Chapter 15

HYDROLOGY, FLOOD RISK AND DRAINAGE

15 Hydrology, Flood Risk and Drainage

Preface

This ES chapter has been updated to reflect current policy and guidance, baseline conditions on-site, and consultation feedback received on the Submitted Scheme. The Flood Risk Assessment and Drainage Strategy (Appendix 15.1) has also been updated.

The majority of the ES chapter remains broadly unchanged from the 2021 ES and there is no change in the significance of residual effects stated in the 2021 ES.

15.1 Introduction

15.1.1 This chapter of the ES has been prepared by Bailey Johnson Hayes and presents an assessment of the likely significant effects of the Development, on hydrology, flood risk and drainage.

15.1.2 Mitigation measures are identified, where appropriate, to avoid, reduce or offset any significant adverse effects identified and / or enhance likely beneficial effects both on and off-site. The nature and significance of the likely residual effects are reported.

15.1.3 The chapter is supported by the following appendices:

- Appendix 15.1: Site Specific Flood Risk Assessment (FRA) and Drainage Strategy. Issue 3 (January 2024) by Bailey Johnson Hayes; and
- Appendix 15.2: Report on Preliminary Phase II Ground Investigation at Land Adjacent to Junction 10 M40, Ardley. Issue 2 (August 2021) by Applied Geology.

Competence

15.1.4 William Bailey C.Eng., F.I.Struct.E., M.I.C.E. is the principal author of this hydrology, flood risk and drainage chapter of the ES. He has over 50 years' experience of carrying out assessments and authoring technical chapters.

15.2 Legislation, Planning Policy and Guidance

Legislation Context

15.2.1 The following legislation is relevant to the Development:

- The Water Act (1989) as amended (2014)[1];
- The Water Industry Act (1991) as amended (1999)[2];
- The Water Resources Act (1991) as amended (2009)[3];
- The Land Drainage Act (1991) as amended (1994)[4];
- The Environment Act (1995)[5] and;
- The Flood and Water Management Act (2010)[6].

Planning Policy Context

National

15.2.2 The following national planning policy is relevant to the Development:

- National Planning Policy Framework[7];

Regional

15.2.3 The following regional planning policy is relevant to the Development:

- Oxfordshire County Council Drainage Policy DP1-DP9 (2021)[8]; and
- Oxfordshire Plan 2050 Scoping Document (2019)[9].

Local

15.2.4 The following local planning policy is relevant to the Development:

- Cherwell Local Plan 2011-2031 Part 1, adopted July 2015 ('CLP 2015')[10];
- Saved policies of the Adopted Cherwell Local Plan (1996)[11];
- Cherwell Local Plan 2011 – 2031 Part 2, Issued Consultation, January 2016[12];
- Cherwell Level 1 and 2 Strategic Flood Risk Assessment (SFRA), 2017[13]; and
- Cherwell Council Surface Water Management Plan Phase 2[14].

Guidance

15.2.5 The following guidance is relevant to the Development:

- Sustainable Drainage Systems, Non-statutory technical standards for sustainable drainage systems, (2015)[15];
- CIRIA Guidance Notes; The SuDS Manual C753, (2015)[16];
- CIRIA C741 - Environmental Good Practice on Site, (2015)[17];
- CIRIA C532 - Control of Water Pollution from Construction Sites, (2001)[18];
- Pollution Prevention for Businesses Guidance, (2016)[19];
- Planning Practice Guidance, (2021)[20];
- Flood Risk Assessments; Climate Change Allowance, (2016)[21];
- Sector Guidance in relation to the adoption of sewerage assets by sewerage companies in England, Version 2.2, (2022)[22]; and
- Part H - Drainage and Waste Disposal – Building Regulations, (2015)[23].

15.3 Assessment Methodology

Consultation

15.3.1 Table 15.1 summarises key comments raised by consultees of relevance to this assessment and how the assessment has responded to them.

Table 15.1: Consultation Response Summary

Consultee and Comment	Response
CDC Scoping Opinion (29/07/2021)	
CDC has recognised that the Site lies entirely within Flood Zone 1, although the southern part of the Western Site is subject to medium risk of surface water flooding from the brook to the south. CDC acknowledge that the Development could lead to potentially significant increases in water demand and foul water discharge. Accordingly, it is recommended that this should be scoped into the ES.	An ES chapter is provided within the ES. This was informed by an FRA and Drainage Assessment (Appendix 15.1) that identified the risks of flooding and provided potential mitigation measures, to reduce the risk of surface water flooding to satisfactory levels. The ES chapter addresses the preliminary options for foul water discharge.
Thames Water scoping consultation response (29/07/2021)	
Thames Water advise the following matters should be considered: ▪ The Development's demand for sewage infrastructure; ▪ The Development's surface water drainage requirements; and ▪ The Development's demand for water supply and network infrastructure.	The FRA and Drainage Assessment have outlined the concept foul and surface water drainage requirements for the Development. This will enable more detailed consultation discussions at the planning stage.
Thames Water outline consultation response (08/10/2021)	
Thames Water has identified an inability of the existing water network infrastructure to accommodate the needs of this development proposal. Thames Water have no objection subject to requested condition being added to any planning permission that may be granted.	ESC Limited (M&E Consultant) are satisfied with the proposed water infrastructure condition relating to water network upgrades, proposed flows and development phasing plan. ESC will engage with Thames Water to establish a design solution in due course.
OCC (LLFA) outline consultation response (19/11/2021)	
Objection - Unable to find FRA in the submission.	FRA / Drainage strategy provided in Appendix 15.1.
Anglian Water outline consultation response (05/04/2022)	
Anglian Water has identified that foul drainage from this development is in the catchment of Ardley Water Recycling Centre which currently does not have capacity to treat the flows the development. Anglian water confirm that should planning permission be granted they will be obligated to ensure sufficient capacity is provided. No objection subject to planning condition.	Bailey Johnson Hayes are satisfied with the proposed foul water drainage condition for further details relating to scheme for on-site foul water drainage, proposed connection points and proposed discharge rates to Anglian Water infrastructure. We will in due course liaise directly with Anglian Water and submit a Pre-planning enquiry to progress the design when appropriate to develop a satisfactory drainage solution.
OCC (LLFA) outline consultation response (28/04/2022)	
Objection - Unable to find FRA in the submission.	FRA / Drainage strategy provided in Appendix 15.1.

Consultee and Comment	Response
Environment Agency outline consultation response (08/07/2022)	
No Objection following submission of additional information.	No further response.
OCC (LLFA) outline consultation response (24/11/2022)	
Objection – Previous LLFA comments no addressed.	FRA / Drainage strategy provided in Appendix 15.1.

Study Area and Scope

15.3.2 This chapter assesses the potential effects of the Development on the surrounding water environment, water resources infrastructure, water quality and the potential effects of the surrounding water environment on the Development. The scope of this assessment includes the Site and relevant local waterbodies and water resource features which could potentially be affected by the Development, including the underlying groundwater, groundwater abstractions and the catchment area for surface water, foul water drainage and potable water supply within approximately 1km of the Site boundary.

Establishing Baseline Conditions

15.3.3 This assessment establishes the baseline as 2022 / 2023. The existing baseline conditions at the two Sites and surrounding areas with regard to flooding, drainage, surface water quality, surface water resources and groundwater were determined with reference to the following information sources.

15.3.4 Topographical land survey data was obtained by MK Surveys in June 2021 from drone fly over and traditional land surveying techniques used to determine the landform of the existing Site (Appendix B of Appendix 15.1). This was used to assist in determining the existing surface water drainage arrangements.

15.3.5 Historical maps were reviewed to identify any previous water features known to be located in and around the Site and their direction of flow (Appendix B of Appendix 15.2). A desk top study of Ordnance Survey maps and historical mapping were examined to establish local water features, local topography, and the present water regimes. The Cultural Heritage Desk Based Assessment (Appendix 11.1) and geophysical survey data (Appendices 11.2 and 11.3) was also reviewed to establish the archaeological and geological history of the Site.

15.3.6 Sewer and water main records were obtained from Thames Water (Water) and Anglian Water (Wastewater) and the existing surface water networks were reviewed (Appendix E of Appendix 15.1). Consultation was also undertaken with CDC to ascertain information on historical flooding and existing surface water drainage regimes.

15.3.7 The FRA and Drainage Strategy was undertaken using the following methods of data collection; desk study, walk-over survey, MicroDrainage hydraulic modelling, and professional judgement to establish baseline flood risk.

15.3.8 A two-part review of the Geo-Environmental site investigations was also undertaken with specific focus on the geotechnical and hydrological data. Applied Geology were appointed by the Applicant to carry out a Phase I Preliminary Desk Study in 2015 which was supplemented by Phase II Intrusive Ground Investigation and laboratory sample testing in

June-August 2021. The purpose of these reports is to provide adequate information for planning and development design (included in Appendix 15.2).

Identifying Likely Significant Effects

15.3.9 Below are descriptions and explanations of the methodologies used to identify and assess the likely significant effects during the Enabling Works, during construction of the Development and once the Development is completed and operational. This includes a description / explanation on the use of modelling, forecasting, professional judgement, and other methods where relevant.

Enabling Works & Construction

15.3.10 The methods used to assess the effects of the Enabling Works and construction phase of the Development include consideration of the potential effects on water quality of nearby waterbodies due to excavation, demolition, enabling and construction activities.

Completed Development

15.3.11 A FRA and Surface Water Drainage Strategy has been undertaken in order to assess potential significant effects of the completed Development on changes in flood risk, surface water runoff and drainage, and water quality. An assessment of the increased demand for potable and foul water provision is also provided. The methodology follows a three-step assessment approach:

a) hazard identification incorporating both probabilities of occurrence and the anticipated potential damages;

b) vulnerability (exposure and coping capacity) in the flood-prone areas; and

c) annualised flood risk (estimated on annual basis). The surface water strategy is guided by the latest SuDS design practices in order to achieve the objects of effective water management. Professional judgement is applied to select the best options & solutions.

15.3.12 The Enabling Works will be completed and superseded by the Western Development so this was designed in consideration of the Eastern and Western Developments; the completed Enabling Works are not discretely considered.

Cumulative Effects

15.3.13 The committed developments outlined in Chapter 3: EIA Methodology for consideration in the cumulative assessment are all considered to be of a proximity from the Site such that there is no hydraulic connectivity and cumulative effects would not occur. Additionally, each development would be required to implement a drainage strategy that would ensure that off-site flooding and water quality are not adversely affected by the proposed scheme.

15.3.14 Potable and wastewater infrastructure effects will likely be compounded and interlinked in the region which are managed through the respective statutory undertakers. As such, the assessment of cumulative effects is scoped out of this chapter.

Determining Effect Significance

15.3.15 The significance of an impact is determined by combining the predicted magnitude of the effect with the sensitivity of the receptor.

Sensitivity of Receptor

15.3.16 Table 15.2 sets out the assigned definitions of receptor sensitivity that are used in the assessment process for drainage, flood risk and hydrology.

Table 15.2: Receptor Sensitivity Descriptors

Value (Sensitivity)	Descriptor
High	High importance and rarity, national scale and limited potential for substitution. Receptor has very limited or no capacity to accommodate physical or chemical changes or influences.
Medium	Medium or high importance and rarity, regional scale, and limited potential for substitution. Receptor has a limited capacity to accommodate physical or chemical changes or influences.
Low	Low or medium importance and rarity, local scale. Receptor has a moderate capacity to accommodate physical or chemical changes or influences.
Negligible	Very low importance and rarity, local scale. Receptor is generally tolerant of and can accommodate physical or chemical changes or influences.

Magnitude of Impact

15.3.17 Magnitude considers factors such as severity, size or extent of an impact. To help define impact magnitude, the criteria presented in Table 15.3 were adopted for the purposes of this assessment.

Table 15.3: Magnitude of Impact Descriptors

Impact Magnitude	Descriptor
High	Permanent / irreplaceable change, which is certain to occur. Loss of resource and / or integrity of the resource; severe damage to key characteristics, features or elements (Adverse). Large scale improvement of resource or attribute quality; extensive restoration or enhancement (Beneficial).
Medium	Long-term though reversible change, which is likely to occur. Moderate loss of, or alteration to, one (maybe more) key characteristics, features or elements; measurable change in attributes, quality or vulnerability (Adverse). Minor improvement to, or addition of, one (maybe more) key characteristics, features or elements of the resource; minor improvement to attribute quality (Beneficial).
Low	Short- to medium-term though reversible change, which could possibly occur. Very minor loss of, or alteration to, one (maybe more) key characteristics, features or elements; noticeable change in attributes, quality or vulnerability (Adverse). Very minor improvement to, or

Impact Magnitude	Descriptor
	addition of, one (maybe more) key characteristic, feature or element; very minor improvement to attribute quality (Beneficial).
Negligible	Short-term, intermittent and reversible change, which is unlikely to occur. Temporary or intermittent very minor loss of, or alteration to, one (maybe more) characteristic, feature or element; possible change in attributes, quality or vulnerability (Adverse). Possible very minor improvement to, or addition of, one (maybe more) characteristic, feature or element; possible improvement to attribute quality (Beneficial).

Assessing Significance

15.3.18 The effect significance was determined by applying the EIA significance matrix set out in Chapter 3: EIA Methodology combining the sensitivity of a receptor with the magnitude of impact to form an overall judgement.

15.3.19 Professional judgement was applied to define the significance where a potential effect falls in the major / moderate and moderate / minor categories. These predictions carry a degree of subjectivity, as they are based on expert judgement regarding the effect-receptor interaction that occurs.

15.3.20 Effects classified as moderate or major in scale are considered 'significant'. Effects classified as minor or negligible in scale are considered 'not significant'.

15.3.21 All likely significant effects were identified using one of two descriptors, adverse and beneficial. Following their identification, significant effects were classified based on their nature as follows: temporary or permanent, direct or indirect, secondary, and cumulative.

Assumptions and Limitations

15.3.22 The derivation of the baseline scenario is reliant on the available sources. All comments, assessments, analysis, results, and conclusions in this chapter are based on the information currently available at the time of writing.

15.3.23 MicroDrainage storage estimate calculations are based on the latest Flood Estimation Handbook (FEH) rainfall data available at the time of assessment. assumptions of impervious catchment areas set out in paragraph 5.12 of the FRA (Appendix 15.1).

15.3.24 The assessment in this Chapter is reliant on the data presented in the FRA / Drainage Strategy in Appendix 15.1 and information obtained from CDC, OCC as the Lead Local Flood Authority (LLFA) and the Environment Agency. The Environment Agency's flood data changes regularly over time. However, it is not considered that this would have a significant bearing on the outcome of the assessment.

15.4 Baseline Conditions

Ground Conditions

15.4.1 A review of available geological mapping, Phase I Preliminary Desk Study (2015) and Phase II Intrusive Ground Investigation and laboratory sample testing (2021) has been undertaken for each Site. As the results for both sites are similar results have be summarised together. The findings of this review are described below.

Eastern and Western Site

15.4.2 Generally, an initial layer of natural organic topsoil is present across the Site from ground level to depths of between 0.15m and 0.35m below ground level (bgl). This is in keeping with expectations for typical crop farming fields. Small horizons of subsoil are present on the western and eastern margins of the Site.

15.4.3 The White Limestone Formation is present across the Site beneath the topsoil. The depth to the top of the stratum is fairly uniform across the Site influenced by the overlaying topsoil / subsoil. The base of this stratum was not encountered in any of the trial pits which were excavated down to a competent rock strength material at depths of between 0.80m and 2.90m bgl.

15.4.4 The weathered strata of the White Limestone Formation comprise of a highly variable mix of clayey, sandy, gravelly material with gravel of fine to course angular limestone and occasional to frequent cobbles. Variations across the Site are extensive with cohesive and granular material sometimes either interbedded or absent. Underlaying the initial weathered horizon, the materials became competent rock strength material at depths ranging from 0.70m and 2.49m bgl depending on the degree of weathering above.

15.4.5 A bedrock of solid limestone is expected below the Site, although this has not been encountered in the recent set of intrusive investigations. Further investigations would be required to establish the depth and competence of this material, although the foundations are unlikely to be piled in industrial use so this may not be required.

Groundwater and Soakaway Tests

15.4.6 During the intrusive ground investigation two soakaway tests were undertaken on the Eastern Site and three undertaken on the Western Site. Groundwater observations were also taken at all trial pit locations.

Eastern Site

15.4.7 Groundwater was observed as standing water in only one of the trial pits at a depth of 1.90m bgl on the centre of the southern Eastern Site boundary. Discrete groundwater seepages were recorded in some pits on the southern boundary at depths of 2.0m bgl. These observations suggest that the groundwater table is of significant depth (over 3m bgl) across the Eastern Site.

15.4.8 Calculated infiltration rates from the two tests on the eastern section of the Eastern Site range between 1 x 10^{-3} m/s and 2 x 10^{-5} m/s. These are considered quite substantial variations which reflects the high degree of variability in the weather horizons of White Limestone Formation strata. The groundwater occurrence and soakaway tests results suggest variable ground permeability / infiltration rates across the Eastern Site.

Western Site

15.4.9 Groundwater was observed as standing water in three of the trial pits at a depth of between 0.90m and 1.60m on the south east corner of the Western Site. Discrete groundwater seepages were recorded in some pits on the south eastern Western Site boundary at depths of between 0.90m and 2.0m bgl. These observations suggest that the groundwater table is of significant depth (over 3m bgl) across the majority of the Western Site, similar to the Eastern Site.

15.4.10 Calculated infiltration rates from the three tests on the western section of the Western Site ranged between 7 x 10-4 m/s and 7 x 10-6 m/s. These are considered quite substantial variations which reflects the high degree of variability in the weather horizons of White Limestone Formation strata. The groundwater occurrence and soakaway tests results suggest variable ground permeability / infiltration rates across the Western Site.

Hydrology and Hydrogeology

15.4.11 Detailed assessment of hydrology and hydrogeology is provided in the latest FRA & Drainage Strategy (Appendix 15.1). A summary of the main features for both Sites are provided below.

Eastern Site

15.4.12 The nearest surface watercourse is the Padbury Brook which is located approximately 35m south of the Eastern Site boundary and flows to the east. The Environment Agency Chemical Quality Grade by standards for the determinants biochemical oxygen demand (BOD), ammonia and dissolved oxygen for this watercourse is 'A' (Very Good).

15.4.13 According to the Applied Geology report (Appendix 15.2) there are no surface water abstractions within 2km of the Site. There are many licensed discharges within 500m of the Site, the nearest one being 30m south of the Eastern Site of emergency discharges from Cherwell Valley Services into the Padbury Brook. The majority of the other licensed discharges are for storm overflow.

15.4.14 The Environment Agency website indicates that the Eastern Site lies outside of any flood zone and is therefore located in Flood Zone 1 which has a less than 0.1% chance of flooding.

15.4.15 According to the Environment Agency, the White Limestone Formation is classified as a Principal Aquifer. There are three groundwater abstractions within 500m of the centre of the Eastern Site, the nearest being 100m to the south-east for commercial use at the Cherwell Valley Services from the Eastern Site boundary. The Eastern Site is not located within a groundwater Source Protection Zone.

Western Site

15.4.16 The nearest surface watercourse is the Padbury Brook which is located approximately 150m south of the Western Site, with the nearest licensed discharge located circa 300m south-east of the Western Site boundary. The Western Site is therefore located in Flood Zone 1 which has a less than 0.1% chance of flooding.

15.4.17 There are three groundwater abstractions within 500m of the centre of the Western Site, the nearest being 200m north west for household (potable) use and for general farming use. The Western Site is not located within a groundwater Source Protection Zone.

Surface Water Drainage and Surface Water Features

Eastern Site

15.4.18 No known formal surface water drainage features have been identified on the Site. Levels from the topographical survey indicate that the highest point in the north is 117.0m AOD and generally levels fall in a south-easterly direction to a low point of 109.5m AOD. Average falls across the Site are of the order of 1 in 60, with some slightly steeper localised slopes.

15.4.19 The Site conditions indicate that overland flow paths are possible but limited. Generally, most rainfall is assumed to infiltrate directly into the ground where permeable. On the eastern boundary, a field ditch 0.5m to 1.0m deep, conveys very local runoff southwards to a natural low point in the south east corner of the Site. There is no evidence of any formal connection into the Padbury Brook to the south of the Site.

15.4.20 Given there are no significant water features on the Site, surface water is assumed to discharge through interception by vegetation, evaporation and/or infiltration directly into permeable ground. No flooding is known to have taken place on the Site.

Western Site

15.4.21 There are no known formal surface water drainage features identified on the Site at the time of assessment. Site levels from the topographical survey indicate that the highest point in the north is 128.0m AOD and generally levels fall in a south-easterly direction to a low point of 112.0m AOD. Average falls across the Site are of the order of 1 in 60, with some slightly steeper localised slopes.

15.4.22 Similarly to the Eastern Site, the Western Site conditions indicate that overland flow paths are possible but limited. Generally, most rainfall is assumed to infiltrate directly into the ground where permeable. On the eastern boundary, a field ditch 0.5m to 1.0m deep, conveys very local runoff southwards to a natural low point in the south-east corner of the Site. There is no evidence of any formal connection into the Padbury Brook to the south of the Site.

15.4.23 On the northern boundary, a field ditch of generally 0.5m to 1.0m deep separates the Site from the B4100, conveying water in an easterly direction. There is a natural low point on the Site in the south east corner. Surface water generally discharges through direct infiltration into the ground throughout the Site. No flooding is known to have taken place on the Site.

Surface Water Quality

15.4.24 There are no known issues with water quality from the Eastern or Western Sites. Rainfall generally drains into the ground which is naturally filtered by the overlaying strata to feed into the groundwater table at depth below ground. See Applied Geology report for further information (Appendix 15.2). There is no known contamination on the Eastern or Western Sites.

Canals, Reservoirs and Waterbodies

15.4.25 The nearest canal is the Oxford Canal which runs adjacent to the River Cherwell approximately 5.0km west of the Site. The nearest large waterbody is a large pond located

on Park Farm approximately 1.25km north east of the Site. The potential effect on canals, reservoirs and waterbodies is negligible given the location.

Rainfall

15.4.26 According to Meteorological Office data, the annual average rainfall for the period 1981-2010 for the nearest Met Office weather station to the application sites (Oxford, located approximately 15 miles to the south) is 659.7mm, with the wettest months being October to January. This compares with the higher averages of 1154mm for the UK, 854.8mm for England and 798.3mm for the Midlands Region. Oxfordshire has some of the lowest average annual rainfall in the UK.

Water Supply

15.4.27 The Baynard's Green and Ardley area is supplied with potable water by Thames Water which has provided local service asset plans. Existing water usage on both Sites is likely to be minimal to none at present, and in the past would have related to general agricultural activities. The volume of water required for the previous agricultural land use on the Site is not known.

15.4.28 There is an existing water main which runs northwards adjacent to the A43 between the Eastern and Western Sites to service Baynard’s Green Petrol station and McDonald's restaurant.

Foul Water Drainage

15.4.29 There are no known existing public foul or effluent connections located on the Site. The nearest Anglian Water adopted foul water pumping station is located 60m south of the Eastern Site at the Moto Cherwell Service station. Foul water is pumped from the service station approximately 650m east, via a 100mm diameter pipe, directly to Ardley Wastewater Recycling Centre. There is also a gravity foul system which serves the village of Ardley which is eventually pumped approximately 200m to the wastewater treatment facility.

Future Baseline

15.4.30 In the absence of the Development, the frequency and severity of flood events, due to climate change, could increase with the predicted increase in the frequency and intensity of rainfall events and river flow rates. In addition, surface water discharge from the Site and surrounding area into the local river system would increase as a result of peak rainfall intensity. This could result in an increase in run-off pollutants entering the system and increase erosion of the Padbury Brook channel through the turbulence created by the surface water outlets.

15.4.31 The alterations in other baseline conditions cannot be predicated (e.g. water quality) or are not considered likely to change (e.g. geological setting).

Summary of Receptors and Sensitivity

15.4.32 Table 15.5 defines the sensitivity of identified sensitive receptors.

Table 15.5: Summary of Receptor Sensitivity

Receptor	Sensitivity (Value)
Existing	
Padbury Brook watercourse	High
Local public water supply and sewerage networks	High
People and property on and adjacent to the Site	High
Ground water table (Eastern Site)	Medium
Ground water table (Western Site)	Medium
Surface water ditch (Eastern Site)	Medium
Surface water ditch, M40 (Western Site)	Medium
Surface water ditch, B4100 (Western Site)	Medium
Existing field boundary hedgerows	Low / Medium
Local biodiversity and trees	Low / Medium
Future	
Construction workers	High
Foul drainage infrastructure	High
Buildings, businesses, and workers	High
Sustainable Drainage System (SuDS) features	Medium
Access roads	Medium
Footpaths, including Public Rights of Way	Low

15.5 Scheme Design and Management

Enabling Works and Construction

15.5.1 Measures will be undertaken during the Enabling Works and Construction phase to minimise disruption and manage the impacts of the Development.

15.5.2 The design and implementation of construction works will be undertaken in accordance with ISO 14001 and industry regulatory procedures. As such, the following measures will be implemented to achieve this :

- Construction Environmental Management Plan (CEMP);
- Site Drainage Plan - Implementation and use of a temporary surface water drainage system during construction to prevent materials soaking into the ground which reduce infiltration potential and silt traps to prevent blockage of surface water features;
- Following the Environment Agency's Pollution Prevention Guidance (PPG) notes to ensure good practice in construction;
- Adherence to CIRIA Guidance in manuals C502 (Environmental Good Practice on Site) and C532 (Control of Water Pollution from Construction Sites);
- Production of a Pollution Incidence Response Plan in line with the Environment Agency's PPG 21 pollution Incident Response Planning;
- Adherence to a Construction Traffic Management Plan (CTMP); and
- The identification, mitigation and remediation of contaminated land.

These measures are set out in the Framework CEMPs in Appendices 6.1 and 6.2.

Completed Development

15.5.3 The surface water drainage strategy will be adopted to ensure all hardstanding and other areas that may be affected by contaminants will be attenuated and treated prior to discharge thus preventing contaminated surface water percolating into the soil. The drainage strategy seeks to maintain the existing hydrology in terms of the volume and rate of surface water run-off from both the Eastern and Western Developments so not to increase the risk of flooding on or off-site.

15.5.4 The main components of the surface water drainage strategy are summarised below, with the concept drainage, site levels and external works schemes presented in the FRA (see Appendix 15.1):

- Swales;
- Infiltration Basins;
- Permeable Paving;
- Petrol Interceptors (Class 1 interceptors will be used for all drains before discharging to local watercourses);
- Catchpits, Gullies and Line Drains; and
- Flow control devices such as Hydro-brakes.

15.5.5 While there is some variation in ground conditions and particularly permeability in the upper strata an 'Infiltration only' approach has been taken for the surface water drainage system. The concept design uses a large series of swales and infiltration basins in order to convey runoff into the ground as sporadically as possible around the site to mimic flows pre-development . Also, to assist with this regime all car park areas will be of permeable paving construction, infiltrating directly into the ground.

15.5.6 Surface water generated from the upgraded A43 / B4100 and additional footway/cycleway connection to Bicester will continue to drain in a similar manor to existing drainage regime either, direct infiltration to ground from adjacent verges/ditches or formalised drainage by road gullies/channels into highways drainage infrastructure, in agreement with the local authority. A SuDS approach is to be adopted where possible.

15.5.7 The measures to manage surface water run-off are designed to ensure that:

- The Development does not flood from surface water up to and including the design storm event and surface water flooding up to the 1 in 30-year storm event can be safely contained on the Development; and
- Discharges will not exceed the pre-development rates across a range of storm events up to and including the 1 in 100-year storm plus a 40% climate change allowance.

15.5.8 High efficiency water fixtures and fittings could be incorporated within buildings which achieve good quality user experience while minimising potable water demand, through features such as aeration, and hidden approaches to minimising water wastage such as sensors to shut off supply when facilities are not being used.

15.5.9 Commercial water consumption would be measured using smart meters. Through use of efficient practice fixtures and fittings, it is anticipated that the Development can reduce potable water demand.

15.6 Construction

Assessment of Effects

15.6.1 Phase-specific construction phase effects or mitigation are not expected for the Enabling Works, Eastern Development or Western Development. As such, a construction phase assessment is provided for the Development as a whole and is applicable to all three applications. All effects are considered to be temporary and short-term.

Human Health

15.6.2 The potential for flooding or contamination to affect the health of construction workers is low. Human receptors are classed as high sensitivity and assuming construction site practice and management measures outlined in the Section 15.5: Scheme Design and Management will be implemented, a negligible effect is predicted.

Increased Sediment Loading

15.6.3 Construction activities are likely to comprise the large-scale disturbance of soil, including topsoil and subsoil stripping, stockpiling of stripped material, heavy plant, and vehicular movements, dewatering and foundation, superstructure, and infrastructure constructions.

15.6.4 Such construction activities could result in increased surface water release and run-off as a result of the removal of surface vegetation and topsoil, and an increase in areas of hardstanding for the Site compound and temporary car parking. The scouring effects of water would pick up soil particles and transport them in suspension. This would lead to a low magnitude of impact. The Padbury Brook and on-Site ditches are classed as high and medium sensitivity respectively, so with the embedded mitigation measures in place the potential effects are considered to be minor adverse.

Accidental Leaks of Hazardous Materials

15.6.5 Leakage and spillage of oils etc. from construction plant and vehicles, although unlikely, could occur and cause local contamination of ground, groundwater, and surfaces of water. Other pollution sources that could be associated with the construction compound, stores and delivery include solvents, curing agents, paints, cement, and chemicals could result in release of substances and cause contamination of ground water. In addition, construction fuel tanks could leak or accidentally discharge, potentially causing significant environmental effects to local wildlife and habitats. The Padbury Brook is high sensitivity and on-site ditches, and groundwater are medium sensitivity, respectively. The magnitude of impact is considered negligible, therefore potential effects are considered to be negligible.

Construction Traffic

15.6.6 During peak construction periods, there will be construction workers, vehicles and deliveries arriving to the Site throughout the day. Large construction vehicles can draw excessive dirt and debris onto the highway which could block existing surface water features. Wheel washing protocols will be available to wash down vehicles when appropriate and reduce the risk of blockages and lead to a negligible effect.

Construction Infrastructure

15.6.7 Temporary water supplies and drainage facilities will be provided to support the construction employee population on the Site and connections to local sewers will be arranged for these temporary usages. The potential effects associated with supply of water and drainage facilities for the construction workforce is considered to be negligible.

Mitigation, Monitoring and Residual Effects

15.6.8 No additional mitigation is required over and above the measures included in Section 15.5. Monitoring will take place via regular inspections by the contractor throughout the construction process. This will result in residual effects of negligible significance during construction of the Development, requiring no additional mitigation measures.

15.7 Completed Development

15.7.1 It is assumed for the purposes of this assessment that both parts of the Development (Eastern and Western) will be completed simultaneously and will be occupied at a similar time, leading to the most pressure on water and drainage resources. The effects of the completed Development, incorporating the mitigation measures discussed in section 15.5 are assessed below:

Assessment of Effects

Water Quality

15.7.2 Surface water drained from potentially contaminative sources within the Development such as service yards, delivery areas, car parks and internal roads will pass through SuDs filtration layers or petrol interceptors before outflowing into swales / infiltration basins. SuDS systems have natural filtration processes through features such as reedbeds, filtration membranes, subgrade stone etc. where silts can be removed before flow controls release water into local water courses or the ground at approved water quality. With these design measures in place, effects of the completed Development on water quality are expected to be negligible.

Surface Water Drainage and Flood Risk

15.7.3 The completed Development will result in a significant increase in impervious surfaces associated with buildings, service yards and delivery areas compared to the existing situation. This will increase the volume and rate of surface water run-off compared to that of the existing Site. However, through the use of permeable materials and SuDS as set out in Section 15.5 of the chapter, the potential impacts on local watercourses resources would be negligible.

15.7.4 The B4100 roundabout accesses and off-site footpath/cycleway works will be designed to reduce the risk of flooding to cater for modern rainfall and climate change events. This is expected to provide a minor beneficial impact on to the local surface water drainage infrastructure.

Groundwater Flooding

15.7.5 Although natural lateral flow via the groundwater table would be reduced by the introduction of impermeable and semi-permeable surface coverings, maximising the areas of SuDS infiltration basins around the Development reduces the minor changes to groundwater mobility. Contamination of groundwater from spills and leaks will be prevented by the

installation of interceptors, bunding and good site management and maintenance. As such, the potential effects are considered to be negligible.

Foul Water Drainage

15.7.6 The FRA outlines a number of viable options which will be explored, detailed and extensive discussions and assessments undertaken to find the final solution. Three viable options for discharge have been considered such as; pumping to a local treatment works, on-site treatment, and discharge to new or upgraded foul wastewater infrastructure. The preferred option is to pump foul waste to a nearby wastewater treatment plant, to be defined during the detailed design stage. Foul water drainage is to be agreed with Anglian Water as the wastewater undertaker at the reserved matters stage.

The receptors of pumping foul waste could be contaminating the ground, watercourses, or any other sensitive wildlife if the pipe burst, however this is highly unlikely when designed properly. The potential effects are considered to be of negligible significance.

Potable Water

15.7.7 The Development will increase the current water demand on the Site. On the assumption that Thames Water will implement improvements to meet the increased water demand of new development (the details of which will be agreed at reserved matters stage) and through the application of water use efficiency measures, no adverse impact is predicted on the local public water supply resulting in a negligible effect.

Mitigation, Monitoring and Residual Effects

15.7.8 No additional mitigation or monitoring is considered necessary. As such, the residual effects remain as stated for the completed Development.

Table 15.6: Summary of Residual Effects

Effect	Receptor (Sensitivity)	Geographic Scale	Temporal Scale	Magnitude of Impact		Mitigation and Monitoring		Residual Effect	
Construction									
Impacts on human health	Construction workers (High)	Local	Temporary	Enabling Works	Minor adverse	Enabling Works	Adherence to the CEMP	Enabling Works	Negligible
				Eastern Development	Minor adverse	Eastern Development		Eastern Development	Negligible
				Western Development	Minor adverse	Western Development		Western Development	Negligible
				Development	Minor adverse	Development		Development	Negligible
Increased sediment loading	Padbury Brook watercourse (High) Surface water ditches (Medium)	Regional & Local	Temporary	Enabling Works	Negligible	Enabling Works	Adherence to temporary drainage scheme	Enabling Works	Negligible
				Eastern Development	Moderate / Minor adverse	Eastern Development		Eastern Development	Negligible
				Western Development	Moderate / Minor adverse	Western Development		Western Development	Negligible
				Development	Moderate / Minor adverse	Development		Development	Negligible
Accidental leaks of hazardous materials	Padbury Brook watercourse (High) Surface water ditches (Medium) Groundwater table (Medium)	Regional & Local	Temporary	Enabling Works	Negligible	Enabling Works	Adherence to the CEMP	Enabling Works	Negligible
				Eastern Development	Moderate adverse	Eastern Development		Eastern Development	Negligible
				Western Development	Moderate adverse	Western Development		Western Development	Negligible
				Development	Moderate adverse	Development		Development	Negligible
Dust and dirt from construction traffic	People and property on and adjacent to the Site (High) Surface water ditches (Medium)	Local	Temporary	Enabling Works	Negligible	Enabling Works	Adherence to CTMP	Enabling Works	Negligible
				Eastern Development	Minor adverse	Eastern Development		Eastern Development	Negligible

Effect	Receptor (Sensitivity)	Geographic Scale	Temporal Scale	Magnitude of Impact		Mitigation and Monitoring		Residual Effect	
				Western Development	Minor adverse	Western Development		Western Development	Negligible
				Development	Minor adverse	Development		Development	Negligible
Demand on water supply from construction infrastructure	People and property on and adjacent to the Site (High)	Regional & Local	Temporary	Enabling Works	Negligible	Enabling Works	Monitor infrastructure for defects	Enabling Works	Negligible
				Eastern Development	Negligible	Eastern Development		Eastern Development	Negligible
				Western Development	Negligible	Western Development		Western Development	Negligible
				Development	Negligible	Development		Development	Negligible
Completed Development									
Changes to water quality	Surface water ditches (Medium) Groundwater table (Medium)	Local	Permanent	Eastern Development	Minor adverse	Eastern Development	None required.	Eastern Development	Negligible
				Western Development	Minor adverse	Western Development		Western Development	Negligible
				Development	Minor adverse	Development		Development	Negligible
Changes to surface water drainage and flood risk – Development (exc. detailed site access and off-site pedestrian infrastructure)	Groundwater table (Medium) People and property on and adjacent to the Site (High)	Local	Permanent	Eastern Development	Moderate adverse	Eastern Development	None required.	Eastern Development	Negligible
				Western Development	Moderate adverse	Western Development		Western Development	Negligible
				Development	Development	Development		Development	Negligible
Changes to surface water drainage and flood risk – Site access and off-site pedestrian infrastructure	Surface water ditches (Medium) Groundwater table (Medium)	Local	Permanent	Eastern Development	Minor Beneficial	Eastern Development	None required.	Eastern Development	Minor Beneficial
				Western Development	Minor Beneficial	Western Development		Western Development	Minor Beneficial

Effect	Receptor (Sensitivity)	Geographic Scale	Temporal Scale	Magnitude of Impact		Mitigation and Monitoring		Residual Effect	
	People and property on and adjacent to the Site (High)			Development	Minor Beneficial	Development		Development	Minor Beneficial
Groundwater flood risk	Groundwater table (Medium)	Local	Permanent	Eastern Development	Moderate adverse	Eastern Development	None required.	Eastern Development	Negligible
				Western Development	Moderate adverse	Western Development		Western Development	Negligible
				Development	Moderate adverse	Development		Development	Negligible
Changes in demand on foul water drainage infrastructure	Surface water ditches (Medium) Groundwater table (Medium) People and property on and adjacent to the Site (High)	Local	Permanent	Eastern Development	Negligible	Eastern Development	None required.	Eastern Development	Negligible
				Western Development	Negligible	Western Development		Western Development	Negligible
				Development	Negligible	Development		Development	Negligible
Changes in demand on potable water drainage infrastructure	People and property on and adjacent to the Site (High)	Local	Permanent	Eastern Development	Negligible	Eastern Development	None required.	Eastern Development	Negligible
				Western Development	Negligible	Western Development		Western Development	Negligible
				Development	Negligible	Development		Development	Negligible

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