary and affected by the Scheme if the rail sidings are used (see figure 16.1). There are no other changes to the extent of the water environment affected.

16.7.2 Potential changes to likely significant effects

During construction

The Scheme will require one additional temporary bridge or other form of crossing, to allow the temporary haul road between the main works area and the rail sidings to cross Hinksey Stream. We will need to work on the bank to allow the bridge to be placed. We will remove the bridge after use of the rail sidings ends, as part of the removal of the temporary haul road. As the bridge will be in place for less than two years it will not result in a breach of the Water Environment Regulations. The significance of this impact is **minor adverse**; it will not materially change the magnitude or significant of construction effects on Hinksey Stream.

The bridge will not materially affect flood risk given its temporary nature and its location. The bridge will not cause any local impoundment and will maintain uninterrupted conveyance with the haul road in place. The significance of this impact remains **minor adverse**; it will not materially change the magnitude or significant of construction effects on Hinksey Stream.

Similarly, the low bridge or cable protection measures to span over the Electric Road to avoid damage by construction traffic will not have any impact on flood flows or levels, water will be able to pass around each end of the temporary structure.

The temporary track will be slightly raised compared to existing ground level and any raised sections and temporary local topsoil storage alongside the track will be provided with gaps or pipe openings to allow flood water to pass.

The planning application for the sidings option will be accompanied by a separate Flood Risk Assessment. We will ensure that the use of the sidings does not divert or act as a barrier to flood water while the haul road is in place.

During operation

The temporary crossing of Hinksey Stream and associated works will be removed, and the temporary track reinstated upon completion of the works. Therefore, there will be no change to the effects on water compared to the Scheme if the rail sidings are not used.

16.7.3 Additional mitigation

The crossing will be a clear span bridge and therefore not obstruct movement of fish and invertebrates up and down the stream.

16.7.4 Potential changes to residual effects

No potential changes to the residual effects of the Scheme are identified as a consequence of the use of the rail sidings.

16.8 Cultural heritage

16.8.1 Changes to the existing environment considered

No additional designated or non-designated heritage assets require consideration in light of the proposed use of the rail sidings.

The proposed haul route, outside of the line of the proposed channel, has not been subject to any archaeological investigation as part of the Scheme. Therefore, the archaeological potential of this area is currently unknown.

16.8.2 Potential changes to likely significant effects

During construction

Archaeological Remains

Groundworks for the construction of the proposed haul road have the potential to impact on previously unknown archaeological remains through partial or complete removal. The value of such assets is currently unknown but given the results of the adjacent investigations it can reasonably be predicted to be low at best. The magnitude of impact is predicted to be minor and the significance of effect **slight adverse**.

Historic Buildings

There will be a temporary impact on the Grade II listed Church of St John the Evangelist (OA31) and associated Grade II New Hinksey Vicarage (OA20), which lie approximately

150m to the east of the rail sidings, due to the presence of proposed storage areas and associated, noise, dust and vibration from loading and increased train movements. The magnitude of impact will be minor adverse and the significance of effect will be **slight adverse** (based on a medium value receptor).

Historic Landscape

No changes to likely significant effects to assets in the category of historic landscape are predicted as a consequence of the use of the rail sidings.

During operation

No changes to likely significant effects are predicted as a consequence of the use of the rail sidings during the operation phase of the Scheme to cultural heritage assets.

16.8.3 Additional mitigation

Archaeological Remains

A programme of archaeological monitoring (watching brief) will be undertaken during groundworks for the construction of the haul road.

Historic Buildings

None proposed.

Historic Landscape

None proposed.

16.8.4 Potential changes to residual effects

No potential changes to the residual effects of the Scheme are identified as a consequence of the use of the rail sidings.

16.9 Traffic and transport

16.9.1 Changes to the existing environment considered

The rail line to be used to export the spoil forms part of the main line around Oxford and is heavily used during the daytime. As well as stops in the local area the line links major cities around the UK including London and Manchester.

16.9.2 Potential changes to likely significant effects

The removal of spoil from the site by rail rather than road, along the A34, will have a positive influence in terms of the potential impacts of the Scheme on the highway and those using it. Potential negative impacts on the rail line and its users will be avoided due rail operators' passenger priorities. Rail movements will be scheduled into available vacant train slots on the network which will likely result in some night-time train movements into and out of the sidings.

During construction

This section outlines the potential changes to any significant effects of the Scheme due to the use of the rail line to remove spoil from the site.

Highway

Removal of the majority of spoil arising from the channel works by rail during construction will lessen the impact of the Scheme on the highway by reducing the number of HGV movements required to move material by road. It has been assumed that removal of material by rail will have a commensurate reduction in the quantity required to be moved by road from Area 3 of the Scheme. Material from the works to the south of Old Abingdon Road will be removed from site by road due to programme restrictions associated with the A423 replacement bridge for this part of the works

Section 11.2.1 of this ES identifies that, in relation to earthworks transportation, 70 two-way HGV trips per day would be expected to use the Area 3 access from Parker Road in normal circumstances, should the use of the rail line not occur. This has been identified as a **minor adverse** impact. The number of HGVs using Area 3 associated with removal of material from site would significantly reduce as the majority of material from the channel works would be removed by rail. However, in this scenario material from Area 1 would be brought into Area 3 by road vehicle to also be transported away by rail. This would result in a short term peak of HGV movements per day into South Hinksey for a 15 week period while the main channel excavation works in Area 1 are implemented.

The use of rail would result in a reduction in impacts on the highway, particularly the A34 and South Hinksey Interchange as less HGV traffic would be expected to use the route and junction. However, given the existing environment and the overall traffic flows identified in table 11.3 of this ES this change in HGV flows as a result in the use of rail is unlikely to change the overall impact of the Scheme on the highway network. Therefore, impacts of the Scheme on the highway network will likely remain as **minor adverse**. However there would be local benefits in the locality of the South Hinksey Junction.

Rail

Material transport associated with the Scheme may occur at any point during the day depending on availability of train paths but it is likely that overnight train movements will be used. As existing, otherwise-vacant, train paths will be used the Scheme will not impact upon regular rail operations.

During operation

The proposals to remove spoil by rail rather than by road during construction will not generate any environmental impacts during operation.

16.9.3 Additional mitigation

Given that removal of material via rail rather than road will not change the overall impacts of the Scheme, and in all likelihood will cause a marginal reduction in impacts, particularly locally to the South Hinksey junction on the A34, no additional mitigation is proposed.

16.9.4 Potential changes to residual effects

Given that removal of material via rail rather than road will not change the overall impact of the Scheme, and in all likelihood will cause a marginal reduction in impacts on the overall network, no significant changes to the residual effects are expected.

16.10 Sustainable use of land

16.10.1 Changes to the existing environment considered

The temporary track to access the sidings from the site working area will cross existing agricultural fields. A temporary stone track will be installed which will be in place for two summers. During this time this area of land covered by the track will not be available for

agricultural purposes. Upon completion the temporary stone track will be completely removed and topsoil restored and seeded to return the area back to agricultural use.

The proposed operations within the sidings are similar to the existing operations and utilise existing open stockpile areas. Therefore, there are no changes to the use of land within the sidings area.

16.10.2 Potential changes to likely significant effects

During construction

The area of the track being taken out of agricultural production during the period the temporary track is in place will result in a **minor adverse** impact.

During operation

There will be no change to the operation of the Scheme and therefore no change to operational impacts to the public or recreation activities.

16.10.3 Additional mitigation

None required.

16.10.4 Potential changes to residual effects

The residual effects are likely to remain unchanged.

16.11 Air quality

16.11.1 Changes to the existing environment considered

Changes to air quality related to the change to use of rail as a waste transport route are limited to vehicle emissions and possible dust from the haul road and operations within the sidings.

16.11.2 Potential changes to likely significant effects

Vehicle emissions will be similar to the road transport option in the local area of the site. Site vehicles will transport the material to the sidings which is a similar distance from most areas of the site to the alternative transport route to the main site compound. Similar plant will be used to load material on train wagons as would be needed to be used to load it onto road going vehicles.

The location of the haul road from the site working area to the sidings is located away from most receptors and will be damped down during very dry periods to prevent dust.

The operations within the sidings are limited to loading trains with alluvium from the site. This is a soft clay type material and will not generate dust unless it is dried over a period of time. Due to the limited stockpile areas in the sidings and the need to meet the production rates of excavation from site it is not expected that the stockpiles will be left in the sidings for a sufficiently long period to allow the material to dry out significantly.

During construction

Where necessary the haul road will be damped during very dry periods to avoid dust from vehicles. Vehicle emissions will be unchanged from the alternative road transport option and the impact on air quality is considered to be **nil impact** compared to alternative solutions.

During operation

There will be no change to the operation of the Scheme and therefore no change to operational impacts to the public or recreation activities.

16.11.3 Additional mitigation

None required.

16.11.4 Potential changes to residual effects

The residual effects are likely to remain unchanged.

16.12 Carbon, sustainability and climatic factors

16.12.1 Changes to the existing environment considered

An initial review of the impacts on carbon emissions associated with the use of the rail option compared to the alternative road vehicle option indicates that the overall carbon emissions are very similar.

The main benefit of the use of rails is the reduction in road vehicle movements at South Hinksey and on the A34 along with the associated reduction in risk of delays to traffic due to construction traffic.

There are no impacts on sustainability or climatic factors as a result of the work described in this chapter.

16.12.2 Potential changes to likely significant effects

During construction

Based on the carbon emission calculations completed using the data currently available the use of rail has **nil impact**. The effect of the lower carbon impact per tonne per mile of rail transport compared to road is similar to the opposite effect of the additional distance the trains need to travel to a suitable site with a railhead to receive the material. No change is expected in DB Cargo's other activities at the sidings, therefore overall there will be no significant effect on carbon emissions. As more information becomes available on the locations for disposal of material the carbon calculations will be reviewed and updated.

During operation

There will be no change to the operation of the Scheme and therefore no change to operational impacts to the public or recreation activities.

16.12.3 Additional mitigation

None required.

16.12.4 Potential changes to residual effects

The residual effects are likely to remain unchanged.

16.13 Cumulative effects and inter-relationships

16.13.1 Changes to the existing environment considered

The use of rail will be coordinated by DB Cargo to ensure there are no cumulative impacts on other operations at the sidings or on the wider rail network.

Should a conflict with other operations or schemes arise then it is likely that the solution for the transport of material from the site would revert to road vehicles which is covered elsewhere in this statement.

16.13.2 Potential changes to likely significant effects

During construction

No cumulative impacts have been identified during the construction period.

During operation

There will be no change to the operation of the Scheme and therefore no change to operational impacts to the public or recreation activities.

16.13.3 Additional mitigation

None required

16.13.4 Potential changes to residual effects

The residual effects will remain unchanged.

17 Management and Monitoring

17.1 Environmental Action Plan

All mitigation measures identified in this ES necessary to protect the environment prior to and during construction, or during operation of the Scheme, will be incorporated into the contract documents by means of an Environmental Action Plan (EAP). The initial EAP is provided in Appendix G and is a mechanism by which we manage the environmental impacts set out in the ES and ensure compliance with environmental commitments. This will be maintained as a live document throughout Scheme finalisation and delivery, for example by adding any additional commitments as may be required to meet planning conditions.

The EAP includes the requirement for a number of separate method statements and sub-plans relating to specific areas of mitigation (including a Construction Traffic Management Plan and a Site Waste Management Plan). We have defined roles and responsibilities in the EAP to ensure, firstly, the implementation of the mitigation measures, secondly, the monitoring procedures to check their implementation and thirdly, audit and review mechanisms to ensure that mitigation measures are implemented and adhered to. Specifically, the following has been tabulated:

- The location of the mitigation measure
- The objective of the mitigation
- The actions to be taken to implement the proposed mitigation, including any special monitoring requirements
- The timing and the party responsible for implementing the mitigation
- Information on any further action and progress made during the construction.

The EAP therefore collates mitigation measures identified throughout the ES, both for ease of reference and for use by those overseeing the contract documents. It provides a record of our commitments, and those of the Contractor, which will be incorporated within the contract documents and to which the Contractor will be obliged to adhere throughout the contract period. Together with contract supervision, the EAP will be used to control any details of design over and above those included in the ES, and the implementation of environmental mitigation and improvement measures (e.g. through the employment of an Ecological Clerk of Works (ECoW) and Environmental Clerk of Works (ECW)).

17.2 Post-construction Monitoring Plan

We have committed to undertaking some post-construction monitoring to ensure that mitigation measures will deliver their target outcomes. These are outlined in Table 17.1.

Table 17.1: Provisional monitoring schedule

Topic Area/Receptor	Suggested Monitoring Method	Purpose	Years 1-5	Years 6-10	Years 11-25
Recreation and public access					
Use of public open space	Repeat pre-Scheme questionnaire	To assess influence of Scheme on use of public open space	Year 2 and 5		
Flora and fauna					
Existing Creeping Marshwort site at	Creeping marshwort survey	To determine the extent of any changes and to	Annual	Set frequency based on	

Topic Area/Receptor	Suggested Monitoring Method	Purpose	Years 1-5	Years 6-10	Years 11-25
Willow Walk Meadow		identify if any mitigation is required.		results Years 1-5	
Proposed Creeping Marshwort site (TBC)	Creeping marshwort survey	Is the plant colonising successfully? Annual check for invasive/competitive species.	Annual	Set frequency based on results Years 1-5	
Existing Floodplain Meadow (MG4a) at Hinksey Meadow	NVC Survey	To determine the extent of community change across the meadow	Year 2 and 5	Year 10	Year 15 Year 20 Year 25
	Pollinator Survey	To assess impacts on populations of invertebrate pollinators	Monthly during selected seasons in alternate years	Set frequency based on results Years 1-5	Set frequency based on results Years 6-10
	Invertebrate survey	Invertebrate assemblage is linked to grassland quality and will indicate any changes.	Year 5	Year 10	Set frequency based on results of Years 5 and 10
	Soil phosphate survey	Is soil fertility still within the range of the MG4? If soil fertility is changing, management changes may be required.	Year 3	Year 6 Year 9	Year 15 Year 20 Year 25
	Take groundwater dipwell readings using data loggers	To determine whether groundwater levels are behaving as predicted or whether further mitigation is required? Are they still likely to support the existing plant communities?	Monthly	Set frequency based on results Years 1-5	Set frequency based on results Years 6-10
Translocated Floodplain Meadow (MG4a)	NVC Survey	To determine success against the set objectives	Years 2 and 5	Year 10	Set depending on results Years 5 and 10
	Invertebrate survey	Invertebrate assemblage is linked to grassland quality and will indicate any changes.	Year 5	Year 10	Set depending on results Years 5 and 10
	NVC Survey	To determine the extent of community change across the meadow. Are expected plant communities developing? Plants that have established can	Years 2 and 5	Year 10	Year 15 Year 20 Year 25

Topic Area/Receptor	Suggested Monitoring Method	Purpose	Years 1-5	Years 6-10	Years 11-25
Proposed Floodplain Meadow (MG4)		tell us about groundwater levels and soil fertility			
	Pollinator Survey	To assess impacts on populations of invertebrate pollinators	Monthly during selected seasons in alternate years		
	Invertebrate survey	Invertebrate assemblage is linked to grassland quality and will indicate any changes.	Year 5	Year 10	Review depending on results Years 5 and 10
	Soil phosphate survey	Is soil fertility still within the range of the target plant community? If soil fertility is changing, management changes may be required.	Year 3	Year 6 Year 9	Year 15 Year 20 Year 25
	Take groundwater dipwell readings using data loggers	To determine whether groundwater levels are behaving as predicted. Are they likely to support the target plant communities?	Monthly	Set frequency based on results Years 1-5	Set frequency based on results Years 6-10
Comparator Floodplain Meadow Site (Iffley Meadow)	NVC Survey	To determine the extent of any community change across floodplain meadows in the wider Oxford area	Year 5	Year 10	
	Invertebrate survey	To assess any changes in populations of invertebrate pollinators in the wider Oxford area.	Year 5	Year 10	
	Soil phosphate survey	Is soil fertility changing within the wider Oxford area?	Year 3	Year 6 Year 9	
	Take dipwell readings using data loggers	To determine whether groundwater levels are changing within the wider Oxford area.	Monthly	Set frequency based on results Years 1-5	
Proposed Floodplain Grazing Marsh	NVC Survey	Are expected plant communities developing? Plants that have established can tell us about groundwater levels and soil fertility	Year 5	Year 10	Set frequency based on results of previous surveys

Topic Area/Receptor	Suggested Monitoring Method	Purpose	Years 1-5	Years 6-10	Years 11-25
Existing Whorled Water Milfoil site at Kennington Pond	Macrophyte survey	Is the whorled water milfoil present/surviving?	Annual	Set frequency based on results Years 1-5	
Proposed Whorled Water-Milfoil site (if required)	Macrophyte survey	Is the introduced whorled water milfoil present/surviving?	Annual	Set frequency based on results Years 1-5	
Invasive Non-Native (INN) Plants	Visual survey during routine maintenance works	To prevent the establishment or spread of INN plant species throughout the Scheme area.	Annual	Annual	Set frequency based on previous results
Badgers	Visual survey for field signs and/or camera-trapping or night-sight surveys	To ensure badger activity not adversely affected by the Scheme	During construction period		
Otters	Field survey/camera-trapping as necessary	Identify any new holts so that otters are not disturbed	During construction , if required		
Bats	Activity survey and box-checks	To establish level of activity in modified landscape and use of artificial bat boxes provided as compensation	Years 2 and 5	Year 10	
Water Voles	Survey of translocation site (if translocation is required)	To monitor the translocated population	Annual		
	Survey of new channel	To see if the new channel becomes occupied.	Years 2 and 5		
Fish in existing watercourses (Seacourt Stream, Hinksey Stream, Bulstake Stream)	Fish Survey (time of year)	To monitor fish populations and assess whether Scheme has had any impact on fish/river quality	Year 2 and 4	Year 6	
Fish in new watercourse	Fish Surveys	To monitor use of the new watercourse by fish, to ensure delivery of high-quality river habitat.	Years 2 and 4	Year 6	
Macroinvertebrates in existing watercourses (Seacourt Stream, Hinksey Stream, Bulstake Stream)	Macroinvertebrate kick sample surveys	To assess the effect of the project on existing, retained watercourses	Years 2 and 4	Year 6	

Topic Area/Receptor	Suggested Monitoring Method	Purpose	Years 1-5	Years 6-10	Years 11-25
Macroinvertebrates in new watercourse	Macroinvertebrate kick sample surveys	To monitor colonisation of the new watercourse by macroinvertebrates as an indicator of habitat quality.	Years 2 and 4	Year 6	
Wintering Birds	Wintering bird survey	To assess the impacts on the Scheme on wintering birds. Does the wetland corridor attract more wetland species?	Years 3 and 6	Year 9	Set frequency based on results of previous surveys
Breeding Birds	Nesting box checks in winter	To assess use of nest boxes and clear them out.	Annual		
	Breeding bird surveys	To assess the impacts of the Scheme on breeding birds. Does the wetland corridor attract more wetland species?	Years 3 and 6	Year 9	
Water and hydromorphology					
Groundwater	Monitoring of boreholes and dipwells throughout the Scheme area.	What effect, if any, is the Scheme having on groundwater levels? Are the results as expected? Do any fine-tuning works need to be carried out?	Monthly	Set frequency based on results of Years 1-5	Set frequency based on results of Years 6-10
Groundwater	Monitoring of boreholes for contaminated waters associated with contaminated land / landfills	What effect, if any, is the Scheme having on contaminated water adjacent to and downstream of landfills? Are the results as expected? Do any fine-tuning works need to be carried out?	Monthly	Set frequency based on results of Years 1-5	Set frequency based on results of Years 6-10
River flows	Hydrometric data from flow stations	What sort of flows are the channels carrying throughout the year? Is the Scheme working as anticipated?	Monthly	Monthly	Monthly
New River Corridor and Habitat	River Corridor Surveys (RCS) and River Habitat Surveys (RHS) also fixed point photography	To monitor the development of the new watercourse to ensure delivery of high-quality river habitat.	Years 2 and 5	Year 8	Year 13
Carbon					
Whole-life carbon emissions	Review construction and management	Monitor whether the carbon-saving actions are delivered, whether	On completing construction	Following any significant	Following any significant

Topic Area/Receptor	Suggested Monitoring Method	Purpose	Years 1-5	Years 6-10	Years 11-25
	techniques used against those assumed in the carbon calculator	further efficiencies are identified and whether long-term management meets expectations.	then annually	change of manage-ment techniques	change of manage-ment techniques

These measures will be detailed in a Monitoring Plan, together with roles, responsibilities and timescales, for discussion and agreement with affected landowners and conservation organisation in advance of the works.

We will review the Monitoring Plan regularly during Years 1-25 to ensure that it remains relevant and fit for purpose. Where appropriate and of mutual benefit, we will carry out the monitoring in partnership with local universities, colleges, schools, interested individuals, groups and organisations. In this way, the Scheme will provide ongoing opportunities for environmental education and research in Oxford.

Mitigation strategies for the management of impacted habitats and protected species are discussed in Chapter 8 'Flora and Fauna'.

17.3 Landscape and Habitat Management Plan

All new tree and other plant species to be planted upon completion of the Scheme as part of our landscaping proposals have been carefully selected to ensure that they are suitable for local conditions and resilient to future climate change. For example, we will be planting wetland grass mixes that will tolerate more frequent flooding and tree species that are typically found in floodplains (as well as being local to Oxford).

A Landscape and Habitats Management Plan is submitted with the planning application. This plan details the five-year management and establishment of the landscape and habitats associated with the Scheme. It provides further details for the following five to ten years and principals for the longer-term management. We aim to promote the management of the Scheme area in a way that is as sustainable as possible, requiring little intervention.

Our management proposals cover a 25 year period for areas where we will retain the ownership of the land, including the new first stage stream and most of the new second stage channel, so that the restoration of the Scheme area after construction is secured beyond the initial five-year period.

17.4 Environmental Vision

The Environmental Vision is our long term plan to support the effective management of the Scheme area. The nature of the Scheme when operational means that the maintenance of the Scheme as a whole is inextricably linked with the landscape and habitat management. We are committed to ensuring maintenance for the Scheme for the lifetime of the development. This will be achieved by partnering with a specialist environmental organisation, who will lease the Environment Agency owned land once the Scheme is in place. They will dedicate specific resources to the area for many years, taking the lead in managing the habitat-related maintenance and ensuring additional environmental improvements over the long-term.

The agreement with the partner will also go beyond this, to ensure there will be additional environmental enhancements, community connections with the Scheme, educational outreach and opportunities for research. Our aim for the Environmental Vision will deliver a long term green legacy to the area.

18 Summary

The proposed Scheme comprises a combination of a new stream, a second stage channel to carry flood flows, modifications to existing channels and new flood defences, to move flood water away from developed areas and reduce the frequency of flooding.

These improvements will consist of:

- Construction of a new channel, between the A34 to the west and the railway to the east, to the west of Oxford city centre, and extending over a distance of approximately 5km. The new channel will accommodate excess flow from the Seacourt Stream, Bulstake Stream and Hinksey Stream channels during a flood, thereby reducing the water level in the main River Thames and so reducing the frequency of flooding in built-up areas. The channel will comprise two stages:
    - First stage, a new stream that will look natural and connect with the existing braided network of streams at different points. The new stream will be permanently wet and carry flowing water all of the time; and
    - Second stage, a wide, shallow-sloped channel, less deep than the first stage, created by lowering the ground between 0.5m and 1.2m on one or both sides of the first stage stream. The second stage channel will be dry for most of the time but when river levels are sufficiently high, water will flow along the second stage channel. This may occur regularly during wetter periods, especially during the winter months. During large floods, the fields in the existing floodplain around the new channel will also continue to be inundated.
- New flood embankments and walls to defend homes and businesses, which would otherwise continue to flood even with the reduced river levels.
- New culverts and bridges to maintain access routes.
- New flood gates for access.
- Installation of a control structure on the Eastwyke Stream.
- Creation of new and/or improved habitat for wildlife e.g. new wetland habitat within the footprint of the second stage channel including scrapes, ponds and backwaters and in-channel habitat improvements including riffles, pools and side-bars; and
- Removal of Towles Mill weir, to help facilitate fish passage around Oxford.

The Scheme will require a temporary road layout at the junction of Old Abingdon Road and Kennington Road, to allow traffic to continue to use both roads during construction of new bridges below these roads, and a main construction compound to the north of South Hinksey.

The Scheme has two options for transport of excavated material away from the site. One, described in chapters 1 to 15 of the ES, would see all material removed by road, with the majority using an access onto the A34 at the existing South Hinksey junction. The other, described in chapter 16, would see most of the excavated material instead removed by rail, using the existing rail sidings adjacent to the construction area.

This ES presents the results of an EIA undertaken in accordance with the Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 2011 (SI 2011 No.1824). The Scheme is likely to give rise to significant environmental effects and therefore requires this statutory EIA. Planning permission is also required for the Scheme.

In this assessment, we have identified that the Scheme will result in the following significant beneficial impacts following mitigation:

- Reduced flood risk to people, property and businesses;
- Reduced flood risk to infrastructure including the road and rail network;
- Reduced frequency of flooding to recreational assets including public rights of way, public access land, parks and recreation grounds, and the natural environment in parts of Oxford, with associated beneficial effects on health;
- Reduced flood risk to numerous Listed Buildings;
- Improved standard of protection against flooding for existing land uses including Grade 3b agricultural land, soils and landfills within the floodplain;
- A new permissive path along the edge of the second stage channel between Osney Mead and Devil's Backbone and connecting to existing paths south to Old Abingdon Road;
- Significantly improved environment for wildlife upon completion of the Scheme with an overall net gain in habitat due to the incorporation of new and enhanced watercourses and wetland habitats in the Scheme design; and
- Improved riparian zone and geomorphology of new channels, designed to provide better quality habitat than they replace.

Some significant adverse impacts will be experienced during construction and/or on completion of the Scheme. However, most of these impacts can be adequately controlled through the application of procedures that have been detailed in the EAP, which will be implemented through measures included in the contract documentation for the works. The following significant adverse impacts remain following mitigation:

- Temporary disruption to residents, visitors and businesses due to localised noise and access disturbance during construction. Measures to minimise any nuisance and reduce anxiety for these receptors have been identified and we will keep the local community informed of the nature and timing of the works.
- Temporary reduction in visual amenity and adverse impacts on landscape character during construction. Long term deterioration in visual amenity for recreational users and changes to landscape character of Kendall Copse, due to the loss of 1.13ha of plantation woodland, new bridges and new channel.
- Loss of lowland meadow at Hinksey Meadows (which supports nationally rare MG4a grassland communities). We will compensate for this by creating approximately 17.8ha of meadow grassland, including one area in which we will experimentally translocate turf from the area of meadow which will be lost, in addition to reinstating meadow in the original location, where the ground will be lower than at present.
- Loss of other grassland areas, notably a field south of North Hinksey and an area near the railway south of Osney Mead.
- Loss of wet woodland during construction. These losses will be offset by creating approximately 8.9ha of wet woodland and further wet woodland in offsite locations to ensure an overall net gain in habitat.
- Potential direct damage to parts of a medieval causeway at Old Abingdon Road, which are considered of national importance, from partial removal of buried remains of Norman and medieval culverts, road surfaces and structures, which will lead to the reduced significance of the structure during construction of channel culverts. Further archaeological excavation will be undertaken to record appropriately any features lost.
- Loss of buried archaeology in some areas of known value, offset by a strip, map and sample programme to record all finds.
- Temporary disturbance to Grade 3b agricultural land during construction and permanent loss to agriculture of up to 100ha of agricultural land in the permanent footprint of the Scheme.
- Permanent impact on the land available to some farm businesses.

It is concluded that the Scheme will result in significant socio-environmental benefits by reducing flood risk to people, property and infrastructure, delivering a net gain in biodiversity, providing and maintaining access to wildlife and securing a more sustainable environment for the future.

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List of abbreviations

Term	Meaning / Definition
ALC	Agricultural Land Classification
APIS	Air Pollution Information System
AQAL	Air Quality Assessment Level
AQMA	Air Quality Management Area
AQS	Air Quality Standards
ARN	Affected Road Network
BAP	Biodiversity Action Plan
BPM	Best Practice Measures
CEMP	Construction Environmental Management Plan
CFMP	Catchment Flood Management Plan
CIEEM	Chartered Institute of Ecology and Environmental Management
CIfA	Chartered Institute for Archaeologists
CPO	Compulsory Purchase Order
CRoW	Countryside and Rights of Way
CTMP	Construction Traffic Management Plan
DBA	Desk-Based Assessment
Defra	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
DMRB	Design Manual for Roads and Bridges
DM	Do-Minimum
DS	Do-Something
EA	Environment Agency
EAP	Environmental Action Plan
ECW	Environmental Clerk of Works
EIA	Environmental Impact Assessment
ES	Environmental Statement
EU	European Union
FAS	Flood Alleviation Scheme
FRA	Flood Risk Assessment

FRMS	Flood Risk Management Strategy
GI	Green Infrastructure
GIS	Geographical Information Systems
HGV	Heavy Good Vehicle
HRA	Habitat Regulations Assessment
IAQM	Institute of Air Quality Management
IEMA	Institute of Environmental Management and Assessment
LAQM	Local Air Quality Management
LDF	Local Development Framework
LNR	Local Nature Reserve
LTP	Local Transport Plan
LWS	Local Wildlife Site
NERC	Natural Environment Research Council
NGO	Non-Governmental Organization
NO_X	Nitrogen Oxides
NPPF	National Planning Policy Framework
OFAS	Oxford Flood Alleviation Scheme
OxLEP	Oxfordshire Local Enterprise Partnership
PEIR	Preliminary Environmental Information Report
PM	Particulate Matter
PPG	Planning Practice Guidance
PPV	Peak Particle Velocity
PRoW	Public Right of Way
RSPB	Royal Society for the Protection of Birds
SAC	Special Area of Conservation
SoP	Standard of Protection
SSSI	Site of Special Scientific Interest
TMWG	Traffic Management Working Group
TVERC	Thames Valley Environmental Records Centre
VoWH	Vale of White Horse
VoWHDC	Vale of White Horse District Council
WER	Water Environment Regulations
WLMP	Water Level Management Plan

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.
Ancient Semi Natural Woodland	Sites that have retained woodland and shrub cover since 1600, previously the site of original woodland. They may have been managed by coppicing and allowed to regenerate naturally.
Aquifer	An underground layer of rock with water storage capability.
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
Biodiversity Action Plan (BAP)	An agreed plan for a habitat or species, which forms part of the UK's commitment to biodiversity in response to the Convention on Biological Diversity, Rio de Janeiro 1992
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.
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.
Cumulative Impacts	The combined impacts of several projects within an area, which individually are not significant, but together amount to a significant impact.
Department for Environment, Food	The government department responsible for flood management policy in England

and Rural Affairs (Defra)	
Desk-Based Assessment (DBA)	An assessment of the below ground archaeological, and above ground heritage assets to understand their significance, and potential impacts upon them.
Ecological Impact Assessment	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.
Ecosystem Services	The services that ecosystems provide which can provide value to people and the wider environment. Includes: Supporting services (e.g. oxygen production), Provisioning services (e.g. fuel), Regulating services (e.g. climate), Cultural services (e.g. recreation).
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 Report/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 alleviation scheme (FAS)	Scheme designed to reduce the risk of flooding in a given area
Flood defence	A structure (or system of structures) that reduce flooding from rivers or the sea
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 risk mapping	A system of maps created by the Environment Agency to show areas that are at risk of a flood that has a specific chance of occurring in any given year
Geographical Information Systems (GIS)	A computer based system for capturing, storing, integrating, manipulating, analysing and displaying data spatially.
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 and wild flora and fauna) 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 English Nature. Together these sites are referred to as the Natura 2000 network.
Habitat Regulations Assessment	A recognised step by step process, which helps determine likely significant effect and, where appropriate, assess adverse impacts on the integrity of a European site, examines alternative solutions, and provides justification for Imperative Reasons of Overriding Public Interest.
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.
Historic England	Government statutory advisor on the historic environment.
Land Drainage Regulations	The Environmental Impact Assessment (Land Drainage Improvement Works) Regulations (SI 1999 No. 1783) apply to improvement works to land drainage infrastructure undertaken by land drainage bodies, including the Environment Agency. Such works are permitted development and therefore not subject to the Town and Country Planning EIA requirements.
Local Nature Partnerships	Local Nature Partnerships were one of the key proposals made in the June 2011 Natural Environment White Paper. Their purpose is to bring a diverse range of individuals, businesses and organisations together to create a vision and plan of action about how the natural environment can be taken into account in decision making in that area.
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 English Nature.
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.
MG4	MG4 grassland communities; a National Vegetation Classification. Meadow grassland typified by the grass species *Alopecurus pratensis* and the wildflower *Sanguisorba officinalis*.
Mitigation measures	Actions that are taken to minimise, prevent or compensate for adverse effects of the development.
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.
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.

Riparian	Area of land or habitat adjacent to rivers and streams
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.
Site of Special Scientific Interest (SSSI)	Nationally important sites designated for their flora, fauna, geological or physiographical features under the Wildlife and Countryside Act (1981) (as amended) and the Countryside Rights of Way (CRoW) Act (2000).
Special Area for Conservation (SAC)	Sites of European importance for habitats and non-bird species. Above mean low water mark they are also SSSIs.
Standard of protection (SoP)	The level of protection from flooding, for example an 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 (1%) in any year
Strategy	See Flood Risk Management Strategy
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”
Water Environment Regulations 2017 (WER)	WER sets out environmental objectives 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. The objectives are adopted from the EU Water Framework Directive.
Water level management plan (WLMP)	A plan that sets out water level management requirements in a defined floodplain area (usually an SSSI) which is designed to reconcile different needs for drainage.

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