Statutory Consultation 2022

Preliminary Environmental Information Report

Volume 2: Main Report

Chapter 20: Water Resources and Flood Risk

Contents

Tables

20 WATER RESOURCES AND FLOOD RISK

20.1 Introduction

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

20.1.2 The EIA Scoping Report set out the proposed scope for the assessment of Water Resources and Flood Risk. In summary, the following have been assessed in this PEIR:

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 Volume 3 to this PEIR:

a. Preliminary Flood Risk Assessment (FRA) (**Appendix 20.1**);

b. Preliminary Water Framework Directive (Ref. 20.1) (WFD) Compliance Assessment (**Appendix 20.2**);

c. Hydrogeological Characterisation Report (**Appendix 20.3**); and

d. Drainage Design Statement (DDS) (**Appendix 20.4**).

20.1.4 The DDS which describes the proposed drainage design has informed this assessment and is provided in **Appendix 20.4** of Volume 3 to this PEIR. 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 in Volume 2 of this PEIR 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) is provided as **Appendix 17.2** of Volume 3 to this PEIR and provides an assessment of the risk of contamination from the landfill to the underlying groundwater resources.

20.1.6 **Chapter 17** and associated appendices 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 please see **Section 20.1**.

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 the Water Resources and Flood Risk preliminary assessment
b. **Section 20.3** Scope of the assessment
c. **Section 20.4** Stakeholder engagement undertaken to inform the preliminary assessment
d. **Section 20.5** Methodology applied to the preliminary assessment
e. **Section 20.6** Assumptions and limitations at this stage of work
f. **Section 20.7** Baseline conditions
g. **Section 20.8** Embedded and good practice mitigation
h. **Section 20.9** Preliminary assessment
i. **Section 20.10** Additional mitigation
j. **Section 20.11** Residual effects
k. **Section 20.12** In-combination climate change
l. **Section 20.13** Monitoring
m. **Section 20.14** Assessment summary
n. **Section 20.15** Completing the assessment - remaining work to complete the EIA for the Environmental Statement (ES)

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 the Water Resources and Flood Risk assessment which may 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 the PEIR.

Legislation

Table 20.1: Water Resources and Flood Risk legislation

Legislation	How and where addressed in PEIR
The Water Framework Directive (Standards and Classification) Directions 2015 (Ref. 20.1) and the Water Environment (England and Wales) Regulations 2017 (Ref. 20.2) transpose the EU WFD 2000 into law in England and Wales. The legislation sets out the need to ensure that 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 (20.2) have been applied to develop the assessment methodology described in the preliminary WFD Compliance Assessment provided in **Appendix 20.2** of the PEIR. This identifies the need for a detailed assessment in relation to the implementation of infiltration drainage to ensure the WFD status and/or future objectives of the groundwater body is not compromised.
The Flood Risk Regulations 2009 (Ref. 20.3) 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. 20.4) into law in England and Wales. The Flood and Water Management Act 2010) (Ref. 20.5) 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 (20.3) and Flood and Water Management Act 2010 (20.5) in relation to the management of flood risk for main rivers and ordinary watercourses have been applied to complete the preliminary FRA provided as **Appendix 20.1** of this PEIR and have informed the drainage design described in detail in the DDS (**Appendix 20.4**) and summarised in **Section 20.8** of this report.
The Water Act 2014, amending the Water Industry Act 1991 (Ref. 20.6) outlines the requirements regarding water and	The provisions regarding water industry infrastructure have been taken into account in the drainage design of the Proposed Development as described in the

Legislation	How and where addressed in PEIR
sewerage undertaker infrastructure, permitting and connections.	DDS (**Appendix 20.4**) and summarised in **Section 20.8** of this report. It has also informed the stakeholder engagement completed with the relevant water and sewerage undertakers summarised in **Section 20.4.**
Environment Act 1995 (Ref. 20.7) 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** of the PEIR. 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. 20.8) 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. 20.9) amends multiple articles in the Water Resources Act 1991. Water Act 2003 (Ref. 20.10) makes provisions with respect to compensation under Section 61 of the Water Resources Act 1991.	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 an overall water cycle strategy that will support the ES, which links water use and the drainage strategy together.
Water Resources (Environmental Impact Assessment (EIA)) Regulations 2003 (Ref. 20.) outline procedural requirements for EIAs in relation to water resources. Water Resources (EIA) (England and Wales) Regulations 2006 (Ref. 20.11) amends multiple articles in the Water Resources (Environmental Impact Assessment) Regulations 2003. Infrastructure Planning (EIA) Regulations 2017 (Ref. 20.12) 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 Water Resources and Flood Risk chapter (**Chapter 20**) of the PEIR. The Infrastructure Planning (EIA) Regulations 2017 also inform the content required in **Chapter 20**.

Legislation	How and where addressed in PEIR
The Environmental Permitting (England and Wales) Regulations 2016 (Ref. 20.13) 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 collated to allow permits to be gained in the future. Discussions are outlined in **Section 20.4**.
Groundwater WFD (England) Direction 2016 (Ref. 20.14) transposes the requirements of the EU Groundwater Directive 2006/118/EC and establishes quality standards for groundwater and introduces measures to prevent or limit inputs of pollutants to groundwater. Groundwater Regulations 2009 (Ref. 20.15) provides clarification on certain objectives of the EU Groundwater Directive 2006/118/EC to prevent prevention and control of groundwater pollution and establishes groundwater quality standards. The Contaminated Land (England) Regulations (Amendment) 2012 (Ref. 20.16) outlines specific requirements on the management of controlled waters as specified under the WFD.	The principles outlined in the Groundwater WFD Direction 2016, the Groundwater Regulations 2009 and The Contaminated Land Regulations 2011 related to the prevention of risks to groundwater have been applied in the completion of the Hydrogeological Characterisation Report and DQRA Risk Assessment (**Appendix 20.3 and Appendix 17.2**) and have informed the drainage design for the Proposed Development as described in DDS **(Appendix 20.4)**. They have also informed the preliminary WFD Compliance Assessment provided in **Appendix 20.2**.

Policy

Table 20.2: Water Resources and Flood Risk policy

Policy	How and where addressed in PEIR
Section 14 of the National Planning Policy Framework (NPPF), July 2021 (Ref. 20.17) 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 preliminary FRA provided as **Appendix 20.1** of the PEIR.
National Policy Statement for National Networks – December 2014 (NPSNN) (Ref. 20.18) The NPSNN sets out the need for, and Government's policies to deliver,	There are no elements of the Proposed Development that would be classified as a NSIP on the national road or rail network. However, the NPSNN remains a relevant consideration as works are proposed on the SRN at Junction 10 as part of the

Policy	How and where addressed in PEIR
development of nationally significant infrastructure projects on the national road and rail networks in England. It provides planning guidance for promoters of nationally significant infrastructure projects (NSIP) on the road and rail networks. The provisions of the NPSNN relevant to environmental assessment broadly mirror those as outlined in the ANPS.	Proposed Development. As provisions relevant to environmental assessment broadly mirror those as outlined in the ANPS they have been appropriately considered in this preliminary assessment. Further consideration of the proposals against relevant NPSNN policies will take place following this consultation and in preparation of the DCO application.
Policy LLP36 – Flood risk, Policy LLP37 – Climate change, carbon and waste reduction and sustainable energy and Policy LLP38 – Pollution and Contamination of the Luton Borough Council (LBC) Local Plan 2011-2031 (Ref. 20.19) 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 flood risk, water quality and climate which have informed the design of mitigation measures identified in in **Sections 20.8 and 20.10** of the PEIR. These objectives have also informed the assessment provided in the preliminary FRA (**Appendix 20.1**) and preliminary WFD Compliance Assessment (**Appendix 20.2**).
Central Bedfordshire Council (CBC) Local Plan 2035: Pre-submission, January 2018 (Ref. 20.20) includes policies on the river and waterway network and climate change and sustainability outline requirements for the management of water resources and flood risk.	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 measures identified in in **Sections 20.8 and 20.10** of the PEIR.
Central Bedfordshire Local Plan 2015-2035 July 2021 (Ref. 20.21) includes policies on waterways and rivers and climate change and sustainability aspects of flood risk management, water resources and water supply/sewerage infrastructure.	
Policy SP11 – Natural resources and Policy NE8 – Sustainable drainage systems in the North Hertfordshire District Council (NHDC) Proposed Submission Draft Local Plan for 2011-2031, October 2016 (Ref. 20.22) 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 measures identified in **Sections 20.8 and 20.10** of the PEIR. The use of SuDS has been implemented into the drainage design as described in the DDS (**Appendix 20.4**).

20.2.3 The Airports National Policy Statement (ANPS) (Ref. 20.23) 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.

20.2.4 Accordingly, whilst the ANPS does not have effect in relation to the Proposed Development, it 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 PEIR is provided within **Table 20.3**.

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

ANPS Section	How and where addressed in PEIR
Paragraphs 5.152-5.157 set out the approach to flood risk assessment that is relevant for airport development	The preliminary FRA has been completed in line with the requirements outlined in the ANPS and provided in **Appendix 20.1** of Volume 3 to this PEIR.
Paragraphs 5.158 to 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 to drainage design 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** and described in **Section 20.8** of the PEIR. The sequential approach has been applied in the completion of the preliminary FRA provided in **Appendix 20.1** of Volume 3 to this PEIR.
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."*	**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. A preliminary assessment of the impacts of the Proposed Development on water quality and water resources has been undertaken and is outlined in **Section 20.9.** A preliminary WFD Compliance Assessment has been completed, in line with methodology agreed with the

ANPS Section	How and where addressed in PEIR
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.	Environment Agency and outlined in the Scoping Report and is provided as **Appendix 20.2** of Volume 3 to this PEIR. An assessment of the cumulative effects of the Proposed Development on the water environment is provided in **Chapter 21** in Volume 2 of this PEIR.
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 the PEIR 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 (including WFD) has been provided in the preliminary WFD Compliance Assessment provided as **Appendix 20.2** of Volume 3 to this PEIR.

Guidance

Table 20.4: Water Resources and Flood Risk guidance

Guidance	How and where addressed in PEIR
Sustainable Drainage Systems Manual 2015 describes the current best practice in SuDs and provides technical and planning considerations for their design (Ref. 20.24).	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 the PEIR and to inform the design of mitigation measures described in **Sections 20.8** and **20.10** of the PEIR.
Design Manual for Roads and Bridges – LA113 Road drainage and the water environment 2020 (Ref. 20.25) sets out the	The DMRB guidance (LA113 2020) has been utilised to develop the methodology described in **Section 20.5** of the PEIR.

Guidance	How and where addressed in PEIR
requirements for the assessment and management potential impacts on the water environment for highway projects.	The assessment of the impact of the 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. 20.26) 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** and the drainage design as described in **Section 20.8** of the PEIR.
Luton Water Cycle Strategy 2015 (Ref. 20.27) provides baseline information and requirements on the management on the management of water resources within Luton Borough Council.	The principles and requirements outlined in the Luton Water Cycle Strategy have been applied in completing the DDS for the Proposed Development provided as **Appendix 20.4** in Volume 3 to this PEIR.
Luton Surface Water Management Plan (SWMP) 2012 (Ref. 20.28) 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 flood documentation has been applied in the completion of the FRA provided as **Appendix 20.1** in Volume 3 to this PEIR and has informed the identification of mitigation measures (including SuDs) to manage the impacts of the Proposed Development on flood risk in **Sections 20.8 and 20.10** of the PEIR.
Luton Preliminary Flood Risk Assessment (PFRA) 2011 (Ref. 20.29) provides a description of existing flood risk in Luton and the potential impacts of climate change.	
Luton Level 1 Strategic Flood Risk Assessment (SFRA) update (Ref. 20.30) 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. 20.31) provides a description of existing flood risk in Luton and guidance considering flood risk in planning for new developments, emergency planning and flood risk mitigation.	
CBC Preliminary Flood Risk Assessment (PFRA) 2011 (Ref. 20.32) 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. 20.33) to	

Guidance	How and where addressed in PEIR
update the assessment of risk outlined in 2011.	
CBC LFRMS 2014 (Ref. 20.34) provides an overview of how flood risk should be managed and assessed in Central Bedfordshire.	
NHDC SFRA 2008 (Ref. 20.35) 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.	
HCC SFRA Addendum 2017 (Ref. 20.36) provides an overview of existing flood risk in Hertfordshire and guidance on the completion of FRAs using the Sequential Test.	
HCC LFRMS 2017 (Ref. 20.37) provides an overview of how flood risk should be managed and assessed in Hertfordshire.	
HCC PFRA 2017 (Ref. 20.38) provides a description of existing flood risk in Hertfordshire and the potential impacts of climate change.	
Environment Agency Approach to Groundwater Protection 2018 (Ref. 20.39).	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 **(Appendix 17.2).**
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. 20.40).	

20.3 Scope of the assessment

20.3.1 This section describes the scope of the 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 Volume 3 to this PEIR.

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** in Volume 3 of this PEIR.

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 PEIR. Final responses to all comments received during Scoping will be provided in an appropriate format in the ES.

Table 20.5: Water Resources and Flood Risk Scoping Opinion comments

Scoping Opinion ID	Scoping Opinion comment	How is this 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 preliminary FRA, **Appendix 20.1** in Volume 3 to this PEIR due to the potential for local groundwater mounding associated with the infiltration tank for untreated effluent included as part of the Proposed Development 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 and WFD (Standards and Classification) Directions 2015 are described in **Section 20.2** of this chapter and in the preliminary WFD Compliance Assessment provided as **Appendix 20.2** in Volume 3 of this PEIR.

Scoping Opinion ID	Scoping Opinion comment	How is this addressed
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 ZOI for the water resources assessment is described in **Section 20.3** of this chapter.
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 is provided in the DDS provided as **Appendix 20.4** in Volume 3 to this PEIR. A summary of this information is provided in **Section 20.7** 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 EA.	A Hydrogeology Characterisation Report and DQRA have been completed and are provided as **Appendices 20.3 and 17.2** respectively, in Volume 3 of this PEIR. The Hydrogeology Characterisation Report and DQRA describe the existing groundwater conditions of the Proposed Development and provides a detailed assessment of the risk of contamination from the landfill to the underlying groundwater utilising Consim modelling. The methodology applied in these appendices has been agreed in consultation with the Environment Agency (see **Section 20.4**). A preliminary assessment of the impact of the Proposed Development on all groundwater receptors has been undertaken in the PEIR based on the successful implementation of the Draft CoCP (**Appendix 4.2**) and DDS (**Appendix 20.4**). The key outcomes of these assessments are summarised in

Scoping Opinion ID	Scoping Opinion comment	How is this addressed
		Sections 20.7 (paragraphs **20.7.8-20.7.36**), **20.8** (e.g. paragraph **20.8.11**) and **20.9** (e.g. paragraphs **20.9.3-20.9.5**) of this chapter and in **Chapter 17** Soils and Geology of this PEIR.
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 EA.	A preliminary assessment of the impact of the Proposed Development on all groundwater receptors has been undertaken in the PEIR based on the successful implementation of the CoCP (**Appendix 4.2**) and DDS (**Appendix 20.4**). Efforts have been made and are ongoing to agree assessment methodologies. A detailed assessment to identify any potential impacts to groundwater flow patterns beneath the Proposed Development and impacts to receptors associated with the underlying aquifer, arising from the Proposed Development will be undertaken to support the ES.
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, 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	The approach to defining the existing baseline, the assessment undertaken to inform this PEIR are outlined in **Section 20.5**. Efforts have been made and are ongoing to agree assessment methodologies. The proposed surface and foul water drainage design including the methods of treatment and disposal are described in **Appendix 20.4** in Volume 3 to this PEIR and outlined in **Section 20.8.** 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). This plant will also accept effluent from the terminal and other buildings. The WTP will enable

Scoping Opinion ID	Scoping Opinion comment	How is this addressed
	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 EA. 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.	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. In addition, hydrogeological assessment is underway to take account of the considerations raised. This design has been discussed with the Environment Agency and the final design will be supported by the results of groundwater quality modelling to support the Hydrogeological Risk Assessment required to support the ES, which in turn will be used in the permitting process.
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.	Connections are to be identified following the confirmation of the drainage design for the Off-site Highway Interventions. Engagement with National Highways is ongoing and will continue as further details are developed and agreed.
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 (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 preliminary FRA (**Appendix**

Scoping Opinion ID	Scoping Opinion comment	How is this addressed
		20.1) and **Section 20.9** of this chapter of the PEIR. Consultation and baseline data collection, regarding potable water distribution network infrastructure, will continue to support the ES and during detailed design, following granting of development consent.
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 of the PEIR and the preliminary WFD Compliance Assessment (**Appendix 20.2**).
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 will 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 will then be collected and transported off site for appropriate treatment and disposal. This water will not be treated within the on-site WTP and so will not be discharged to ground.
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 a construction stage surface water management strategy is to be prepared by the lead contractor. The principles to be followed are included in the Draft Code of Construction Practice (CoCP) provided as **Appendix 4.2** in Volume 3 to this PEIR.
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	**Figures 20.1-20.5** provided in Volume 4 to this PEIR and referenced in **Section 20.7**

Scoping Opinion ID	Scoping Opinion comment	How is this addressed
	supported by clear figures to depict these waterbodies.	includes identification of the River Mimram and the River Lee. Ippolitts Brook is no longer considered a receptor as the proposed 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 of affecting the River Hiz. Therefore, **Figures 20.1 – 20.5** provided in Volume 4 to accompany this PEIR now include this watercourse.
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 preliminary assessment of the flood risk has not identified any potential impacts on human health. A detailed assessment of the impacts of the Proposed Development on groundwater quality will be undertaken to inform the ES. This will be supported by a Hydrogeological Risk Assessment that will form an appendix to **Chapter 20** Water Resources and Flood Risk of the ES. This assessment takes account of impacts to human health through the use of human health based water quality and drinking water standards in the methodology for assessment of effects. The DQRA provides an assessment of the risk of contamination from the landfill to the underlying aquifer and considers human health. The DQRA is provided as **Appendix 17.2** in Volume 3 to this PEIR.

Spatial scope

20.3.5 The spatial scope for the 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** in Volume 4 to this PEIR.

20.3.6 A 1km radius was selected as this adequately captures all water resource and flood risk features and their associated receptors with the potential to be directly and indirectly affected by the Proposed Development. 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 and ground water features and the Proposed Development (see **Figure 20.1** in Volume 4 to this PEIR). This approach captures all water resources and flood risk receptors affected by the Main Application Site and the off site proposals.

Study area

20.3.7 As identified in **Section 20.3.5** and **Section 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.

20.3.8 The water environment within this 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, agricultural abstractions. There are also licensed discharges of water to the groundwater regime. Finally, the groundwater regime supports a number of local habitats.

20.3.9 Groundwater from the aquifer, issues to one of 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.

20.3.10 The Proposed Development includes a number of interventions at locations throughout the highway networks. These are 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 in Hitchin at the Upper Tilehouse Road and Stevenage Road roundabout junctions require the inclusion of the Ippolitts Brook as a surface water receptor. Further details of these locations is provided in **Chapter 4** Proposed Development in Volume 2 of this PEIR. The Off-site Highway Interventions do not require any additional groundwater receptors to be included.

Zone of influence

20.3.11 The Zone of Influence (ZOI) 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 **Sections 20.3.5** and **20.3.6**, and is more precautionary to ensure all development with the potential to have cumulative impact on the underlying aquifer is considered.

20.3.12 It should be noted that the developments being considered in the cumulative assessment will be subject to further screening before they are assessed in terms of water resources and flood risk.

20.3.13 The preliminary cumulative effects assessment is provided in **Chapter 21** In-Combination and Cumulative Effects Assessment in Volume 2 of this PEIR.

Temporal Scope

20.3.14 The Proposed Development will be delivered in two phases over approximately 18 years, therefore three assessment phases are considered, Phases 1, 2a and 2b as described in **Table 5.3** in **Chapter 5**, during which construction and operation may take place simultaneously.

20.3.15 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 3 years); and
d. permanent.

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

Receptors

20.3.17 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;
d. discharges to groundwater and surface water resources;
e. habitats and ecosystems related to the groundwater and surface water resources; and
f. existing sewerage and water supply infrastructure.

Matters scoped in

20.3.18 The EIA Scoping Report 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, Source Protection Zones (SPZs) and water resources, surface water flood risk and existing water infrastructure and assets (foul, combined and surface water sewerage).

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

20.3.20 The preliminary assessment also includes the existing public and private water supply infrastructure.

Matters scoped out

20.3.21 The Preliminary FRA (**Appendix 20.1** in Volume 3 of this PEIR) 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 the PEIR.

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 (Sustainable Places and associated technical specialists and National Permitting Service)

b. The Lead Local Flood Authorities (including representatives from Luton Council, Central Bedfordshire District Council and Hertfordshire County Council)

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 and in advance of the 2019 statutory consultation. Engagement has then continued following the 2019 PEIR in order to inform the design of the Proposed Development and this PEIR.

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 The **2019 Statutory Consultation Feedback Report** contains a full account of that 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 the 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.

20.4.7 **Table 20.6** provides a summary of engagement with relevant stakeholders, undertaken to inform the PEIR to date, 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. Landslide 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 to be employed in the EIA Scoping Report.
DDS update meeting 1 18 October 2018	LLFAs and Thames Water	Update provided on landslide DDS. Agreement that volume of storage provided in DDS is sufficient. Confirmation from LBC of their expectation that a Water Cycle Strategy be prepared and that this should be provided with the 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 permitting team is required to confirm approach to discharge permits.

Meeting name and date	Attendees (organisation)	Summary of discussion
Detailed risk assessment 1 July 2019	Environment Agency	Update provided on the findings of the 2018/2019 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 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 discharge to Thames Water network can be considered as part of the Proposed Development.
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	Affinity Water	Update provided on DDS and overview of Hydrogeological Risk Assessment provided.

Meeting name and date	Attendees (organisation)	Summary of discussion
Meeting – Drainage (2) 16 March 2020		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) 10 September 2020	Affinity Water	Update provided on DDS to address queries from Affinity 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 submission with the ES. Environment Agency encourage the Proposed 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

Meeting name and date	Attendees (organisation)	Summary of discussion
		surface water to the Thames Water network.

20.4.8 Stakeholder engagement will continue as the Proposed Development progresses and will include further meetings with the Environment Agency, LLFA, Affinity Water and Thames Water to discuss the preliminary assessments as informed by this PEIR and next steps towards submission of the ES as part of the application for 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 was determined by identifying the surface water and groundwater features located within the Main Application Site and within 1km of the Main Application site.

20.5.3 This spatial scope has then been 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.

20.5.4 The spatial scope has then been 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 **Figure 20.1** in Volume 4 to this PEIR).

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

a. Ordnance Survey mapping (Ref. 20.41);
b. topographical survey data (see **Chapter 17**);
c. Google maps (Ref. 20.42);
d. Environment Agency mapping data sets (Flood Zones, Risk of Flooding from Rivers and Sea (RoFRS), Risk of Flood from Surface Water (RoFSW) (Ref. 20.43) and Groundwater susceptibility mapping (Ref. 20.44);
e. British Geological Survey (BGS) geological and hydrogeological maps and the webviewer (Ref. 20.45);
f. ground investigation reports and interpretive reports (see **Chapter 17**);
g. Environment Agency public register (Ref. 20.46) for information on Environment Agency permits; and
h. asset location plans of existing sewerage and water supply infrastructure (See DDS, **Appendix 20.4**).

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. 20.43), Groundwater susceptibility mapping data sets (Ref. 20.44) 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. 20.47);
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. 20.48);
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. 20.49);
d. aquifer status, as designated by the Environment Agency and British Geological Survey and represented on the 1:50,000 Aquifer Designation maps. This information is available from the UK governments' magic map data source (Ref. 20.49);
e. the Environment Agency Source Protection Zone 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. 20.49);
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);
g. the status and relationship of any habitats dependent upon the underlying groundwater as identified on UK governments' magic map data source (Ref. 20.49); 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. 20.46);

20.5.9 The attributes outlined in **Section 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**. 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. 20.17) 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. 20.25).

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 the PEIR 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. Groundwater locally supports Groundwater Dependent Terrestrial Ecosystems (GWDTE). Source Protection Zone (SPZ) 1.

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

		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} ≤ 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. The future baseline considered for Water Resources and Flood Risk is described **Section 20.7** of this chapter.

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. 20.25); this is shown in **Table 20.8**.

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

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. 20.43).

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.

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 will 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 will 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 3 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 half of a WFD cycle (6 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 preliminary 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**) as The assessment examines the potential impacts associated with all phases of the Proposed Development with

a specific focus on the drainage strategy as described in the DDS (**Appendix 20.4).**

20.5.30 The preliminary FRA (**Appendix 20.1**) has examined impacts to existing surface water and groundwater catchments imposed by the proposed drainage strategy for the Main Application Site. The preliminary 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 preliminary WFD Compliance Assessment (**Appendix 20.2**) applies a specific WFD assessment methodology (different to that applied to this PEIR 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 preliminary assessment. The WFD assessment methodology has been agreed with the Environment Agency (see **Table 20.6**).

20.5.32 The proposed highway interventions have been screened in terms of the scope and scale of the works proposed. The key factor is the potential for there to be a change in the area of hardstanding. The works have also been examined in terms of their impact on local traffic flow numbers compared to existing. These two factors have been taken into account to determine the following:

a. the need for additional analysis such as application of National Highways water quality assessment tool (HEWRAT) as described in LA113 to inform the ES; and

b. the likely scale of drainage improvements to be incorporated into the detailed design stage.

20.6 Assumptions and limitations

20.6.1 This section provides a description of the assumptions and limitations to the water resources 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 British Geological Society (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 ground investigation and the existing 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 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 the existing drainage layout and surface water catchments have not been substantially altered by works currently being undertaken by the current airport operators.

20.6.8 The proposed water quality monitoring system proposed as part of the surface water management system, as outlined in the DDS (**Appendix 20.4**) will operate as specified and be appropriately maintained.

20.6.9 The WTP proposed as part of the overall water management system, as outlined in the DDS (**Appendix 20.4**) will operate as specified and be appropriately maintained.

20.6.10 The water reuse and rainwater harvesting systems proposed as part of the overall water management system, as outlined in the DDS (**Appendix 20.4**) will operate as specified and be appropriately maintained.

20.6.11 The operation of the fire training ground will preclude any water, contaminated by materials related to fire training, reaching the surface water management system for the other areas of the airport.

20.6.12 It is assumed that all required Environment Agency environmental permits and consents from Thames Water will be successfully secured prior to each phase of construction and operation.

20.6.13 It is assumed that stakeholder engagement will continue throughout the construction and operation phases of the Proposed Development and that

future requirements from stakeholders will be incorporated as appropriate by the responsible party.

20.6.14 The requirements of the Draft CoCP, provided as **Appendix 4.2** in Volume 3 to this PEIR, and the other good practice activities outlined in **Section 20.8** will be implemented by the lead contractors.

Reasonable Worst Case

20.6.15 **Chapter 5** Approach to the Assessment describes the general approach adopted to ensure that a reasonable worst case is assumed in this assessment including the use of parameters, accounting for uncertainty, and incorporating flexibility in design and demand forecasts.

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

a. the DDS (**Appendix 20.4**) considers how the system will operate during a failure of the treatment facilities 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. the Hydrogeological Risk Assessment (to be provided with the ES) will consider a worst case scenario by evaluating the impact if there is no water quality treatment in place.

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** in Volume 4 to this PEIR 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 PEIR and all supporting documentation, Lee will be applied), surface water discharge consents, and fluvial and surface water flood zones (**Figure 20.1 and Figure 20.3**). The key groundwater features include the underlying aquifer, groundwater discharges and abstractions and SPZs (**Figure 20.2**). 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** in Volume 4 to this PEIR.

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. 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.**Error! Bookmark not defined.**).	High

	In 2019 WFD classification, Cycle 2, classified as achieving a Bad WFD status with target to achieve Good by 2027 (Ref. 20.48). 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. 20.47) 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	
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. 20.48). In 2019 WFD classification, Cycle 2, achieved a Moderate WFD status with the target to achieve Moderate by 2015 which it achieved (Ref. 20.48). Q95 is reported in the NRFA (Ref. 20.48) as 0.014 m^3/s at Whitwell gauging station. This low value is assumed to reflect its dependence on groundwater for baseflow and the modification of the groundwater regime by abstraction and so the importance has been based on its chalk stream designation.	High
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). The River Hiz a tributary if 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.	Medium

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

	Designated under the WFD as the Hiz (through Hitchin) (WFD ID: GB105033037680) (Ref. 20.48) 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. 20.47) as 0.003 m^3/s at Hitchin gauging station.	

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** in Volume 3 of this ES.

20.7.7 Seven surface water discharge consents are located within the study area. All of these discharge consents are to the River Lee and all consents are regulated by Thames Water.

Groundwater features

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

20.7.9 Further details on the bedrock aquifer and superficial deposits are provided in the Hydrogeological Characterisation Report provided as **Appendix 20.4** in Volume 3 to this PEIR.

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 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, an intermittent stream flowing from a spring. Within the study area, identified as main water bearing strata and most important aquifer unit in the Thames Basin supplying potable water for public consumption. Designated WFD groundwater body (Upper Lee Chalk) (WFD ID: GB40601G602900) (Ref. 20.48). 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. 20.48).	High
Superficial deposits	Clay-with-Flints Formation underlies majority of Main Application Site and is designated as unproductive stratum by the Environment Agency.	Low

[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*'.

	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.	
Groundwater abstractions and associated SPZs	A number of licensed groundwater abstractions located in the study area which abstract water from the chalk aquifer. These are for industrial and public water supply. Their approximate locations are shown on **Figure 20.2** in Volume 4 of this PEIR. The two most notable abstractions are for public water supply. One of these is in the vicinity of Kings Walden (approximately 1km to the north east of the Main Application Site) and the other at Nine Wells located approximately 4.5km to the east of Main Application Site. They are operated by Affinity Water. The north west of the Main Application Site is located within the total catchment SPZ associated with these abstractions. There are two further public water supply abstractions in the vicinity of the airport. On south of East Hyde in the vicinity of the River Lee. The total catchment SPZ associated with this abstraction is approximately 400m south of the existing airport. Finally there is abstraction in Luton itself. The total catchment SPZ for all the abstractions local to the airport merge and so the north western corner of the Main Application Site can be considered within the total catchment SPZ for the abstraction within Luton as well as within the abstractions to the south and east. 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.	High

	There are four private groundwater abstractions in locations where there is potential hydraulic connectivity with the Main Application Site. Their approximate locations are shown on **Figure 20.2** in Volume 4 of this PEIR. It is assumed they are for potable uses.	
Groundwater-surface water interactions	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.	All High
Groundwater dependent terrestrial ecosystems	Woodland at Netherfield Spring Woodland at Birch Spring Woodland at Slipe Spring Woodland at Diamond End Spring (represented by the Diamond End, Limekiln Wood and Pondcroft Local Wildlife Site Woodland at Deacons Spring Woodland at Long Toms Spring Batsford Spring Local Nature Reserve	All High
Discharge consents	Fourteen consents. Their approximate locations are shown on **Figure 20.2** in Volume 4 of this PEIR.	All Low

Groundwater flow

20.7.10 The hydrogeological map of the area and monitoring of regional groundwater levels in the area 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 Proposed Development to the east of the existing airport is located within the River Mimram catchment.

20.7.11 As identified in the Hydrogeological Characterisation Report (**Appendix 20.3**), 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.

20.7.12 In addition, the presence of the existing infiltration basins in the existing airport can cause local increases in groundwater level also known as 'doming'. 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)**.

Groundwater level

20.7.13 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. Further details on borehole locations and monitoring data are provided in the DQRA (**Appendix 17.2**). Further details on the baseline hydrogeological conditions are provided in the Hydrogeological Characterisation Report provided as **Appendix 20.3** in Volume 3 to this PEIR. .

20.7.14 Monitoring completed indicates that the groundwater levels beneath the former landfill range between 105m AOD and 115mAOD, at a depth of approximately 30 metres Below Ground Level (mBGL) to 45mBGL. The highest groundwater level recorded 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 the DQRA, **Appendix 17.2**). 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.

20.7.15 Groundwater levels beneath the landfill have been identified as showing seasonal variability of up to 7.6m and also varied 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 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 Vale of St Albans (VoSA) hydrogeological model (Ref. 20.50) that covers the Luton area.

Groundwater Quality

20.7.16 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.

20.7.17 The DQRA prepared for the Proposed Development provides a detailed account of the existing groundwater quality and is provided in **Appendix 17.2** of Volume 3 to this PEIR. The WFD Compliance Assessment (**Appendix 20.2**)

provides a more detailed description of the WFD status of the underlying aquifer.

20.7.18 The DQRA indicates that the concentration of contaminants of concern, result in relatively few exceedances, in comparison to the number of samples tested as part of the soil analysis undertaken for the Proposed Development, when viewed against the Environmental Quality Standard (EQS) for the contaminants monitored. Exceedances recorded in groundwater beneath the Proposed Development site were mainly for polyaromatic hydrocarbons and metals.

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

20.7.20 The DQRA did identify that contamination of the chalk aquifer in the vicinity of Luton by chlorinated solvents and a wide variety of contaminants (including nitrate, ammonia, pesticides, bromate, hydrocarbons and solvents) have been detected 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 River Lee.

Flooding

Fluvial flooding (Flooding associated with rivers and streams)

20.7.21 The preliminary FRA (**Appendix 20.1**) demonstrates that the Main Application Site is located within Flood Zone 1 as shown in **Figure 20.1** of Volume 4 to this PEIR.

20.7.22 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 Gyratory; and

b. A1081 New Airport Way / B653 / Gipsy Lane.

20.7.23 None of the other Off-site Highway Interventions are within 50m of a river or stream.

Surface water flooding

20.7.24 The Environment Agency's RoFSW shown on **Figure 20.3** in Volume 4 to this PEIR 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 Airport Approach Road.

20.7.25 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.

20.7.26 The following locations of proposed Off-site Highway 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 Way 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.

20.7.27 There are also areas of surface water flood risk associated with the Airport Access Road (AAR) required as part of the Proposed Development:

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

20.7.28 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.

20.7.29 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.

20.7.30 The LBC LFRMS (Ref. 20.31) 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 Lead Local Flood Authority, as a location where groundwater flooding could occur at surface.

20.7.31 The NHDC SFRA (Ref. 20.36) identifies incidents of historical groundwater flooding within the dry valleys located approximately 500m south east of the Proposed Development 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.

20.7.32 The CBC PFRA (Ref. 20.33) 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.

20.7.33 HCC's PFRA (Ref. 20.38) and SFRA (Ref. 20.36) 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.

20.7.34 Furthermore, the PFRA (Ref. 20.38) 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 in particular, Kimpton in North Hertfordshire and an area to the north east of St Albans between Sandridge and Jersey Farm.

20.7.35 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 Proposed Development. 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 Volume 3 to this PEIR.

Flood risk receptors

20.7.36 **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	Source of flooding	Importance value (as described in Annex 3 of the NPPF (Ref. 20.17)
Existing airport infrastructure	Surface water	High (Essential infrastructure)
M1	Surface water	High (Essential infrastructure)
Kimpton (Residential properties and roads)	Groundwater	Medium (More vulnerable development)
Windmill Road	Fluvial flooding from River Lee Surface water	Medium (More vulnerable development)
Crawley Green Road	Fluvial flooding from River Lee Surface water	Medium (More vulnerable development)
Kimpton Road	Surface water	Medium (More vulnerable development)
Wigmore Lane	Surface water	Medium (More vulnerable development)
Raynham Way	Surface water	Medium (More vulnerable development)
Eaton Green Road	Surface water	Medium (More vulnerable development)
Lalleford Road	Surface water	Medium (More vulnerable development)
Frank Lester Way	Surface water	Medium (More vulnerable development)
Pirton Road	Surface water	Medium (More vulnerable development)
Offley Road	Surface water	Medium (More vulnerable development)
Upper Tilehouse Street	Surface water	Medium (More vulnerable development)

A505 Park Way	Surface water	Medium (More vulnerable development)
Access road to Eaton Green Recycling Centre	Surface water	Medium (More vulnerable development)
Provost Way	Surface water	Medium (More vulnerable development)
A1081 Airport Way	Surface water	Medium (More vulnerable development)
Agricultural and park land	Surface water	Low (Less vulnerable development)
Commercial properties on Windmill Road, St Mary's Road and Crawley Green Road	Surface water	Low (Less vulnerable development)
Commercial properties to the north of A1018 Airport Way	Surface water	Low (Less vulnerable development)

Existing water infrastructure

20.7.37 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 Volume 3 to the PEIR.

20.7.38 The surface water generated on the Main Application Site is currently captured by a pipe network owned and operated by Veolia Water. 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 discharges into the River Lee. Whether the water is discharged to the existing soakaways or the public surface water drainage network is dependent on the catchment.

20.7.39 The pipe network, the linkages to the public drainage systems and the existing soakaway features are described in detail in the preliminary FRA (**Appendix 20.1**) and the DDS **(Appendix 20.4)** of Volume 3 to the PEIR.

20.7.40 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.

20.7.41 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.

20.7.42 Contaminated runoff from the fire training ground is collected in an isolated system and tankered off-site for treatment.

20.7.43 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.

20.7.44 Further detail on all existing water infrastructure has been provided in the FRA in **Appendix 20.1** of Volume 3 to this PEIR.

20.7.45 Existing infrastructure affected by the Proposed Development is assigned a medium importance value based on the criteria in section **20.5.10.**

Future baseline

20.7.46 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 PEIR.

20.7.47 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 and National Highways future investment strategy and the impacts of climate change.

20.7.48 These highway interventions are assumed to be delivered, and present 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 preliminary assessment. The FRA (**Appendix 20.1**) has also accounted for the potential impacts of the highway interventions on fluvial and surface water flood risk.

20.7.49 Climate change is projected to result in changes to local precipitation patterns and increase the risk of extreme weather events (e.g. flooding) as well as increasing temperatures. **Chapter 9** Climate Change Resilience 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 PEIR.

Embedded

Assessment Phase 1

20.8.2 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 prepared for the Proposed Development provided in **Appendix 20.4** in Volume 3 of this PEIR.

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

20.8.4 A rainwater harvesting system will be introduced to allow roof water from T1 to be used as a non potable water source. The rainwater will be stored and subject to treatment to ensure the quality is fit for the intended non-potable use. Preliminary treatment will 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. 20.51).

20.8.5 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 Overview Layout plan for Phase 1 provided in the DDS (**Appendix 20.4**).

20.8.6 Surface water discharge from the new car park (P6) will discharge to the Thames Water surface sewerage network as shown in Overview Layout plan for Phase 1 provided in the DDS (**Appendix 20.4**). Petrol interceptors and treatment to remove residual hydrocarbons, silts and heavy metals will 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**). It is thought that the Thames Water network in this area connects into a Thames Water owned infiltration feature located to the south of the roundabout at the Eaton Green Road/Wigmore Lane junction. This discharges surface water to the underlying aquifer. Therefore, directing the water generated by this car park to the Thames Water network and onto the existing infiltration basin maintains the catchment contributing to the underlying aquifer.

20.8.7 As T1 expands from 18 mppa, foul water discharge to the Thames Water network will increase which will be facilitated by upgrades to the network as discussed and agreed with Thames Water.

Assessment Phases 2a and 2b

20.8.8 The proposed drainage system to be implemented for construction Phase 2 is described in detail in the DDS prepared for the Proposed Development provided in **Appendix 20.4** in Volume 3 of this PEIR. The descriptions are supported by Overview Layout plans, also provided in the DDS **(Appendix 20.4)**

20.8.9 The main drainage infrastructure for the Proposed Development will be installed in Phase 2a of the Proposed Development. This will include the installation of the new WTP, attenuation tanks and two infiltration tanks for the Proposed Development. The two infiltration tanks consist of a large infiltration tank for ‘untreated’ surface water and a smaller 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.

20.8.10 The new drainage system will include real-time monitoring of contaminant level and volume to determine if 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 treated effluent infiltration tank; as shown in the Overview Layout plans for Phases 2a and 2b provided in the DDS (**Appendix 20.4**).

20.8.11 The WTP will consist of a single plant that encompasses two treatment processes - one process for sewage load from the proposed T2 building and a second process for surface runoff which will include treatment of de-icing agents. The treatment processes to be implemented at the WTP are described in detail in the DDS (**Appendix 20.4**). The design of the treatment processes

have been informed by the Hydrogeological Characterisation Report (**Appendix 20.3**) in consultation with the Environment Agency.

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

20.8.13 The design of the surface water drainage for 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.

20.8.14 All foul water from T2 will be directed to the WTP and the treated effluent will be discharged to the treated effluent infiltration tank. However, the provision of the onsite WTP provides an opportunity for the airport to maximise water reuse by recycling the treated effluent generated by the WTP and using the water for non-potable uses. This has been used in the airport's water balance and will substantially reduce the demand for potable water. This is described in more detail in the DDS prepared for the Proposed Development provided in **Appendix 20.4** in Volume 3 of this PEIR.

20.8.15 The attenuation tanks and infiltration tanks will 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 Volume 3 to this PEIR.

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

20.8.17 The proposed fuel storage area will be surrounded by a bund. Surface water will drain through petrol interceptors with sensors to measure water quality. If contamination trigger levels are exceeded, the water will 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.

20.8.18 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 greywater reuse and rainwater harvesting. The development of these measures and assessment of their impact on water supply will be described further in the Water Cycle Strategy provided as an appendix to the ES.

20.8.19 A surface water management system has been provided 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. The runoff will be collected in an engineered

pipework system, attenuated and discharged in accordance with the hierarchy of discharge.

20.8.20 The drainage network for AAR will remain separate from the other infrastructure and it is assumed that it will be adopted and managed by Luton Borough Council, and will be developed with their further engagement.

20.8.21 The drainage design strategies for the Off-site Highway Interventions (separate to the DDS) will be developed following the principles of sustainable drainage design and contemporary highway design standards. Therefore, 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.

Good Practice

20.8.22 The Draft CoCP provided in **Appendix 4.2** in Volume 3 to this PEIR outlines the requirement for the lead contractors 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.

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

a. confirmation of the water resource and flood risk receptors as identified in the 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); and

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;

20.8.24 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.

20.8.25 The Draft CoCP 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 Draft CoCP;

b. provision of a Piling Risk Assessment in accordance with appropriate methodology developed in consultation with the Environment Agency;

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

d. implementation of appropriate remediation measures as outlined in the Remediation Strategy (**Appendix 17.3**);

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.

20.8.26 The Draft CoCP 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 include developed in consultation with the relevant statutory water undertaker;

c. implementation of water efficiency measures to minimise water consumption; and

d. monitoring of surface water consumption and quality.

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

a. The Design Manual for Roads and Bridges LA113: Road drainage and the water environment (Ref. 20.25);

b. The Sustainable Urban Drainage System (SuDS) Manual (C753) CIRIA (2015) (Ref. 20.24);

c. Control of water pollution from construction sites: Guidance for consultants and contractors (C532) CIRIA (2001) (Ref. 20.52);

d. Environment Agency Guidance on pollution prevention:

   i. Prevention of pollution for businesses (Ref. 20.53);
   ii. Reporting an environmental incident (Ref. 20.54);
   iii. Getting permission to discharge to surface or groundwater (Ref. 20. 55);
   iv. Storage of oil (Ref. 20.56);
   v. Oil storage regulations (Ref. 20.57);
   vi. Discharging sewage with no mains drainage (Ref. 20.58);
   vii. Works on or near water (Ref. 20.59);
   viii. Manage water on land (Ref. 20.60).

e. Environment Agency Groundwater Protection Guides (Ref. 20.61); and

f. LLFA Flood Risk documentation.

20.9 Preliminary assessment

20.9.1 This section presents the results of the preliminary 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 20.9** in **Section 20.14**. A brief commentary on effects assessed as not significant, and further detail on likely significant effects identified is provided in this section.

Construction effects

Groundwater quality and quantity

20.9.3 The preliminary assessment has concluded that with implementation of the Draft CoCP **(Appendix 4.2),** there would not be any direct adverse significant effects to groundwater quality cause by the construction phases.

20.9.4 The processing and treatment of a portion of the former landfill waste prior to reuse in Phase 1 will provide the opportunity to remove potential sources of contaminants, this will 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 Phase 1.

20.9.5 The processing and treatment of a larger portion of the former landfill waste, prior to reuse in Phase 2a will provide the opportunity to remove potential sources of contaminants, this will result in a long term beneficial impact of low magnitude on the underlying aquifer. The underlying aquifer is a high value receptor and therefore this is a **moderate beneficial** effect which is **significant** in Phase 2a.

Surface water quality and quantity

20.9.6 The preliminary assessment has concluded that with implementation of the Draft CoCP **(Appendix 4.2),** there would not be any direct adverse significant effects to surface water quantity and quality caused by the construction phases.

20.9.7 The implementation of the water consumption management measures as outlined in the Construction Method Statement and Programme Report (**Appendix 4.1**) and Draft CoCP (**Appendix 4.2)** will ensure there are no significant effects on the local water resources regime. A more detailed assessment of the potential impacts of construction activities on the local water supply will be provided in the Water Cycle Strategy to be provided as an appendix to the ES.

20.9.8 The processing and treatment of a portion the former landfill waste prior to reuse in Phases 1 and 2a will provide the opportunity to remove potential sources of contaminants, this will 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.**

Flood risk

20.9.9 A detailed assessment of the potential impacts of construction activities on flood risk is provided in the FRA (**Appendix 20.1**). The assessment concluded the effects are **not significant**.

Operational effects

Groundwater quality and quantity

20.9.10 In Phases 2a and 2b, a capping layer will 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 will 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 will result in a low beneficial impact on the underlying aquifer. The underlying aquifer is a high value receptor and therefore this is a **moderate beneficial** effect which is **significant**.

20.9.11 The impact of the proposed drainage system described in the DDS **(Appendix 20.4)** on the underlying aquifer is considered to be very low adverse, in terms of quality and quantity for all phases of the Proposed Development. This is based on the fact that the DDS **(Appendix 20.4)** maintains existing net contributions from the surface water catchments to the existing groundwater catchments. Furthermore, the DDS **(Appendix 20.4)** specifies a water quality monitoring system that will 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 will not change the quality of the water within the underlying aquifer. Therefore, the effect is **minor adverse**, which is **not significant.**

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

20.9.13 The DDS also outlines how water reuse and rainwater harvesting can be implemented to reduce increases in abstraction from the public water supply network operated and maintained by Affinity Water. The preliminary calculations indicate that by maximising the use of treated effluent from the WTP for non potable water uses, the increase in water demand from Affinity Water can be restricted to very low daily rates. This would represent a **minor adverse** effect to the existing water abstraction regime from the underlying chalk aquifer, which is **not significant** .

Surface water quality and quantity

20.9.14 In Phase 2a and 2b, the landfill capping layer (as outlined in paragraphs 20.9.10 and 20.9.11) 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**.

20.9.15 The impact of the proposed drainage system described in the DDS **(Appendix 20.4)** on the quality of the River Mimram and River Lee is considered to be very low adverse for all phases of the Proposed Development. This is based on the fact that the DDS maintains existing the net contribution both from and to existing surface water catchments. Furthermore, the DDS **(Appendix 20.4)** specifies a water quality monitoring system that will 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 will 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.**

20.9.16 In Phases 2a and 2b the implementation of the untreated infiltration tank will see large volumes of surface water directed to a 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)**. Any changes in the downstream surface water regime will be restricted to very low. Therefore, the preliminary assessment has determined this to be **minor adverse**, which is **not significant**.

20.9.17 A screening assessment has been undertaken to determine the risk posed by the proposed Off-site Highway Interventions to the receptor of surface water. A full HEWRAT assessment has not been completed as the design provided is not of sufficient detail. The screening process has been based on evaluating potential change in traffic volumes and potential extent of works. This screening process has identified that only the works associated with the A1081 New Airport Way / M1 Junction 10 (as described in **Chapter 4** of this PEIR) may lead to a change in pollutant loading that may need a detailed HEWRAT assessment. This could lead to the need for the surface water management system at that location requiring additional water quality treatment measures. This information will be developed during the detailed design stages, following development consent being granted, in consultation with the LLFA. Although at this stage it is considered to be a very low impact, resulting in a **minor adverse** effect, which is **not significant**.

Sensitivity Analysis

20.9.18 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.

20.9.19 **Table 20.13** 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 20.13: 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 system as a result of faster growth. This would require additional discussions with Thames Water and Affinity Water.	No change
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. A321Neo acoustic performance	No change anticipated to the outcomes of the assessment. Aircraft performance does not impact water resources.	No change
5. Next generation aircraft	No change anticipated to the outcomes of the assessment. Aircraft performance does not impact water resources.	No change

20.10 Additional mitigation

20.10.1 No significant adverse effects have been identified during construction and operation and therefore no additional mitigation measures have been identified as 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 20.13**.

20.12 In-combination climate change effects

20.12.1 This section provides a preliminary 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 PEIR. The results are provided in **Table 20.14**.

Table 20.14: Water Resources and Flood Risk in-combination climate change impacts

Climate hazard	Likely ICCI	Consequence of ICCIs considering embedded environmental measures/good practice	Significance of ICCI effects
Increase in mean annual and summer air temperatures	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 Water Cycle Strategy will also be prepared to inform the ES to assess how potential water use associated with the Proposed Development will affect water resources and infrastructure considering potential impacts of climate change. The DDS (**Appendix 20.4**) includes a description of measures to minimise water use and maximum water	Not significant

Climate hazard	Likely ICCI	Consequence of ICCIs considering embedded environmental measures/good practice	Significance of ICCI effects
		reuse. The use of such measures will be considered in the Water Cycle Strategy prepared to inform the ES.	
Increase in mean and minimum winter air temperatures	Less snow and ice, potentially resulting in increased surface water runoff in winter periods	The DDS (**Appendix 20.4**) 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.	Not significant
Decrease in annual and summer precipitation rates	Changing precipitation patterns and water shortage (Potentially drought)	A Water Cycle Strategy will be prepared to inform the ES to assess how potential water use associated with the Proposed Development will affect water resources and infrastructure considering potential impacts of climate change. Implementation of the DDS **(Appendix 20.4**) maintains existing surface water and groundwater catchments and so existing conditions are not affected in terms of overall catchment water balance. Furthermore the adoption of water	Not significant

Climate hazard	Likely ICCI	Consequence of ICCIs considering embedded environmental measures/good practice	Significance of ICCI effects
		reuse and rainwater harvesting reduces increases in water demand for potable water	
Increase in annual summer and winter specific humidity	Increase in heavier precipitation events and risk of flooding and impact on leachate generation	The drainage 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 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 will not interact with the waste to reduce the potential for leachate generation. The impact of this is considered not significant.	Not significant

20.13 Monitoring

Construction monitoring

20.13.1 The Draft CoCP (**Appendix 4.2**) 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 will 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 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 will be completed in line with a methodology agreed by Affinity Water as the regulatory local water supplier.

20.13.4 For further details of monitoring of groundwater quality and levels are provided in **Chapter 17** Soils and Geology of this PEIR.

Operational monitoring

20.13.5 Real-time continuous monitoring of contaminants will be completed across the Proposed Development drainage network to ensure that any contaminated runoff will 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.

20.13.6 The monitoring of water consumption associated with the Proposed Development will be maintained during operation in agreement with Affinity Water.

20.13.7 The monitoring of groundwater levels and quality will be undertaken throughout operation; further details are provided in **Chapter 17** Soils and Geology.

20.14 Preliminary assessment summary

20.14.1 **Table 20.15** provides a summary of the identified impacts, mitigation and likely effects of the Proposed Development on water resources and flood risk receptors. Additional mitigation and how it will be secured are described and its efficacy shown by the reported residual effect.

Table 20.15: Water Resources and Flood Risk preliminary assessment summary

Impact	Embedded/Good Practice Mitigation	Magnitude	Receptor Sensitivity	Description of effect and significance	Additional Mitigation	Residual Effect
Construction						
Phases 1, 2a and 2b Increase in water consumption during construction affecting local water supply	Implementation of water efficiency measures to reduce consumption are described in the Construction Method Statement and Programme Report **(Appendix 4.1)** and Draft CoCP (**Appendix 4.2**)	Very low adverse	Medium	Minor adverse effect on the local water supply network resilience, not significant	None required	Minor adverse effect, not significant
Phases 1, 2a and 2b Increase in surface water flood risk due to construction activities.	The Construction Method Statement and Programme Report **(Appendix 4.1)** and Draft CoCP (**Appendix 4.2**) 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 and Off-site Highway Interventions, 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
Phases 1, 2a and 2b Changes to water quality in the River Lee and River Hiz due to construction activities associated with Off-site Highway Interventions	The Draft CoCP outlines the requirements for appropriate management and disposal of potentially polluted runoff during construction activities associated with the Off-site Highway Interventions.	Very low adverse	High *(River Lee)* Medium *(River Hiz)*	Minor adverse effect on water quality in the River Lee and River Hiz, not significant.	None required	Minor adverse effect, not significant
Phase 1 Direct changes to quality of the aquifer as a result of changes to groundwater quality during construction	The Remediation Strategy (**Appendix 17.3**) outlines requirements to process and treat former landfill waste for reuse. This provides an opportunity to remove potential sources of contaminants.	Very low beneficial	High	Minor beneficial effect on underlying aquifer, not significant	None required	Minor beneficial effect, not significant
Phase 1 Indirect changes to water quality in the River Mimram as a	The Remediation Strategy (**Appendix 17.3**) outlines requirements to process and treat former landfill waste	Very low beneficial	High	Minor beneficial effect on 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
result of changes to groundwater quality during construction	for reuse. This provides an opportunity to remove potential sources of contaminants. Further information will be provided in the Hydrogeological Risk Assessment that will be undertaken to inform the ES.					
Phase 2a and 2b Direct changes to quality of the aquifer as a result of changes to groundwater quality during construction	The Remediation Strategy (**Appendix 17.3**) which outlines requirements to process and treat former landfill waste for reuse. This provides an opportunity to remove potential sources of contaminants.	Low beneficial	High	Moderate beneficial effect on the underlying aquifer, significant	None required	Moderate beneficial effect, significant
Phase 2a and 2b Indirect changes to water quality in the River Mimram as a result of	The Remediation Strategy (**Appendix 17.3**) which outlines requirements to process and treat former landfill waste for reuse. This provides an	Very low beneficial	High	Minor beneficial effect on 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
changes to groundwater quality during construction	opportunity to remove potential sources of contaminants.					
Operation						
Phases 1, 2a and 2b Increase in water consumption as a result of increase in passengers which will affect the local water supply.	Water efficiency, rainwater harvesting and reuse of from the WTP will be implemented to maximise water reuse as described in the DDS (**Appendix 20.4**).	Low adverse	Medium	Minor adverse effect on the local water supply network, not significant.	None required.	Minor adverse effect, not significant.
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**) includes a description of the upgrades required to the Thames Water network to accommodate increase in foul runoff in Phase 1.	Very low adverse	Medium	Minor adverse effect on water quality in the existing water infrastructure, 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
Phase 1 Changes to water quality in the River Lee as a result of discharge of contaminated runoff (from car park P6) and T1 to the Thames Water surface water sewer that discharges into the River Lee.	The drainage design for Phase 1 will provide appropriate treatment prior to the discharge of runoff from car park P6 to the Thames Water surface water sewer.	Very low adverse	High	Minor adverse effect on water quality in the River Lee, not significant.	None required.	Minor adverse effect, not significant.
Phase 2a and 2b Changes to groundwater quality as a result of the discharge treated effluent	Treatment measures and consented limits of contaminant to ensure effluent does not affect groundwater quality	Very low adverse	High	Minor adverse effect on underlying aquifer, not significant.	None required.	Minor adverse effect, not significant.
Phase 2a and 2b	Surface water runoff will be subject to	Very low adverse	High	Minor adverse effect on	None required.	Minor adverse

Impact	Embedded/Good Practice Mitigation	Magnitude	Receptor Sensitivity	Description of effect and significance	Additional Mitigation	Residual Effect
Changes to groundwater quality as a result of the discharge of surface water to the untreated effluent infiltration tank.	appropriate treatment prior to discharging to the untreated effluent infiltration tank via petrol interceptors. All contaminated surface water will be identified, isolated and directed to the WTP			underlying aquifer, not significant.		effect, not significant.
Phase 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 Phase 2a and 2b.	The implementation of the capping layer on the historic landfill will 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.	Low beneficial	High	Moderate beneficial effect on underlying aquifer, significant	None required	Moderate beneficial effect, significant
Phase 2a and 2b Indirect change to water quality of the River Mimram as a result of	The implementation of the capping layer on the historic landfill will minimise surface water infiltration into the underlying waste and prevent	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
changes to groundwater quality due to installation of capping layer on extent of historic landfill affected by operation of Phase 2a and 2b.	generation of future landfill leachate that could adversely impact the groundwater quality in the underlying aquifer.					
Phases 1, 2a and 2b Change to water quality of the River Lea due to M1 Junction 10 off-site highway intervention	A screening assessment indicates a potential change in surface water runoff at this location. Detailed design to be developed in accordance with sustainable drainage principles and contemporary highway drainage design standards.	Very low adverse	High	Minor adverse effect on water quality in the River Lea, not significant	None required	Minor adverse, not significant
Phases 2a and 2b Increase in surface water flood risk as a result of	The drainage design for Phases 2a and 2b has been designed to account for a 1 in 100 year flood event plus a 40% climate change	Very low adverse	High	Minor adverse effect on surface water flood risk receptors, 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
expansion of impermeable surface area	allowance as described in the DDS (**Appendix 20.4**).					
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**).	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).**	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.
Phases 2a and 2b Increased surface water flood risk for flood risk receptors located within close proximity	An appropriate drainage design will be implemented for each off-site highway intervention in line with accepted highway design standards to ensure no unacceptable	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	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
to AAR works as defined in the FRA (**Appendix 20.1**).	increases in flood risk. For a detailed assessment of impacts of flood risk please see FRA (**Appendix 20.1).**			value surface water flood risk receptors, not significant.		
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**).	The DDS (**Appendix 20.4**) identifies that there will be reduction in discharges to the central soakaway during 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.
Phases 2a and 2b Localised increase in surface water catchments	Infiltration tanks have been designed with consideration of maximum groundwater levels taken into account, including mounding.	Very low adverse	High (Existing airport infrastructure) Medium (Kimpton)	Minor adverse effect on localised flooding of existing airport infrastructure and community	None required.	Minor adverse effect, not significant.

Impact	Embedded/Good Practice Mitigation	Magnitude	Receptor Sensitivity	Description of effect and significance	Additional Mitigation	Residual Effect
contributing to a point source infiltration (untreated effluent infiltration tank.) as defined in the FRA (**Appendix 20.1**). 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 affect flood risk at	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**).			in Kimpton, not significant.		

Impact	Embedded/Good Practice Mitigation	Magnitude	Receptor Sensitivity	Description of effect and significance	Additional Mitigation	Residual Effect
Kimpton downstream						

20.15 Completing the assessment

20.15.1 The following activities will be undertaken to complete the assessment, the results of which will be presented in the ES:

a. Hydrogeological Risk Assessment to provide a detailed confirmatory assessment of the impact on the Proposed Development on groundwater quality. The Hydrogeological Risk Assessment will be undertaken in line with the Environment Agency tiered methodology. This in turn will inform the detailed assessment of the potential impacts of the Proposed Development on the Upper Lee Chalk WFD waterbody;

b. Water Cycle Strategy to provide further confirmatory description of the water strategy for the Proposed Development; and

c. All activities will be informed by engagement with the LLFA's, Environment Agency, Affinity Water and Thames Water.

COMPETENT EXPERTS

Topic	Role	Company	Qualifications/competencies/experience of author
Water Resources	Technical reviewer	Arup	Full member of the Chartered Institute of Water and Environmental Management (MCIWEM) with 18 years of experience working as a flood risk and water resources manager on infrastructure and building projects in the UK. Led numerous teams of water and flood risk 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 6 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.

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
DCO	Development Consent Order
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 located within the Main Application site
NPPF	National Planning Policy Framework
NPSNN	National Planning Statement for National Networks
PFRA	Preliminary Flood Risk Assessment
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
CoCP	Code of Construction Practice
CSWMS	Construction Surface Water Management Strategy
DCO	Development Consent Order
DMRB	Design manual for roads and bridges
DQRA	Detailed Quantitative Risk Assessment

REFERENCES

Ref. 20.1 Secretary of State (2015) *Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015*
Ref. 20.2 Secretary of State (2017) *Water Environment (WFD) (England and Wales) Regulation*
Ref. 20.3 HMSO (2009) 2009 No. 3042 Environmental Protection. Flood Risk Regulations [online] [Accessed: 13 March 2019]
Ref. 20.4 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. 20.5 HMSO (2010) Flood and Water Management Act [online] [Accessed: 13 March 2019]
Ref. 20.6 HMSO (2014). The Water Act [online] [Accessed: 13 March 2019]
Ref. 20.7 HMSO (1995) The Environment Act [online] [Accessed: 13 March 2019]
Ref. 20.8 HMSO (1991) Water Resources Act. [online] [Accessed: 13 March 2019]
Ref. 20.9 HMSO (2009) Water Industry Act (Amendment) (England and Wales) Regulations 2009
Ref. 20.10 HMSO (2003) Water Act 2003
Ref. 20.11 HMSO (2006) Water Resources (EIA) (England and Wales) Regulations 2006
Ref. 20.12 HMSO (2017) The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 [Accessed: 28 October 2021]
Ref. 20.13 HMSO (2016) The Environmental Permitting (England and Wales) Regulations 2016
Ref. 20.14 HMSO (2016) The Groundwater WFD (England) Direction 2016
Ref. 20.15 The Groundwater (England and Wales) Regulations 2009 No. 2902 [online] [Accessed: 13 March 2019]
Ref. 20.16 The Contaminated Land (England) Regulations (Amendment) 2012 [Accessed: 13 March 2019]
Ref. 20.17 Ministry of Housing, Communities & Local Government (2021) National Planning Policy Framework [online] [Accessed: 15 March 2019]
Ref. 20.18 Department for Transport (2014) National Policy Statement for National Networks. HMSO, UK
Ref. 20.19 Luton Borough Council (2017). Local Luton Plan 2011-2031 [online] [Accessed: 15th February 2019]
Ref. 20.20 CBC Local Plan (2015-2035) (Emerging) [online] [Accessed: 15th February 2019]
Ref. 20.21 CBC Local Plan (2015-2035) [online] [Accessed: 10th November 2021]
Ref. 20.22 North Hertfordshire District Council (NHDC) Proposed Submission Draft Local Plan for 2011-2031, October 2016 [Accessed: 10 March 2019].
Ref. 20.23 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. 20.24 CIRIA (2015). C753 The SuDs Manual [online] [Accessed: 10 March 2019]
Ref. 20.25 Highways England (2019) LA 113: Road drainage and the water environment [online] [Accessed: 20 December 2019]
Ref. 20.26 Environment Agency (2016). Flood Risk Assessments: Climate Change Allowances. [online] [Accessed: 10 March 2019]
Ref. 20.27 Luton Borough Council (2015) Luton Water Cycle Strategy [online] [Accessed: 13 March 2019]
Ref. 20.28 Luton Borough Council (2012) Surface Water Management Plan [online] [Accessed: 13 March 2019]
Ref. 20.29 Luton Borough Council (2011) Luton Preliminary Flood Risk Assessment [online] [Accessed: 13 March 2019]
Ref. 20.30 Luton Borough Council (2013) Luton Level 1 SFRA update [online] [Accessed: 13 March 2019]
Ref. 20.31 Luton Borough Council (2015) Luton Borough Council Local Flood Risk Management Strategy [online] [Accessed: 13 March 2019]
Ref. 20.32 Central Bedfordshire Council (2011) Preliminary Flood Risk Assessment [online] [Accessed: 13 March 2019]
Ref. 20.33 Central Bedfordshire Council (2017) Preliminary Flood Risk Assessment addendum [online] [Accessed: 13 March 2019]
Ref. 20.34 Central Bedfordshire Council (2014) Local Flood Risk Management Strategy for Central Bedfordshire [online] [Accessed 13 March 2019]
Ref. 20.35 North Hertfordshire District Council (2008) North Hertfordshire District Council Strategic Flood Risk Assessment [online] [Accessed: 13 March 2019]
Ref. 20.36 Hertfordshire County Council (2017) Addendum to the Level 1 Strategic Flood Risk Assessment (SFRA) [online] [Accessed: 13 March 2019]

Ref. 20.37 Hertfordshire County Council (2017) Addendum to the Level 1 Strategic Flood Risk Assessment (SFRA) [online] [Accessed: 13 March 2019]
Ref. 20.38 Hertfordshire County Council (2011) Preliminary Flood Risk Assessment [online] [Accessed: 13 March 2019]
Ref. 20.39 Environment Agency (2018) Environment Agency Approach to Groundwater Protection
Ref. 20.40 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. 20.41 DEFRA (2021) Magic Map [online] [Accessed: 15 November 2021]
Ref. 20.42 Google (2021) Google Maps [online] [Accessed: 15 November 2021]
Ref. 20.43 Environment Agency (2021) Long term flood risk map [online] [Accessed: 10 November 2021]
Ref. 20.44 BGS (2021) Susceptibility to groundwater flooding
Ref. 20.45 BGS (2021) Geology of Britain viewer [online] [Accessed: 7 November 2021]
Ref. 20.46 Environment Agency (2020) Environment Agency Public register [online] [Accessed: 10 March 2019]
Ref. 20.47 UK Centre for Ecology & Hydrology (2021) National River Flow Archive [online] [Accessed: 15 September 2021]
Ref. 20.48 Environment Agency (2021) Environment Agency Catchment Data Explorer [online] [Accessed: 15 March 2021]
Ref. 20.49 Natural England (2021) Magic Map [online] [Accessed: 20 September 2021]
Ref. 20.50 Atkins (2007) Environment Agency. Vale of St Albans Groundwater Model. Phase 1: Data collation and formulation of Initial Conceptual Model. Final Report
Ref. 20.51 British Standards Institute (2018) BS EN 16941-1:2018 On-site non-potable water systems. Systems for the use of rainwater
Ref. 20.52 CIRIA (2001) Control of water pollution from construction sites: Guidance for consultants and contractors (C532) [online] [Accessed: 10 September 2021]
Ref. 20.53 Environment Agency (2019) Pollution prevention for businesses [online [Accessed: 5 September 2021]
Ref. 20.54 Environment Agency (2021) Report an environmental incident [online] [Accessed: 7 September 2021]
Ref. 20.55 Environment Agency (2021) Discharges to surface water and groundwater: environmental permits [online] [Accessed: 3 September 2021]
Ref. 20.56 Environment Agency (2020) Oil storage regulations for businesses [online] [Accessed: 11 September 2021]
Ref. 20.57 Environment Agency (2021) Storing oil at your home or business [online] [Accessed: 12 September 2021]
Ref. 20.58 Environment Agency (2021) Septic tanks and treatment plants: permits and general binding rules [online] [Accessed: 14 September 2021]
Ref. 20.59 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. 20.60 Environment Agency (2015) Manage water on land: guidance for land managers [online] [Accessed: 20 September 2021]
Ref. 20.61 Environment Agency (2017) Groundwater protection [online] [Accessed: 6 September 2021]