Luton Rising
Our airport.
Our community.
Our planet.

February 2023

London Luton Airport Expansion

Planning Inspectorate Scheme Ref: TR020001

Volume 5 Environmental Statement and Related Documents

5.01 Chapter 20: Water Resources and Flood Risk

Application Document Ref: TR020001/APP/5.01
APFP Regulation: 5(2)(a)

The Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

London Luton Airport Expansion Development Consent Order 202x

5.01 ENVIRONMENTAL STATEMENT CHAPTER 20: WATER RESOURCES AND FLOOD RISK

Regulation number:	Regulation 5(2)(a)
Planning Inspectorate Scheme Reference:	TR020001
Document Reference:	TR020001/APP/5.01
Author:	Luton Rising

Version	Date	Status of Version
Issue 1	February 2023	Application issue

Contents

Page

20 Water Resources and Flood Risk 1
20.1 Introduction 1
20.2 Legislation, policy and guidance 3
20.3 Scope of the assessment 13
20.4 Stakeholder engagement and consultation 23
20.5 Methodology 30
20.6 Assumptions and limitations 38
20.7 Baseline conditions 41
20.8 Embedded and good practice mitigation measures 57
20.9 Assessment 63
20.10 Additional mitigation 82
20.11 Residual effects 82
20.12 In-combination climate change effects 82
20.13 Monitoring 87
20.14 Assessment summary 88

Competent Experts 104

Glossary and Abbreviations 105

References 107

Tables

Table 20.1: Water Resources and Flood Risk legislation
Table 20.2: Water Resources and Flood Risk policy
Table 20.3: How relevant Water Resources and Flood Risk requirements of ANPS are addressed in this ES
Table 20.4: Water Resources and Flood Risk guidance
Table 20.5: Water Resources and Flood Risk Scoping Opinion comments
Table 20.6: Stakeholder engagement relating to Water Resources and Flood Risk
Table 20.7: Importance values for water resource and flood risk receptors
Table 20.8: Magnitude of impact for Water Resource and Flood Risk receptors
Table 20.9: Significance of effects
Table 20.10: Surface water features in the study area
Table 20.11: Groundwater features and receptors
Table 20.12: Flood risk receptors in the study area
Table 20.13: Groundwater Receptors – Construction Impacts
Table 20.14: Groundwater Receptors - Operational Impacts
Table 20.15: Qualitative Sensitivity Analysis

Table 20.16 Water Resources and Flood Risk in-combination climate change impacts
Table 20.17: Water Resources and Flood Risk assessment summary

20 WATER RESOURCES AND FLOOD RISK

20.1 Introduction

20.1.1 This chapter reports the assessment of the likely significant effects of the Proposed Development on Water Resources and Flood Risk.

20.1.2 The Environmental Impact Assessment (EIA) Scoping Report (provided as **Appendix 1.1** and **1.2** of this ES **[TR020001/APP/5.05]** set out the proposed scope for the assessment of Water Resources and Flood Risk. In summary, the following have been assessed in this Environmental Statement (ES):

a. changes to existing water level, volume and flow characteristics that could increase flood risk or reduce water available for existing abstractions, or receptors in the natural environment;

b. surface water and groundwater quality;

c. water supply and sewerage infrastructure; and

d. Water Framework Directive (WFD) bodies and potential changes to their status.

20.1.3 The following appendices have been completed to inform this assessment and are provided in this ES:

a. Flood Risk Assessment (FRA) (**Appendix 20.1** of this ES **[TR020001/APP/5.07]**);

b. Water Framework Directive (Ref. 20.1) (WFD) Compliance Assessment (**Appendix 20.2** of this ES **[TR020001/APP/5.02]**);

c. Hydrogeological Characterisation Report (**Appendix 20.3** of this ES **[TR020001/APP/5.02]**);

d. Drainage Design Statement (DDS) (**Appendix 20.4** of this ES **[TR020001/APP/5.02]**);

e. Water Cycle Strategy (WCS) (**Appendix 20.5** of this ES **[TR020001/APP/5.02]**); and

f. Hydrogeological Risk Assessment Report: Drainage (**Appendix 20.6** of this ES **[TR020001/APP/5.02]**).

20.1.4 Further details on the key principles and assumptions included in the DDS are outlined in **Sections 20.8 and 20.9** of this chapter.

20.1.5 **Chapter 17** Soils and Geology of this ES **[TR020001/APP/5.01]** provides an assessment of the likely significant effects of the Proposed Development with respect to contamination and geological and geomorphological features of interest. The Detailed Quantitative Risk Assessment (DQRA) – Controlled Waters is provided as **Appendix 17.4** of this ES **[TR020001/APP/5.02]** and provides an assessment of the risk of contamination from the landfill to the underlying groundwater resources.

20.1.6 **Chapter 17** Soils and Geology of this ES **[TR020001/APP/5.01]** and associated appendices **[TR020001/APP/5.02]** should be read in combination with this

chapter to provide a full understanding of the hydrogeological context and the likely impacts of contaminated soils on human health, the environment and buildings/buried infrastructure in the Proposed Development study area.

20.1.7 A detailed assessment of the impacts of the Proposed Development on flooding associated with rivers and streams has been scoped out of the assessment. For further information reference should be had to **Section 20.3**.

20.1.8 The remainder of this chapter consists of:

a. **Section 20.2** Legislation, policy and guidance relevant to the scope and methodology of this Water Resources and Flood Risk assessment;
b. **Section 20.3** Scope of the assessment;
c. **Section 20.4** Stakeholder engagement and consultation undertaken to inform this assessment;
d. **Section 20.5** Methodology applied to this assessment;
e. **Section 20.6** Assumptions and limitations;
f. **Section 20.7** Baseline conditions;
g. **Section 20.8** Embedded and good practice mitigation;
h. **Section 20.9** Assessment of impacts;
i. **Section 20.10** Additional mitigation;
j. **Section 20.11** Residual effects;
k. **Section 20.12** In-combination climate change effects;
l. **Section 20.13** Monitoring; and
m. **Section 20.14** Assessment summary.

20.2 Legislation, policy and guidance

20.2.1 This section identifies the key legislation, policy and guidance relevant to the scope and methodology for this Water Resources and Flood Risk assessment which will influence the type of mitigation measures that could be incorporated into the Proposed Development during construction or operation.

20.2.2 **Table 20.1** to **Table 20.4** provides a description of the relevant legislation, policy and guidance, and where each of these have been addressed in this ES.

Legislation

Table 20.1: Water Resources and Flood Risk legislation

Legislation	How and where addressed in ES
Environment Act 2021 (Ref. 20.1)	The Act relates to the Secretary of State for Environment, Food and Rural Affairs ability to manage water resources and wastewater infrastructure. It gives powers to the Secretary of State to specify what chemicals should be taken into account in assessing water quality and further controls over licenced abstractions. The Act primarily affects the water utility providers, but is relevant to developers creating and managing new infrastructure that will connect to the water network. The Act has been considered in preparation of the DDS (**Appendix 20.4** of this ES **[TR020001/APP/5.02]**).
The WFD (Standards and Classification) Directions 2015 (Ref. 20.2) and the Water Environment (England and Wales) Regulations 2017 (Ref. 20.3) transpose the EU WFD 2000 into law in England and Wales. The legislation sets out the need to ensure that new developments will not result in the deterioration of the waterbody WFD status or affect the future WFD objective to achieve compliance.	The principles of the WFD Directions 2015 and the Water Environment Regulations 2017 (Ref. 20.2) have been applied to develop the assessment methodology described in the WFD Compliance Assessment provided in **Appendix 20.2** of this ES **[TR020001/APP/5.02]**. This is a stepped assessment process to identify the requirement for detailed assessment in relation to the Proposed Development to ensure the WFD status and/or future objectives of the water bodies are not compromised. The stepped assessment is detailed in the WFD Compliance Assessment provided in **Appendix 20.2** of this ES **[TR020001/APP/5.02]**, which screened out the requirement for a detailed assessment for any of the WFD water bodies.

Legislation	How and where addressed in ES
	Note that the Cycle 2 River Basin Management Plan (Ref. 20.4) has been utilised as the basis for the application for development consent.
The Flood Risk Regulations 2009 (Ref. 20.5) outlines requirements for the assessment of existing flood risk and the need to design new developments to ensure that they are safe from flooding and do not increase flood risk for surrounding receptors and transposes the Floods Directive 2007/EC/60 (Ref. 20.6) into law in England and Wales. The Flood and Water Management Act 2010) (Ref. 20.7) includes requirements related to management of flood risk associated with extreme weather, compounded by climate change.	The principles and provisions outlined in the Flood Risk Regulations 2009 (Ref. 20.3) and Flood and Water Management Act 2010 (Ref. 20.5) in relation to the management of flood risk for main rivers and ordinary watercourses have been applied to complete the FRA provided as **Appendix 20.1** of this ES **[TR020001/APP/5.07]** and have informed the drainage design described in detail in the DDS (**Appendix 20.4** of this ES **[TR020001/APP/5.02]**) and summarised in **Section 20.8** of this chapter.
The Water Act 2014, amending the Water Industry Act 1991 (Ref. 20.8) outlines the requirements regarding water and sewerage undertaker infrastructure, permitting and connections.	The provisions regarding water industry infrastructure have been considered in the drainage design of the Proposed Development as described in the DDS (**Appendix 20.4** of this ES **[TR020001/APP/5.02]**) and summarised in **Section 20.8** of this chapter. It has also informed the stakeholder engagement completed with the relevant water and sewerage undertakers summarised in **Section 20.4.**
Environment Act 1995 (Ref. 20.9) provides for the establishment of the Environment Agency and their requirements and functions in relation to drainage and flood risk.	The Environment Act 1995 includes measures related to drainage and flood defence which have informed the drainage design for the Proposed Development as described in **Section 20.8**. It has also informed the stakeholder engagement completed with the relevant water and sewerage undertakers summarised in **Section 20.4.**
Water Resources Act 1991 (Ref. 20.10) provides requirements for the regulation of water resources, water quality and pollution and flood defence. Water Industry Act (Amendment) (England and Wales) Regulations 2009 (Ref. 20.11)	The Water Resources Act 1991, Water Industry Act (Amendment) (England and Wales) Regulations 2009 and Water Act 2003 provide a general structure for the management of water resources that has been applied in the development of the WCS (**Appendix 20.5** of this ES

Legislation	How and where addressed in ES
amends multiple articles in the Water Resources Act 1991. Water Act 2003 (Ref. 20.12) makes provisions with respect to compensation under Section 61 of the Water Resources Act 1991.	**[TR020001/APP/5.02]**), which links water use and the DDS (**Appendix 20.4** of this ES **[TR020001/APP/5.02]**) together.
Water Resources (EIA) Regulations 2003 (Ref. 20.13) outline procedural requirements for EIAs in relation to water resources. Water Resources (EIA) (England and Wales) Regulations 2006 (Ref. 20.14) amends multiple articles in the Water Resources (Environmental Impact Assessment) Regulations 2003. Infrastructure Planning (EIA) Regulations 2017 (Ref. 20.15) outline the EIA process and the content required in an EIA.	The Water Resources (EIA) Regulations 2003 and Water Resources (EIA) Regulations 2006 provide a general structure for this chapter. The Infrastructure Planning (EIA) Regulations 2017 also inform the content of this chapter.
Environmental Permitting (England and Wales) (Amendment) (EU Exit) Regulations 2019 (Ref. 20.16)	See Environmental Permitting (England and Wales) Regulations 2016 (Ref. 20.20). This legislation ensures that The Environmental Permitting (England and Wales) Regulations 2016 (Ref. 20.20) continue to function in accordance with the European Union (Withdrawal) Act 2018 (Ref. 20.17).
Environment (Amendment etc.) (EU Exit) Regulations 2019: Part 2 (Ref. 20.18)	See Environment Act 1995 (Ref. 20.9). This legislation amends the following primary legislation of relevance to the water environment: The Environmental Protection Act 1990 (Ref. 20.19), and The Environment Act 1995 (Ref. 20.9).
The Environmental Permitting (England and Wales) Regulations 2016 (Ref. 20.20) aim to streamline the legislation for permitting to encourage best practice in the operation of regulated facilities.	The Environmental Permitting (England and Wales) Regulations 2016 have been used to inform discussions with the Environment Agency regarding permitting requirements to ensure that the Proposed Development is designed appropriately, and sufficient information is collated to allow permits to be gained in the future. Discussions are outlined in **Section 20.4**.

Legislation	How and where addressed in ES
Groundwater WFD (England) Direction 2016 (Ref. 20.21) transposes the requirements of the EU Groundwater Directive 2006/118/EC (Ref. 20.22) into UK law and establishes quality standards for groundwater and introduces measures to prevent or limit inputs of pollutants to groundwater. Groundwater Regulations 2009 (Ref. 20.23) provide clarification on certain objectives of the EU Groundwater Directive 2006/118/EC (Ref. 20.22) to prevent prevention and control of groundwater pollution and establishes groundwater quality standards. The Contaminated Land (England) Regulations (Amendment) 2012 (Ref. 20.24) outline specific requirements on the management of controlled waters as specified under the WFD.	The principles outlined in the Groundwater WFD (England) Direction 2016, the Groundwater Regulations 2009 and The Contaminated Land (England) Regulations (Amendment) 2012 related to the prevention of risks to groundwater have been applied in the completion of the Hydrogeological Characterisation Report, Hydrogeological Risk Assessment Report: Drainage and DQRA Risk Assessment (**Appendix 20.3, Appendix 20.6** and **Appendix 17.4** of this ES **[TR020001/APP/5.02]** respectively) and have informed the drainage design for the Proposed Development as described in DDS **(Appendix 20.4** of this ES **[TR020001/APP/5.02])**. They have also informed the WFD Compliance Assessment provided in **Appendix 20.2** of this ES **[TR020001/APP/5.02]**.

Policy

Table 20.2: Water Resources and Flood Risk policy

Policy	How and where addressed in ES
Section 14 of the National Planning Policy Framework (NPPF), July 2021 (Ref. 20.25) outlines the requirements to ensure that flood risk is considered at all stages of the planning process to direct development away from areas at highest risk.	The approach outlined in the NPPF 2021 in relation to flood risk has been applied to the FRA provided as **Appendix 20.1** of this ES **[TR020001/APP/5.07]**.
National Policy Statement for National Networks – December 2014 (NPSNN) (Ref. 20.26) The NPSNN sets out the need for, and Government's policies to deliver, development of nationally significant infrastructure projects (NSIPs) on the national road and rail networks in England. It provides planning guidance for promoters of NSIPs on the road and rail networks. The provisions of the NPSNN relevant to environmental	There are no elements of the Proposed Development on the national road or rail network that would be classified as an NSIP in their own right. However, the NPSNN remains an important and relevant consideration, particularly as works are proposed on the Strategic Road Network (SRN) at Junction 10 of the M1 as part of the Proposed Development. The relevant polices of the NPSNN are consistent with the relevant policies of the ANPS and have not, therefore, been repeated here and accordingly the

Policy	How and where addressed in ES
assessment broadly mirror those as outlined in the Airport National Policy Statement (ANPS).	ANPS compliance table (**Table 20.3**) provides the necessary policy response.
Policy LLP6 – London Luton Airport Strategic Allocation, in particular Part F which states 'provision is made for sustainable drainage and the disposal of surface water in order to ensure protection of the underlying aquifer and prevent any harm occurring to neighbouring and lower land' Policy LLP36 – Flood risk, Policy LLP37 – Climate change, carbon and waste reduction and sustainable energy Policy LLP38 – Pollution and Contamination of the Luton Borough Council (LBC) Local Plan 2011-2031 (Ref. 20.27) outlines requirements to minimise the risk and impact of flooding and contamination of water resources, considering the impacts of climate change.	The Local Plan 2011-2031 outlines LBC's strategic objectives in relation to the airport, flood risk, water quality and climate which have informed the design of the drainage, mitigation and monitoring measures identified in **Sections 20.8 and 20.13** of this chapter, and the DDS (**Appendix 20.4** of this ES **[TR020001/APP/5.02]**). These objectives have also informed the assessment provided in the FRA (**Appendix 20.1** of this ES **[TR020001/APP/5.07]**) and WFD Compliance Assessment (**Appendix 20.2** of this ES **[TR020001/APP/5.02]**).
Central Bedfordshire Local Plan 2015-2035 July 2021 (Ref. 20.28) includes policies on waterways and rivers and climate change and sustainability aspects of flood risk management, water resources and water supply/sewerage infrastructure.	The policies and requirements on water resources and flood risk outlined in the emerging and adopted CBC Local Plan 2035 have informed the design of mitigation and monitoring measures identified in **Sections 20.8 and 20.13** of this ES. Relevant policies include, but are not limited to: CC3: Flood Risk Management CC4: Development close to Watercourses CC5: Sustainable Drainage CC6: Water Supply and Sewerage Infrastructure CC7: Water Quality, and CC8: Pollution and Land Instability
Policy SP11 – Natural resources and Policy NE8 – Sustainable drainage systems in the North Hertfordshire District Council (NHDC) Local Plan for 2011-2031, November 2022 (Ref. 20.29) outline requirements for the management of water resources and flood risk and use of Sustainable Drainage Systems (SuDS).	The Local Plan 2011-2031 outlines policies on the management of water resources and flood risk that have informed the design of mitigation and monitoring measures identified in **Sections 20.8 and 20.13** of this ES. The use of SuDS has been implemented into the drainage design as described in the DDS (**Appendix 20.4** of this ES **[TR020001/APP/5.02]**).
Dacorum Borough Council (DBC) Core Strategy 2006 – 2031 (Ref. 20.30)	The policies and requirements on water resources and flood risk outlined in the DBC

Policy	How and where addressed in ES
includes policies on Air, Soil and Water Quality (Policy CS32).	Core Strategy 2006-2031 have informed the design of mitigation and monitoring measures identified in **Sections 20.8 and 20.13** of this ES.

20.2.3 The ANPS (Ref. 20.31) does not have effect in relation to an application for development consent for an airport development not comprised of an application relating to the Heathrow Northwest Runway. Nevertheless, as set out within paragraph 1.41 of the ANPS, the Secretary of State considers that the contents of the ANPS will be both important and relevant considerations in the determination of such an application, particularly where it relates to London or the south east of England. In particular, the ANPS makes clear that, alongside the provision of a new Northwest Runway at Heathrow, the government supports other airports making best use of their existing runways as set out in Beyond the Horizon: Making best use of existing runways (Ref. 20.32), which is the specific policy context for this application.

20.2.4 In addition, whilst the ANPS does not have effect in relation to the Proposed Development, it sets out a number of principles for environmental impact assessment and compliance and these will be an important and relevant consideration in the determination of the application for development consent. A summary of the relevant provisions for the Water Resources and Flood Risk assessment and how these have been addressed in this ES is provided within **Table 20.3**.

Table 20.3: How relevant Water Resources and Flood Risk requirements of ANPS are addressed in this ES

ANPS Section	How and where addressed in ES
Paragraphs 5.152-5.157 set out the approach to flood risk assessment that is relevant for airport development	The FRA has been completed in line with the requirements outlined in the ANPS and provided in **Appendix 20.1** of this ES **[TR020001/APP/5.07]**.
Paragraphs 5.158-5.165 and 5.178-5.181 outline the requirements to mitigate the impact of flooding including the use of sustainable drainage systems (including infiltration devices, rainwater recycling, ponds) with the aim to ensure that surface runoff do not increase in comparison to baseline and the requirement to apply the sequential approach.	The drainage design for the Proposed Development has applied a hierarchical approach that promotes a sustainable approach and includes the use of infiltration tanks and rainwater recycling. Open water systems (such as ponds) have not been used due to space constraints and potential risk of bird strike. The drainage design and changes to the current surface water regime are described in the DDS provided as **Appendix 20.4** of this ES **[TR020001/APP/5.02]** and summarised in **Section 20.8** of this chapter.

ANPS Section	How and where addressed in ES
	The sequential approach has been applied through the design process and in the completion of the FRA provided in **Appendix 20.1** of this ES **[TR020001/APP/5.07]**.
Paragraphs 5.172–5.174 set out the assessment considerations for water quality and resources and 5.175 states that: *"Where the proposed development is subject to an Environmental Impact Assessment and the development is likely to have significant adverse effects on the water environment, the applicant should ascertain the existing status of, and carry out an assessment of, the impacts of the proposed project on water quality, water resources and physical characteristics as part of the environmental statement."* Paragraphs 5.176 and 5.177 identify the requirements for the ES to describe: a. baseline water quality, water resources and characteristics of the water environment; b. impacts of the Proposed Development on water bodies or protected areas under the WFD, source protection zones and abstractions; c. impacts of the Proposed Development on the water and wastewater treatment network; and d. cumulative effects.	**Section 20.7** describes all surface water and groundwater receptors identified in the study area. This includes a description of baseline water quality, water resources and WFD status. An assessment of the impacts of the Proposed Development on water quality and water resources (including source protection zones and abstractions) has been undertaken and is outlined in **Section 20.9.** A WFD Compliance Assessment has been completed, in line with methodology agreed with the Environment Agency and outlined in the Scoping Report, and is provided as **Appendix 20.2** of this ES **[TR020001/APP/5.02]**. An assessment of the cumulative effects of the Proposed Development on the water environment is provided in **Chapter 21** of this ES **[TR020001/APP/5.01]**.
Paragraphs 5.182-5.186 outline the requirements for the Proposed Development to consider interactions with Environment Agency requirements (in relation to water quality and resources), WFD requirements and environmental permitting.	The methodology, definition of baseline conditions and assessment provided in this ES has been informed by ongoing engagement with the Environment Agency regarding permitting, water quality (including WFD requirements) and water resources. A summary of this engagement is provided in **Section 20.4**. The impacts of the Proposed Development on water quality and water resources

ANPS Section	How and where addressed in ES
	(including WFD) have been provided in the WFD Compliance Assessment provided as **Appendix 20.2** of this ES **[TR020001/APP/5.02]**.

Guidance

Table 20.4: Water Resources and Flood Risk guidance

Guidance	How and where addressed in ES
Sustainable Drainage Systems Manual 2015 (Ref. 20.33) describes the current best practice in SuDs and provides technical and planning considerations for their design.	The approach outlined in the Sustainable Drainage Systems Manual 2015 has been used to inform the drainage design described in the DDS provided as **Appendix 20.4** to this ES **[TR020001/APP/5.02]** and to inform the design of mitigation measures described in **Section 20.8** of this ES.
Design Manual for Roads and Bridges (DMRB) – LA113 Road drainage and the water environment 2020 (Ref. 20.34) sets out the requirements for the assessment and management potential impacts on the water environment for highway projects.	The DMRB guidance (LA113 2020) has been utilised to develop the methodology described in **Section 20.5**. The assessment of the impact on water quality has been completed in line with the routine runoff and surface quality assessment (HEWRAT) guidance provided in LA113 (Ref. 20.23)
Climate Change Allowance Guidance 2021 (Ref. 20.35) provided by the Environment Agency outlines the allowance that needs to be made in the design of new developments to ensure resilience to the impacts of climate change on flood risk.	The Environment Agency Climate Change Allowance Guidance 2021 has been used to inform the DDS provided as **Appendix 20.4** of this ES **[TR020001/APP/5.02]** and the drainage design as described in **Section 20.8**.
Luton Water Cycle Strategy 2015 (Ref. 20.36) provides baseline information and requirements for the management of water resources within LBC's administrative area.	The principles and requirements outlined in the Luton Water Cycle Strategy 2015 have been applied in completing the DDS for the Proposed Development provided as **Appendix 20.4** of this ES **[TR020001/APP/5.02]**.
Luton Surface Water Management Plan (SWMP) 2012 (Ref. 20.37) outlines the preferred surface water management strategy for Luton and requirements on sewer and drainage flooding, surface water flooding and groundwater flooding.	The guidance provided in the Lead Local Flood Authority (LLFA) flood documentation (together with relevant guidance from the host authorities) has been applied in the completion of the FRA provided as **Appendix 20.1** of this ES **[TR020001/APP/5.07]** and has informed the identification of mitigation measures (including SuDs) to manage the impacts of the Proposed
Luton Preliminary Flood Risk Assessment (PFRA) 2011 (Ref.	

Guidance	How and where addressed in ES
20.38) provides a description of existing flood risk in Luton and the potential impacts of climate change.	Development on flood risk as outlined in **Section 20.8**.
Luton Level 1 Strategic Flood Risk Assessment (SFRA) update (Ref. 20.39) provides a description of existing flood risk in Luton and guidance on the completion of FRAs and implementation of SuDs.	
Luton Local Flood Risk Management Strategy (LFRMS) 2013 (Ref. 20.40) provides a description of existing flood risk in Luton and guidance for considering flood risk in planning for new developments, emergency planning and flood risk mitigation.	
CBC PFRA 2011 (Ref. 20.41) provides a description of existing flood risk in Central Bedfordshire and the potential impacts of climate change. An addendum was provided by CBC in 2017 (Ref. 20.42) to update the assessment of risk outlined in 2011.	
CBC LFRMS 2014 (Ref. 20.43) provides an overview of how flood risk should be managed and assessed in Central Bedfordshire.	
NHDC SFRA 2008 (Ref. 20.44) provides a description of existing flood risk in North Hertfordshire, impacts of climate change on flood risk and guidance on the completion of FRAs using the Sequential Test.	
Hertfordshire County Council (HCC) SFRA Addendum 2017 (Ref. 20.45) provides an overview of existing flood risk in Hertfordshire and guidance on the completion of FRAs using the Sequential Test.	
HCC LFRMS 2019 (Ref. 20.46) provides an overview of how flood risk should be managed and assessed in Hertfordshire.	

Guidance	How and where addressed in ES
HCC PFRA 2017 (Ref. 20.47) provides a description of existing flood risk in Hertfordshire and the potential impacts of climate change.	
DBC SFRA 2007 (Ref. 20.48) provides a description of existing flood risk in DBC, impacts of climate change on flood risk and guidance on the completion of FRAs using the Sequential Test.	
Environment Agency Approach to Groundwater Protection 2018 (Ref. 20.49).	The principles and approach outlined in the Environment Agency Approach to Groundwater Protection 2018 and NC/99/73 2001 have been applied in the completion of the DQRA – Controlled Waters provided as **Appendix 17.4** of this ES **[TR020001/APP/5.02].**
National Groundwater and Contaminated Land Centre's report Piling and Penetrative Ground Improvements on Land Affected by Contamination: Guidance on Pollution Prevention (NC/99/73 2001) (Ref. 20.50).	

20.3 Scope of the assessment

20.3.1 This section describes the scope of this Water Resources and Flood Risk assessment, including how the assessment has responded to the Scoping Opinion. The temporal and spatial scope, the relevant receptors, and matters scoped in and out are identified. A description of engagement undertaken with relevant technical stakeholders to develop and agree this scope is provided in **Section 20.4**.

Scoping Opinion

20.3.2 The EIA Scoping Report set out the proposed scope and assessment methodologies to be employed in the EIA and is provided in **Appendix 1.1 and 1.2** of this ES **[TR020001/APP/5.05]**.

20.3.3 In response to that Scoping Report, a Scoping Opinion was received from the Planning Inspectorate on 9 May 2019 and is provided in **Appendix 1.3** of this ES **[TR020001/APP/5.05]**.

20.3.4 **Table 20.5** describes the main matters highlighted by the Planning Inspectorate in the Scoping Opinion and how these have been addressed in this ES. Responses to all comments received during scoping are presented in **Appendix 1.4** of this ES **[TR020001/APP/5.02].**

Table 20.5: Water Resources and Flood Risk Scoping Opinion comments

Scoping Opinion ID	Scoping Opinion comment	How this is addressed
4.7.1	The Inspectorate is content that the Main Application Site is located entirely within Flood Zone 1 and is not located in an area susceptible to groundwater flooding. The Inspectorate is content that the assessment of impacts associated with flooding from rivers and groundwater can be scoped out of the ES as significant effects are unlikely to occur.	An assessment of the impacts of groundwater flooding has now been scoped in as part of the FRA, **Appendix 20.1** of this ES **[TR020001/APP/5.07]**, due to the potential for local groundwater mounding associated with the infiltration tanks and potential to affect local groundwater flood risk and downstream receptors (including Kimpton).
4.7.2	The ES should also refer to The Water Environment (WFD) (England and Wales) Regulations 2017.	The Water Environment (WFD) (England and Wales) Regulations 2017 (Ref. 20.3) and WFD (Standards and Classification) Directions 2015 (Ref. 20.2) are described in **Section 20.2** of this chapter and have been taken into account in the WFD Compliance Assessment provided as

Scoping Opinion ID	Scoping Opinion comment	How this is addressed
		Appendix 20.2 of this ES **[TR020001/APP/5.02]**.
4.7.3	The Scoping Report does not state the proposed assessment study area for the ES. The ES should clearly state and justify the study area used, which should be applicable to the ZOI of the Proposed Development.	The study area and Zone of Influence (ZOI) for the water resources assessment is described in **Section 20.3** of this chapter, and illustrated on **Figure 20.1** and **Figure 20.2** of this ES **[TR020001/APP/5.03]**.
4.7.4	Consultation bodies have identified the likely attenuation tank in Eaton Green Road and potential sources of information (see Appendix 2 to the Opinion). The ES should clearly describe and identify the drainage network likely to be affected by the Proposed Development, including clear figures.	A detailed description of the existing drainage network, together with clear figures showing existing drainage infrastructure, are provided in the DDS provided as **Appendix 20.4** of this ES **[TR020001/APP/5.02]**. A summary of this information is provided in **Section 20.8** of this chapter.
4.7.5	The Inspectorate notes the intention to use and refine an existing Environment Agency groundwater model of the Vale of St Albans to understand the existing groundwater levels and flow paths, but that details of the model are not yet available. The ES and/or accompanying appendices should include details of the modelling methodology, including any assumptions made or limitations encountered. Efforts should also be made to agree the modelling with the relevant consultation bodies, including the Environment Agency.	A Hydrogeology Characterisation Report, Hydrogeological Risk Assessment Report: Drainage and DQRA – Controlled Waters have been completed and are provided as **Appendices 20.3, 20.6 and 17.4** of this ES **[TR020001/APP/5.02]**, respectively. The Hydrogeology Characterisation Report and DQRA describe the existing groundwater conditions of the Proposed Development and provide a detailed assessment of the risk of contamination from the landfill to the underlying groundwater utilising Consim modelling. The groundwater quality risks from the drainage system are considered in the Hydrogeological Risk Assessment Report: Drainage. The methodology applied in these appendices has been agreed in consultation with the Environment Agency (see **Section 20.4**). An assessment of the impact of the Proposed Development on all

Scoping Opinion ID	Scoping Opinion comment	How this is addressed
		groundwater receptors has been undertaken in this ES based on the successful implementation of the Code of Construction Practice (CoCP) (**Appendix 4.2** of this ES **[TR020001/APP/5.02]**) and design principles set out in the DDS (**Appendix 20.4** of this ES **[TR020001/APP/5.02]**). The key outcomes of these assessments are summarised in **Section 20.7** of this Chapter and in **Chapter 17** Soils and Geology of this ES **[TR020001/APP/5.01]**. The Environment Agency's Vale of St Albans model has been superseded by the Hertfordshire Model which has been utilised, in agreement with the Environment Agency.
4.7.6	The Applicant should undertake a detailed assessment, including hydrogeological modelling, to identify any potential impacts to groundwater flow patterns beneath the Proposed Development arising from the surface water DDS and assess any likely significant effects on sensitive receptors. Effort should be made to agree the assessment methodology, including modelling, with relevant consultation bodies including the Environment Agency.	An assessment of the impact of the Proposed Development on all groundwater receptors has been undertaken in this ES based on the successful implementation of the CoCP (**Appendix 4.2** of this ES **[TR020001/APP/5.02]**) and DDS (**Appendix 20.4** of this ES **[TR020001/APP/5.02]**). As part of the Hydrogeological Risk Assessment: Drainage (**Appendix 20.6** of this ES **[TR020001/APP/5.02]**), an assessment of the mounding from the drainage system has been included. Methodologies of the assessments (including modelling) were discussed and agreed during stakeholder engagement (see **Section 20.4**).
4.7.7	The ES should make clear the proposed strategy and route for the discharge of treated sewage to ground arising from the Proposed Development. An assessment of effects to sensitive water receptors,	The approach to defining the existing baseline and the assessment undertaken to inform this ES are outlined in **Section 20.5.** The proposed surface and foul water drainage design including the methods of treatment and disposal are

Scoping Opinion ID	Scoping Opinion comment	How this is addressed
	including effects on groundwater quality in the underlying chalk principal aquifer, should be provided where likely significant effects could occur. The Applicant should make effort to agree the assessment methodology, including the need for a detailed hydrogeological risk assessment, with relevant consultation bodies. The hydrogeological assessment should include: consideration of the potential effects that both chemical and microbiological contaminants may have on the underlying aquifer; details of the proposed treatment process; details of the proposed discharge arrangement; and long-term monitoring (including groundwater quality monitoring) arrangements. The Inspectorate notes the Applicant's intention to discharge treated surface water flows and treated sewage effluent flows via a single discharge point to ground. It is recommended that two separate discharge points are considered. The Applicant should seek to agree this matter with the Environment Agency. Noting that the proposed discharge of the treated surface water drainage and discharge of treated sewage effluent both require permits under the Environmental Permitting Regulations.	described in **Appendix 20.4** of this ES **[TR020001/APP/5.02]** and outlined in **Section 20.9.** This includes the provision of a real time monitored surface water drainage system that will activate a diversion of surface water runoff to a Water Treatment Plant (WTP) when trigger levels are exceeded. This plant will also accept effluent from the terminal and other buildings. The WTP will enable treatment of water to remove all identified contaminants (chemical and biological). The drainage design then includes two separate soakaways, one for the untreated and uncontaminated surface water runoff and one for fully treated foul discharge. A Hydrogeological Risk Assessment Report: Drainage (**Appendix 20.6** of this ES **[TR020001/APP/5.02])** has been undertaken to quantitively assess the impacts of the proposed discharge (both chemical and microbiological contaminants) on the groundwater environment. The assessment methodology for the assessment was agreed with the Environment Agency during stakeholder engagement (see **Section 20.4**). The strategic drainage design documented within the DDS (**Appendix 20.4** of this ES **[TR020001/APP/5.02])** has been discussed with the Environment Agency, with further stakeholder consultation required prior to construction as the detailed design is developed and appropriate environmental permits are applied for.

Scoping Opinion ID	Scoping Opinion comment	How this is addressed
4.7.8	The Applicant should seek to agree the need or otherwise for connections to the Highways England drainage network with Highways England. Noting that no new connections are permitted to the Highways England drainage network and that in the case of an existing 'permitted' connection, this can only be retained if there is no change to land use.	The proposed works at Junction 10 of the M1 are within the highway boundary and do not require permanent land use change. Drainage connections are to be identified during the development of the detailed drainage designs for the Off-site Highway Interventions which are to be developed with approval by the relevant planning authority (as secured by the drainage Requirement of Schedule 2 of the Development Consent Order (DCO) **[TR020001/APP/2.01]**) Engagement with National Highways is ongoing and will continue as further details are developed and agreed following the submission of the application for development consent, prior to construction.
4.7.9	The ES should also consider the potential impact of damage to the existing distribution network of Affinity Water and the private network at the airport.	The Proposed Development has been designed in consultation with Affinity Water, Veolia Water, and London Luton Airport Operations Ltd (LLAOL, the airport operator). Therefore, existing infrastructure related to the public and private water supply distribution networks have been identified in relation to the Main Application Site and has informed the assessment outlined in the FRA (**Appendix 20.1** of this ES **[TR020001/APP/5.07]**) and **Section 20.9**. Consultation and baseline data collection, regarding potable water distribution network infrastructure, will continue to support the detailed design, should the development consent be granted.
4.7.10	The ES should also assess impacts arising from the discharge of sewage effluent during operation, where likely significant effects could occur.	An assessment of the impact of discharge of sewage effluent during operation is provided in **Section 20.9** of this chapter and the WFD

Scoping Opinion ID	Scoping Opinion comment	How this is addressed
		Compliance Assessment (**Appendix 20.2** of this ES **[TR020001/APP/5.02]**).
4.7.11	The ES should assess impacts to water quality arising from the operation of the relocated Fire Training Ground, where likely significant effects could occur. For example, through the generation and release of firefighting foam, hydrocarbons and used water runoff.	During fire training operation, the Fire Training Ground would be isolated from the rest of the airside sections of the airport by way of valves incorporated into the drainage pipe network. Water generated by the fire training activities, including wash down after the event has ceased, would then be collected and transported off site for appropriate treatment and disposal. This water would not be treated within the on-site WTP and so would not be discharged to ground. This is described in the DDS (**Appendix 20.4** of this ES **[TR020001/APP/5.02]**).
4.7.12	The Scoping Report commits to providing surface water strategies with the ES. The Inspectorate considers that any such strategies should include measures to address impacts during construction, where significant effects are likely to occur.	The requirement for the lead contractor to prepare a construction stage surface water management strategy is secured via the CoCP Requirement in Schedule 2 of the DCO **[TR020001/APP/2.01]**. The principles to be followed are included in the CoCP provided as **Appendix 4.2** of this ES **[TR020001/APP/5.02]**.
4.7.13	The figures provided with the Scoping Report do not clearly identify the River Mimram or the Ippollitts Brook. The ES should be supported by clear figures to depict these waterbodies.	**Figures 20.1** to **20.5** of this ES **[TR020001/APP/5.03]** identify the River Mimram and the River Lee. Ippolitts Brook is no longer considered a receptor as the works to the highway network in the vicinity of this watercourse are no longer proposed. However, off site works are now proposed along the A602 at junctions which have the potential to affect the River Hiz. Therefore, **Figures 20.1** to **20.5** of this ES **[TR020001/APP/5.03]** now include this watercourse.

Scoping Opinion ID	Scoping Opinion comment	How this is addressed
4.7.14	The Health and Communities aspect chapter of the Scoping Report identifies that impacts to health effects of water and groundwater contamination and flooding will be elsewhere in the ES, presumably in the Water Resources aspect chapter. However, it is not apparent from the Scoping Report that the Water Resources aspect chapter will assess these matters. The ES must include an assessment of likely significant effects to health arising from water and groundwater contamination and flooding associated with the Proposed Development.	The assessment of the flood risk, outlined in the FRA (**Appendix 20.1** of this ES **[TR020001/APP/5.07]**), has not identified any potential impacts on human health. The Hydrogeological Risk Assessment Report: Drainage (**Appendix 20.6** of this ES **[TR020001/APP/5.02]**) provides an assessment of the risk of contamination of the Principal Aquifer beneath the Main Application Site (which water companies abstract from for public water supply) from the discharge of treated water to ground from the Proposed Development. Human health impacts from water contamination are considered within **Chapter 17** Soils and Geology of this ES **[TR020001/APP/5.01],** such as the DQRA – Controlled Waters which provides an assessment of the risk of contamination from the landfill to the underlying aquifer. The DQRA is provided as **Appendix 17.4** of this ES **[TR020001/APP/5.02]**.

Spatial scope

20.3.5 The spatial scope for this water resources assessment was primarily defined as encompassing all water resources receptors located within 1km radius of the Main Application Site as shown on **Figure 20.1** of this ES **[TR020001/APP/5.03]**.

20.3.6 The initial 1km radius was selected to capture the water resource and flood risk features (and their associated receptors) most likely to be potentially directly and/or indirectly affected by the Proposed Development and develop the conceptual understanding of the area. However, over the course of the assessment process the spatial scope has been extended to identify all receptors with a defined hydraulic connection to the surface water and groundwater features and the Proposed Development (see **Figure 20.1** of this ES **[TR020001/APP/5.03]**). This approach captures all water resources and flood risk receptors affected by the Main Application Site, Off-site Car Parks, and Off-site Highway Interventions as defined in **Chapter 2** of this ES **[TR020001/APP/5.01]**).

20.3.7 The study area for this water resources assessment has been agreed with the Environment Agency and LLFAs.

Study area

20.3.8 As identified in **Paragraph 20.3.5** and **Paragraph 20.3.6** the study area extends out to cover all surface and groundwater features and their associated receptors that are hydraulically linked (by groundwater or surface water flow paths) to the Proposed Development.

20.3.9 The water environment within the study area is dominated by a chalk aquifer. This underlies the Main Application Site, Luton to the north and west and the countryside to the south and east. The scale of this aquifer means that it is able to support abstractions. These include large abstractions of potable water by Affinity Water to supply the local community with drinking water. There are also a number of smaller domestic, commercial and agricultural abstractions. There are also licensed discharges of water to the groundwater regime. Finally, the groundwater regime supports a number of local water courses and potentially habitats.

20.3.10 Groundwater from the aquifer issues to the local surface water catchments represented by the River Lee to the west of the existing airport and the River Mimram located approximately 3.5km to the south west of the existing airport. These rivers are also fed by natural surface water discharges from tributary watercourses and overland flow paths and also by licensed discharges from public and private sewerage systems.

20.3.11 The Proposed Development includes a number of interventions at locations throughout the highway networks around the airport (Off-site Highways Interventions). These may be required to allow the major access routes (including the M1) to the airport to accommodate the predicted increase in traffic numbers, without increasing congestion. Some of these junctions are located a notable distance from the Main Application Site. Proposed works to the A602 Park Way/A505 Upper Tilehouse Street, A602 Park Way/Stevenage Road and A505 Moormead Hill/B655 Pirton Road/Upper Tilehouse Street in Hitchin require the consideration of the River Hiz as a surface water receptor. Further details of these locations are provided in **Chapter 4** Proposed Development of this ES **[TR020001/APP/5.01]**. The Off-site Highway Interventions do not require any additional groundwater receptors to be included.

20.3.12 The Off-site Car Parks are within the study area of the Main Application Site, with no additional surface water or groundwater receptors therefore included.

Cumulative Assessment Study Area

20.3.13 The study area to be applied for the cumulative assessment for water resources is a 5km radius from the Main Application Site. This differs from the study area defined in **Paragraph 20.3.5**, and is more precautionary to ensure all development with the potential to have cumulative impact on the underlying aquifer is considered.

20.3.14 The cumulative effects assessment is provided in **Chapter 21** In-Combination and Cumulative Effects Assessment of this ES **[TR020001/APP/5.01]**.

Temporal Scope

20.3.15 The Proposed Development would be delivered incrementally over approximately 18 years. Therefore, three assessment phases are considered, assessment Phases 1, 2a and 2b as described in **Table 5.3** in **Chapter 5** Approach to the Assessment of this ES **TR020001/APP/5.01]**, during which construction and operation may take place simultaneously.

20.3.16 The temporal scope of the assessment takes account of these assessment phases by considering how long an impact is likely to persist using the following temporal categories:

a. temporary short term (less than three months);
b. temporary medium term (more than three months but less than a year);
c. temporary long term (more than a year but less than three years); and
d. permanent.

20.3.17 These categories are considered in the determination of the magnitude of an impact.

Receptors

20.3.18 The receptors considered in the assessment are listed below:

a. watercourses, both main river and ordinary watercourses with a hydraulic link from the Proposed Development;
b. underlying groundwater resources (aquifers) with a hydraulic link from the Proposed Development;
c. abstractions from groundwater and surface water resources (together with Source Protection Zones (SPZs));
d. discharges to groundwater and surface water resources;
e. potential groundwater-surface water interactions such as springs;
f. habitats and ecosystems related to the groundwater and surface water resources; and
g. existing sewerage and water supply infrastructure.

Matters scoped in

20.3.19 The EIA Scoping Report (provided as **Appendix 1.1** and **1.2** of this ES **[TR020001/APP/5.05]**) set out the proposed scope for this assessment, scoping in the assessment of the impacts of the Proposed Development on surface and ground water quality, abstractions, SPZs and water resources, surface water flood risk and existing water infrastructure and assets (foul, combined and surface water sewerage).

20.3.20 Following scoping, the assessment now also examines the potential risk posed by the surface water management strategy for the Proposed Development on the local groundwater regime.

20.3.21 The assessment also includes consideration of the existing public and private water supply infrastructure.

Matters scoped out

20.3.22 The FRA (**Appendix 20.1** of this ES **[TR020001/APP/5.07]**) has determined that a detailed assessment of the impacts of the Proposed Development on flooding associated with rivers and streams, which would include fluvial hydraulic analysis and peak flow estimation is not required and so has been scoped out of this ES.

20.4 Stakeholder engagement and consultation

20.4.1 Engagement in relation to the Water Resources and Flood Risk assessment has been undertaken with a number of prescribed and non-prescribed stakeholders.

20.4.2 For Water Resources and Flood Risk a working group was formed comprising representatives from:

a. Environment Agency (such as Sustainable Places and associated technical specialists and National Permitting Service); and

b. The LLFAs (including representatives from :BC, CBC and HCC)

20.4.3 Engagement has been undertaken with the working group throughout the project lifecycle to reflect updates to the design and programme. This included a period of engagement in association with the EIA Scoping Report (provided as **Appendix 1.1** and **1.2** of this ES **[TR020001/APP/5.05])** and in advance of the 2019 statutory consultation. Engagement continued following stakeholder feedback on the 2019 Preliminary Environmental Information Report (PEIR) and was considered in the preparation of the PEIR published to support a 2022 statutory consultation. Feedback received on both the 2019 and 2022 PEIR's was discussed through further engagement to inform the design of the Proposed Development and this ES.

20.4.4 Engagement has also been undertaken with Affinity Water and Thames Water as statutory undertakes for public water supply and sewerage respectively.

20.4.5 Veolia Water operate the existing private water supply and sewerage infrastructure located within the existing airport and engagement has been undertaken to determine how their existing systems operate.

20.4.6 Engagement has also been undertaken throughout with LLAOL who operate the airport, including the surface water drainage system.

20.4.7 The **Consultation Report** submitted with the application for development consent **[TR020001/APP/6.01]** and **[TR020001/APP/6.02]** contains a full account of the statutory consultation process and issues raised in feedback. Matters raised regarding the scope, methodology, mitigation or compensation being considered as part of the Water Resources and Flood Risk assessment were subject to further discussions directly with stakeholders during working group meetings. The main matters/themes raised during consultation considered relevant to the Water Resources and Flood Risk assessment were:

a. the assessment methodology and approach to be applied in this ES;

b. the potential impacts of the Proposed Development on the underlying aquifer and interactions with the historical landfill and other sources of contamination;

c. potential impacts of the Proposed Development on surface water quality and flood risk;

d. the treatment and management of surface water and foul discharge;

e. water supply and consumption during construction and operation stages; and

f. environmental permitting requirements.

20.4.8 **Table 20.6** provides a summary of engagement with relevant stakeholders, undertaken to date to inform this ES , including the date and time of meetings and a summary of discussions to resolve matters raised.

Table 20.6: Stakeholder engagement relating to Water Resources and Flood Risk

Meeting name and date	Attendees (organisation)	Summary of discussion
Pre statutory consultation (2019)		
Introductory meetings 26 March 2018	Environment Agency and LLFAs (LBC, CBC and HCC)	Introduction to the key components and timescales associated with Proposed Development and agreement on the assessment methodology for the Scoping Report, PEIR and ES and key findings of the Scoping Report. Agreement on approach to stakeholder engagement for the Scoping Report, PEIR and ES. Presentation on status and scope of the ground investigation (GI) was also shared and agreed in the meeting.
Introduction to DDS and methodology to be employed in the EIA 1 August 2018	Environment Agency	Presentation and discussion of landside DDS. Landside DDS agreed in principle but Environment Agency confirmed that evidence that any water discharged to ground is treated appropriately (in line with Environmental Quality Standards) is required. Agreement on the water resources assessment methodology and study area to be employed in the EIA Scoping Report.
DDS update meeting 1 18 October 2018	LLFAs and Thames Water	Update provided on landside DDS. Agreement that volume of storage provided in DDS is sufficient.

Meeting name and date	Attendees (organisation)	Summary of discussion
		Confirmation from LBC of their expectation that a WCS be prepared and that this should be provided with this ES.
DDS update meeting 2 25 April 2019	Environment Agency, LLFAs and TW	Presentation of preferred option for Proposed Development and DDS for landside and airside drainage. Agreement that rainwater harvesting will be considered as part of the DDS. Agreement that engagement with Environment Agency National Permitting Service is required to confirm approach to discharge permits.
Detailed risk assessment 1 July 2019	Environment Agency	Update provided on the findings of the 2018/2019 Ground Investigation (GI) and findings of detailed assessment work discussed. The Environment Agency identified that they were satisfied with the work undertaken to date. Agreement with the Environment Agency on the proposed remediation strategy for the Proposed Development in relation to groundwater quality.
DDS update meeting 3 19 August 2019	Thames Water	Presentation of preferred option for DDS for the Proposed Development. Thames Water noted a potential benefit to the River Lee as a result of infiltration within the River Lee catchment. Confirmation from Thames Water that discharges to Thames Water network can be considered as part of the Proposed Development.

Meeting name and date	Attendees (organisation)	Summary of discussion
Introduction to Proposed Development and DDS 25 November 2019	Affinity Water	Presentation of preferred option for DDS for the Proposed Development and estimate of water resource requirements. Agreement in principal that Affinity Water will supply water to Proposed Development during construction and operation.
Environmental Permitting 6 December 2019	Environment Agency	Environment Agency outlined the permitting requirements for the Proposed Development and confirmation of the requirement for a hydrogeological risk assessment. Confirmation that temporary works may also require additional permits.
Post statutory consultation (2019)		
Post Statutory Consultation Meeting – Drainage 13 January 2020	Affinity Water	Update provided on DDS. Affinity Water provided agreement in principle to DDS proposals. Confirmation that there will be a net increase in potable demand as a result of the Proposed Development. Level of increase will be mitigated via introduction of rainwater harvesting and water re-use.
Statutory Consultation Meeting – Drainage (2) 16 March 2020	Affinity Water	Update provided on DDS and overview of Hydrogeological Risk Assessment provided. Provided confirmation to Affinity Water that the Hydrogeological Risk Assessment will confirm the impact of the Proposed Development to water quality in the existing aquifer.
Statutory Consultation Meeting – Drainage (3)	Affinity Water	Update provided on DDS to address queries from Affinity

Meeting name and date	Attendees (organisation)	Summary of discussion
10 September 2020		Water on the WTP and quality of discharge from the WTP. Proposed Development team requested details on existing Affinity Water assets to inform assessment.
Statutory Consultation Meeting – Drainage (1) 10 September 2020	Thames Water	Update provided on DDS. Agreement that Proposed Development can utilise Thames Water network for foul and surface water discharge, noting that Thames Water requirements for water quality and quantity must be met by the Proposed Development.
Statutory Consultation Meeting – Drainage (4) 24 September 2020	Affinity Water	Preliminary forecasts of water supply based on Proposed Development design and savings associated with rainwater harvesting. Affinity Water confirmed that the forecasts were *"very encouraging".* Further details requested on the quality of the treated discharge from the WTP.
Pre statutory consultation (2022)		
Meeting – Drainage Strategy update 19 October 2021	Affinity Water	Presentation on updated DDS and water supply and discharge forecasts. Confirmation and agreement on monitoring of contaminants in untreated and treated discharge from Proposed Development.
Meeting – Drainage Strategy update 21 October 2021	Environment Agency	Presentation on updated DDS and Proposed Development timescales. Agreement on Hydrogeological Risk Assessment methodology and intent for submission with this ES. Environment Agency encourage the Proposed

Meeting name and date	Attendees (organisation)	Summary of discussion
		Development to explore opportunities to implement lessons learnt from other airport projects.
Meeting – Drainage Strategy update 21 October 2021	Thames Water	Presentation on updated DDS and Proposed Development timescales. Updated DDS accepted in principle, requirements for additional information in relation to forecasts for the discharge of surface water to the Thames Water network.
Meeting – Scheme and Preliminary Flood Risk Assessment update 17 December 2021	Luton LLFA	Presentation on updated design and drainage proposals. Agreed requirement for future drainage design of Off-site Highway Interventions (to be completed after planning consent, secured by the surface and foul water drainage Requirement of Schedule 2 of the DCO **[TR020001/APP/2.01]**) to account for LLFA drainage/highway design requirements where relevant.
Post statutory consultation (2022)		
Meeting – East Hyde Upgrade Strategy and Potential Headroom 21 June 2022	Thames Water	Presentation on Proposed Development progress since previous engagement.
Meeting – Drainage Strategy Update 23 June 2022	Affinity Water	Re-engagement following statutory consultation
Meeting – Drainage strategy update and statutory consultation comments 8 July 2022	Luton LLFA	Presentation on updated DDS and Proposed Development timescales. Discussed and agreed responses to comments raised by Luton LLFA during statutory consultation which would be included within this ES and

Meeting name and date	Attendees (organisation)	Summary of discussion
		associated appendices where appropriate.
Meeting – Drainage Strategy Update 12 August 2022	Environment Agency	Presentation on updated design proposals and timeline for the submission of the application for development consent. Review and discussion of statutory consultation comments and proposed responses. Agreed that DDS will include additional information on contaminants present in discharge from WTP.
Meeting – Drainage Strategy Update 13 September 2022	Thames Water	Closing out outstanding actions.
Meeting – Drainage Strategy Update 7 November 2022	Thames Water	Discussion regarding documents (Draft DCO, explanatory memorandum, land plans, works plans and scheme layout plans) issued to Thames Water on 29 September 2022.
Meeting - Hydrogeological Risk Assessment Presentation 18 November 2022	Environment Agency	Presented findings of Hydrogeological Risk Assessment Report: Drainage appendix, prior to issue to the Environment Agency for review.
Meeting – Water Environment related documentation for submission 3 February 2023	Environment Agency	Discussion on documents to be issued at DCO submission, areas for continued discussion and Statement of Common Ground.

20.4.9 Stakeholder engagement will continue as the Proposed Development progresses and would include further meetings with the Environment Agency, LLFAs, Affinity Water and Thames Water following grant of development consent.

20.5 Methodology

Overview

20.5.1 This section outlines the methodology employed for assessing the likely significant effects on Water Resources and Flood Risk from the construction and operation of the Proposed Development.

Baseline

20.5.2 In the first instance the baseline conditions in terms of Water Resources and Flood Risk were determined by identifying the surface water and groundwater features located within the Main Application Site and Off-site Car Parks and within 1km of the Main Application site.

20.5.3 This spatial scope was extended to account for receptors with a hydraulic link to the surface and groundwater features identified, as well as the Main Application Site, as a result of an existing surface or groundwater flow path (see spatial scope in **Section 20.3** for defined study areas).

20.5.4 The spatial scope was then further extended to account for the surface and groundwater features and receptors, hydraulically linked with the Off-site Highway Interventions, as a result of an existing surface or groundwater flow path (see **Figures 20.1** and **20.2** of this ES **[TR020001/APP/5.03]**).

20.5.5 The features and receptors have been identified using the following data sources:

a. Ordnance Survey mapping (Ref. 20.51);
b. topographical data (see **Appendix 17.1** Preliminary Risk Assessment of Land Contamination of this ES **[TR020001/APP/5.02]**);
c. Google maps (Ref. 20.52);
d. Environment Agency mapping data sets (Flood Zones, Risk of Flooding from Rivers and Sea (RoFRS), Risk of Flood from Surface Water (RoFSW) (Ref. 20.53) and Groundwater susceptibility mapping (Ref. 20.54);
e. British Geological Survey (BGS) geological and hydrogeological maps and the web viewer (Ref. 20.55);
f. ground investigation reports and interpretive reports (see **Chapter 17** Soils and Geology of this ES **[TR020001/APP/5.01]**);
g. request for information from local authorities on private water supplies;
h. Environment Agency public register (Ref. 20.56) and a request for information on Environment Agency licenses/permits; and
i. asset location plans of existing sewerage and water supply infrastructure (See DDS, **Appendix 20.4** of this ES **[TR020001/APP/5.02]**).

20.5.6 With regards the existing surface water regime, the baseline accounts for all rivers, streams, inland waterways, drainage ditches, and overland flow paths. It also accounts for large ponds and lakes (none located in study area), as well as

sewerage (surface water and foul) and public water supply infrastructure maintained and operated by Affinity Water, Thames Water and Veolia Water. Furthermore, it identifies receptors linked to these surface water receptors such as abstractions, discharges and water dependent habitats that are also hydraulically linked to the Proposed Development.

20.5.7 The Environment Agency Flood Zones, RoFRS and RoFSW (Ref. 20.53), Groundwater susceptibility mapping data sets (Ref. 20.54) and the following types of flood risk reports, prepared by the local authorities (see Section **20.2** for specific document references), have also been used to identify the receptors that are currently at risk off flooding within the study area:

a. Preliminary Flood Risk Assessments (PFRA);
b. Strategic Flood Risk Assessments (SFRA);
c. Surface Water Management Plans (SWMP); and
d. Local Flood Risk Management Strategies (LFRMS).

20.5.8 The importance of the surface and groundwater features and receptors identified within the study area, has been determined based on measures related to scale, sensitivity and value using the following criteria:

a. the size of a watercourse as indicated by the flow exceeded 95% of the time (Q95). This information has been obtained for the National River Flow Archive (Ref. 20.57);
b. if a watercourse is a designated WFD waterbody as indicated by the River Basin Management Plan (RBMP) as identified on the Environment Agency's catchment data viewer (Ref. 20.58);
c. the status and relationship of any habitats in the vicinity of a watercourse as identified on the UK governments' magic map data source (Ref. 20.59);
d. aquifer status, as designated by the Environment Agency and BGS and represented on the 1:50,000 Aquifer Designation maps. This information is available from the UK governments' magic map data source (Ref. 20.59);
e. the Environment Agency SPZ mapping that indicates the risk posed to groundwater potable water abstractions, based on the time for groundwater to travel to an abstraction point from within an abstractions zone of influence. This information is available from UK governments' magic map data source (Ref. 20.59);
f. the volume of water licensed for abstraction from groundwater for agricultural and industrial purposes. This information has been obtained from the Environment Agency via Envirocheck report (for further details please see **Chapter 17** Soils and Geology of this ES **[TR020001/APP/5.01]**);
g. the status and relationship of any habitats dependent upon the underlying groundwater as identified on UK governments' magic map data source (Ref. 20.59); and

h. the characteristics of a licensed discharge in relation to the receiving surface or groundwater feature. This information has been obtained from Environment Agency public register for information on Environment Agency permits (Ref. 20.56).

20.5.9 The attributes outlined in **Paragraph 20.5.8** have then been used to determine the importance of a receptor based on the examples used in **Table 20.7**.

20.5.10 The importance of water infrastructure has been based on the size and scale of the asset as identified by asset location plans in the DDS as provided in **Appendix 20.4** of this ES **[TR020001/APP/5.02]**. This considers factors such as pipe diameter for sewerage and water supply networks and storage volumes of tanks, ponds and infrastructure related to pumped systems.

20.5.11 The importance of flood risk receptors has been determined by cross referencing the information provided in Table 2: Flood risk vulnerability classification, of the National Planning Policy Framework Guidance for Flood Risk and Coastal Change (Ref. 20.25) with the existing land uses within areas identified to be at risk of flooding.

20.5.12 These criteria have been aligned to determine an importance value for each feature and receptor using **Table 20.7**. This is based on DMRB LA113: Road drainage and the water environment (Ref. 20.34).

20.5.13 The 'importance' value has been amended on a project wide basis, such that the highest receptor importance value related to the Proposed Development is 'high' and the lowest is 'very low', whereas LA113 applies a range from 'very high' to 'low'. This amendment has been implemented to achieve consistency in terminology across this ES and it does not change the consideration of the value of receptors, categories of receptors and the judgement as to whether an effect is significant or not.

Table 20.7: Importance values for water resource and flood risk receptors

Importance	Description	Example
High	Nationally significant attribute of high importance.	Watercourse having a WFD classification shown in a RBMP[1] and $Q_{95} \geq 1.0 m^3/s$. Site protected/designated under EC or UK legislation (Special Area of Conservation (SAC), Special Protection Area (SPA), Site of Special Scientific Interest (SSSI), Ramsar site, salmonid water)/Species protected by UK legislation for ecology and nature conservation. Principal aquifer providing a regionally important resource and/or supporting a site protected under UK legislation for ecology and nature conservation.

[1] RBMPs are produced by the Environment Agency and Defra.

Importance	Description	Example
		Groundwater locally supports Groundwater Dependent Terrestrial Ecosystems (GWDTE). SPZ 1. Flood risk receptors classified as essential infrastructure or highly vulnerable development[2].
Medium	Locally significant attribute of high importance.	Watercourse having a WFD classification shown in a RBMP and $Q_{95} < 1.0m^3/s$. Species protected UK legislation for ecology and nature conservation. Principal aquifer providing locally important resource or supporting a river ecosystem. Groundwater supports a GWDTE. SPZ 2. Flood risk receptor classified as more vulnerable development[2].
Low	Of moderate quality and rarity.	Watercourse not having a WFD classification shown in a RBMP and $Q_{95} > 0.001m^3/s$. Aquifer providing water for agricultural or industrial use with limited connection to surface water. SPZ 3. Flood risk receptors classified as less vulnerable development[2].
Very Low	Lower quality	Watercourse not having a WFD classification shown in a RBMP and $Q_{95} \leq 0.001m^3/s$. Unproductive strata. Flood risk receptors classified as water compatible development[2].

20.5.14 The approach to defining future baseline is described in **Section 5.4** of **Chapter 5** Approach to the Assessment of this ES **[TR020001/APP/5.01]**. The future baseline considered for Water Resources and Flood Risk is described in **Section 20.7** of this chapter.

[2] As defined in the Flood Risk section (Annex 3) of the Technical Guidance to the NPPF 2021.

Construction assessment methodology

20.5.15 The assessment of construction effects is based on determining the magnitude of impact for the various construction activities proposed across the Proposed Development.

20.5.16 Each impact has been assigned a magnitude based on criteria adapted from Table 3.71 of LA113: Road drainage and the water environment (Ref. 20.34); this is shown in **Table 20.8**.

Table 20.8: Magnitude of impact for Water Resource and Flood Risk receptors

Magnitude of impact	Description
High adverse	Results in a loss of attribute and/or quality and integrity of the attribute. For example, a change in catchment size in excess of 10% compared to existing conditions.
Medium adverse	Results in effect on integrity of attribute, or loss of part of attribute. For example, a change in catchment size in excess of 5% and less than 10%.
Low adverse	Results in some measurable changes in attributes, quality or vulnerability. For example, a change in catchment size in excess of 1% and less than 5%.
Very low	Results in effect on attribute, but of insufficient magnitude to affect the use or integrity. For example, a change in catchment size less than 1%.
Low beneficial	Results in some beneficial effect on attribute or a reduced risk of negative effect occurring.
Medium beneficial	Results in moderate improvement of attribute quality.
High beneficial	Results in major improvement of attribute quality.

20.5.17 The construction activities that have the potential to affect the surface and groundwater receptors are:

a. Release of sediment and construction related pollutants (e.g. fuels, lubricants, alkaline materials such as concrete and cement and waterproofing materials), particulates, chemicals (as a result of accidental spills) and other materials.

b. Creation of preferential pollution pathways to the underlying aquifer due to excavation, piling etc.

c. Mobilisation of existing groundwater contaminants, remaining from historical and/or associated with current industrial and agricultural land use, as a result of earthworks activities or below ground works.

d. Increase in surface water and fluvial flood risk due to an increase in the volume and rate of water reaching watercourses and a decrease in

groundwater recharge associated with an increase in the extent of impermeable surface area.

e. Increase in surface water and fluvial flood risk as a result of storage of construction materials occupying areas currently used as flood storage (Flood Zones 2 and 3) and areas identified to be at risk of surface water flooding by the Environment Agency's RoFSW mapping (Ref. 20.53).

f. Disruption of existing surface and groundwater flow paths due to construction activities, leading to changes in hydrological characteristics within existing surface and groundwater catchments. This could propagate increased flooding in one catchment and a reduction of flow in another.

g. Reduction in groundwater levels or flows affecting existing groundwater abstractions as a result of the introduction of cuttings or shallow earthworks and dewatering of underlying geological strata to facilitate excavation.

h. Impacts to the hydromorphological and ecological quality of watercourses associated with works within or in close proximity to watercourses, including physical change to the watercourses and longer-term changes due to sediment deposition (and any associated contaminants within that sediment).

i. Damage and disruption to existing pipes, culverts, bridges and other hydraulic structures present within the study area (such as the existing distribution network).

j. Displacement/removal of groundwater surface water features such as abstraction and discharge points and sinks, springs and issues as a result of construction.

20.5.18 All these impacts are related to either a change in water quality (impacts a to c above) or a change in water quantity (impacts d to j above).

20.5.19 The magnitude of water quality impacts have been judged based on identifying the following:

a. the substances that could be released;

b. the characteristics of the substance (i.e. is it hazardous/non-hazardous, does it persist and accumulate in the water environment or does it degrade);

c. the quantities of the substance that could be released;

d. the proximity and vulnerability of the receptor (will the substance be intercepted before it reaches the receptor); and

e. the dilution available within the receptor.

20.5.20 These factors have been determined based on:

a. the construction activity being proposed;

b. the scale of the activity; and

c. the characteristics of the receptor at the location where exposure to contaminants could occur.

20.5.21 Where possible, numerical values have been used to calculate changes from existing conditions. However, in most cases professional judgement has been used to determine the likely magnitude of impact in relation to the descriptions in **Table 20.8**.

20.5.22 Impacts to existing water infrastructure have been considered where activities would require physical works to them or in close proximity to them.

20.5.23 The assessment of construction impacts is generally related to short term, temporary impacts that would cease once construction is completed. However, there is a risk of some changes introduced at the construction stage becoming permanent.

20.5.24 The duration of temporary impacts is taken into account in the assessment using the criteria outlined in **Paragraph 20.3.16**.

20.5.25 Temporary effects are considered as those impacts that would only persist over a three year timescale (or less). This is to align with the approach undertaken in WFD compliance assessments, where it has been determined that effects experienced for more than three years (being half of a WFD cycle of six years) are considered permanent. Temporary effects are considered to be reversible as the implementation of mitigation measures during the construction and operation stages would fully mitigate the adverse effect on the receptor. For example, a temporary adverse effect on water consumption prior to the implementation of water efficiency measures during operation.

20.5.26 Permanent effects are considered to be irreversible where the implementation of mitigation measures can only reduce the adverse effect on the receptor. For example, a permanent change in the waterbody status of a WFD waterbody.

20.5.27 The significance of effect in relation to construction activities has been determined based on **Table 20.9**. This combined the importance value as described in **Table 20.7** and the magnitude of impact as described in **Table 20.8**.

Table 20.9: Significance of effects

Importance value of receptor	Magnitude of impact			
	High	**Medium**	**Low**	**Very Low**
High	Major (Significant)	Major (Significant)	Moderate (Significant)	Minor
Medium	Major (Significant)	Moderate (Significant)	Minor	Minor
Low	Moderate (Significant)	Minor	Minor	Negligible
Very Low	Minor	Minor	Negligible	Negligible

20.5.28 Major and moderate effects are considered to be significant, whilst minor and negligible effects are considered to be not significant.

Operational assessment methodology

20.5.29 The assessment of the operational effects provided in this chapter uses the same methodology outlined in relation to construction assessment methodology above to assess the magnitude of impacts (see **Table 20.8**) and the significance of effects (see **Table 20.9**). The assessment examines the potential impacts associated with all assessment phases of the Proposed Development with a specific focus on the proposed drainage strategy as described in the DDS (**Appendix 20.4** of this ES **[TR020001/APP/5.02]**)**.**

20.5.30 The FRA (**Appendix 20.1** of this ES **[TR020001/APP/5.07]**) has examined impacts to existing surface water and groundwater catchments imposed by the proposed drainage strategy for the Main Application Site. The FRA follows the same methodology to assess the magnitude of impacts (see **Table 20.8**) as the construction assessment methodology as outlined above but does not assess the significance of effects.

20.5.31 The WFD Compliance Assessment (**Appendix 20.2** of this ES **[TR020001/APP/5.02]**) applies a specific WFD assessment methodology (different to that applied to this ES chapter) and has examined the potential for the Proposed Development to affect the overall status of a WFD waterbody and identifies where additional analytical work is required to reinforce the conclusions made in this assessment. The WFD assessment methodology has been agreed with the Environment Agency (see **Table 20.6**).

20.5.32 The proposed Airport Access Road (AAR) and Off-site Highway Interventions have been screened in terms of the scope and scale of the works proposed and potential impact on traffic. The screening methodology applied has included the following stages:

a. Stage 1 - Review based on minimum Annual Average Daily Traffic (AADT) using the threshold defined in the DMRB (Ref. 20.34);
b. Stage 2 - applies a filter based on the anticipated need for physical works at a given intervention; and
c. Stage 3 - applies a final filter, screening out any remaining interventions, where the anticipated increase to AADT is less than 20% based on guidance provided in the DMRB (Ref. 20.34).

20.5.33 For the AAR and any proposed Off-site Highway Interventions identified as requiring further assessment in the screening, an assessment has been undertaken using the HEWRAT as described in LA113 (Ref. 20.34). This assessment has assumed outfall locations based on the location of the proposed highways interventions and watercourses identified in the Proposed Development study area. Catchment areas for inputting to HEWRAT have been estimated using the WebFEH mapping tool (Ref. 20.60).

20.5.34 The methodology for the HEWRAT assessments has been shared with the Environment Agency and LLFAs.

20.6 Assumptions and limitations

20.6.1 This section provides a description of the assumptions and limitations to this Water Resources and Flood Risk assessment.

20.6.2 This assessment has been based on the collation and evaluation of available documentation provided by various stakeholders, including the local authorities, the Environment Agency and the BGS. This data is assumed to be correct at the time of the assessment.

20.6.3 It is assumed that the information provided to-date from GI and the airport operator has identified all potential sources of potentially polluting material. The proposed treatment train including the WTP has been defined based on this understanding.

20.6.4 It is assumed that all existing potable and non-potable water sources used within the airport have been identified and accounted for.

20.6.5 It is assumed that the permeability values of the underlying chalk are appropriate. Extensive analysis has been undertaken and this indicates that the values being applied in the design of the infiltration tank is representative of the local conditions while being precautionary.

20.6.6 It is assumed that the existing geological conditions preclude significant fracture flow pathways. The evidence collected from on-site ground investigation and the established understanding of the local geological conditions indicate that this is a valid assumption.

20.6.7 It is assumed that all excavation works would be undertaken above the groundwater table. The design of any subterranean structures has been informed by the site-specific groundwater monitoring across site and historic water monitoring.

20.6.8 It is assumed that the existing drainage layout and surface water catchments have not been substantially altered by works currently being undertaken by the current airport operator, based on ongoing discussions between the design teams.

20.6.9 The water quality monitoring system proposed as part of the surface water management system, as outlined in the DDS (**Appendix 20.4** of this ES **[TR020001/APP/5.02]**), would operate as specified and be appropriately maintained.

20.6.10 The WTP proposed as part of the overall water management system, as outlined in the DDS (**Appendix 20.4** of this ES **[TR020001/APP/5.02]**) would operate as specified and be appropriately maintained.

20.6.11 The water reuse and rainwater harvesting systems proposed as part of the overall water management system, as outlined in the DDS (**Appendix 20.4** of this ES **[TR020001/APP/5.02]**), would operate as specified and be appropriately maintained.

20.6.12 During operation of the Fire Training Ground, the Fire Training Ground would be isolated from the rest of the airside sections of the airport by way of valves

incorporated into the drainage pipe network. Water generated by the fire training activities including wash down after the event has ceased would then be collected and transported off-site for appropriate treatment and disposal. This water would not be treated within the on-site WTP and so would not be discharged to ground. As such, it is assumed that the operation of the Fire Training Ground would preclude any water, contaminated by materials related to fire training, reaching the surface water management system for the other areas of the airport.

20.6.13 It is assumed that all required Environment Agency licenses and/or permits, together with consents from Thames Water, will be applied for and successfully secured prior to the relevant construction and/or operational activities as required.

20.6.14 It is assumed that stakeholder engagement would continue throughout the construction and operation of the Proposed Development and that future requirements from stakeholders would be incorporated, as appropriate, by the relevant party.

20.6.15 The requirements of the CoCP, provided as **Appendix 4.2** of this ES **[TR020001/APP/5.02]** (which includes the good practice measures outlined in **Section 20.8**) would be implemented by the lead contractor, as secured by the DCO.

Reasonable Worst Case

20.6.16 **Chapter 5** Approach to the Assessment of this ES **[TR020001/APP/5.01]** describes the general approach adopted to ensure that a reasonable worst case is assumed, including the use of parameters, accounting for uncertainty, and incorporating flexibility in design and demand forecasts.

20.6.17 This Water Resources and Flood Risk assessment has incorporated the following considerations which ensure that it represents a reasonable worst case scenario where appropriate:

a. the DDS (**Appendix 20.4** of this ES **[TR020001/APP/5.02]**) considers how the system would operate during a failure of the treatment facilities (in particular the WTP) to ensure no adverse impacts on the water environment;

b. the surface water management infrastructure has been designed for a 1 in 100 year return period storm event with a 40% allowance to account for the future impacts of climate change (100 year + CC);

c. the surface water management infrastructure has been tested to determine its performance during a 100 year + CC rainfall event when groundwater levels are at the level calculated to be the 1 in 100 year return period level; and

d. water quality modelling within the Hydrogeological Risk Assessment Report: Drainage (**Appendix 20.6** of this ES **[TR020001/APP/5.02]**) assesses the discharge of key contaminants (identified in the DDS; **Appendix 20.4** of this ES **[TR020001/APP/5.02]**) that could be discharged to groundwater without posing a pollution risk to the principal

aquifer. During detailed design, the influent and effluent characteristics would be refined and target treatment threshold values agreed (during the environmental permitting process) with key stakeholders.

20.7 Baseline conditions

20.7.1 This section provides a description of the existing conditions in the study area. **Figure 20.1** and **Figure 20.2** of this ES **[TR020001/APP/5.03]** show the existing surface water and groundwater receptors within the Water Resources study area. The key surface water features of interest are the River Mimram and River Lee (often referred to as Lea but for the purpose of this ES and all supporting documentation, Lee has been applied), surface water discharge consents, and fluvial and surface water flood zones (**Figure 20.1 and Figure 20.3** of this ES **[TR020001/APP/5.03]**). The key groundwater features include the underlying aquifer, groundwater-surface water interactions (such as springs), groundwater dependent terrestrial ecosystems, groundwater discharges, abstractions, and SPZs (**Figure 20.2** of this ES **[TR020001/APP/5.03]**). The baseline also describes the existing foul and surface water network serving the airport.

Existing conditions

Topography

20.7.2 The airport is located north east of the River Lee on an elevated escarpment area that forms part of a scarp slope of the Chilterns Hills.

20.7.3 The Main Application Site is located within two river valleys, the River Lee and the River Mimram. The existing airport sits on a plateau between these two river valleys at an elevation of approximately 160m Above Ordnance Datum (AOD).

20.7.4 The east of the Main Application Site is located within the head of the River Mimram valley. The land here dips to the south east with elevations ranging between approximately 115m and 160m AOD.

Surface water features

20.7.5 The surface water features located in the study area are described in **Table 20.10** and identified on **Figure 20.1** of this ES **[TR020001/APP/5.03]**.

Table 20.10: Surface water features in the study area

Receptor	Description	Importance value
River Lee	Designated main river located approximately 450m to the south west of the boundary of the Main Application Site. It is also crossed by the Off-site Highway Interventions at the A1081 New Airport Way/B653/Gipsy Lane and the Windmill Road/Manor Road/St Mary's Road/Crawley Green Road gyratory. It is a major tributary of the River Thames and flows in a south easterly direction, generally within an open channel. Designated waterbody under the WFD (Lee [from Luton to Luton Hoo Lakes], WFD ID: GB106038033391) as a heavily modified waterbody (Ref. 20.58).	High

Receptor	Description	Importance value
	In 2019 WFD classification, Cycle 2, classified as achieving a Bad WFD status with target to achieve Good by 2027 (Ref. 20.58). Within the study area, identified as a chalk stream[3] which has the potential to be in continuity with the chalk aquifer and may act as a sink for groundwater. Q95 is reported in the National Flow River Archive (NRFA) (Ref. 20.57) as 0 m^3/s at Luton Hoo gauging station and 0.001 m^3/s at East Hyde gauging station. These extremely low values are assumed to reflect the scale of modification of the rivers flow regime and so the importance has been based on its chalk stream designation.	
Luton Hoo lakes	The lakes at Luton Hoo are part of the privately-owned Luton Hoo Estate. They are man-made, on-line lakes located approximately 400m from the boundary of the Main Application Site. The River Lee flows through the north and south lakes at it leaves Luton. The lakes have been identified as affected by pollution feeding into the river from the surrounding area (Ref. 20.61). It is located within the extent of the Lee (from Luton to Luton Hoo Lakes, WFD ID: GB106038033391) WFD waterbody but is not designated under the WFD. It forms part of the Luton Hoo Registered Park and Garden estate and is used for recreational purposes.	Low
River Mimram	Designated main river located approximately 3.5km to the east of the boundary of the Main Application Site. Identified as a chalk stream and fed by underlying chalk aquifer. Designated under the WFD as the Mimram (Whitwell to Codicote Bottom) (WFD ID: GB106038033460) (Ref. 20.58). In 2019 WFD classification, Cycle 2, achieved a Moderate WFD status with the target to achieve Moderate by 2015 which it achieved (Ref. 20.58). Q95 is reported in the NRFA (Ref. 20.58) as 0.014 m^3/s at Whitwell gauging station. This low value is assumed to reflect its dependence on groundwater for baseflow and	High

[3] Chalk stream watercourses have very specific ecological and habitat types and have been reported as being in decline across Southern England.

Receptor	Description	Importance value
	the modification of the groundwater regime by abstraction and so the importance has been based on its chalk stream designation.	
River Hiz	Designated 'ordinary watercourse' located approximately 7km to the east of the boundary of the Main Application Site and approximately 500m from both the Off-site Highway Interventions along the A602 within Hitchin (at Pirton Road roundabout and Stevenage Road roundabout). A tributary of the River Ivel that in turn feeds the River Great Ouse. Its source is the chalk aquifer but it is not designated a chalk stream. Designated under the WFD as the Hiz (through Hitchin) (WFD ID: GB105033037680) (Ref. 20.58) and as a heavily modified waterbody. In 2019 WFD classification, Cycle 2, achieved a Moderate WFD status with the target to achieve Good by 2027. Q95 is reported in the NRFA (Ref. 20.57) as 0.003 m^3/s at Hitchin gauging station.	Medium

20.7.6 Further details on the WFD classification and objectives for the River Lee, River Mimram and River Hiz are provided in **Appendix 20.2** of this ES **[TR020001/APP/5.02]**.

20.7.7 No surface water abstractions are recorded within the study area.

20.7.8 A number of surface water discharge consents are located in the west of the study area. All of these discharge consents are to the River Lee and all consents are owned by Thames Water (but regulated by the Environment Agency). Their approximate locations are shown on **Figure 20.1** of this ES **[TR020001/APP/5.03]**.

Groundwater features

20.7.9 The groundwater features and receptors considered in this assessment are summarised in **Table 20.11**.

20.7.10 Further details on the bedrock aquifer and superficial deposits are provided in the Hydrogeological Characterisation Report provided as **Appendix 20.3** of this ES **[TR020001/APP/5.02]**.

Table 20.11: Groundwater features and receptors

Feature/Receptor	Description	Importance
Chalk bedrock aquifer	Present under the Main Application Site and also the Off-site Highway Intervention and Off-site Car Park locations. Soft white carbonate rock traversed by flint and marl layers, consisting of minute calcareous shells which impart a high porosity to the matrix so that the water contained in pore spaces is held in by capillary forces. Storage and transport of water is also via a network of fractures, although these features are of low coincidence in this area due to an area of heavy weathering which reduces the susceptibility of fractures near the surface. Designated as an Environment Agency principal aquifer[4]. Supports river flows within chalk bournes; intermittent streams flowing from a spring. Identified as main water bearing strata and most important aquifer unit in the Thames Basin supplying potable water for public consumption. The Main Application Site is part of Affinity Water's supply area and is considered as an area under 'Serious' Water Stress. Designated WFD groundwater body (Upper Lee Chalk) (WFD ID: GB40601G602900) (Ref. 20.58). In the 2019 WFD classification, Cycle 2, identified as having Poor overall status and an objective to achieve a Good status for the chemical status element by 2027 and to achieve a Poor status for the quantitative status element by 2015 which has been achieved. Poor status attributed to elevated contamination levels and over abstraction (Ref. 20.58).	High

[4] An Environment Agency principal aquifer can be defined as '*layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale*'.

Feature/Receptor	Description	Importance
Superficial deposits	Clay-with-Flints Formation underlies majority of Main Application Site and is designated as unproductive stratum by the Environment Agency. In the upper reaches for the Mimram, to the east of the Main Application Site the superficial deposits are formed of Head – clay, silt, sand and gravel. These deposits are designated as Secondary Undifferentiated Aquifers. Glaciofluvial deposits – sand and gravel and Alluvium – clay, silt, sand and gravel are located along the River Lee and are designated as Secondary A aquifers. Small extent of Lowestoft Formation – Diamicton (designated as Secondary Undifferentiated Aquifer) located in the eastern portion of the study area as well as made ground.	Low
Groundwater abstractions and associated SPZs	The approximate locations of groundwater abstractions and SPZs are shown on **Figure 20.2** of this ES **[TR020001/APP/5.03]**. Four licensed groundwater abstractions (Boreholes A to D; operated by the same company) are located within the 1km study area to the west of the Main Application Site which abstract water from the chalk aquifer. These are for industrial use. In the wider area, there are a number of notable abstractions which are utilised for potable supply. To the east of the Main Application Site, there are two main abstractions utilised for public water supply. One of these is in the vicinity of Kings Walden (approximately 1.5km to the north east of the Main Application Site) with another at Nine Wells (located approximately 4.5km to the east of the Main Application Site). To the north west of the Main Application Site, at circa 1.5km distance, are the Crescent Road and Albert Road Public Water Supply (PWS) abstractions within Luton, with the East Hyde Pumping Station PWS abstractions approximately 4.0km to the south. The five main public water supply abstraction sites in the vicinity of the airport are all operated by Affinity Water. The Main Application Site and Off-site Car Parks are located within the total catchment SPZs associated with these abstractions. With the	High

Feature/Receptor	Description	Importance
	proposed infiltration points located within the catchments of the eastern abstractions. The proposed Off-site Highway Interventions at Windmill Road/St Mary's Road/Crawley Green Road Gyratory and Windmill Road/Manor Road are within the Inner Protection zone SPZ1 associated with the public water supply abstraction within Luton. There are a number of private groundwater abstractions (<20 m^3/d) within the wider area (but outside the 1km study area) where there is potential hydraulic connectivity with the Main Application Site. Their approximate locations are shown on **Figure 20.2** of this ES **[TR020001/APP/5.03]**. It is assumed they are for potable uses.	
Potential groundwater-surface water interactions	A number of potential groundwater-surface water features have been identified within the local area, including: Netherfield Spring located approximately 580m to the east of the eastern end of the existing runway. Birch Spring located approximately 600m south of existing runway. Diamond End Spring located approximately 780m to the south east of the eastern end of the existing runway. Slipe Spring located approximately 1.4km north of the Main Application Site boundary. Deacons Spring located approximately 2.2km south of existing runway. Long Toms Spring located approximately 2.5km south east of existing runway. Heysham Spring located approximately 2.9km east south east of existing runway. Folly Spring located approximately 3.2km north east of airport. Approximate locations of the nearest potential springs are shown on **Figure 20.2** of this ES **[TR020001/APP/5.03]**.	All High
Potential groundwater dependent terrestrial ecosystems	There are no designated GWDTE (SSSIs comprising water dependent designated features) located within the study area. A number of potential GWDTE sites have been identified within the local area: Woodland at Netherfield Spring	All High

Feature/Receptor	Description	Importance
(GWDTE)	Woodland at Birch Spring Woodland at Diamond End Spring (represented by the Diamond End, Limekiln Wood and Pondcroft Local Wildlife Site) Woodland at Slipe Spring Woodland at Deacons Spring Woodland at Long Toms Spring Batsford Spring Local Nature Reserve	
Discharge consents	Several discharge consents to ground have been identified within the study area (including three operated by the airport within the Main Application Site; for the main site soakaways, the northern soakaway and the Fire Training Ground soakaway). Their approximate locations are shown on **Figure 20.2** of this ES **[TR020001/APP/5.03]**.	All Low

Groundwater flow

20.7.11 The hydrogeological map of the area, Environment Agency Hertfordshire hydrogeological model (Ref. 20.62) and monitoring of regional groundwater levels indicate that the regional flow within the chalk of the northern Thames Basin is predominately towards the south east along the dip direction of the chalk. The main area of groundwater recharge is the Chiltern Hills along the northern boundary where the high topographical escarpments form a major groundwater divide. The location of the groundwater divide indicates that the existing airport infrastructure is located within the River Lee catchment, whereas the area of the Main Application Site to the east of the existing airport is located within the River Mimram catchment.

20.7.12 As identified in the Hydrogeological Characterisation Report (**Appendix 20.3** of this ES **[TR020001/APP/5.02]**), the groundwater flow direction in the River Lee catchment is influenced by local abstractions and flows in a westerly direction. Similarly, the groundwater flow in the Mimram catchment is affected by the potable abstraction near Kings Walden which creates a local easterly flow direction.

20.7.13 The presence of the existing infiltration basins in the existing airport can cause local increases in groundwater level also known as ‘doming’ or ‘mounding’. This effect is localised and so does not directly influence the location of the main groundwater divide in the study area. Further details are provided in the Hydrogeological Characterisation Report **(Appendix 20.3** of this ES **[TR020001/APP/5.02])**.

Groundwater level

20.7.14 Seventeen boreholes were initially installed for the purposes of groundwater monitoring as part of the GI for the Proposed Development in 2017. An

additional seven boreholes were then installed from June 2018 to December 2018 to provide additional information on groundwater levels.

20.7.15 Groundwater levels were measured in the GI boreholes manually, using a calibrated electronic dipmeter, from a selected datum at the surface. Data loggers were installed in three GI boreholes to collect groundwater levels electronically at five minute intervals over the 2018/19 winter period.

20.7.16 A more detailed discussion on the GI borehole locations and monitoring data are provided in the Generic Quantitative Risk Assessment (**Appendix 17.2** of this ES **[TR020001/APP/5.02]**). Further details on the baseline hydrogeological conditions and groundwater monitoring are also provided in the Hydrogeological Characterisation Report provided as **Appendix 20.3** of this ES **[TR020001/APP/5.02],** including an assessment of maximum on-site groundwater conditions in Section 5.8 of that appendix.

20.7.17 Monitoring completed indicates that the groundwater levels beneath the former landfill range between 105m AOD and 125m AOD, at a depth of approximately 30 metres Below Ground Level (mBGL) to 45mBGL. The highest groundwater level recorded during the main on-site monitoring period was 124.46mBGL (28.55mBGL) in June 2018 in a borehole located to the south west of the landfill (as shown on Figure 2 in **Appendix 17.4** DQRA – Controlled Waters of this ES **[TR020001/APP/5.02]**). Groundwater levels in this borehole have been identified as consistently higher than the levels recorded elsewhere. This indicates that it is possible that groundwater levels in this borehole are being influenced by the nearby central soakaway for the existing airport.

20.7.18 Groundwater levels beneath the landfill have been identified as showing seasonal variability of up to 7.6m (excluding a suspected anomalous variation of 10.94m) and also variability on an annual basis. Larger seasonal and year-to-year variations in groundwater levels were observed beneath the landfill area than within the dry valley. Within the dry valley, most of the GI boreholes displayed a seasonal variation of less than 5m. Though due to the lower topographical elevation within the dry valley, groundwater levels are closer to the surface (15mBGL to 25mBGL). Monitoring of groundwater levels supports the outputs of the Environment Agency Hertfordshire hydrogeological model (Ref. 20.62) that covers the Luton area.

20.7.19 Although these on-site monitoring rounds can give a good insight into the groundwater levels at the Proposed Development, it is noted that the on-site groundwater monitoring is of limited duration and can only provide a short-term, non-continuous dataset of the groundwater levels and is unlikely to record extreme minimum and maximum groundwater events. Therefore, although June 2018 displays the maximum groundwater level captured in the full on-site monitoring, it is not the maximum groundwater conditions that should be used for design and risk assessment purposes (manual monitoring of a limited number of GI boreholes undertaken in March 2020 indicated higher groundwater levels). As such, Environment Agency groundwater monitoring installations and the Hertfordshire groundwater model have been utilised to understand likely maximum and minimum groundwater levels across the Main Application Site, temporally and spatially. See the Hydrogeological

Characterisation Report provided as **Appendix 20.3** of this ES **[TR020001/APP/5.02]** for further details and an assessment of the likely maximum groundwater levels.

Groundwater Quality

20.7.20 The WFD Compliance Assessment (**Appendix 20.2** of this ES **[TR020001/APP/5.02]**) provides a more detailed description of the WFD status of the underlying aquifer.

20.7.21 As discussed in further detail in the GQRA (**Appendix 17.2** of this ES **[TR020001/APP/5.02]),** a wide variety of contaminants including nitrate, hydrocarbons and pesticides have been detected historically in the chalk between the River Colne (a tributary of the River Thames that flows through the London Borough of Hillingdon in its downstream extent) and the River Lee. Groundwater quality in the vicinity of Luton has been previously identified as poor due to a 'low level halo' of solvent contamination related to the surrounding area's heritage.

20.7.22 As part of the site-specific ground investigation works, groundwater samples were obtained from the monitoring installations using low flow micro-purging and sampling techniques. The representative samples of the chalk aquifer were tested for a range of analytes including metals, volatile and semivolatile organic compounds, petroleum hydrocarbons, polyaromatic hydrocarbons, pesticides, phenols, polychlorinated biphenyls, poly and perfluorinated substances (PFAS) and volatile fatty acids.

20.7.23 The GQRA prepared for the Proposed Development provides a detailed account of the existing groundwater quality and is provided in **Appendix 17.2** of this ES **[TR020001/APP/5.02]**. Screening of the groundwater data has been undertaken using UK Drinking Water Standards (DWS) where available due to the chalk aquifer being used for public water supply. The screening is included within Appendix G of **Appendix 17.2 [TR020001/APP/5.02]**.

20.7.24 The GQRA indicates that overall there are several groundwater samples with exceedances of potential contaminants of concern in groundwater beneath the Main Application Site, which are discussed in detail within Section 12.2 of **Appendix 17.2** of this ES **[TR020001/APP/5.02].** A summary of the screening undertaken is included in Table 12.1 of the GQRA, with exceedances summarised in Tables 12.4 to 12.8.

20.7.25 Concentrations of perfluorooctane sulfonic acid (PFOS) and perfluorooctanoic acid (PFOA) have been recorded above the laboratory limit of detection in a number of groundwater samples at the Main Application Site. Both PFOS and PFOA are two of the most abundant substances of a group of contaminants known collectively as poly and perfluorinated substances (PFAS). The presence of PFAS in the groundwater is considered likely to be the result of historic usage across the region. It is noted that the airport does not currently use fire-fighting foams which contain PFAS.

20.7.26 Where exceedances were recorded, these tended to be in GI boreholes beneath or close to the landfill and were typically limited in extent. The DQRA –

Controlled Waters (**Appendix 17.4** of this ES **[TR020001/APP/5.02])** indicated that whilst there is evidence of a weak leachate plume in groundwater down-gradient of the site, on-site groundwater monitoring provided limited evidence that the landfill is causing any notable contamination of the groundwater.

Flooding

Fluvial flooding (flooding associated with rivers and streams)

20.7.27 The FRA (**Appendix 20.1** of this ES **[TR020001/APP/5.07]**) demonstrates that the Main Application Site is located within Flood Zone 1 as shown in **Figure 20.1** of this ES **[TR020001/APP/5.03]**.

20.7.28 The following Off-site Highway Interventions are located in the vicinity of the River Lee with the Windmaill Road/Manor Road being located with Flood Zone 3:

a. Windmill Road/Manor Road/St Mary's Road/Crawley Green Road; and
b. A1081 New Airport Way/B653/Gipsy Lane.

20.7.29 None of the other Off-site Highway Interventions are within 50m of a river or stream, and therefore have not been considered further in respect of fluvial flooding.

Surface water flooding

20.7.30 The Environment Agency's RoFSW shown on **Figure 20.3** of this ES **[TR020001/APP/5.03]** shows numerous areas of surface water flooding across the Main Application Site. Low lying areas identified at high risk to surface water flooding are located to the east of the existing terminal building within land that is currently used for car parking and in the vicinity of the existing soakaways. A surface water flow path (identified as presenting a high risk of surface water flooding) has been identified along the existing Airport Approach Road.

20.7.31 Surface water flow paths associated with the upper reaches of the Mimram catchment also provide a source of surface water flood risk to existing agricultural and park land in the south eastern portion of the Main Application Site.

20.7.32 The following locations of proposed Off-site Highways Interventions are affected by surface water flooding:

a. Windmill Rd/Manor Rd/St. Mary's Rd/Crawley Green Rd – areas of high and medium surface water risk identified on the carriageways of Windmill Road and Kimpton Road and beneath the carriageway of the roads which affects the surrounding commercial properties;
b. A1081 New Airport Way/B653/Gipsy Lane – surface water flow path that passes beneath the carriageway of Gipsy Lane;
c. M1 Junction 10 – small area of low surface water flood risk on the carriageway of the M1 northbound lanes;

d. Eaton Green Road/Lalleford Road – surface water flow paths (identified as presenting a medium risk of surface water flooding) located along Lalleford Road and Eaton Green Road;

e. Eaton Green Road/Frank Lester Way – surface water flow paths (identified as presenting a medium risk of surface water flooding) located along Frank Lester Way and Eaton Green Road;

f. A1081 New Airport Way/A505 Kimpton Road/Vauxhall Way– areas at medium risk of surface water flooding located along Lalleford Way and Eaton Green Road;

g. A505 Moormead Hill/B655 Pirton Road/Upper Tilehouse Street – areas of high surface water flood risk on the carriageways or Pirton Road, Offley Road and Upper Tilehouse Street; and

h. A602 Park Way/Stevenage Road – areas at high surface water flood risk on A602 Park Way.

20.7.33 There are also existing areas of surface water flood risk along the proposed route of the AAR, which will need to be considered in the detailed design of the AAR drainage:

a. AAR/Provost Way – areas of medium surface water flood risk affecting commercial properties on Provost Way;

b. AAR/Frank Lester Way – areas of low surface water flood risk on carriageway of Frank Lester Way and high surface water flood risk affecting commercial properties on Frank Lester Way;

c. AAR/Eaton Green Road Link – surface water flow paths (identified as presenting high surface water flood risk) on Eaton Green Road and access road to Eaton Green Recycling Centre; and

d. AAR/A1081 Airport Way/Percival Way Junction – areas of high and medium surface water flood risk located on the carriageway of A1081 Airport Way and affecting the commercial properties to the north.

Groundwater flooding

20.7.34 Localised flooding associated with overtopping of the existing central soakaway in the existing airport has been observed during very intense rainfall events or at times of prolonged wet weather.

20.7.35 The Environment Agency have identified two main areas designated with the potential for groundwater flooding within the study area. These are associated with the River Lee to the west of the existing airport, and the dry valleys to the east and south east of the existing airport.

20.7.36 The LBC LFRMS (Ref. 20.40) presents groundwater flood risk by using the susceptibility to groundwater flooding data set as developed by the BGS. This identifies that the majority of Luton Borough, including the Main Application Site has ‘Limited potential for groundwater flooding to occur’. However, it identifies the River Lee corridor including the section of the river south of Luton, where CBC are the LLFA, as a location where groundwater flooding could occur at surface.

20.7.37 The NHDC SFRA (Ref. 20.45) identifies incidents of historical groundwater flooding within the dry valleys located approximately 500m south east of the Main Application Site that affected the village of Kimpton in February 2001. These events occurred during the winter of 2000 to 2001 caused the re-emergence of the historically dry River Kym which subsequently caused flooding of Kimpton village downgradient of the river. Environment Agency monitoring borehole records in the area confirm that groundwater levels within dry valleys were at peak levels during these events.

20.7.38 The CBC PFRA (Ref. 20.42) presents the susceptibility to groundwater flooding data for the Central Bedfordshire area. However, the data is presented in terms of the percentage of the land area that is susceptible to groundwater flooding, in an Ordnance Survey 1:50,000 scale map grid square. In terms of areas in the vicinity of the Main Application Site, the data identifies the River Lee corridor to the south east of the airport as having between 25% and 50% of the area susceptible to groundwater flooding with the grid square centred around New Mill End having between 50% and 75% of the area susceptible.

20.7.39 HCC's PFRA (Ref. 20.47) and SFRA (Ref. 20.45) also presents the susceptibility to groundwater flooding data in the same manner as CBC and identifies the grid square to the east of Winch Hill Road as having between 25% and 50% area susceptible to groundwater flooding.

20.7.40 Furthermore, the PFRA (Ref. 20.47) outlines historical cases of groundwater flooding. These were especially prevalent in the winter of 2000 – 2001, when groundwater levels were exceptional and peaked at record measured levels. Much of the emergence was in dry river valleys and mostly affected areas of agricultural land although a number of roads were also affected. Measures also had to be put in place to manage the impact on two settlements; Kimpton in North Hertfordshire and an area to the north east of St Albans between Sandridge and Jersey Farm.

20.7.41 The groundwater flooding event at Kimpton recorded in February 2001 is the only historical groundwater flooding event within the dry valleys located downgradient of the Main Application Site. Therefore, groundwater flooding in the study area appears to be associated with very extreme groundwater levels only. Further information is provided in the FRA provided as **Appendix 20.1** of this ES **[TR020001/APP/5.07]**.

Flood risk receptors

20.7.42 **Table 20.12** below includes a list of all flood risk receptors in the study area which have the potential to be impacted by the Proposed Development and their importance value.

Table 20.12: Flood risk receptors in the study area

Receptor	Relevant design feature	Source of flooding	Importance value (as described in Annex 3 of the NPPF (Ref. 20.25)
Existing airport infrastructure	Main Application Site	Surface water	High (Essential infrastructure)
M1	Main Application Site	Surface water	High (Essential infrastructure)
Kimpton (Residential properties and roads)	Main Application Site	Groundwater	Medium (More vulnerable development)
Windmill Road	Off-site Highway Interventions	Fluvial flooding from River Lee Surface water	Medium (More vulnerable development)
Crawley Green Road	Off-site Highway Interventions	Fluvial flooding from River Lee Surface water	Medium (More vulnerable development)
Kimpton Road	Off-site Highway Interventions	Surface water	Medium (More vulnerable development)
Wigmore Lane	Off-site Highway Interventions	Surface water	Medium (More vulnerable development)
Raynham Way	Off-site Highway Interventions	Surface water	Medium (More vulnerable development)
Eaton Green Road	Off-site Highway Interventions	Surface water	Medium (More vulnerable development)
Lalleford Road	Off-site Highway Interventions	Surface water	Medium (More vulnerable development)
Frank Lester Way	Off-site Highway Interventions	Surface water	Medium (More vulnerable development)
Pirton Road	Off-site Highway Interventions	Surface water	Medium (More vulnerable development)
Offley Road	Off-site Highway Interventions	Surface water	Medium (More vulnerable development)
Upper Tilehouse Street	Off-site Highway Interventions	Surface water	Medium (More vulnerable development)

Receptor	Relevant design feature	Source of flooding	Importance value (as described in Annex 3 of the NPPF (Ref. 20.25)
A505 Park Way	Off-site Highway Interventions	Surface water	Medium (More vulnerable development)
Access road to Eaton Green Recycling Centre	Off-site Highway Interventions	Surface water	Medium (More vulnerable development)
Provost Way	Off-site Highway Interventions	Surface water	Medium (More vulnerable development)
A1081 Airport Way	Off-site Highway Interventions	Surface water	Medium (More vulnerable development)
Agricultural and park land	Off-site Highway Interventions	Surface water	Low (Less vulnerable development)
Commercial properties on Windmill Road, St Mary's Road and Crawley Green Road	Off-site Highway Interventions	Surface water	Low (Less vulnerable development)
Commercial properties to the north of A1018 Airport Way	Off-site Highway Interventions	Surface water	Low (Less vulnerable development)

Existing water infrastructure

20.7.43 Foul water at the existing airport is currently discharged to the public foul and combined water network owned and operated by Thames Water. This is via the airport's own private sewerage system operated by Veolia Water. The plan drawing of this network is available in the DDS in **Appendix 20.4** of this ES **[TR020001/APP/5.02]**.

20.7.44 The surface water generated on the Main Application Site is currently captured by a pipe network managed by LLAOL, the airport operator. The network was designed with a first flush system. This directs the first pulse of a rainfall event (assumed to contain the majority of any polluting matter) to the public combined sewerage system and onto East Hyde Treatment Works, operated and maintained by Thames Water. As flows increase the water is then directed towards one of the existing soakaways located on the Main Application Site or the public surface water drainage network operated and maintained by Thames Water and which ultimately discharges to ground (the northern soakaway) or to

the River Lee. Whether the water is discharged to the existing soakaways or the public surface water drainage network is dependent on the catchment.

20.7.45 The pipe network, the linkages to the public drainage systems and the existing soakaway features are described in detail in the FRA (**Appendix 20.1** of this ES **[TR020001/APP/5.07]**) and the DDS **(Appendix 20.4** of this ES **[TR020001/APP/5.02])**.

20.7.46 All existing soakaways and discharges to the Thames Water network are permitted by the appropriate environmental permits and trade effluent consents, listed below:

a. Environment Agency Permit (EPR/RP3221GC) for the discharge of runoff to the northern soakaway via oil interceptors issued April 2012;
b. Environment Agency Permit (WR0180/V001) for discharge of runoff to the four existing soakaways serving the airport issued May 2013;
c. Environment Agency Permit (WR0448) for the discharge of trade effluent from the Fire Training Ground;
d. Thames Water consent (EHY00012) for discharge of trade effluent (Waste liquids arising from aviation industry processes and contaminated surface waters) to Thames Water foul sewers issued November 1995; and
e. Thames Water consent (TEHY.0105A) issued for discharge of trade effluent (Waste liquids arising from pavement and de-icing activities) to Thames Water foul sewers (at a rate of 72m^3/hour) issued January 1998.

20.7.47 Within the study area to the west of the runway, the Environment Agency have also issued a permit to a third party to discharge runoff to settlement tanks, a soakaway system and a non-standard infiltration trench serving a third party organisation office. This permit is not associated with airport operations.

20.7.48 Currently, contaminated runoff from the Fire Training Ground is collected in an isolated system and tankered off-site for treatment.

20.7.49 The public water supply assets serving the Main Application Site and surrounding area are owned and operated by Affinity Water. There is a private network of water supply assets operated by Veolia Water within the airport.

20.7.50 Further detail on all existing water infrastructure has been provided in the FRA in **Appendix 20.1** of this ES **[TR020001/APP/5.07]**.

20.7.51 Existing infrastructure affected by the Proposed Development is assigned a medium importance value based on the criteria in **Paragraph 20.5.10** and **Table 20.7.**

Future baseline

20.7.52 In the absence of the Proposed Development, there is likely to be a change to the future baseline conditions as a result of other factors and developments in proximity to the airport. These are the conditions that will prevail ‘Without Development’ in place. The ‘Without Development’ scenario is used, where

appropriate, as a comparator for the assessed case, to show the effect of the Proposed Development against an appropriate reference point. The approach to defining future baseline and the developments identified for consideration are described in **Section 5.4** of **Chapter 5** Approach to the Assessment of this ES **[TR020001/APP/5.01]**.

20.7.53 For the purpose of this assessment, the key aspects of the future baseline that will impact upon water resources and flood risk receptors are the number of highway interventions proposed in the East Luton Study, Bartlett and National Highways future investment strategy, Bartlett Square development and the impacts of climate change.

20.7.54 These highway interventions are assumed to be delivered and operational at the appropriate time in the traffic modelling and therefore their potential impact on water quality has been accounted for inherently in the assessment. The FRA (**Appendix 20.1** of this ES **[TR020001/APP/5.07]**) has also accounted for the potential impacts of the highway interventions on fluvial and surface water flood risk.

20.7.55 The Bartlett Square Development (18/00271/EIA) is assumed to be completed prior to commencement of the Proposed Development and has the potential to result in an adverse impact on the Thames Water network as a result of a requirement to discharge surface and foul water to the network. The drainage strategy to be implemented during assessment Phase 1 will also require an increase in the volume of water to be discharged to the Thames Water network. However, both developments include measures in their design to ensure no significant impacts on the Thames Water network and have been developed in consultation with Thames Water. As such, it is considered there will not be a change in the overall effect of the Proposed Development on the Thames Water network.

20.7.56 Climate change is projected to result in changes to local precipitation patterns and increase the risk of extreme weather events (such as flooding and droughts) as well as increasing temperatures. **Chapter 9** Climate Change Resilience **[TR020001/APP/5.01]** provides a full description of projected climate change for the future and an In-combination Climate Change Impacts assessment is provided in **Section 20.12.** In addition, the DDS for the Proposed Development has been developed to accommodate the volume and rate of water generated by a 1 in 100 year return period storm event, including a 40% uplift to allow for potential increases in rainfall due to climate change.

20.8 Embedded and good practice mitigation measures

20.8.1 This section describes the embedded and good practice mitigation for Water Resources and Flood Risk that has been incorporated into the Proposed Development design or assumed to be in place before undertaking the assessment. A definition of these classifications of mitigation and how they are considered in the EIA is provided in **Chapter 5** Approach to the Assessment of this ES **[TR020001/APP/5.01]**.

20.8.2 The main water environment mitigation measures are documented within the CoCP (for construction, **Appendix 4.2 [TR020001/APP/5.02]**) and DDS (for operational mitigation, **Appendix 20.4 [TR020001/APP/5.02]**) which are secured through the CoCP and surface and foul water drainage Requirements in Schedule 2 of the **draft DCO [TR020001/APP/2.01]**.

Embedded

Assessment Phase 1

20.8.3 The design of the Proposed Development has been undertaken in cognisance of the groundwater levels, with no excavations proposed below the groundwater table. This embedded mitigation limits the potential for groundwater lowering impacts which could lead to a reduction in baseflow to receptors (such as potential springs, potential GWDTE and surface water courses) or derogation of existing abstractions.

20.8.4 A summary of the embedded and good practice mitigation measures included in the drainage design for the Proposed Development is provided below. These measures are described in further detail in the DDS provided in **Appendix 20.4** of this ES **[TR020001/APP/5.02]**.

20.8.5 In assessment Phase 1 surface water from existing areas of the airport and new infrastructure created as part of the Proposed Development would continue to discharge to the existing central soakaway within the Main Application Site and the Thames Water surface water sewerage network.

20.8.6 A rainwater harvesting system would be introduced to allow roof water from Terminal 1 to be used as a non-potable water source. The rainwater would be stored and subject to treatment to ensure the quality is fit for the intended non-potable use. Preliminary treatment would include a series of filters and separators located upstream of the storage tanks to ensure that all coarse solids and organic matter is removed from the network. The treatment system will adhere to requirements outlined in BS EN 16941-1:2018 On-site non-potable water systems – Systems for the use of rainwater (Ref. 20.63).

20.8.7 Surface water discharge from the proposed apron and existing, but reconfigured, long stay car park (P5) will be discharged to the central soakaway as shown in the DDS (**Appendix 20.4** of this ES **[TR020001/APP/5.02]**). Live monitoring of contaminants is proposed to safeguard the central soakaway, with contaminated water diverted to the Thames Water foul sewerage network.

20.8.8 Surface water discharge from the new car park would discharge to the Thames Water soakaway asset (outside the existing airport footprint) as shown in the DDS (**Appendix 20.4** of this ES **[TR020001/APP/5.02]**). Petrol interceptors and treatment to remove residual hydrocarbons, silts and heavy metals would be provided prior to discharging to the Thames Water network. Further details on the treatment of this runoff is provided in the DDS (**Appendix 20.4** of this ES **[TR020001/APP/5.02]**).

20.8.9 As Terminal 1 expands from 18 mppa, foul water discharge to the Thames Water network would increase. The DDS (**Appendix 20.4** of this ES **[TR020001/APP/5.02]**) proposes to accommodate the resulting increase in discharge by attenuating the peak flows within storage tanks and discharging to the network at off-peak times.

Assessment Phases 2a and 2b

20.8.10 The design of the Proposed Development has been developed in cognisance of the groundwater levels, with no excavations proposed below the groundwater table. This embedded mitigation limits the potential for groundwater lowering impacts which could lead to a reduction in baseflow to receptors (such as springs, GWDTE and surface water courses) or derogation of existing abstractions.

20.8.11 The proposed drainage system to be implemented for assessment Phases 2a and 2b is described in detail in the DDS in **Appendix 20.4** of this ES **[TR020001/APP/5.02]**. The descriptions are supported by Overview Layout plans, also provided in the DDS **(Appendix 20.4** of this ES **[TR020001/APP/5.02]**).

20.8.12 The main drainage infrastructure for the Proposed Development would be installed in assessment Phase 2a of the Proposed Development. This would include the installation of the new WTP, attenuation tanks and infiltration tanks for the Proposed Development. The two infiltration tanks consist of a large infiltration tank for ‘untreated’ surface water and a smaller infiltration tank for treated effluent. The untreated infiltration tank serves as a replacement for the existing central soakaway. These infiltration tanks are to be located underground to avoid bird strike risk at the south eastern corner of the Proposed Development.

20.8.13 Inline pollution prevention measures such as full retention separators would be utilised for all runoff from aprons, taxiways and the runway, whilst permeable paving comprising bio-membranes would be utilised beneath car parks.

20.8.14 Uncontaminated surface runoff would be directed to the large infiltration tank (for untreated surface water) located at the south eastern extent of the Main Application Site.

20.8.15 The design of the surface water drainage for assessment Phase 2a has been developed to accommodate the volume and rate of water generated by a 1 in 100 year return period storm event, including a 40% uplift to allow for potential increases in rainfall due to climate change.

20.8.16 The new drainage system will include real-time monitoring of contaminant levels and volumes to determine if surface water runoff from across the remainder of the Main Application Site is contaminated. When contaminants are detected, water will be diverted into storage tanks. From the storage tanks, contaminated runoff will then be diverted to the WTP for treatment before discharging into the treated effluent infiltration tank; as shown in the Overview Layout plans for assessment Phases 2a and 2b provided in the DDS (**Appendix 20.4** of this ES **[TR020001/APP/5.02]**).

20.8.17 The WTP would consist of a single plant that encompasses three treatment streams - one process for sewage load from the proposed Terminal 2 building, a second process for contaminated airfield drainage (such as de-icing agents) and a third process for attenuated surface water for reuse . The treatment processes to be implemented at the WTP are described in further detail in the DDS (**Appendix 20.4** of this ES **[TR020001/APP/5.02]**).

20.8.18 All foul water from Terminal 2 and contaminated airfield drainage would be directed to the WTP and the treated effluent would be discharged to the treated effluent infiltration tank. Attenuated surface water would be treated to remove solids. After this process, the greywater will be returned to the terminals via a holding tank for non-potable use. This has been used in the airport's water balance and would substantially reduce the demand for potable water. This is described in more detail in the DDS provided in **Appendix 20.4** of this ES **[TR020001/APP/5.02]**.

20.8.19 The attenuation tanks and infiltration tanks would all be located beneath the Main Application Site and have been positioned to account for the potential maximum groundwater level as defined in the Hydrogeological Characterisation Report provided in **Appendix 20.3** of this ES **[TR020001/APP/5.02]**.

20.8.20 The drainage system as outlined within the DDS (**Appendix 20.4** of this ES **[TR020001/APP/5.02]**) has been developed in cognisance of the risk of chalk degradation as a result of infiltration. The storage and infiltration tanks will be constructed as separate modules to facilitate maintenance and inspection to assess the asset performance and integrity. The modularity of the system will allow portions to be isolated without full decommissioning. The infiltration tanks will comprise perforated tanks or similar, opposed to granular backfilled soakaways, which will reduce erosion potential.

20.8.21 The proposed Fire Training Ground will be self-contained. During fire training activities, surface water runoff will be diverted to a holding tank and would not drain to ground under any circumstances. Effluent generated from fire activities (containing foam and hydrocarbon breakdown constituents) would either be directed into the existing public foul sewerage system (subject to the necessary consents) or tankered away for appropriate treatment.

20.8.22 The proposed fuel storage area would be surrounded by a bund. Surface water would drain through petrol interceptors with sensors to measure water quality. If contamination trigger levels are exceeded, the water would be diverted away from the infiltration tank and to the WTP. If a substantial leak occurred from the tanks, then the drainage would close completely and the isolated fuel spill would be collected and tankered off-site for treatment.

20.8.23 Engagement with Affinity Water has been undertaken to understand how potential water use affects their overall strategy, water resources and infrastructure. The drainage design for the Main Application Site includes measures to maximise water reuse such as surface water treatment and reuse and rainwater harvesting. The development of these measures and assessment of their impact on water supply is described further in the WCS **Appendix 20.5** of this ES **[TR020001/APP/5.02]**.

20.8.24 A surface water management system has been designed for the AAR that is able to accommodate a 1 in 100 year return period storm event plus a 40% uplift for climate change and is compliant with contemporary standards of sustainable drainage design, as outlined in the DDS **Appendix 20.4** of this ES **[TR020001/APP/5.02]**.

20.8.25 The drainage network for AAR would remain separate from the other infrastructure and it is assumed that it would be adopted and managed by LBC, and be developed with their further engagement.

20.8.26 The drainage design strategies for the Off-site Highway Interventions would be developed following grant of development consent, secured by the surface and foul water drainage Requirement of Schedule 2 **[TR020001/APP/2.01]**, in consultation with the relevant planning authority and Environment Agency. The drainage design strategies will follow the principles of sustainable drainage design and contemporary highway design standards. Attenuation and water quality management systems will be implemented where required in response to changes in hardstanding, increased pollutant loading or to help mitigate existing surface water flooding issues. The design principles for the proposed Off-site Highway Interventions are outlined in the DDS **Appendix 20.4** of this ES **[TR020001/APP/5.02]**.

Good Practice

20.8.27 The CoCP provided in **Appendix 4.2** of this ES **[TR020001/APP/5.02]** outlines the requirement for the lead contractor to prepare a Construction Surface Water Management Strategy (CSWMS) as part of their Environmental Management System (EMS) to protect the quality of surface water resources during construction.

20.8.28 The key measures to be implemented via the CSWMS will include:

a. Confirmation of the water resource and flood risk receptors as identified in this ES, which could be affected during the construction works.

b. Identification of the potentially polluting material used in construction processes and the activities to which they relate. This will enable plans to be developed to safeguard the surface water and groundwater receptors from these potentially polluting activities. This will include pollution incident response planning.

c. Precautions to be taken to prevent the release of silt or other forms of suspended polluting material from construction areas.

d. Precautions to be taken to prevent surface water from inundating construction areas.

e. Precautions to prevent the creation of surface water flow paths towards existing infrastructure, or off-site where they do not currently exist.

f. Procedures for managing surface water runoff generated within construction areas. This will include appropriate water treatment and must include obtaining the necessary approval from the relevant statutory water undertaker for connections to a receptor (groundwater, river or stream or sewerage network).

g. Provision of facilities to appropriately manage foul water discharge, including the required approval from the relevant statutory water undertaker for any discharges to a public sewer.

20.8.29 Furthermore, the CSWMS would include the following details:

a. a layout of how surface water will be collected, treated and discharged to an appropriate receptor;

b. plans that outline how construction works will be undertaken being mindful of flood risk, this will include removing any potential obstacles to existing surface water flow paths, taking preventative action before a new pathway is created and storing materials out of any areas subject to a significant risk of flooding;

c. development of a plan defining how construction activities will be managed during an extreme flood event, this should include reference to an appropriate flood warning system and identification of suitable access and refuge areas;

d. awareness of relevant LLFA flood risk management plans and continued engagement with LLFAs during construction; and

e. if it is determined that any of the works require an Environment Agency Flood Risk Activities Permit, this must be obtained prior to construction of the relevant works commencing.

20.8.30 The CoCP (**Appendix 4.2** of this ES **[TR020001/APP/5.02])** outlines the requirements for measures that need to be put in place to avoid groundwater contamination during construction works. The key measures include:

a. completion of groundwater monitoring and analysis in accordance with the CoCP;

b. provision of a Piling Risk Assessment in accordance with appropriate methodology developed in consultation with the Environment Agency to address how risks to the aquifer and associated receptors will be addressed (e.g. contamination, turbidity etc.);

c. use of appropriate measures in the historic landfill mass to monitor and periodically remove leachate as required;

d. implementation of appropriate remediation measures as outlined in the Outline Remediation Strategy (**Appendix 17.5** of this ES **[TR020001/APP/5.02]**);

e. implementation of appropriate measures to control the mobilisation of contaminants to the underlying aquifer during construction;

f. ongoing engagement with relevant local authorities and Environment Agency regarding control or protection measures required during construction; and

g. validation testing of remediated ground or groundwater and preparation of appropriate reports.

20.8.31 The CoCP (**Appendix 4.2** of this ES **[TR020001/APP/5.02])** also outlines the need for the consumption of water to be considered within the construction process. This includes undertaking the following:

a. Identification of appropriate sources of water for use across construction related activities. This will focus on the use of locally collected water in preference to potable water.

b. Completion of a risk assessment and identification of mitigation measures to manage water consumption during construction. This should be developed in consultation with the relevant statutory water undertaker.

c. Implementation of water efficiency measures to minimise water consumption.

d. Monitoring of surface water consumption and quality.

20.8.32 The following guidance will be followed during construction to ensure a good practice approach to managing potential impacts on water resources:

a. The DMRB LA113: Road drainage and the water environment (Ref. 20.34);

b. The SuDS Manual (C753) CIRIA (2015) (Ref. 20.33);

c. Control of water pollution from construction sites: Guidance for consultants and contractors (C532) CIRIA (2001) (Ref. 20.64);

d. Environment Agency Guidance on pollution prevention:

i. Prevention of pollution for businesses (Ref. 20.65);
ii. Reporting an environmental incident (Ref. 20.66);
iii. Getting permission to discharge to surface or groundwater (Ref. 20. 67);
iv. Storage of oil (Ref. 20.68);
v. Oil storage regulations (Ref. 20.69);
vi. Discharging sewage with no mains drainage (Ref. 20.70);
vii. Works on or near water (Ref. 20.71); and
viii. Manage water on land (Ref. 20.72);

e. Environment Agency Groundwater Protection Guides (Ref. 20.73); and

f. LLFA Flood Risk documentation (see **Section 20.2**).

20.9 Assessment

20.9.1 This section presents the results of the assessment with the embedded and good practice mitigation measures, as described in section **20.8,** in place.

20.9.2 A summary of the assessment of effects is provided on **Table 20.17** in **Section 20.14**. A commentary on the main effects to receptors is provided in this section.

Construction effects

Groundwater quality and quantity

20.9.3 The limitation of excavation works to above the water table would result in no groundwater lowering. With drawdown of the groundwater table not undertaken as part of the construction works, it is considered that the identified groundwater receptors within the study area (such as the chalk, springs, GWDTE, abstractions and surface water courses) would not be impacted by a reduction in baseflow. This limits potential effects to the groundwater receptors to the impacts from groundwater mounding (which is considered in operational effects) and groundwater quality impacts (discharge of contamination water, turbidity spikes etc).

20.9.4 Some foundations, such as piling, may require works beneath the water table, which would require a separate specific risk assessment, as included within the CoCP **(Appendix 4.2** of this ES **[TR020001/APP/5.02]).**

20.9.5 Polluted or uncontrolled surface water runoff containing silts and hydrocarbons can migrate and be discharged to groundwater. This has the potential to result in long-term degradation of water quality, derogation of existing abstractions, pollution of environmental receptors and the potential loss of aquatic habitat (which in turn may result in impacts on amenity and economic value of receptors).

20.9.6 Following implementation of mitigation listed within the CoCP **(Appendix 4.2** of this ES **[TR020001/APP/5.02]),** the magnitude (and likelihood) of a pollution incident as a consequence of the construction on the groundwater receptors documented in the baseline section above is considered to be very low. With the sensitivity of the receptors across the study area ranging from very low to high, and a magnitude of impact of very low, the overall effect is considered to be **negligible** to **minor adverse,** which is **not significant**.

20.9.7 The processing and treatment of a portion of the former landfill waste prior to reuse in assessment Phase 1 provides the opportunity to remove potential sources of contaminants. This would result in a long term beneficial impact of very low magnitude on the underlying aquifer. The underlying aquifer is a high value receptor and therefore this results in a **minor beneficial** effect, which is **not significant** in assessment Phase 1.

20.9.8 The processing and treatment of a larger portion of the former landfill waste, prior to reuse in assessment Phase 2a provides the opportunity to remove potential sources of contaminants, this would result in a long term beneficial impact of very low magnitude on the underlying aquifer. The underlying aquifer

is a high value receptor and therefore this is a **minor beneficial** effect which is **not significant** in assessment Phase 2a.

20.9.9 The implementation of the water consumption management measures as outlined in the CoCP (**Appendix 4.2** of this ES **[TR020001/APP/5.02]**) would reduce water requirements during construction. The WCS (**Appendix 20.5** of this ES **[TR020001/APP/5.02]**) concludes that the increase in water demand from Affinity Water is only likely during construction works which would be temporary. This would represent a **minor adverse** effect to the existing water abstraction regime from the underlying chalk aquifer, which is **not significant**.

20.9.10 **Table 20.13** summarises the assessed construction impacts, mitigation measures and overall effects to the groundwater receptors identified in the baseline conditions (see **Table 20.11**).

Table 20.13: Groundwater Receptors – Construction Impacts

Feature/Receptor	Assessed impact and Embedded/Best Practice Mitigation Measures	Effect
Chalk bedrock aquifer	Present under the Main Application Site and also the Off-site Highway Interventions and Off-site Car Park locations. The chalk is a high value receptor under serious water stress, as well as the primary pathway to the majority of other receptors in the area. Due to its criticality, mitigation measures need to be implemented during construction that prevent any deterioration of the water body; either quality or quantity. The design of the Proposed Development has been undertaken in cognisance of likely worst-case groundwater levels, with no structures proposed that would require construction dewatering to be undertaken. The CoCP (**Appendix 4.2** of this ES **[TR020001/APP/5.02]**) requires the contractor to implement water consumption management measures to minimise water requirements during the construction stage. The primary risk to the aquifer during construction is through the discharge of pollutants to the underlying aquifer. The construction works would be undertaken several metres above the groundwater level during normal conditions which would reduce the risk of discharge of contaminants to the aquifer and turbidity spikes. Best practice proactive mitigation measures to minimise risk, as well as reactive mitigation measures to prevent and control pollution are to be implemented as outlined in the CoCP (**Appendix 4.2** of this ES **[TR020001/APP/5.02]**) to reduce the likelihood and severity of any pollution incident. The Outline Remediation Strategy (**Appendix 17.5** of this ES **[TR020001/APP/5.02]**) outlines requirements to process and treat former landfill waste for reuse. This provides an opportunity to remove potential sources of contaminants. The risk of turbidity spikes will be reduced by limiting works to above the groundwater table (generally several metres during normal conditions). Where works have the potential to be in contact with the groundwater (e.g.	**Magnitude:** Very Low **Sensitivity:** High **Effect and Significance:** **Minor adverse, not significant** (no deterioration of aquifer)

Feature/Receptor	Assessed impact and Embedded/Best Practice Mitigation Measures	Effect
	piling) a piling risk assessment (developed in consultation with the Environment Agency) is to address how risks to the aquifer will be addressed**.**	
Superficial deposits	The Clay-with-Flints Formation underlies the majority of the Main Application Site and is designated as unproductive stratum by the Environment Agency. Best practice proactive mitigation measures to minimise risk, as well as reactive mitigation measures to prevent and control pollution are to be implemented as outlined in the CoCP (**Appendix 4.2** of this ES **[TR020001/APP/5.02]**) to reduce the likelihood and severity of any pollution incident.	**Magnitude:** Very Low **Sensitivity:** Low **Effect and Significance:** **Negligible, not significant**
Groundwater abstractions and associated SPZs	The approximate locations of groundwater abstractions (both licensed abstractions and private supplies) and associated SPZs are shown on **Figure 20.2** of this ES **[TR020001/APP/5.03]**. No abstractions are located in areas which could be directly impacted by construction works (no abstractions located where construction works proposed). However, the abstractions and associated SPZs highlighted previously are all assumed to abstract from the chalk and have the potential to be impacted by groundwater quality and quantity impacts to the chalk from construction activities. The proposed construction works will not require lowering of the groundwater table limiting potential impacts from alterations to groundwater levels. This limits the primary risk to the groundwater abstractions and associated SPZs to groundwater quality impacts. Best practice proactive mitigation measures to minimise risk, as well as reactive mitigation measures to prevent and control pollution are to be implemented as outlined in the CoCP (**Appendix 4.2** of this ES **[TR020001/APP/5.02]**) to reduce the likelihood	**Magnitude:** Very Low **Sensitivity:** High **Effect and Significance:** All **Minor adverse, not significant** (no deterioration of abstractions)

Feature/Receptor	Assessed impact and Embedded/Best Practice Mitigation Measures	Effect
	and severity of any pollution incident during construction which could impact the chalk aquifer (and subsequently any abstractions). The proposed Off-site Highway Interventions at Windmill Road/St Mary's Road/Crawley Green Road Gyratory (Work No. 6e(i), as described in **Chapter 4** of this ES **[TR020001/APP/5.01]**) is within the Inner Protection zone SPZ1, and Windmill Road/Kimpton Road (Work No. 6e(a)) within the total catchment, associated with the public water supply abstraction within Luton. As with the Main Application Site, best practice proactive mitigation measures to minimise risk, as well as reactive mitigation measures to prevent and control pollution are to be implemented as outlined in the CoCP (**Appendix 4.2** of this ES **[TR020001/APP/5.02]**) to reduce the likelihood and severity of any pollution incident during construction which could impact the chalk aquifer (and subsequently any abstractions).	
Potential groundwater-surface water interactions	A number of potential groundwater-surface water features were identified through desk study within the local area during the baseline. Review of the potential groundwater-surface water interactions against both the topography and the anticipated groundwater levels within the Hydrogeological Characterisation Report (**Appendix 20.3** of this ES **[TR020001/APP/5.02]**) indicate that the nearest potential groundwater-surface water interactions within the study area are unlikely to be chalk fed springs, as the modelled groundwater level during peak periods is several metres below ground level at the potential spring locations. No potential springs are located in areas which could be directly impacted by construction works (no springs located where construction works proposed). Any groundwater-surface water interactions within the area have the potential to be impacted by groundwater quality and quantity impacts to the chalk from construction activities. The proposed construction works will not require lowering of the groundwater table limiting potential impacts from alterations to groundwater levels.	**Magnitude:** Very Low **Sensitivity:** High **Effect and Significance:** All **Minor adverse, not significant** (no deterioration)

Feature/Receptor	Assessed impact and Embedded/Best Practice Mitigation Measures	Effect
	This limits the primary risk to any potential groundwater-surface water interactions to groundwater quality impacts. Best practice proactive mitigation measures to minimise risk, as well as reactive mitigation measures to prevent and control pollution are to be implemented as outlined in the CoCP (**Appendix 4.2** of this ES **[TR020001/APP/5.02]**) to reduce the likelihood and severity of any pollution incident during construction which could impact the chalk aquifer (and subsequently any potential groundwater-surface water interactions).	
Potential groundwater dependent terrestrial ecosystems (GWDTE)	A number of potential GWDTE features were identified through desk study within the local area during the baseline assessment. Review of the potential GWDTE against both the topography and the anticipated groundwater levels within the Hydrogeological Characterisation Report (**Appendix 20.3** of this ES **[TR020001/APP/5.02]**) indicate that the nearest potential GWDTE within the study area are unlikely to be chalk fed GWDTE, as the modelled groundwater level during peak periods is several metres below ground level at the potential spring locations. Any chalk fed GWDTE within the area have the potential to be impacted by groundwater quality and quantity impacts to the chalk from construction activities. The proposed construction works will not require lowering of the groundwater table limiting potential impacts from alterations to groundwater levels. This limits the primary risk to any potential GWDTE to groundwater quality impacts. Best practice proactive mitigation measures to minimise risk, as well as reactive mitigation measures to prevent and control pollution are to be implemented as outlined in the CoCP (**Appendix 4.2** of this ES **[TR020001/APP/5.02]**) to reduce the likelihood and severity of any pollution incident during construction which could impact the chalk aquifer (and subsequently any potential GWDTE).	**Magnitude:** Very Low **Sensitivity:** High **Effect and Significance:** All **Minor adverse, not significant** (no deterioration)
Discharge consents	Several discharge consents to ground were identified within the study area (including three operated by the airport within the Main Application Site; for	**Magnitude:** Very Low

Feature/Receptor	Assessed impact and Embedded/Best Practice Mitigation Measures	Effect
	the main site soakaways, the northern soakaway and the Fire Training Ground soakaway). Their approximate locations are shown on **Figure 20.2** of this ES **[TR020001/APP/5.03]**. The consents operated by the airport will be modified or revoked, as the new drainage design (**Appendix 20.4** of this ES **[TR020001/APP/5.02]**) is implemented, with new bespoke permits applied for from and regulated by the Environment Agency. No further discharges are located in areas which could be directly impacted by construction works (no non-Luton airport discharges located where construction works are proposed). However, the discharge consents to ground (which are assumed to discharge to chalk) have the potential to be impacted by groundwater quality and quantity impacts to the chalk from construction activities. The proposed construction works will not require lowering of the groundwater table limiting potential impacts from alterations to groundwater levels. This limits the primary risk to the groundwater discharge consents to groundwater quality impacts. Best practice proactive mitigation measures to minimise risk, as well as reactive mitigation measures to prevent and control pollution are to be implemented as outlined in the CoCP (**Appendix 4.2** of this ES **[TR020001/APP/5.02]**) to reduce the likelihood and severity of any pollution incident during construction which could impact the chalk aquifer (and subsequently the operation of any discharge consents).	**Sensitivity:** Low **Effect and Significance:** All **Negligible, not significant** (no deterioration)

Surface water quality and quantity

20.9.11 The majority of surface water features in the area are chalk fed, and as such the assessment of impact on the chalk is considered relevant to the assessment of the surface water features.

20.9.12 The assessment has concluded that with implementation of the CoCP **(Appendix 4.2** of this ES **[TR020001/APP/5.02])**, there would not be any direct adverse significant effects to surface water quantity and quality caused by construction. No alterations to groundwater levels are proposed which could impact baseflows to surface water features, whilst CoCP mitigation measures would be implemented at source to prevent degradation of the chalk (and subsequently the chalk fed surface water courses).

20.9.13 The Off-site Highway Interventions at the A1081 New Airport Way/B653/Gipsy Lane, Windmill Road/St Mary's Road/Crawley Green Road and in Hitchin may affect water quality in the River Lee, Luton Hoo (by association) and River Hiz during construction due to their proximity to the watercourse and the potential for sediments and other polluting matter to be released. The implementation of the management measures in the CoCP (**Appendix 4.2** of this ES **[TR020001/APP/5.02]**) would reduce the likelihood and magnitude of a pollution incident, thus resulting in a very low impact. The River Lee is a high value receptor and therefore this results in a **minor adverse** effect which is **not significant**. The River Hiz is a medium value receptor and therefore this results in a **minor adverse** effect which is **not significant**. Luton Hoo lake is a low value receptor and therefore this results in a **negligible** effect which is **not significant**.

20.9.14 The processing and treatment of a portion the former landfill waste prior to reuse in assessment Phases 1 and 2a provides the opportunity to remove potential sources of contaminants. This would result in a long term beneficial impact of very low magnitude on the River Mimram. The River Mirmam is a high value receptor and therefore this results in a **minor beneficial** effect which is **not significant.** Conversely the River is in continuity with the chalk bedrock and is potentially susceptible to a pollution event at the Main Application Site. Following implementation of mitigation listed within best practice guidance and the CoCP **(Appendix 4.2** of this ES **[TR020001/APP/5.02]),** the magnitude of a pollution incident as a consequence of the construction on the River Mimram is considered to be very low. This results in a **minor adverse** effect which is **not significant.**

Flood risk

20.9.15 A detailed assessment of the potential impacts of construction activities on flood risk is provided in the FRA (**Appendix 20.1** of this ES **[TR020001/APP/5.07]**). The assessment concluded the effects are **not significant**.

Existing infrastructure

20.9.16 As outlined in the CoCP **(Appendix 4.2** of this ES **[TR020001/APP/5.02]),** services critical to the airport operations would be protected at all times during the construction works. All works will be carried out in accordance with the

guidance provided by the HSE in their document HSG47 'Avoiding Danger from Underground Services' (Ref. 20.74). Existing utility networks will be located by the lead contractor through a utility survey in accordance with PAS128 (Ref. 20.75) (or equivalent standard applicable at the time), prior to start of intrusive works, and appropriate clearances will be clearly demarcated on the ground.

20.9.17 The implementation of mitigation measures would reduce the likelihood and magnitude of an impact to the existing network to very low. The existing infrastructure is considered to be a medium value receptor and as such the overall effect would be **minor adverse** which is **not significant.**

Operational effects

Groundwater quality and quantity

20.9.18 The limitation of the construction works to above the water table (with the exception of some foundations which require a separate risk assessment) would result in minimal disturbance of the aquifer and flow paths below the water table during operation. Assessment of groundwater mounding within **Appendix 20.3** Hydrogeological Characterisation Report of this ES **[TR020001/APP/5.02],** has indicated localised mounding during long term average rainfall conditions, with minimal groundwater level impacts at distance from the Main Application Site and minimal impact at the local water courses (River Lee and River Mimram) which could impact the WFD elements.

20.9.19 In assessment Phases 2a and 2b, a capping layer would be provided for the extent of the historic landfill affected to minimise surface water infiltration into the underlying waste and prevent generation of future landfill leachate. The implementation of the capping layer on the landfill would close the potential pathway for contaminants, which can currently be mobilised by downward migration of surface water through the landfill material and into the wider aquifer. Therefore, this would result in a very low beneficial impact on the underlying aquifer. The underlying aquifer is a high value receptor and therefore this is a **minor beneficial** effect which is **not significant**.

20.9.20 Surface water runoff would be discharged to ground through one of the infiltration tanks and as such has the potential to impact groundwater quality. Surface water runoff will be subject to appropriate inline treatment such as petrol interceptors or permeable pavements prior to discharge. Surface water runoff from the aprons will be subject to live monitoring which will identify contaminated water and divert to the WTP for treatment (as outlined in the DDS **(Appendix 20.4** of this ES **[TR020001/APP/5.02]**). With the live monitoring and inline treatment preventing the discharge of contaminated water, the impact on the underlying aquifer from surface water runoff is considered to be very low.

20.9.21 On the basis that the proposed WTP would reduce potential pollutant concentrations to below polluting levels, peak flows are attenuated and water reuse measures are implemented, the impact of the proposed drainage system described in the DDS **(Appendix 20.4** of this ES **[TR020001/APP/5.02])** on the underlying aquifer is considered to be very low, in terms of quality and quantity for all assessment phases.

20.9.22 This is based on the DDS **(Appendix 20.4** of this ES **[TR020001/APP/5.02])** maintaining existing net contributions from the surface water catchments to the existing groundwater catchments, a water quality monitoring system that would detect, isolate and treat any contaminated surface water and the concentration of potentially polluting materials consented in the final effluent will be restricted to concentrations that would not change the quality of the water within the underlying aquifer. Therefore, the effect is considered to be **minor adverse**, which is **not significant.**

20.9.23 Overall the effect of the Proposed Development on the underlying aquifer is considered **minor adverse**, which is **not significant**. This is a precautionary assessment balancing the **minor beneficial** effect of removing potentially polluting matter contained within the existing land fill and the **minor adverse** effect of infiltrating treated effluent into the aquifer.

20.9.24 The DDS (**Appendix 20.4** of this ES **[TR020001/APP/5.02]**) and WCS (**Appendix 20.5** of this ES **[TR020001/APP/5.02]**) outline how water reuse and rainwater harvesting would be implemented to reduce increases in abstraction from the public water supply network operated and maintained by Affinity Water.

20.9.25 Based on an average water demand figure of 7.5l/s for the airport, the WCS has concluded that a successful water balance can been achieved for the terminal buildings and the non-terminal water usage throughout assessment Phases 1, 2a and 2b that does not exceed the 7.5l/s baseline.

20.9.26 The calculations indicate that by maximising recycling of water for non-potable water uses, the increase in water demand from Affinity Water is only likely during construction works which would be temporary. This would represent a **minor adverse** effect to the existing water abstraction regime from the underlying chalk aquifer, which is **not significant**.

20.9.27 **Table 20.14** summarises the assessed operational impacts, mitigation measures and overall effects to the groundwater receptors identified in the baseline conditions (see **Table 20.11**).

Table 20.14: Groundwater Receptors - Operational Impacts

Feature/Receptor	Assessed impact and Embedded/Best Practice Mitigation Measures	Effect
Chalk bedrock aquifer	Present under the Main Application Site and also the Off-site Highway Intervention and Off-site Car Park locations. The chalk is a high value receptor under serious water stress, as well as the primary pathway to the majority of other receptors in the area. Due to its criticality, mitigation measures need to be implemented to ensure the operational drainage design does not lead to deterioration of the water body; either quality or quantity. The limitation of the construction works to above the water table (with the exception of some foundations which require a separate risk assessment) would result in minimal disturbance of the aquifer and flow paths below the water table during operation. The proposed infiltration tanks will lead to groundwater mounding, as is currently observed around the existing main soakaway. Assessment of groundwater mounding has been undertaken within **Appendix 20.3** Hydrogeological Characterisation Report of this ES **[TR020001/APP/5.02]** which has indicated localised mounding around the infiltration tanks during long term average rainfall conditions. Impacts of this on surrounding receptors is considered below. The primary risk to the aquifer during operation is through the discharge of contaminated water directly to the underlying aquifer, within the infiltration tanks. The preliminary drainage design (see DDS **Appendix 20.4** of this ES **[TR020001/APP/5.02]**) outlines the principles to be carried forward into the detailed design to minimise the risks to the aquifer. This includes in line passive treatment systems for surface water runoff, live monitoring of surface water to enable diversion of wastewater to a WTP to treat both contaminated surface water runoff and foul water from Terminal 2. A Hydrogeological Risk Assessment Report: Drainage (**Appendix 20.6** of	**Magnitude:** Very Low **Sensitivity:** High **Effect and Significance:** **Minor, not significant** (no deterioration of aquifer)

Feature/Receptor	Assessed impact and Embedded/Best Practice Mitigation Measures	Effect
	this ES **[TR020001/APP/5.02]**) has been undertaken to assess the risk of the proposed discharge effluent (outlined in the DDS) to the aquifer. Bespoke discharge permits will need to be obtained from the Environment Agency for the proposed infiltration tanks following detailed design. These permit applications will need to be supported by evidence confirming that the detailed drainage design will not lead to degradation of the chalk aquifer, and its associated receptors.	
Superficial deposits	The Clay-with-Flints Formation underlies the majority of the Main Application Site and is designated as unproductive stratum by the Environment Agency. Due to the unproductive nature of the stratum, impacts during operation on the superficial deposits are considered to be very low.	**Magnitude:** Very Low **Sensitivity:** Low **Effect and Significance:** **Negligible, not significant**
Groundwater abstractions and associated SPZs	The approximate locations of groundwater abstractions (both licensed abstractions and private supplies) and associated SPZs are shown on **Figure 20.2** of this ES **[TR020001/APP/5.03]**. The abstractions and associated SPZs highlighted previously are all assumed to abstract from the chalk and have the potential to be impacted by groundwater quality and quantity impacts to the chalk from operational activities. The limitation of the construction works to above the water table (with the exception of some foundations which require a separate risk assessment) would result in minimal disturbance of the aquifer and flow paths below the water table during operation. The proposed infiltration tanks could lead to a degree of localised groundwater mounding, as is currently observed around the existing main soakaway. Assessment of groundwater mounding has been undertaken within the Hydrogeological	**Magnitude:** Very Low **Sensitivity:** High **Effect and Significance:** All **Minor, not significant** (no deterioration of abstractions)

Feature/Receptor	Assessed impact and Embedded/Best Practice Mitigation Measures	Effect
	Characterisation Report (**Appendix 20.3** of this ES **[TR020001/APP/5.02])** which has indicated localised mounding around the infiltration basins during long term average rainfall conditions. None of the abstractions identified are within the mounding zone of influence. This limits the primary risk to the groundwater abstractions and associated SPZs to groundwater quality impacts. A Hydrogeological Risk Assessment Report: Drainage (**Appendix 20.6** of this ES **[TR020001/APP/5.02]**) has been undertaken to assess the risk of the proposed discharge effluent (outlined in the DDS) to the aquifer, with a focus on the Kings Walden PWS abstraction which is the nearest PWS abstraction to the infiltration basin. The risk assessment concluded that based on the conditions assessed there was no significant pollution risk to the aquifer. The proposed Off-site Highway Interventions at Windmill Road/St Mary's Road/Crawley Green Road Gyratory (Work No. 6e(i), as described in **Chapter 4** of this ES **[TR020001/APP/5.01]**) are within the Inner Protection zone SPZ1, and Windmill Road/Kimpton Road (Work No. 6e(a)) within the total catchment associated with the public water supply abstraction within Luton. The drainage design for the Off-site Highways Interventions is to be developed after gaining development consent and prior to construction in agreement with the relevant local authority and consultation with the Environment Agency (pursuant to the surface and foul water drainage Requirement in Schedule 2 of the **draft DCO [TR020001/APP/2.01]**). The drainage design will need to include appropriate mitigation measures to not pollute the underlying aquifer. Design principles are outlined in the DDS **Appendix 20.4** of this ES **[TR020001/APP/5.02].**	
Potential groundwater-surface water interactions	A number of potential groundwater-surface water features were identified through desk study within the local area during the baseline. Review of the potential groundwater-surface water interactions against both the topography and the anticipated groundwater levels within the Hydrogeological Characterisation Report (**Appendix 20.3** of this ES	**Magnitude:** Very Low **Sensitivity:**

Feature/Receptor	Assessed impact and Embedded/Best Practice Mitigation Measures	Effect
	[TR020001/APP/5.02]) indicate that the nearest potential groundwater-surface water interactions within the study area are unlikely to be chalk fed springs, as the modelled groundwater level during peak periods is several metres below ground level at the potential spring locations. The limitation of the construction works to above the water table (with the exception of some foundations which require a separate risk assessment) would result in minimal disturbance of the aquifer and flow paths below the water table during operation. The proposed infiltration tanks will lead to groundwater mounding, as is currently observed around the existing main soakaway. Assessment of groundwater mounding has been undertaken within **Appendix 20.3** Hydrogeological Characterisation Report of this ES **[TR020001/APP/5.02]** which has indicated localised mounding around the infiltration basins during long term average rainfall conditions. The majority of potential groundwater-surface water interactions are at substantial distance from the infiltration tanks outside the calculated zones of influence. The nearest potential groundwater-surface water interactions (e.g. Netherfield Spring) are located within the mounding zone of influence. However, review of the potential groundwater-surface water interactions against groundwater levels suggests there are no groundwater-surface water interactions within the mounding zone of influence that are chalk fed. This limits the primary risk to any potential groundwater-surface water interactions to groundwater quality impacts. A Hydrogeological Risk Assessment Report: Drainage (**Appendix 20.6** of this ES **[TR020001/APP/5.02]**) has been undertaken to assess the risk of the proposed discharge effluent (outlined in the DDS) to the aquifer. The risk assessment concluded that based on the conditions assessed there was no significant pollution risk to the aquifer (and in turn no significant risk to potential groundwater-surface water interactions at distance.	High **Effect and Significance:** All **Minor, not significant**
Potential groundwater dependent terrestrial	A number of potential GWDTE features were identified through desk study within the local area during the baseline.	**Magnitude:** Very Low

Feature/Receptor	Assessed impact and Embedded/Best Practice Mitigation Measures	Effect
ecosystems (GWDTE)	Review of the potential GWDTE against both the topography and the anticipated groundwater levels within the Hydrogeological Characterisation Report (**Appendix 20.3** of this ES **[TR020001/APP/5.02]**) indicate that the nearest potential GWDTE within the study area are unlikely to be chalk fed, as the modelled groundwater level during peak periods is several metres below ground level at the potential GWDTE locations. The limitation of the construction works to above the water table (with the exception of some foundations which require a separate risk assessment) would result in minimal disturbance of the aquifer and flow paths below the water table during operation. The proposed infiltration tanks will lead to groundwater mounding, as is currently observed around the existing main soakaway. Assessment of groundwater mounding has been undertaken within **Appendix 20.3** Hydrogeological Characterisation Report of this ES **[TR020001/APP/5.02]** which has indicated localised mounding around the infiltration tanks during long term average rainfall conditions. The majority of potential GWDTE are at substantial distance from the infiltration tanks outside the calculated zones of influence. The nearest potential GWDTE (e.g. Netherfield Spring) are located within the mounding zone of influence. However, review of the potential GWDTE against groundwater levels suggest there are no GWDTE within the calculated mounding zone of influence that are chalk fed. This limits the primary risk to any potential GWDTE to groundwater quality impacts. A Hydrogeological Risk Assessment Report: Drainage (**Appendix 20.6** of this ES **[TR020001/APP/5.02]**) has been undertaken to assess the risk of the proposed discharge effluent (outlined in the DDS) to the aquifer. The risk assessment concluded that based on the conditions assessed there was no significant pollution risk to the aquifer (and in turn no significant risk to potential GWDTE).	**Sensitivity:** High **Effect and Significance:** All **Minor, not significant**
Discharge consents	Several discharge consents to ground were identified within the study area (including three operated by the airport within the Main Application	**Magnitude:** Very Low

Feature/Receptor	Assessed impact and Embedded/Best Practice Mitigation Measures	Effect
	Site; for the main site soakaways, the northern soakaway and the Fire Training Ground soakaway). Their approximate locations are shown on **Figure 20.2** of this ES **[TR020001/APP/5.03]**. The consents operated by the airport will be modified or revoked, as the new drainage design (**Appendix 20.4** of this ES **[TR020001/APP/5.02]**) is implemented, with new bespoke permits applied for, which would be granted and regulated by the Environment Agency. The discharge consents to ground (which are assumed to discharge to chalk) have the potential to be impacted by groundwater quality and quantity impacts to the chalk from operational activities. The limitation of the construction works to above the water table (with the exception of some foundations which require a separate risk assessment) would result in minimal disturbance of the aquifer and flow paths below the water table during operation. The proposed infiltration tanks will lead to groundwater mounding, as is currently observed around the existing main soakaway. Assessment of groundwater mounding has been undertaken within **Appendix 20.3** Hydrogeological Characterisation Report of this ES **[TR020001/APP/5.02]** which has indicated localised mounding around the infiltration tanks during long term average rainfall conditions. No discharge consents are located in the calculated zone of influence from the infiltration basin. This limits the primary risk to the groundwater discharge consents to groundwater quality impacts. A Hydrogeological Risk Assessment Report: Drainage (**Appendix 20.6** of this ES **[TR020001/APP/5.02]**) has been undertaken to assess the risk of the proposed discharge effluent (outlined in the DDS) to the aquifer. The risk assessment concluded that based on the conditions assessed there was no significant pollution risk to the aquifer (and in turn no significant risk to discharge consents).	**Sensitivity:** Low **Effect and Significance:** All **Negligible, not significant**

Surface water quality and quantity

20.9.28 In assessment Phases 2a and 2b, the landfill capping layer (as outlined in **paragraph 7120.9.19**) may result in an indirect beneficial impact of very low magnitude on the River Mimram, resulting in a **minor beneficial** effect which is **not significant**.

20.9.29 The impact of the proposed drainage system described in the DDS **(Appendix 20.4** of this ES **[TR020001/APP/5.02])** on the quality of the River Mimram, River Lee and Luton Hoo lake is considered to be very low for all assessment phases. This is based on the fact that the DDS maintains existing net contributions both from and to existing surface water catchments. Furthermore, the DDS **(Appendix 20.4** of this ES **[TR020001/APP/5.02])** specifies a water quality monitoring system that would detect, isolate and treat any contaminated surface water. Finally, the concentration of potentially polluting materials consented in the final effluent will be restricted to concentrations that would not change the quality of the water within the underlying aquifer, that feeds both the River Mimram and River Lee. Therefore, the effect is **minor adverse**, which is **not significant.**

20.9.30 A screening assessment has been undertaken to determine the risk posed by the proposed AAR and Off-site Highway Interventions to the local surface water receptors. The screening process has been based on evaluating potential change in traffic volumes and potential extent of works. This screening process has identified that the following works (as described in **Chapter 4** of this ES **[TR020001/APP/5.01]**) have the potential to lead to a change in pollutant loading, requiring further assessment using HEWRAT:

a. AAR;
b. A1081 New Airport Way/B653/Gipsy Lane;
c. Windmill Road/Kimpton Road;
d. A505 Vauxhall Way/Eaton Green Road;
e. A1081 New Airport Way/London Road (North);
f. M1 Junction 10;
g. A1081 New Airport Way/Percival Way;
h. Wigmore Lane/Crawley Green Road;
i. Wigmore Lane/Eaton Green Road;
j. Eaton Green Road/Frank Lester Way;
k. Windmill Road/St Mary's Road/Crawley Green Road; and
l. A505 Vauxhall Way/Kimpton Road.

20.9.31 The HEWRAT assessment has been undertaken for the above works and identified the requirement for additional surface water and pollutant management measures to manage impacts on water quality. These measures will be specified during the detailed design stages in consultation with the local authority and Environment Agency (secured by surface and foul water drainage

Requirement of the **draft DCO [TR020001/APP/2.01]**). This will ensure a very low impact on water quality of the receiving surface water courses resulting in **minor adverse** effect, which is **not significant**.

Flood risk

20.9.32 In assessment Phases 2a and 2b, large volumes of surface water runoff would be directed to an infiltration tank. This has the potential of increasing downstream surface water flows as groundwater emerges at the headwaters of the River Mimram at its minor tributaries, in the vicinity of Kimpton. This is described further in the FRA **(Appendix 20.1** of this ES **[TR020001/APP/5.07]),** and in the mounding assessment within the Hydrogeological Characterisation report **(Appendix 20.3** of this ES **[TR020001/APP/5.02])**. The assessment of groundwater mounding and attenuation of surface water prior to discharge have determined the effect is **minor adverse**, which is **not significant**.

20.9.33 A detailed assessment of the potential impacts of operational activities on flood risk is provided in the FRA (**Appendix 20.1** of this ES **[TR020001/APP/5.07]**). With the drainage design taking into account a 1 in 100 year flood event plus a 40% climate change allowance, the assessment concludes the effects are **minor adverse** and **not significant**.

Sensitivity Analysis

20.9.34 There are certain known scenarios or risks that may occur that could influence the conclusions of the core assessment. These scenarios and the general approach to considering them in this assessment are described in **Section 5.4** of **Chapter 5** Approach to the Assessment **[TR020001/APP/5.01]**.

20.9.35 **Table 20.15** provides a qualitative assessment of any likely changes to the conclusions of the assessment reported in this chapter, in the event that that scenario or risk is realised.

Table 20.15: Qualitative Sensitivity Analysis

Sensitivity scenario	Potential impact and change	Likely effect
1. 19 mppa Application	No change anticipated to the assessment as the drainage design would account for changes in baseline capacity in the forecast for water consumption.	No change
2. Faster growth	No change anticipated to the outcomes of the assessment. Drainage design would account for additional pressure on existing drainage systems as a result of faster growth and be subject to approval by the relevant planning	No change

Sensitivity scenario	Potential impact and change	Likely effect
	authority, secured by the surface and foul water drainage Requirement of the **draft DCO [TR020001/APP/2.01].** This would require additional discussions with Thames Water and Affinity Water.	
3. Slower growth	No change anticipated in the outcomes of the assessment as this scenario would not impact on the implementation of the DDS.	No change
4. Next generation aircraft	No change anticipated to the outcomes of the assessment. Aircraft performance does not impact water resources.	No change
5. J10 without National Highways Smart Motorway upgrade (hard shoulder running scheme)	No change anticipated to the outcomes of the assessment, as no change to potential impacts on receptors for water environment and flood risk.	No change
6. Changes to airspace	No change anticipated to the outcomes of the assessment, as no change to potential impacts on receptors for water environment and flood risk.	No change

20.10 Additional mitigation

20.10.1 No significant adverse effects have been identified during construction and operation of the Proposed Development and therefore no additional mitigation measures have been identified as being required.

20.11 Residual effects

20.11.1 Based on the provision of the embedded mitigation measures and good practice as described in **Section 20.8**, the residual effects remain as those assessed and reported in **Section 20.9** and **Table 20.17**.

20.12 In-combination climate change effects

20.12.1 This section provides an assessment of potential changes to the findings of the Water Resources and Flood Risk assessment, taking into account the predicted future conditions as a result of climate change, known as In-combination Climate Change Impacts (ICCI).

20.12.2 This assessment has been undertaken using the methodology and climate change predictions described in **Chapter 9** Climate Change Resilience of this ES **[TR020001/APP/5.01]**. The results are provided in **Table 20.16**.

Table 20.16 Water Resources and Flood Risk in-combination climate change impacts

Climate hazard	Likelihood of climate hazard occurring	Likely ICCIs identified	Description of ICCI considering embedded environmental measures/good practice	Likelihood of ICCI occurring	Consequence	Significance of ICCI effects
Increase in mean annual air temperature Increase in mean Summer air temperature	Frequent	Increase in air temperature potentially affecting groundwater recharge and availability for abstraction	Though increased air temperatures have the potential to effect groundwater recharge and availability, overall impacts are likely to be minor compared with the annual seasonal variations and the increased variability anticipated in rainfall. A WCS **(Appendix 20.5** of this ES **[TR020001/APP/5.02])** has been prepared to inform this ES to assess how potential water use associated with the Proposed Development would affect water resources and infrastructure considering potential impacts of climate change.	Remote	Low	Minor Not significant

Climate hazard	Likelihood of climate hazard occurring	Likely ICCIs identified	Description of ICCI considering embedded environmental measures/good practice	Likelihood of ICCI occurring	Consequence	Significance of ICCI effects
			The DDS **(Appendix 20.4** of this ES **[TR020001/APP/5.02])** includes a description of measures to minimise water use and maximum water reuse. The use of such measures has been considered in the WCS prepared to inform this ES.			
Increase in mean Winter air temperature Increase in minimum air temperature	Frequent	Less snow and ice, potentially resulting in increased surface water runoff in winter periods	The design has been developed to accommodate the volume and rate of water generated by a 1 in 100-year return period storm event, including a 40% uplift to allow for potential increases in rainfall due to climate change.	Remote	Very low	Negligible Not significant
Decrease in annual precipitation rate Decrease in Summer precipitation rate	Frequent	Changing precipitation patterns and water shortage (potentially drought)	A WCS **(Appendix 20.5** of this ES **[TR020001/APP/5.02])** has been prepared to inform this ES to assess how potential water use associated with the Proposed Development	Remote	Low	Minor Not significant

Climate hazard	Likelihood of climate hazard occurring	Likely ICCIs identified	Description of ICCI considering embedded environmental measures/good practice	Likelihood of ICCI occurring	Consequence	Significance of ICCI effects
			would affect water resources and infrastructure considering potential impacts of climate change. The DDS includes a description of measures to minimise water use and maximum water reuse; the use of such measures have been considered in the WCS.			
Increase in annual specific humidity Increase in Summer specific humidity Increase in Winter specific humidity	Frequent	Increase in heavier precipitation events and risk of flooding and impact on leachate generation	The design has been developed to accommodate the volume and rate of water generated by a 1 in 100-year return period storm event, including a 40% uplift to allow for potential increases in rainfall due to climate change. A decrease in annual precipitation would lead to a reduction in leachate generation. However, the increased intensity of	Remote	Very low	Negligible Not significant

Climate hazard	Likelihood of climate hazard occurring	Likely ICCIs identified	Description of ICCI considering embedded environmental measures/good practice	Likelihood of ICCI occurring	Consequence	Significance of ICCI effects
			rainfall events may cause the generation of large quantities of leachate. A capping layer including drainage management systems will be in place across the extent of the historic landfill affected by the Proposed Development to ensure that infiltration would not interact with the waste to reduce the potential for leachate generation.			

20.13 Monitoring

Construction monitoring

20.13.1 The CoCP (**Appendix 4.2** of this ES **[TR020001/APP/5.02]**) identifies the requirement for the lead contractor to outline a monitoring regime for surface water and groundwater quality, groundwater levels and water consumption during construction. This would ensure that pollution prevention measures are installed and operated effectively and, if necessary, the lead contractor can implement additional measures to mitigate any potential incidents.

20.13.2 The monitoring of surface water and groundwater quality will be completed in line with a methodology agreed by the Environment Agency and Thames Water (during permitting processes) as runoff from the Proposed Development will be discharged to the underlying aquifer and the Thames Water network.

20.13.3 The monitoring of water consumption would be completed in line with a methodology agreed by Affinity Water as the regulatory local water supplier.

20.13.4 Further details of proposed monitoring of groundwater quality and levels are provided in **Chapter 17** Soils and Geology of this ES **[TR020001/APP/5.01]**.

Operational monitoring

20.13.5 The monitoring of water consumption associated with the Proposed Development would be maintained during operation in agreement with Affinity Water as the regulatory local water supplier.

20.13.6 The monitoring of groundwater levels and quality would be undertaken throughout operation to ensure no deterioration of the aquifer or significant flood risk in the area surrounding the infiltration tanks; further details are provided in **Chapter 17** Soils and Geology of this ES **[TR020001/APP/5.01]**.

20.13.7 Baseline monitoring of the foul water produced by the airport (the eventual WTP influent) is to be undertaken to ascertain the composition of the foul water and inform the treatment requirements at the proposed WTP. This influent monitoring regime is to be developed with the Environment Agency and will inform future bespoke environmental permits for discharge to the infiltration tanks.

20.13.8 Influent and effluent monitoring will be continued post-WTP installation, in line with environmental permit requirements, to understand any long term variations and to confirm the WTP is working as designed.

20.13.9 Real-time continuous monitoring of contaminants would be completed across the Proposed Development drainage network to ensure that any contaminated runoff would be treated to an appropriate level prior to discharging to the underlying aquifer via the northern and southern infiltration tanks. This is described in the DDS **(Appendix 20.4** of this ES **[TR020001/APP/5.02]**).

20.14 Assessment summary

20.14.1 **Table 20.17** provides a summary of the identified impacts, mitigation and likely effects of the Proposed Development on water resources and flood risk receptors. Any additional mitigation identified is described and its efficacy shown by the reported residual effect.

Table 20.17: Water Resources and Flood Risk assessment summary

Impact	Embedded/Good Practice Mitigation	Magnitude	Receptor Sensitivity	Description of effect and significance	Additional Mitigation	Residual Effect
Construction						
Assessment Phases 1, 2a and 2b Impacts to groundwater and associated receptors (e.g. springs, GWDTE, abstractions etc) from groundwater lowering (additional aquifer stress, reduction in baseflow etc)	Excavation works limited to above the water table, so no construction dewatering is required	Very Low	Very low to High	Negligible to Minor adverse effect, not significant	None required	Negligible to Minor adverse effect, not significant
Assessment Phases 1, 2a and 2b Impacts to groundwater and associated receptors from contaminated surface run-off from the Proposed Development (degradation of water quality)	The Outline Remediation Strategy (**Appendix 17.5** of this ES **[TR020001/APP/5.02]**) outlines requirements to process and treat former landfill waste for reuse. This provides an opportunity to remove potential sources of contaminants. Mitigation listed within best practice guidance and the	Very Low	Very low to High	Remediation of landfill provides a minor beneficial effect, not significant. Pollution prevention measures result in a negligible to Minor adverse effect, not significant	None required	Remediation of landfill provides a minor beneficial effect, not significant. Pollution prevention measures result in a negligible to Minor adverse effect, not significant

Impact	Embedded/Good Practice Mitigation	Magnitude	Receptor Sensitivity	Description of effect and significance	Additional Mitigation	Residual Effect
	CoCP **(Appendix 4.2** of this ES **[TR020001/APP/5.02])** will reduce the likelihood and magnitude of a pollution incident on the groundwater receptors documented in the baseline section above					
Assessment Phases 1, 2a and 2b Increase in water consumption during construction affecting local water supply network	Implementation of water consumption management and efficiency measures to reduce consumption are described in the CoCP (**Appendix 4.2** of this ES **[TR020001/APP/5.02]**). Consultation with Affinity Water on water supply requirements	Very low adverse	High	Minor adverse effect on the local water supply network resilience, not significant	None required	Minor adverse effect, not significant
Assessment Phases 1, 2a and 2b Changes to water quality in the River Lee, Luton	The CoCP (**Appendix 4.2** of this ES **[TR020001/APP/5.0**	Very low adverse	High *(River Lee)*	Minor adverse effect on water quality in the River Lee and	None required	River Lee and Hiz - Minor adverse

Impact	Embedded/Good Practice Mitigation	Magnitude	Receptor Sensitivity	Description of effect and significance	Additional Mitigation	Residual Effect
Hoo and River Hiz due to construction activities associated with Off-site Highway Interventions	**2]**) outlines the requirements for appropriate management and disposal of potentially polluted runoff during construction activities associated with the Off-site Highways Interventions		Medium *(River Hiz)* Low *(Luton Hoo lake)*	River Hiz, not significant. Negligible effect on water quality in the Luton Hoo, not significant.		effect, not significant Luton Hoo Lake - Negligible effect, not significant
Assessment Phase 1, 2a and 2b Indirect changes to water quality in the River Mimram as a result of changes to groundwater quality during construction	The Outline Remediation Strategy (**Appendix 17.5** of this ES **[TR020001/APP/5.02]**) outlines requirements to process and treat former landfill waste for reuse. This provides an opportunity to remove potential sources of contaminants. Mitigation listed within best practice guidance has been	Very low beneficial (remediation) Very low adverse (pollution)	High	Minor beneficial to minor adverse effect on Mimram, not significant	None required	Minor beneficial to minor adverse effect, not significant

Impact	Embedded/Good Practice Mitigation	Magnitude	Receptor Sensitivity	Description of effect and significance	Additional Mitigation	Residual Effect
	included in the CoCP (**Appendix 4.2** of this ES **[TR020001/APP/5.02]**) to reduce magnitude of a pollution incident on the groundwater receptors documented in the baseline section above (**Table 20.11**)					
Assessment Phases 1, 2a and 2b Increase in surface water flood risk due to construction activities	The CoCP (**Appendix 4.2** of this ES **[TR020001/APP/5.02]**) outlines the requirements for appropriate flood risk management measures to be implemented during construction to mitigate any potential increases in surface water flood risk	Very low adverse	High	Minor adverse effect on surface water flood risk receptors located in proximity to Proposed Development, not significant.	None required	Minor adverse effect, not significant
Assessment Phases 1, 2a and 2b	As outlined in the CoCP (**Appendix 4.2** of this ES	Very low	Medium	Minor adverse effect on existing	None	Minor adverse effect, not significant

Impact	Embedded/Good Practice Mitigation	Magnitude	Receptor Sensitivity	Description of effect and significance	Additional Mitigation	Residual Effect
Impacts to existing infrastructure during construction activities	**[TR020001/APP/5.02]**), services critical to the airport operations would be protected at all times during the construction works. All works will be carried out in accordance with the guidance provided by the HSE in their document HSG47 'Avoiding Danger from Underground Services' (Ref. 20.76). Existing utility networks will be located by the lead contractor through a utility survey in accordance with PAS128 (Ref. 20.77) (or equivalent standard applicable at the time), prior to start of intrusive works, and appropriate clearances will be			distribution network, not significant		

Impact	Embedded/Good Practice Mitigation	Magnitude	Receptor Sensitivity	Description of effect and significance	Additional Mitigation	Residual Effect
	clearly demarcated on the ground					
Operation						
Assessment Phases 1, 2a and 2b Impacts to aquifer, flowpaths and associated receptors (e.g. springs, GWDTE, abstractions etc) from works below the water table	Structures designed primarily above the water table to minimise disturbance of the aquifer and flow paths	Very Low	Very low to High	Negligible to Minor adverse effect, not significant	None required	Negligible to Minor adverse effect, not significant
Assessment Phases 1, 2a and 2b Impacts to aquifer, flowpaths and associated receptors (e.g. springs, GWDTE, abstractions etc) from infiltration tank point discharges (mounding)	DDS describes the design of the drainage system to attenuate peak flows and control discharge. System design based on 1 in 100 year flood event with 40% CC allowance. Water efficiency, rainwater harvesting and reuse of water from the WTP would be implemented to maximise water reuse as described in the DDS	Very Low	Very low to High	Negligible to Minor adverse effect, not significant	None required	Negligible to Minor adverse effect, not significant

Impact	Embedded/Good Practice Mitigation	Magnitude	Receptor Sensitivity	Description of effect and significance	Additional Mitigation	Residual Effect
	(**Appendix 20.4** of this ES **[TR020001/APP/5.02]**). Groundwater mounding has been assessed in the Hydrogeological Characterisation Report (**Appendix 20.3** of this ES **[TR020001/APP/5.02]**)					
Assessment Phases 2a and 2b Direct changes to quality of the aquifer as a result of installation of capping layer on extent of historic landfill affected by operation of assessment Phase 2a and 2b	The implementation of the capping layer on the historic landfill would minimise surface water infiltration into the underlying waste and prevent generation of future landfill leachate that could adversely impact the groundwater quality in the underlying aquifer	Very low beneficial	High	Minor beneficial effect on underlying aquifer, significant	None required	Minor beneficial effect, not significant

Impact	Embedded/Good Practice Mitigation	Magnitude	Receptor Sensitivity	Description of effect and significance	Additional Mitigation	Residual Effect
Assessment Phases 1, 2a and 2b Changes to groundwater quality as a result of the discharge of surface water to infiltration tanks	Surface water runoff will be subject to appropriate inline treatment prior to discharge to the untreated effluent infiltration tank, via petrol interceptors etc. Live monitoring of surface water runoff will identify contaminated surface which will be isolated and directed to the WTP	Very low adverse	High	Minor adverse effect on underlying aquifer, not significant.	None required.	Minor adverse effect, not significant.
Assessment Phases 2a and 2b Changes to groundwater quality as a result of the treated effluent discharge	Water treatment measures implemented at the WTP, with appropriate consented limits agreed with Environment Agency to ensure effluent does not affect the groundwater quality in the aquifer and associated receptors (see DDS **Appendix 20.4** of this ES	Very low adverse	High	Minor adverse effect on underlying aquifer, not significant.	None required.	Minor adverse effect, not significant.

Impact	Embedded/Good Practice Mitigation	Magnitude	Receptor Sensitivity	Description of effect and significance	Additional Mitigation	Residual Effect
	[**TR020001/APP/5.02**])					
Assessment Phases 1, 2a and 2b Increase in water consumption as a result of increase in passengers which would affect the local water supply	Water efficiency, rainwater harvesting and reuse of water from the WTP would be implemented to maximise water reuse as described in the DDS (**Appendix 20.4** of this ES **[TR020001/APP/5.02]**). Consultation with Affinity Water on water supply requirements	Very low adverse	High	Minor adverse effect on the local water supply, not significant.	None required.	Minor adverse effect, not significant.
Assessment Phases 2a and 2b Indirect change to water quality of the River Mimram as a result of changes to groundwater quality due to installation of capping layer on extent of historic landfill affected by operation of Assessment Phases 2a and 2b	The implementation of the capping layer on the historic landfill would minimise surface water infiltration into the underlying waste and prevent generation of future landfill leachate that could adversely impact the	Very low beneficial	High	Minor beneficial effect on water quality in the River Mimram, not significant	None required	Minor beneficial effect, not significant

Impact	Embedded/Good Practice Mitigation	Magnitude	Receptor Sensitivity	Description of effect and significance	Additional Mitigation	Residual Effect
	groundwater quality in the underlying aquifer					
Assessment Phases 1, 2a and 2b Changes to water quantity and quality in the River Mimram, River Lee and Luton Hoo as a result of point discharges to the ground at the proposed infiltration tanks	Water treatment measures implemented at the WTP, with appropriate consented limits agreed with Environment Agency (via the permitting process) to ensure effluent does not affect the groundwater quality in the aquifer and associated receptors (see DDS **Appendix 20.4** of this ES [**TR020001/APP/5.02]**) Surface water runoff will be subject to appropriate inline treatment prior to discharge to the untreated effluent infiltration tank, via petrol interceptors etc. Live monitoring	Very low adverse	High *(River Lee and River Mimram)* Low *(Luton Hoo)*	Minor adverse effect on water quality in the River Lee and River Mimram, not significant. Negligible effect on water quality in the River Lee, not significant.	None required.	Minor adverse effect, not significant. Negligible effect, not significant.

Impact	Embedded/Good Practice Mitigation	Magnitude	Receptor Sensitivity	Description of effect and significance	Additional Mitigation	Residual Effect
	of surface water runoff will identify contaminated surface which will be isolated and directed to the WTP					
Assessment Phases 1, 2a and 2b Changes to water quality in the River Lee, Luton Hoo and River Hiz due to Off-site Highway Interventions	The HEWRAT assessment has identified the requirement for additional surface water and pollutant management measures to manage impacts on water quality. These measures will be specified during detailed design in consultation with the relevant local authority and Environment Agency, pursuant to the surface and foul water drainage Requirement in Schedule 2 of the **draft DCO [TR020001/APP/2.01]**, to ensure	Very low adverse	High *(River Lee)* Medium *(River Hiz)* Low *(Luton Hoo lake)*	Minor adverse effect on water quality in the River Lee and River Hiz, not significant. Negligible effect on water quality in the Luton Hoo, not significant.	None required	River Lee and Hiz - Minor adverse effect, not significant Luton Hoo Lake - Negligible effect, not significant

Impact	Embedded/Good Practice Mitigation	Magnitude	Receptor Sensitivity	Description of effect and significance	Additional Mitigation	Residual Effect
	stakeholder feedback is taken into account.					
Assessment Phases 2a and 2b Localised increase in surface water catchments contributing to a point source infiltration (untreated effluent infiltration tank) as defined in the FRA (**Appendix 20.1** of this ES **[TR020001/APP/5.07]**). Large volume of water being directed to this feature may lead to groundwater mounding affecting the area local to the tank and as the mounding recedes the downstream characteristics may change leading to elevated groundwater levels at places such as Kimpton (affecting flood risk at Kimpton)	Infiltration tanks have been designed with consideration of maximum groundwater levels. This has been evaluated against the extreme rainfall event (1 in 100 year plus 40% climate change event) as outlined in the FRA (**Appendix 20.1** of this ES **[TR020001/APP/5.07]**). Groundwater mounding has been assessed in the Hydrogeological Characterisation Report (**Appendix 20.3** of this ES **[TR020001/APP/5.02]**	Very low adverse	High (Existing airport infrastructure) Medium (Kimpton)	Minor adverse effect on localised flooding of existing airport infrastructure and community in Kimpton, not significant.	None required.	Minor adverse effect, not significant.

Impact	Embedded/Good Practice Mitigation	Magnitude	Receptor Sensitivity	Description of effect and significance	Additional Mitigation	Residual Effect
Assessment Phases 2a and 2b Increase in surface water flood risk as a result of expansion of impermeable surface area	The drainage design for assessment Phases 2a and 2b has been designed to account for a 1 in 100 year flood event plus a 40% climate change allowance as described in the DDS (**Appendix 20.4** of this ES **[TR020001/APP/5.02]**)	Very low adverse	High	Minor adverse effect on surface water flood risk receptors, not significant.	None required.	Minor adverse effect, not significant.
Assessment Phases 2a and 2b Increased surface water flood risk for flood risk receptors located within close proximity to Off-site Highway Intervention works as defined in the FRA (**Appendix 20.1** of this ES **[TR020001/APP/5.07]**)	An appropriate drainage design will be implemented for each Off-site Highway Intervention in line with accepted highway design standards to ensure no unacceptable increases in flood risk. For a detailed assessment of impacts of flood risk please see FRA **(Appendix 20.1** of this ES	Very low adverse	High (M1) Medium (Local access roads) Low (Commercial properties on local access roads)	Minor adverse effect on high and medium value surface water flood risk receptors, not significant. Negligible effect on low value surface water flood risk receptors, not significant.	None required	Minor adverse effect, not significant. Negligible effect, not significant.

Impact	Embedded/Good Practice Mitigation	Magnitude	Receptor Sensitivity	Description of effect and significance	Additional Mitigation	Residual Effect
	[TR020001/APP/5.07])					
Assessment Phases 2a and 2b Increased surface water flood risk for flood risk receptors located within close proximity to AAR works as defined in the FRA (**Appendix 20.1** of this ES **[TR020001/APP/5.07]**)	An appropriate drainage design will be implemented for each Off-site Highway Intervention, pursuant to the surface and foul water drainage Requirement in Schedule 2 of the **draft DCO [TR020001/APP/2.01]**, which will be in line with accepted highway design standards to ensure no unacceptable increases in flood risk. For a detailed assessment of impacts of flood risk please see FRA (**Appendix 20.1** of this ES **[TR020001/APP/5.07])**	Very low adverse	Medium (Local access roads) Low (Commercial properties on local access roads)	Minor adverse effect on medium value surface water flood risk receptors, not significant. Negligible effect on low value surface water flood risk receptors, not significant.	None required.	Minor adverse effect, not significant. Negligible effect, not significant.

Impact	Embedded/Good Practice Mitigation	Magnitude	Receptor Sensitivity	Description of effect and significance	Additional Mitigation	Residual Effect
Assessment Phase 1 Localised increase in groundwater flooding at the central soakaway due to an increase in impermeable surfaces as defined in the FRA (**Appendix 20.1** of this ES **[TR020001/APP/5.07]**)	The DDS (**Appendix 20.4** of this ES **[TR020001/APP/5.02]**) identifies that there will be reduction in discharges to the central soakaway during assessment Phase 1	Very low beneficial	High (Existing airport infrastructure)	Minor beneficial effect on localised flooding of existing airport infrastructure in the vicinity of the central soakaway, not significant.	None required.	Minor beneficial effect, not significant.
Assessment Phase 1 Increase in discharge of foul water to the Thames Water network as a result of expansion of airport	The DDS (**Appendix 20.4** of this ES **[TR020001/APP/5.02]**) documents the attenuation of foul water during assessment Phase 1 to enable discharge to the Thames Water network during off-peak periods	Very low adverse	Medium	Minor adverse effect on the existing water infrastructure, not significant.	None required.	Minor adverse effect, not significant.

COMPETENT EXPERTS

Topic	Role	Company	Qualifications/competencies/experience of author
Water Resources	Technical reviewer	Arup	Chartered Geologist with 25+ years of experience working as a hydrogeologist. Led numerous teams of water specialists through the Environmental Impact Assessment process, evaluating the impact of development on the water environment and working with engineers to provide effective methods of environmental mitigation to protect and enhance water resources.
Water Resources	Author	Arup	A water and flood risk specialist with over seven years of experience in completing Environmental Impact Assessments and Flood Risk Assessments to assess the impact of infrastructure developments on the water environment. Obtained an MSc Qualification in Hydrology and Climate Change from the University of Newcastle.
Water Resources	Author	Arup	A hydrogeologist with 10 years' experience providing groundwater input into Environmental Impact Assessments. Chartered Geologist (hydrogeology specialism).

GLOSSARY AND ABBREVIATIONS

Term	Definition
AAR	Airport Access Road
ANPS	Airports National Policy Statement
AOD	Above Ordnance Datum
BGS	British Geological Society
BS	British Standard
CBC	Central Bedfordshire Council
central soakaway	Existing infiltration drainage feature located within the Main Application Site
CIRIA	Construction Industry Research and Information Association
CoCP	Code of Construction Practice
CSWMS	Construction Surface Water Management Strategy
DBC	Dacorum Borough Council
DCO	Development Consent Order
DDS	Drainage Design Statement
DMRB	Design Manual for Roads and Bridges
DQRA	Detailed Quantitative Risk Assessment
EIA	Environmental Impact Assessment
ES	Environmental Statement
FRA	Flood Risk Assessment
GI	Ground Investigation
GWDTE	Groundwater Dependent Terrestrial Ecosystems
HCC	Hertfordshire County Council
LBC	Luton Borough Council
LFRMS	Local Flood Risk Management Strategy
LLAOL	London Luton Airport Operations Limited
LLFA	Lead Local Flood Authority
Luton Rising	A trading name for London Luton Airport Limited, the owners of the airport
NHDC	North Hertfordshire District Council
northern soakaway	Existing infiltration drainage feature operated by Luton Airport located within the Main Application Site
NPPF	National Planning Policy Framework
NPSNN	National Planning Statement for National Networks
PFRA	Preliminary Flood Risk Assessment

Term	Definition
RoFSW	Risk of Surface Water Flooding
SAC	Special Areas of Conservation
SFRA	Strategic Flood Risk Assessment
SPA	Special Protection Areas
SPZ	Source Protection Zones
SuDS	Sustainable Urban Drainage Systems
SSSI	Site of Special Scientific Interest
SWMP	Surface Water Management Plan
WFD	Water Framework Directive
WTP	Water Treatment Plant
ZOI	Zone of Influence

REFERENCES

Ref. 20.1 HMSO (2021) Environment Act 2021 [online] [Accessed: 23 September 2022]
Ref. 20.2 Secretary of State (2015) *Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015*
Ref. 20.3 Secretary of State (2017) *Water Environment (WFD) (England and Wales) Regulation*
Ref. 20.4 Environment Agency (2015) River Basin Management Plans: 2015 Collection [online] [Accessed: November 2022]
Ref. 20.5 HMSO (2009) 2009 No. 3042 Environmental Protection. Flood Risk Regulations [online] [Accessed: 13 March 2019]
Ref. 20.6 Official Journal of the European Union (2007). Directive 2007/60/EC. On the assessment and management of flood risks. [online] [Accessed: 13 March 2019]
Ref. 20.7 HMSO (2010) Flood and Water Management Act [online] [Accessed: 13 March 2019]
Ref. 20.8 HMSO (2014). The Water Act [online] [Accessed: 13 March 2019]
Ref. 20.9 HMSO (1995) The Environment Act [online] [Accessed: 13 March 2019]
Ref. 20.10 HMSO (1991) Water Resources Act. [online] [Accessed: 13 March 2019]
Ref. 20.11 HMSO (2009) Water Industry Act (Amendment) (England and Wales) Regulations 2009
Ref. 20.12 HMSO (2003) Water Act 2003
Ref. 20.13 HMSO (2003) Water Resources (EIA) (England and Wales) Regulations 2003
Ref. 20.14 HMSO (2006) Water Resources (EIA) (England and Wales) Regulations 2006
Ref. 20.15 HMSO (2017) The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 [Accessed: 28 October 2021]
Ref. 20.16 HMSO (2019) Environmental Permitting (England and Wales) (Amendment) (EU Exit) Regulations 2019 [online] [Accessed: 23 September 2022]
Ref. 20.17 HMSO (2018) European Union (Withdrawal) Act 2018 [online] [Accessed: 30 November 2022]
Ref. 20.18 HMSO (2019) Environment (Amendment etc.) (EU Exit) Regulations 2019: Part 2 [online] [Accessed: 23 September 2022]
Ref. 20.19 HMSO (1990) Environment Protection Act 1990 [online] [Accessed: 23 September 2022]
Ref. 20.20 HMSO (2016) The Environmental Permitting (England and Wales) Regulations 2016[online] [Accessed: 30 November 2022]
Ref. 20.21 HMSO (2016) The Groundwater WFD (England) Direction 2016 [online] [Accessed: 30 November 2022]
Ref. 20.22 European Environment Agency (2006) EU Groundwater Directive 2006/118/EC [online] [Accessed: 30 November 2022]
Ref. 20.23 The Groundwater (England and Wales) Regulations 2009 No. 2902 [online] [Accessed: 13 March 2019]
Ref. 20.24 The Contaminated Land (England) Regulations (Amendment) 2012 [Accessed: 13 March 2019]
Ref. 20.25 Ministry of Housing, Communities & Local Government (2021) National Planning Policy Framework [online] [Accessed: 15 March 2019]
Ref. 20.26 Department for Transport (2014) National Policy Statement for National Networks. HMSO, UK
Ref. 20.27 Luton Borough Council (2017). Local Luton Plan 2011-2031 [online] [Accessed: 15th February 2019]
Ref. 20.28 CBC Local Plan (2015-2035) [online] [Accessed: 10 November 2021]
Ref. 20.29 North Hertfordshire District Council (NHDC) Local Plan for 2011-2031, November 2022 [online] [Accessed: 10 January 2022].
Ref. 20.30 DBC Core Strategy 2006 – 2031 [online] [Accessed: 8 Dec 2022].
Ref. 20.31 Department for Transport (2018) Airports National Policy Statement: new runway capacity and infrastructure at airports in the south-east of England (web version) [Accessed: 7 November 2019]
Ref. 20.32 Department for Transport (2018) Beyond the horizon, The future of UK aviation, Making best use of existing runways, June 2018. [online] [Accessed: 30 November 22].
Ref. 20.33 CIRIA (2015). C753 The SuDs Manual [online] [Accessed: 10 March 2019]
Ref. 20.34 Highways England (2019) LA 113: Road drainage and the water environment [online] [Accessed: 20 December 2019]
Ref. 20.35 Environment Agency (2016). Flood Risk Assessments: Climate Change Allowances. [online] [Accessed: 10 March 2019]
Ref. 20.36 Luton Borough Council (2015) Luton Water Cycle Strategy [online] [Accessed: 13 March 2019]

Ref. 20.37 Luton Borough Council (2012) Surface Water Management Plan [online] [Accessed: 13 March 2019]
Ref. 20.38 Luton Borough Council (2011) Luton Preliminary Flood Risk Assessment [online] [Accessed: 13 March 2019]
Ref. 20.39 Luton Borough Council (2013) Luton Level 1 SFRA update [online] [Accessed: 13 March 2019]
Ref. 20.40 Luton Borough Council (2015) Luton Borough Council Local Flood Risk Management Strategy [online] [Accessed: 13 March 2019]
Ref. 20.41 Central Bedfordshire Council (2011) Preliminary Flood Risk Assessment [online] [Accessed: 13 March 2019]
Ref. 20.42 Central Bedfordshire Council (2017) Preliminary Flood Risk Assessment addendum [online] [Accessed: 13 March 2019]
Ref. 20.43 Central Bedfordshire Council (2014) Local Flood Risk Management Strategy for Central Bedfordshire [online] [Accessed 13 March 2019]
Ref. 20.44 North Hertfordshire District Council (2008) North Hertfordshire District Council Strategic Flood Risk Assessment [online] [Accessed: 13 March 2019]
Ref. 20.45 Hertfordshire County Council (2017) Addendum to the Level 1 Strategic Flood Risk Assessment (SFRA) [online] [Accessed: 13 March 2019]
Ref. 20.46 Hertfordshire County Council (2019) Local Flood Risk Management Strategy 2019 – 2029 (LFRMS 2) [online] [Accessed: 8 Dec 2022]
Ref. 20.47 Hertfordshire County Council (2011) Preliminary Flood Risk Assessment [online] [Accessed: 13 March 2019]
Ref. 20.48 Dacorum Borough Council (2007) Dacorum Borough Council Strategic Flood Risk Assessment [online] [Accessed: 8 Dec 2022]
Ref. 20.49 Environment Agency (2018) Environment Agency Approach to Groundwater Protection
Ref. 20.50 Environment Agency (2001) National Groundwater and Contaminated Land Centre's report Piling and Penetrative Ground Improvements on Land Affected by Contamination: Guidance on Pollution Prevention (NC/99/73 2001)
Ref. 20.51 DEFRA (2021) Magic Map [online] [Accessed: 15 November 2021]
Ref. 20.52 Google (2021) Google Maps [online] [Accessed: 15 November 2021]
Ref. 20.53 Environment Agency (2021) Long term flood risk map [online] [Accessed: 10 November 2021]
Ref. 20.54 BGS (2021) Susceptibility to groundwater flooding
Ref. 20.55 BGS (2021) Geology of Britain viewer [online] [Accessed: 7 November 2021]
Ref. 20.56 Environment Agency (2020) Environment Agency Public register [online] [Accessed: 10 March 2019]
Ref. 20.57 UK Centre for Ecology & Hydrology (2021) National River Flow Archive [online] [Accessed: 15 September 2021]
Ref. 20.58 Environment Agency (2021) Environment Agency Catchment Data Explorer [online] [Accessed: 15 March 2021]
Ref. 20.59 Natural England (2021) Magic Map [online] [Accessed: 20 September 2021]
Ref. 20.60 UK Centre for Ecology & Hydrology (2022) Flood Estimation Handbook Web Service [online] [Accessed: 1 Dec 2022]
Ref. 20.61 River Lea Catchment Partnership (2014) Luton Hoo Lake Research [online] [Accessed 15th September 2022]
Ref. 20.62 Mott Macdonald (2019). EA Hertfordshire Groundwater Model. Document Ref. 378959/01/B
Ref. 20.63 British Standards Institute (2018) BS EN 16941-1:2018 On-site non-potable water systems. Systems for the use of rainwater
Ref. 20.64 CIRIA (2001) Control of water pollution from construction sites: Guidance for consultants and contractors (C532) [online] [Accessed: 10 September 2021]
Ref. 20.65 Environment Agency (2019) Pollution prevention for businesses [online [Accessed: 5 September 2021]
Ref. 20.66 Environment Agency (2021) Report an environmental incident [online] [Accessed: 7 September 2021]
Ref. 20.67 Environment Agency (2021) Discharges to surface water and groundwater: environmental permits [online] [Accessed: 3 September 2021]
Ref. 20.68 Environment Agency (2020) Oil storage regulations for businesses [online] [Accessed: 11 September 2021]

Ref. 20.69 Environment Agency (2021) Storing oil at your home or business [online] [Accessed: 12 September 2021]
Ref. 20.70 Environment Agency (2021) Septic tanks and treatment plants: permits and general binding rules [online] [Accessed: 14 September 2021]
Ref. 20.71 Environment Agency (2021) Check if you need permission to do work on a river, flood defence or sea defence [online] [Accessed: 11 September 2021]
Ref. 20.72 Environment Agency (2015) Manage water on land: guidance for land managers [online] [Accessed: 20 September 2021]
Ref. 20.73 Environment Agency (2017) Groundwater protection [online] [Accessed: 6 September 2021]
Ref. 20.74 Health and Safety Executive (2014) HSG47 Avoiding Danger from Underground Services. Health and Safety Executive.
Ref 20.75 British Standards Institution (2022) PAS128 Specification for underground utility detection, verification and location. London: BSI.
Ref. 20.76 Health and Safety Executive (2014) HSG47 Avoiding Danger from Underground Services. Health and Safety Executive.
Ref 20.77 British Standards Institution (2022) PAS128 Specification for underground utility detection, verification and location. London: BSI.