Statutory Consultation 2022

Preliminary Environmental Information Report

Volume 3: Appendix 20.1

Preliminary Flood Risk Assessment

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1 INTRODUCTION

1.1 Report Context

1.1.1 This report is part of the suite of documents prepared to support an application for development consent for the proposed expansion of London Luton Airport (the Proposed Development) Specifically, this Flood Risk Assessment (FRA) is a technical appendix supporting **Chapter 20** Water Resources chapter of the Preliminary Environmental Information Report (PEIR).

1.1.1 This report has been prepared with reference to the National Planning Policy Framework (NPPF) (Ref. 1) the NPPF Flood Risk and Coastal Change web-based Guidance (Ref. 2) and follows the methodology prescribed in CIRIA document C624: Development and Flood Risk, Guidance for the Construction Industry (Ref. 3).

1.2 Proposed Development

1.2.1 An overview of the Proposed Development and the site and surroundings in which it is proposed is provided in **Chapter 2** of Volume 2 of the PEIR. A detailed description of the Proposed Development is provided in **Chapter 4** of Volume 2 to the PEIR. A summary of those elements of the Proposed Development relevant to this FRA is provided below:

a. reconfiguration and improvement of the existing passenger terminal;
b. new passenger terminal building and boarding piers;
c. earthworks to create an extension to the current airfield platform, all of which is generated on site;
d. airside facilities including new taxiways and aprons, together with relocated engine run-up bay and fire training facility;
e. landside facilities including airport associated support buildings such as operations, logistics, energy and snow clearance bases and service yards;
f. enhancement of the existing surface access network, including a new dual carriageway road (Airport Access Road (AAR)) from the A1081 (Airport Roundabout) to the new passenger terminal along with the provision of forecourt and car parking facilities;
g. extension of the DART with a station serving the new passenger terminal;
h. landscaping and ecology improvements, including the replacement of existing and planned public open space and amenities; and
i. further infrastructure enhancements and initiatives to support our goal of a net zero carbon airport by 2040, with carbon neutral commitments being delivered sooner including facilities for greater public transport usage, improved thermal efficiency, electric vehicle charging, on-site energy generation and storage, new aircraft fuel pipeline connection and

storage facilities and sustainable surface and foul water management installations.

1.3 Local Stakeholders and Operating Authorities

1.3.1 With regards to development planning, flood risk and water related issues, there are a number of key local stakeholders and/or approving authorities associated with the Proposed Development. These are described as follows:

a. The Environment Agency (EA) have wide ranging powers for main rivers and groundwater bodies under the Water Resources Act (1991) (Ref. 4) and the Environment Act (1995) (Ref. 5). Under the Flood and Water Management Act (FWMA) (2010) (Ref. 6) they have a responsibility to produce a national strategy towards managing flood risk and are a statutory planning consultee for development and flood risk issues.

b. Lead Local Flood Authorities (LLFA). Under the FWMA the LLFA have responsibility for local flood risk. This includes ordinary watercourses, groundwater and surface water (including the implementation of sustainable drainage (SUDs) techniques. The Main Application Site and the Off-site Highway Interventions (as defined in **Chapter 2** in Volume 2 of the PEIR) extend across the boundaries of three LLFA's, Luton Borough Council (LBC), Central Bedfordshire Council (CBC) and Hertfordshire County Council (HCC).

c. Planning Inspectorate (PINS). The nature and scale of the Proposed Development means that the application will be reviewed by PINS and recommendations made to the Secretary of State as to whether to grant permission for the Proposed Development by way of a Development Consent Order (DCO) . This will include ensuring the Proposed Development is safe in terms of flood risk, does not increase flood risk elsewhere and will seek to implement SUDs, in conjunction with the LLFA.

d. Thames Water (TW) is the public sewerage undertaker under The Water Industry Act 1991 (Ref. 7). They operate and maintain significant infrastructure in proximity to the Main Application Site as well as in proximity of the Off-site Highway Interventions.

e. Affinity Water is primary supplier of public potable water with powers under The Water Industry Act 1991 (Ref. 7). They operate and maintain significant infrastructure in proximity to the Main Application Site as well as in proximity of the Off-site Highway Interventions.

f. Veolia Water are commissioned by London Luton Airport Operations Limited (LLAOL) to operate and maintain the existing water related infrastructure within the existing airport. This includes the private surface and foul water systems that connect into the public sewerage network and private water supply network that takes potable water from the public system.

1.4 Data Sources

1.4.1 The key data used in compiling this FRA is listed below:

a. EA indicative flood mapping (Flood Map for planning) (Ref. 8) and flood risk from rivers or the sea and risk of flooding from surface water (RoFSW) as indicated on the Long term flood risk information page on the gov.uk website (Ref. 9).

b. Information on the existing airport drainage and water supply infrastructure, owned by Luton Rising (a trading name for London Luton Airport Limited (the Applicant)) and operated by Veolia Water on behalf of LLAOL. This includes an 'Asset Management Plan Report' authored by Mott MacDonald in 2008 (Ref. 10) and data available in the Drainage Design Statement, provided in **Appendix 20.6** of Volume 3 to the PEIR, regarding baseline and the proposed surface water management design.

c. Information on existing public drainage (surface water and foul) infrastructure owned and operated by Thames Water (Ref. 11).

d. Information on existing public water supply distribution infrastructure owned and operated by Affinity Water (Ref. 12).

e. Strategic Flood Risk Assessments (SFRA), Preliminary Flood Risk Assessments (PFRA) and Local Flood Risk Management Strategy documents for the three local authorities with LLFA responsibilities (LBC, CBC and HCC). These are listed below:

i. LBC (2015). Local Flood Risk Management Strategy (Ref. 13);
ii. Capita Symonds (2013). Luton Level 1 SFRA update (Ref. 14) (update to original SFRA published in 2008);
iii. Capita Symonds (2011). Luton Borough Council Preliminary Flood Risk Assessment (Ref. 15);
iv. HCC (2018) LFRMS 2 A Strategy for the Management of Local Sources of Flood Risk (update to original LFRMS published in 2011) (Ref. 16).
v. HCC (2018). Hertfordshire Minerals Local Plan Review. Updated Level 1 Strategic Flood Risk Assessment (SFRA) (Ref. 17) (update from original SFRA published in 2015);
vi. HCC (2011). Hertfordshire County Council. Preliminary Flood Risk Assessment (Ref. 18);
vii. HCC (2017); Hertfordshire County Council. Preliminary Flood Risk Assessment Addendum (Ref. 19);
viii. JBA (2017). Central Bedfordshire Council. Level 1 Strategic Flood Risk Assessment (Ref. 20);
ix. CBC (2014). Local Flood Risk Management Strategy for Central Bedfordshire (Ref. 21);
x. Bedford Group of Drainage Boards (2011). Upper River Great Ouse. Tri Lead Local Flood Authority. Preliminary Flood Risk Assessment For Bedford Borough Council, Central Bedfordshire Council and Milton Keynes Council (Ref. 22); and
xi. CBC (2017) Central Bedfordshire Council. Preliminary Flood Risk Assessment Addendum (Ref. 23).

1.4.2 This report was also informed by a site walkover undertaken on the 10 April 2018.

2 FLOOD RISK PLANNING AND LEGISLATIVE CONTEXT

2.1 Airports National Planning Statement

2.1.1 The Airports National Policy Statement (ANPS) (Ref. 24) 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.

2.1.2 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. The relevant provisions of the ANPS considered in this FRA include:

a. paragraphs 5.152-5.157 set out the approach to flood risk assessment that are relevant for airport development; and

b. 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 does not increase in comparison to the baseline and the requirement to apply the sequential approach.

2.2 National Planning Policy Framework

2.2.1 The National Planning Policy Framework (NPPF) (Ref. 1) introduced in 2012 and revised in 2021, is the overarching planning framework guiding the development process on national level across England. Although paragraph 5 makes clear that it does not contain specific policies for nationally significant infrastructure projects, such as the Proposed Development, it will be an important and relevant consideration. In terms of flood risk the aim is to ensure that flood risk is considered at all stages in the planning process, to avoid inappropriate development in areas at risk of flooding and to direct development away from areas at highest risk. It does this by formulating a risk-based approach towards flooding, to be adopted at all levels of planning. It is supported by web based technical guidance (Ref. 2).

2.2.2 The NPPF requires that the "sequential test" is applied during the planning process. The sequential test aims to ensure that preference for developable land is given to land that has the lowest risk of flooding, based on the data available. The starting point for the sequential test is the system of 'flood zoning'.

2.2.3 The flood zoning system adopted in England is described in **Table 2.1** below, as described in NPPF technical guidance (Ref. 2). It describes the risk of an area by rivers and in coastal areas, estuaries and the sea. This information is generated by the EA and Local Planning Authority (LPA) and used to support land use planning decisions. It is shown on the EA's Flood Map for planning (Ref. 8) and is also found in LPA's Strategic Flood Risk Assessments (SFRAs).

Table 2.1: Flood zoning system used across England as defined in NPPF (Ref. 1).

Flood Zone	Definition
Zone 1 Low Probability	Land having a less than 1 in 1,000 (0.1%) annual exceedance probability (AEP) of river or sea flooding. (Shown as 'clear' on the Flood Map – all land outside Zones 2 and 3).
Zone 2 Medium Probability	Land having between a 1 in 100 (1%) and 1 in 1,000 (0.1%) AEP of river flooding; or land having between a 1 in 200 (0.5%) and 1 in 1,000 (1%) AEP of sea flooding. (Land shown in light blue on the Flood Map).
Zone 3a High Probability	Land having a 1 in 100 (1%) or greater AEP of river flooding; or Land having a 1 in 200 (0.5%) or greater AEP of sea flooding (Land shown in dark blue on the Flood Map).
Zone 3b Functional Floodplain	This zone comprises land where water needs to flow or be stored in times of flood. Local planning authorities should identify in their SFRAs areas of functional floodplain and its boundaries accordingly, in agreement with the EA. (Not separately distinguished from Zone 3a on the Flood Map).

2.2.4 The sequential test requires that development only be considered within Flood Zone 2, if there are no appropriate development sites in Flood Zone 1. Development in Flood Zone 3 should only be considered if development is not possible in Flood Zone 2, assuming development in Flood Zone 1 has also been ruled out. This process should be undertaken by the LPA to identify areas appropriate for development and the approach should be adopted by developers on a site-specific basis.

2.2.5 The NPPF also encourages those involved in development to consider the flood vulnerability of a proposed development to the impact of flooding. The vulnerability of different types of development is listed in the online guidance. This is relevant for considering what type of development is appropriate for a site (based on its Flood Zone) and also how a development site should be laid out if there are different Flood Zones encountered within a site. The compatibility of development in terms of its vulnerability and flood zoning is described in **Table 2.2** below which is based on Table 3 in NPPF technical guidance (Ref. 2).

Table 2.2: Flood risk vulnerability and compatibility

Flood zone	Essential infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less vulnerable
Flood Zone 1	✓	✓	✓	✓	✓

Flood zone	Essential infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less vulnerable
Flood Zone 2	✓	✓	Exception test	✓	✓
Flood Zone 3a	Exception test	✓	×	Exception test	✓
Flood Zone 3b "Functional Floodplain"	Exception test	✓	×	×	×

Key:

✓ Development is appropriate,

× Development should not be permitted, "exception test" will be required.

2.2.6 This illustrates how higher vulnerability land uses should be directed to lower flood risk sites and vice versa.

2.2.7 Should the sequential approach show it is not possible fora development to be located in Zones of lower flood risk it may be possible, using the exception test to demonstrate that development is still feasible by adopting flood risk management measures. However, these measures should not increase flood risk elsewhere. The exception test requires the demonstration of the following:

a. the development provides wide sustainability benefits that outweigh the flood risk; and
b. a FRA must be provided.

2.2.8 A FRA is required for any development irrespective of flood zone, for all development in excess of 1 hectare (ha). This is due to the potential flood risk caused by increases in surface water discharges.

2.2.9 A NPPF compliant FRA should be undertaken to consider the following:

a. the risk posed by all potential sources of flooding while also considering the impact of climate change (in most cases the risk should be less than 1% in any given year);
b. the development will not increase flood risk elsewhere from any potential source, with climate change considered once more;
c. the development is designed to be safe with flood protection considered where necessary as well as a design that considers emergency access and egress arrangements;
d. the development process should seek to reduce overall flood risk, wherever practicable;
e. management and funding arrangements to ensure the site can be developed and occupied safely throughout its proposed lifetime; and

f. sustainable drainage systems are incorporated into the development, unless there is clear evidence that this would be inappropriate.

2.2.10 The implementation of sustainable drainage and the requirement for flood risk reduction were specifically reinforced in the July 2018 issue of the NPPF (Ref. 1).

2.3 Flood and Water Management Act 2010

2.3.1 The FWMA (Ref. 6) is a direct result of the recommendations made by Sir Michael Pitt, taken from his report on the severe flooding experienced across the country in 2007 and was given Royal Assent in April 2010. It provides for better, more comprehensive management of flood risk for people, homes and businesses, helps safeguard community groups from unaffordable rises in surface water drainage charges and protects water supplies to the consumer. It set out a legislative framework that compliments NPPF (Ref. 1). The principles of the FWMA (Ref. 6) have been applied to this FRA.

3 FLOOD RISK ASSESSMENT METHODOLOGY

3.1.1 The methodology adopted for this FRA)is outlined below and is compliant with NPPF (Ref. 1).

3.1.2 In the first instance the Proposed Development has been evaluated in terms of the sequential test. This determines the suitability of the Proposed Development considering existing flood risk and the vulnerability of the Proposed Development. This initial test has been based on the EA's Flood Map for planning and the RoFSW data set. Where there are existing flood risk considerations the 'exception test' has been addressed by examining the sustainability benefits of the Proposed Development and signposting to the sections of the FRA which will ensure that the development is safe and that it does not increase flood risk elsewhere.

3.1.3 Following the sequential and exception test stage of the assessment, the baseline conditions of the Main Application Site, Off-site Highway Interventions and Off-site Car Park locations has been compiled. This describes the existing surface and groundwater features, locates existing water related infrastructure and identifies the key flood risk considerations affecting the Main Application Site and the off-site works locations.

3.1.4 Once the baseline was fully compiled the assessment section identifies potential flood risk considerations affecting the Proposed Development.

3.1.5 The assessment section has been structured to examine the Main Application Site, the Off-site Highway Interventions and any other off-site works separately, as the highway interventions are not covered by the Main Application Site drainage strategy even though some are within the Main Application Site boundary. This is because the drainage strategy for the Main Application Site has been developed for areas within the proposed operational airport and highway interventions have different operation and maintenance arrangements.

3.1.6 Once a flood risk consideration was identified the impact, receptor value and effect have been quantified based on the assessment tables contained in **Chapter 20** Water Resources, in Volume 2 of the PEIR. These tables are based on the DMRB LA113 assessment methodology (Ref. 25), although they have been slightly adapted for consistency across assessments and agreed through EIA Scoping and ongoing discussions with relevant stakeholders.

3.1.7 The assessment of flood risk has considered the phasing of construction and operation as outlined in **Chapter 4** in Volume 2 of the PEIR. However, this FRA focuses on the potential operational flood risk impacts. Construction related flood risk impacts are addressed by the measures described in the Draft Code of Construction Practice (CoCP) provided as **Appendix 4.2** in Volume 3 of the PEIR.

4 THE SEQUENTIAL AND EXCEPTION TEST

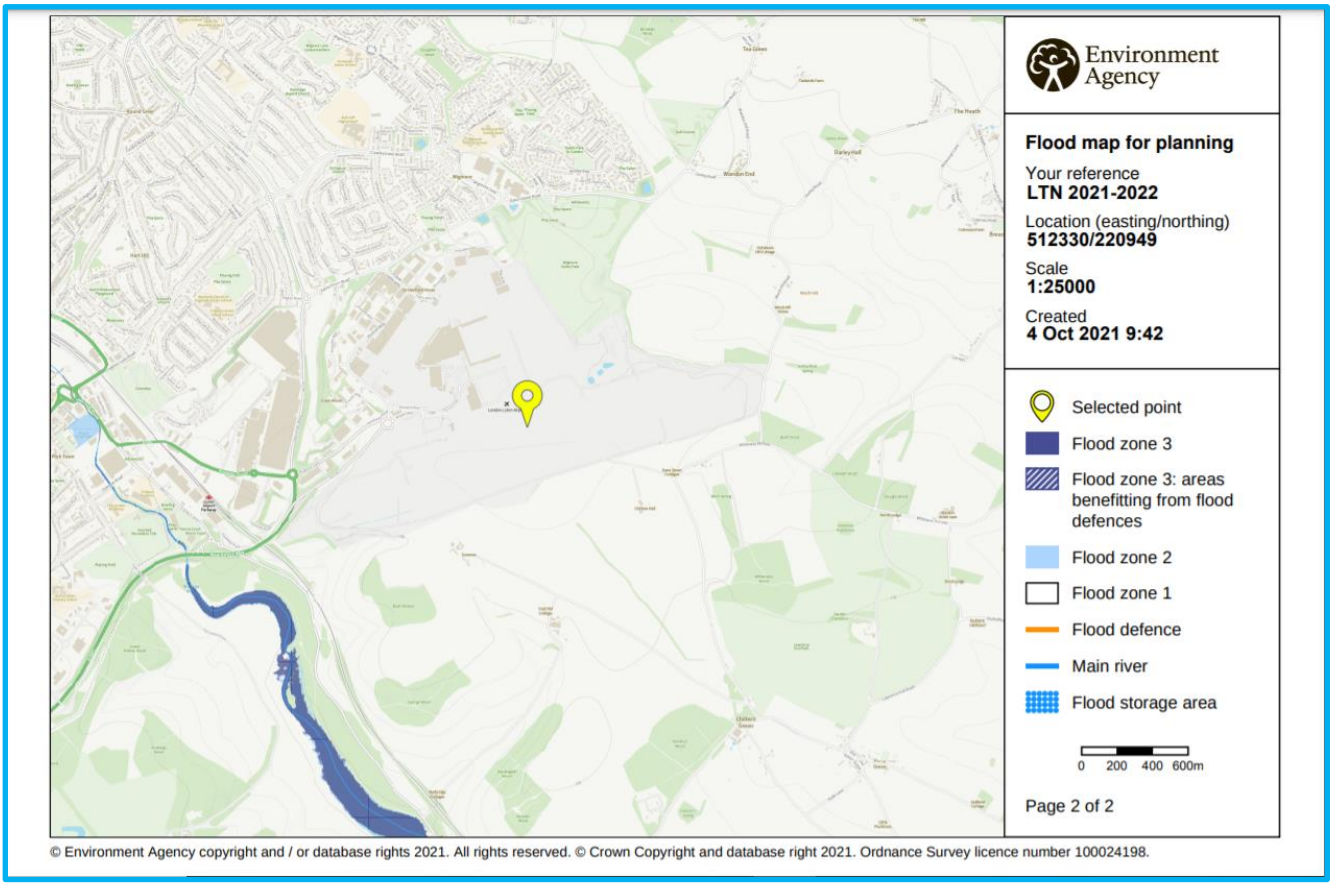
4.1 The sequential test

4.1.1 The sequential test aims to steer development to the areas of lowest flood risk.

Main Application Site

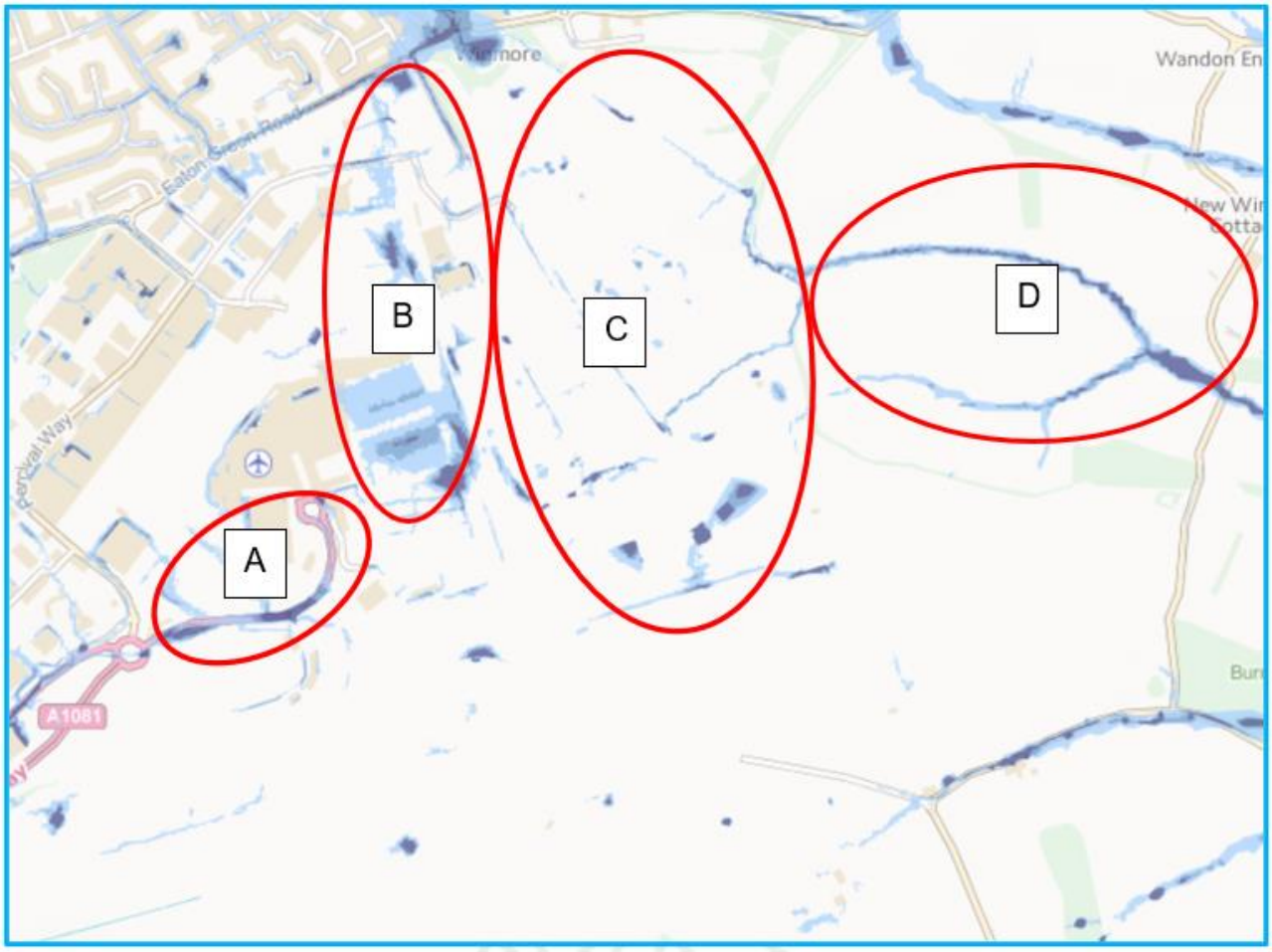
4.1.2 The EA's Flood Map for planning, shown below in **Inset 4.1** indicates the Main Application Site is wholly within Flood Zone 1. This demonstrates that the Main Application site is at low risk of fluvial flooding and as such is appropriate for development.

Inset 4.1: Flood Map for planning for the Main Application Site, courtesy of the EA©.



4.1.3 It is acknowledged that there are areas of potential surface water flooding across the Main Application Site, based on the RoFSW mapping data set (see **Inset 4.2** below).

Inset 4.2: Risk of Flooding from Surface Water (RoFSW) for the Main Application Site, courtesy of the EA©



4.1.4 The data set identifies existing surface water flow paths and/or areas of existing low lying land where water accumulates in the event of a high intensity or prolonged rainfall event. It must be noted that the data set is based on a relatively crude ground model and does not take account of any existing or natural drainage features that could convey water away and so is not a wholly accurate representation of how rainfall behaves once it reaches the surface. However, it provides an indication of where surface water issues may arise.

4.1.5 The data set identifies four main areas across the Main Application Site labelled A – D in Inset 4.2:

a. Area A - An area of elevated surface water flooding along Airport Approach Road;

b. Area B – An area of elevated flood risk within the existing airport stands, associated taxiways and within the land north of the existing airport;

c. Area C – multiple surface water spots identifying discrete locations of low lying land;

d. Area D – two significant flow paths flowing in an easterly direction.

4.1.6 The expansion of the airport is limited in all other directions other than to the east of the existing airport due to existing development. Therefore, it is considered appropriate to consider development to the east of the existing airport and this area is referred to as the Expansion Area within this FRA.

4.1.7 In terms of the vulnerability of the Proposed Development to flooding, overall the airport is considered Essential Infrastructure as defined in **Table 2.2** and in NPPF (Ref. 1). However, when the individual components of the Proposed Development are considered only the proposed T2 building, airport stands, taxiways, buildings, facilities associated with aircraft maintenance, the Wastewater Treatment Plant (WTP), the Fuel Storage Facility and the fire training ground would fall into this category. The car parks and other development associated to the north of the T2 correspond to less vulnerable development.

4.1.8 Taking these factors into account it is appropriate that the Proposed Development advances to the exception test to examine the contribution of the Proposed Development to sustainable development and flood risk safety.

Highway interventions and Off-Site Car Parks

4.1.9 The Flood Map for planning indicates that none of the proposed highway interventions (either within the Main Application Site or off-site) or the Off-site Car Parks are within Flood Zones 2 and/or 3. As such development is appropriate at all these locations. However, it is acknowledged that the following locations are within close proximity to the River Lee, although, this does not affect the sequential test:

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

4.1.10 It is also acknowledged that the following highway interventions are indicated to be affected by surface water flooding, based on the RoFSW mapping reproduced in **Inset 4.3**:

a. Windmill Road/Manor Road;
b. Windmill Road/Manor Road/St Mary's Road/Crawley Green Road gyratory;
c. Hitchin Road/Ramridge Road;
d. A1081 New Airport Way/B653/Gipsy Lane;
e. Proposed airport access road (Airport Access Road)/A1081 Airport Way /Percival Way;
f. M1 Junction 10;
g. Wigmore Lane/Crawley Green Road;
h. Eaton Green Road/Wigmore Lane;
i. Eaton Green Road/Frank Lester Way;

j. A1081 New Airport Way/A505 Kimpton Road/Vauxhall Way;

k. Eaton Green Road/Lalleford Road;

l. A505 Moormead Hill/B655 Pirton Rd/Upper Tilehouse Street; and

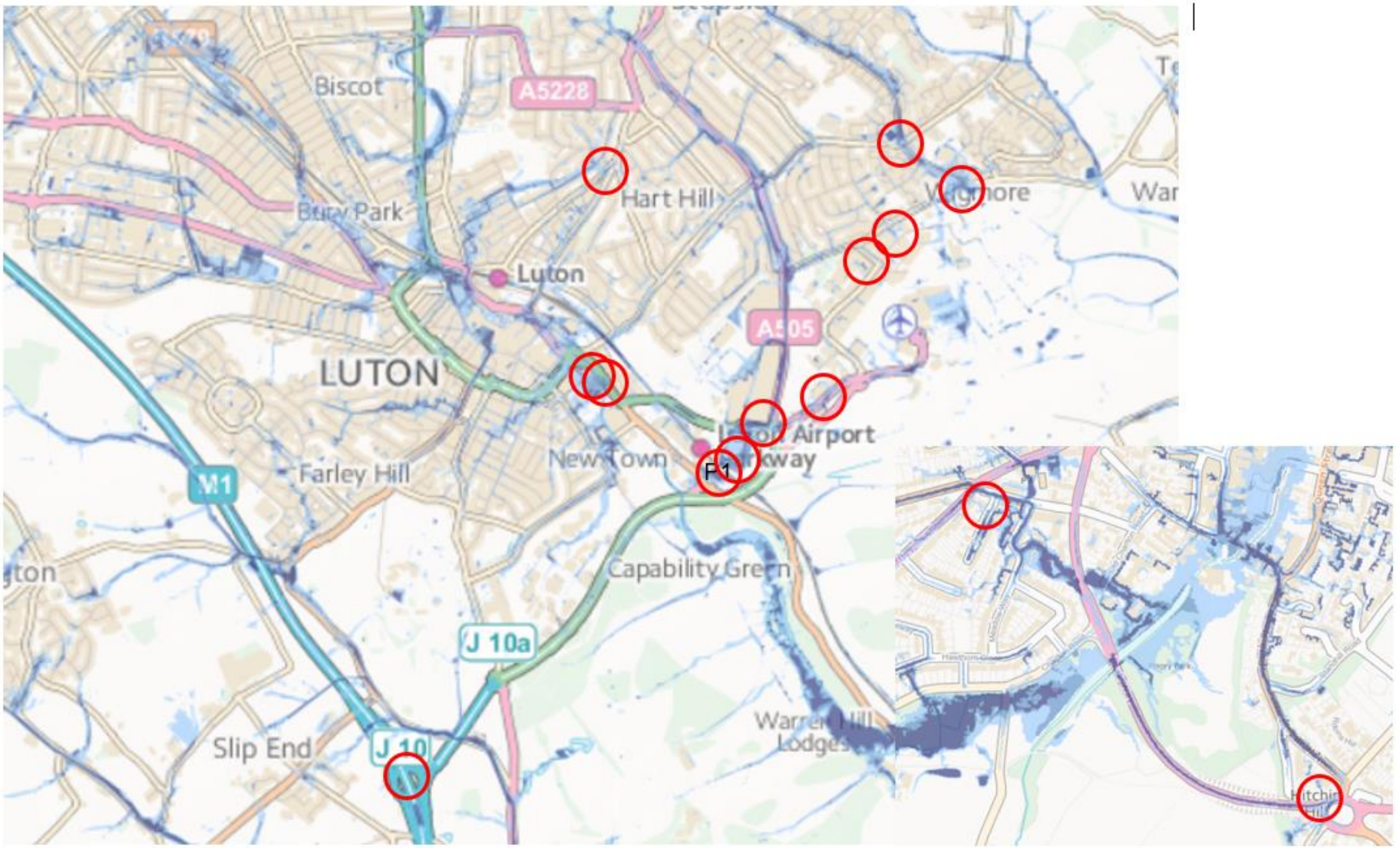
m. A602 Park Way/Stevenage Road.

4.1.11 As the highway intervention works, both off site and within the Main Application Site are located within the existing highway network it is not possible to move existing highway junctions to a lower flood risk location. In terms of flood risk vulnerability, the highway interventions are considered less vulnerable. Therefore, it is considered appropriate to undertake the proposed works at the locations listed above without considering the exception test. However, as these highway interventions are an important component of an Essential Infrastructure development the exception test has been considered.

4.1.12 There are also two off-site car parks (P1 and P2), located to the south west of the Main Application site. Neither are located in Flood Zones 2 or 3 and so are not in a location affected by fluvial flooding. However, P1 is located within an area of elevated surface water flood risk as shown in **Inset 4.3**.

4.1.13 The location of P1 and P2 has been based on proximity to the Main Application Site and the fact they are currently or have previously been used for car parking. In terms of flood risk vulnerability car parks are considered less vulnerable. Therefore, in accordance with the NPPF it is considered appropriate to consider placement of car park P1 in this location as long as surface water management for the site ensures the car park is protected from flooding and does not increase flood risk elsewhere. The full exception test has not been considered for these Off-site Car Parks because the proposed surface water management strategy is considered suitable.

Inset 4.3: RoFSW for highway interventions (within Main Application Site and Off-site) and Off-site Car Parks. Courtesy of the EA©



4.2 The exception test

4.2.1 To satisfy the exception test, evidence has to be provided of how the Proposed Development will provide wider sustainability benefits to the community that outweigh the flood risk and that the Proposed Development will be safe for its lifetime.

Main Application Site

4.2.2 The Proposed Development has looked to provide a sustainable development. A key example of this is the holistic approach to water management, with measures in place to maximise the reuse of rain and wastewater, reduce consumption of potable water at the airport, and improve the treatment of surface water runoff from the airport. This will result in net benefits to the water environment and provide wider sustainability benefits.

4.2.3 The existing surface water flow paths and catchments have been taken into consideration in terms of the surface water drainage design. This ensures that the existing water balance to the existing surface water receptors is maintained. In addition, the surface water management system has been designed to be able to collect and convey high volumes of surface water to safeguard against flooding of the airport facilities within the Proposed Development.

4.2.4 Further details of the proposed surface water management design are provided in the Drainage Design Statement provided as **Appendix 20.4** in Volume 3 of the PEIR.

Highways interventions and Off-site Car Parks

4.2.5 The proposed highway Interventions associated with the Proposed Development, both off site and within the Main Application Site, will help provide the following wider sustainability benefits, which includes taking account of flood risk:

a. Alleviate traffic congestion across the local road network, which in turn will reduce the air emissions associated with slow moving traffic and improve travel time efficiency lowering fuel consumption.

b. The detailed design of these locations will incorporate measures to manage surface water drainage in accordance with contemporary standards of design. This will ensure that local flood risk to existing receptors is not increased.

c. Improvements to the local surface water management provision will be undertaken as part of the works, to alleviate existing surface water flooding issues, where technically feasible.

d. Water quality has been assessed, and measures incorporated into the surface water management design to treat potentially polluted surface water discharges, where technically feasible.

5 ENGAGEMENT

5.1.1 Throughout the pre-application process, input has been sought from the following key stakeholders:

a. the LLFAs responsible for the areas affected by the Proposed Development (CBC, LBC and HCC);

b. the EA with respect to their role in setting a national flood risk strategy and also in respect to their roles to control discharges to controlled waters;

c. Thames Water as the local sewerage undertaker; and

d. Affinity Water as the local public water supply undertaker.

5.1.2 A series of meetings were held with these key stakeholders in order to keep them up to date on the progress of the Proposed Development and the key design features with the potential to affect flood risk. The main focus of these meetings was the proposed drainage strategy.

5.1.3 A summary record of this engagement is provided in **Section 20.4** of **Chapter 20** Water Resources in Volume 2 of the PEIR.

6 BASELINE CONDITIONS

6.1 Site Description

Main Application Site

6.1.1 The site is located in Luton, located approximately 45km north west of London in the south east of England. The existing London Luton Airport is located to the east of Luton town centre and lies within the administrative boundary of LBC.

6.1.2 The Main Application Site of the Proposed Development covers approximately 480ha to the east of the existing London Luton Airport, across Luton and North Hertfordshire to the east. A description of the Application Site, including the Main Application Site, Off-site Highway Interventions and Off-site Car Parks, and the surrounding area is provided in **Chapter 2** in Volume 2 of the PEIR. These development areas are shown in **Figure 2.1** in Volume 4 to the PEIR.

6.1.3 In addition to the existing airport infrastructure, land use within the Main Application Site comprises Wigmore Valley Park, which is characterised by areas of scrub, rough grassland and wooded areas. This is located over a historic landfill site. To the east and south of the park the land is used for arable farming. The Main Application Site extends beyond Winchill Road, to the east.

6.1.4 The airport is located over 450m north east of the River Lee on an elevated escarpment area that forms part of a scarp slope of the Chilterns Hills.

6.1.5 The Main Application Site contributes to 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).

6.1.6 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 160 - 115m AOD.

6.1.7 The Proposed Development includes the AAR that connects to New Airport Way and links in with Percival Way. The majority of the western half of the alignment is proposed to occupy a corridor of undeveloped land between Vauxhall Way and Percival Way. The alignment then arcs around to the north east through existing industrial and commercial properties associated with airport operations and connects into the existing Percival Way.

Highways interventions and Off-site Car Parks

6.1.8 The proposed highway interventions are located at existing highway junctions that have been determined to be affected by the changes in traffic flow caused by the increase in passenger numbers at the airport. These locations are both in the Main Application Site, including the AAR, and at off site locations. There are also two off site car parks (P1 and P2), located to the south west of the Main Application site.

6.2 Existing surface water features and flood risk

Main Application Site

6.2.1 The Main Application Site covers a large geographical area, however, as a result of the underlying geological strata the Main Application Site is devoid of natural permanent surface water features such as rivers or streams. Although, there are a number of surface water features in and around the Main Application Site associated with surface water management of the existing airport and the surrounding residential development. These are described in more detail in **Table 6.1** and **Table 6.2**.

6.2.2 The nearest watercourses are outside of the Main Application Site and are described below.

6.2.3 The River Lee is a designated main river, located approximately 450m to the south west of the Main Application Site. It is a major tributary of the River Thames and generally flows within an open channel in a south easterly direction. It is a groundwater fed river, although over time urbanisation has changed the characteristics of its inflow with a far higher proportion now being surface water runoff.

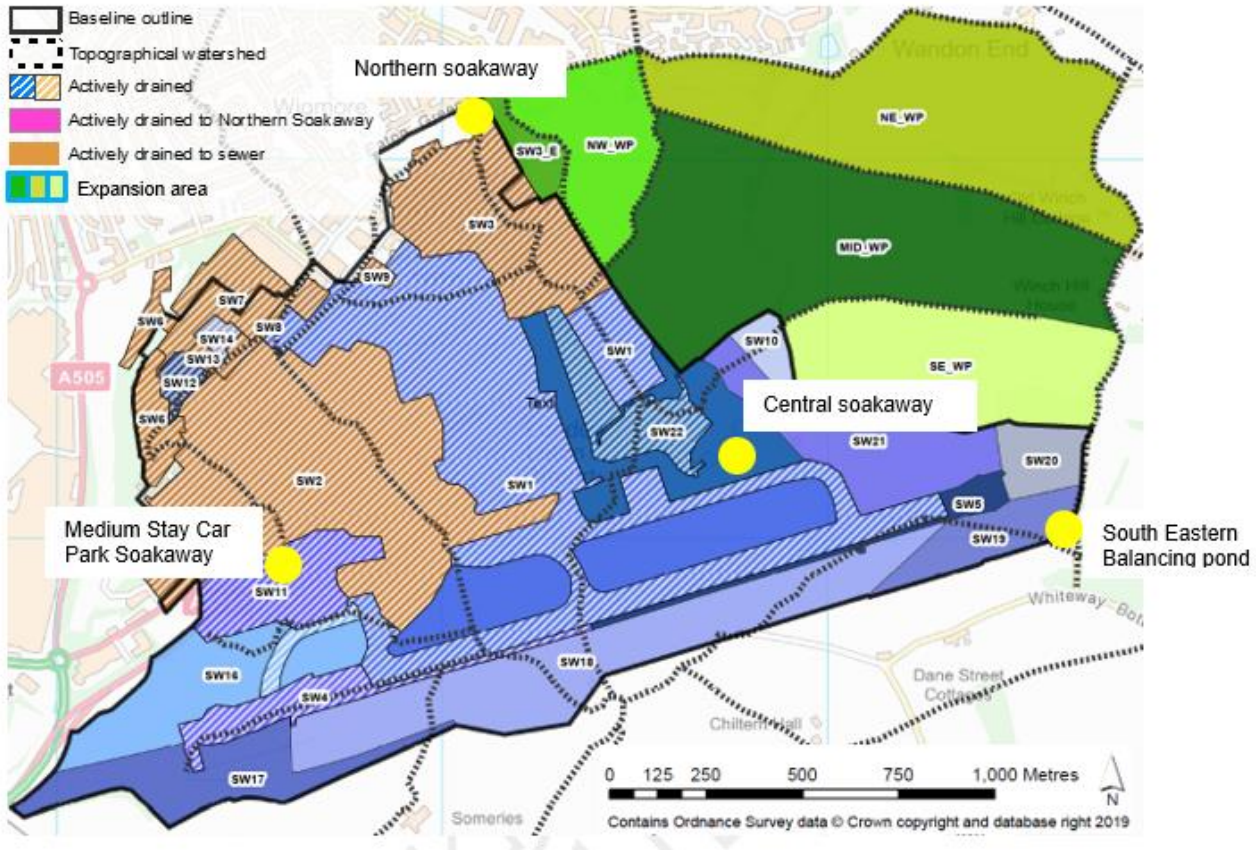
6.2.4 Hydraulic control structures have been installed on the River Lee in the vicinity of the southern access road to Luton Hoo Estate access (not publicly accessible). These control structures were installed in the 18th Century as part of the estates landscaping designed by Capability Brown in order to create two online lakes. This lake is still present today and are known as Luton Hoo Lakes, although they are essentially over-widened sections of the River Lee.

6.2.5 The River Mimram is a designated main river, located approximately 3.5km to the east of the Main Application Site. The Mimram is a chalk stream, a watercourse type with a very specific ecological and habitat response that is in decline across Southern England. It is fed by the local groundwater catchment underlying the Main Application Site.

6.2.6 The Main Application Site is located on an elevated plateau above the River Lee and River Mimram floodplain, this is outlined on **Inset 4.1** and demonstrates that the Main Application Site is located within Flood Zone 1, and as such is at low risk of flooding from the River Lee and River Mimram.

6.2.7 The surface water catchments within the existing airport and across the Main Application Site have been identified based on the Asset Management Plan report produced by Mott McDonald (Ref. 10). The catchments are shown below in **Inset 6.1**.

Inset 6.1: Existing surface water catchments in the Main Application Site.



6.2.8 The catchment names, area in ha, nature of the catchment and receptors are described in **Table 6.1**.

Table 6.1: Existing surface water catchment and details

Catchment name	Receptor	Developed area (ha)	Undeveloped area (ha)
Existing airport			
Central Soakaway (SW1) and undeveloped area SW22	Central Soakaway, although a first flush system is in place this is designed to direct the initial pulse of a rainfall event (assumed containing polluting material from the airside area) to the public drainage system which will then flow to East Hyde treatment works.	65.62	18.00
Airport Way (SW2)	Public drainage system owned and operated by Thames Water. Flows either to the River Lee at Luton Hoo Park via a 1,500mm sewer or to the Public foul water drainage system and onto East Hyde treatment works. First	40.9	NA

Catchment name	Receptor	Developed area (ha)	Undeveloped area (ha)
	flush system governs when flows are directed to the two receptors.		
Northern Soakaway (SW3)	Public foul water drainage system and onto East Hyde treatment works and Northern Soakaway. First flush system governs when flows are directed to the two receptors.	18.68	0.7
Runway West (SW7)	Contributes to Airport Way catchment (Public drainage system owned and operated by Thames Water)	5.33	NA
Easton Green Road (GKN) (SW7)	Public drainage system owned and operated by Thames Water. Flows to the River Lee at Luton Hoo Park via a 1,500mm sewer.	5.29	NA
Easton Green Road (Kerry Ingredients) (SW6)	Public surface water drainage system owned and operated by Thames Water. Flows to the River Lee at Luton Hoo Park via a 1,500mm sewer.	4.05	NA
Frank Lester Way (SW8)	Public surface water drainage system owned and operated by Thames Water. Flows to the River Lee at Luton Hoo Park via a 1,500mm sewer.	1.55	NA
President Way (SW9)	Direct to small local soakaway	0.42	NA
SW11 (Medium Stay car park	Direct to a Medium Stay Car Park Soakaway	9.76	NA
North west of existing runway (SW16)	Infiltrates in dispersed natural way (no formal structures)	0.96 (existing taxiway)	12.4
South western end of runway (SW4)	Airport Way catchment (Public drainage system owned and operated by Thames Water)	5.32	NA
South of western end of runway (SW17)	Flows in a southerly direction and infiltrates in dispersed natural way (no formal structures)	NA	10.9
South of runway (SW18)	Flows in a southerly direction and infiltrates in dispersed natural way (no formal structures)	NA	24.0
South eastern end of runway (SW5)	North East Balancing Pond	2.86	NA

Catchment name	Receptor	Developed area (ha)	Undeveloped area (ha)
To the south of eastern end of runway end (SW19)	South eastern balancing pond	NA	5.9
Land to the east of runway (SW20)	Flows in an easterly direction and infiltrates in a dispersed natural way (no formal structures)	NA	3.84
North of eastern end of runway (SW21)	Flows in an easterly direction and infiltrates in a dispersed natural way (no formal structures)	NA	12.76
Expansion Area			
NW of existing Wigmore Park (NW WP)	North towards existing pond off Eaton Green Road	NA	12.87
North east Wigmore Park (NE WP)	Flow eastwards to Mimram catchment	NA	39.6
Mid Wigmore Park (M WP)	Flows eastwards to Mimram catchment	NA	48.54
Southern rural (S WP)	Flows eastwards to Mimram catchment	NA	23.35

6.2.9 The EA's RoFSW mapping (see Inset 4.2) shows numerous areas of the Main Application Site potentially at risk from surface water flooding (overland flow), particularly to the east of the existing terminal building within the existing aircraft stands.

6.2.10 There are also overland flow paths along Airport Approach Road and then onto Airport Way and two flow paths within the proposed Expansion Area that indicate a significant flow of water south eastwards towards Kimpton.

6.2.11 Isolated spots of low lying land such as the existing soakaways are also identified by this data set across the Main Application Site.

Highway interventions and Off-site Car Parks

6.2.12 The Flood Map for planning indicates that none of the works associated with the highway interventions (within the Main Application Site or off-site) are within Flood Zones 2 and/or 3. However, it is acknowledged that the following locations are within close proximity to the River Lee:

a. Windmill Road/Manor Road;

b. Windmill Road/Manor Road/St Mary's Road/Crawley Green Road gyratory; and

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

6.2.13 The highway interventions affected by surface water flooding, based on the RoFSW mapping (Ref. 9) are shown in **Inset 4.3** and listed in Paragraph 4.1.10.

6.2.14 The off-site car park P1 is also located within an area of elevated surface water flood risk.

6.2.15 It should also be noted that Wigmore Lane and Vauxhall Way have been identified as Critical Drainage Areas (CDA) by LBC in their SWMP (Ref. 26). These are areas where the LLFA have identified a significant surface water flooding and drainage issue.

6.3 Existing Water Infrastructure

Main Application Site

Foul and Combined Drainage

6.3.1 Foul water at the Main Application Site 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 Drainage Design Statement in **Appendix 20.4** of Volume 3 to the PEIR.

Surface Water Drainage

6.3.2 The surface water generated by 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 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.

6.3.3 The pipe network, the linkages to the public drainage systems and the existing soakaway features are described in detail in **Table 6.2** in association with the catchments identified in Inset 6.1. The plan drawing of this network is available in the Drainage Design Statement in **Appendix 20.4** of Volume 3 to the PEIR.

Table 6.2: Infrastructure associated with surface water catchments

Catchment name	Infrastructure and receptor
Central Soakaway (SW1)	Pipe network collects surface water runoff from existing stands and taxi ways in the central area of the existing airport and the majority of the existing runway. This pipe network is served by a first flush system. This means that surface water is directed to the public foul water drainage system and

Catchment name	Infrastructure and receptor
	onto East Hyde treatment works until the rate of discharge causes water to overtop a spillway that allows water to flow to the existing central soakaway (infiltration basins). The idea being that the majority of contaminants are contained within in the initial volume of runoff (first flush). As flow increases not only is the amount of potentially polluting matter present reduced but also the amount of dilution is far greater. This means the majority of higher flows are directed to the central soakaway.
Airport Way (SW2)	Pipe network collecting surface water from existing terminal building, internal road and other buildings on the eastern side of the existing airport. The network is served by another first flush system although this system is designed to direct the first flush of a rainfall event to the public foul water system and onto East Hyde treatment works while higher flows are directed to the River Lee at Hooton Lakes.
Northern Soakaway (SW3)	Pipe network collecting surface water from a section of the existing long stay and other car parking to the north of the existing airport. Discharges to the existing Northern soakaway. Although first flush system is provided to direct potentially contaminated surface water to the public foul water system and onto East Hyde treatment works. This means the majority of higher flows are directed to the Northern soakaway.
Runway West (SW4)	Pipe network that collects the western extent of the existing airport and half of the southern edge of the runway and directs water to the public surface water sewerage system that is ultimately connected to the River Lee.
SW5	Pipe network that collects the eastern extent of the existing airport and half of the southern edge of the runway and directs water to an existing balancing pond (North East Balancing Pond).
Eaton Green Road (GKN and Kerry Ingredients) (SW 6 and 7)	Consists of two small catchments served by pipe networks discharging to the public surface water drainage system that is ultimately connected to the River Lee.
North East Balancing Pond	Drains to existing soakaway.
Frank Lester Way (SW8)	Served by pipe networks discharging to the public surface water drainage system that is ultimately connected to the River Lee.
President Way (SW9)	Served by pipe networks discharging to the public surface water drainage system that is ultimately connected to the River Lee.
SW11 (existing Medium stay car park)	Pipe network to existing soakaway.

Catchment name	Infrastructure and receptor
North west of existing runway (SW16)	No formal pipe network.
South western end of runway (SW4)	Served by pipe networks discharging to the public surface water drainage system that is ultimately connected to the River Lee.
South of western end of runway (SW17)	Served by pipe networks discharging to the public surface water drainage system that is ultimately connected to the River Lee.
South of runway (SW18)	No formal pipe network.
South eastern end of runway (SW5)	Pipe network to the central soakaway.
To the south of eastern end of runway end	No formal pipe network.
Land to the east of runway (SW20)	No formal pipe network.
North of eastern end of runway (SW21)	No formal pipe network.
Fire training ground	Effluent from the existing fire training ground stored and tankered off site.

Water Supply

6.3.4 Within the Main Application Site there is a private network of water supply assets operated by Veolia Water.

Highway interventions and Off-site Car Parks

Drainage Infrastructure

6.3.5 Existing foul, combined and surface water drainage infrastructure has been identified in the vicinity of the following roads affected by the highway interventions within the Main Application Site:

a. Airport Way;

b. Airport Approach Road;
c. Percival Way;
d. Eaton Green Road;
e. Frank Lester Way;
f. President Way;
g. Lalleford Road;
h. Chertsey Close;
i. Layham Drive;
j. Keeble Close;
k. Nayland Close; and
l. Wigmore Lane.

6.3.6 The existing drainage infrastructure for the highway intervention locations outside the Main Application Site have not yet been obtained.

6.3.7 This information will be obtained to inform the detailed design prior to commencement of construction and will be used to ensure that existing assets are not damaged and inform surface water drainage improvements required as a result of the proposed works and as a contribution to help alleviate existing surface water issues.

Water supply

6.3.8 Existing water supply infrastructure has been identified in the vicinity of the following highway interventions within the Main Application Site within the following roads:

a. Airport Way;
b. Vauxhall Way;
c. Eaton Green Road; and
d. Frank Lester Way.

6.3.9 All of these are less than 150mm small diameter distribution pipes.

6.3.10 The existing water supply infrastructure for the highway intervention locations outside the Main Application Site have not yet been obtained.

6.3.11 This information will be obtained to inform the detailed design prior to the commencement of construction and will be used to ensure that existing assets are not damaged and inform surface water drainage improvements required as a result of the proposed works and as a contribution to help alleviate existing surface water issues.

6.4 Geology and hydrogeology

Main Application Site

6.4.1 The Main Application Site is underlain by chalk deposits, mostly by the Lewes Nodular Formation and the Seaford Chalk Formation. The existing dry valleys within the Main Application Site, as represented by the surface water flow paths as shown in **Inset 4.2** and the River Lee valley are indicated to be underlain by The Holywell Nodular Chalk Formation and the New Pit Chalk Formation.

6.4.2 The bedrock deposits are then potentially overlain by the Clay with Flints Formation, although this is missing from the dry valleys and the River Lee deposit. The bottom of these valleys are filled with Head deposits.

6.4.3 These geological formations contain two groundwater bodies located beneath the Main Application Site, an extensive chalk bedrock aquifer and a smaller superficial aquifer associated with head deposits in the upper reaches of the River Mimram catchment.

6.4.4 The chalk is a soft white carbonate rock traversed by flint and marl layers and is designated by the EA as a Principal Aquifer, which are 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.

6.4.5 The regional groundwater flow direction within the chalk is to the south east in the dip direction of the chalk. However, the rivers described above have a marked influence on groundwater flow, with the groundwater in the River Lee catchment flowing in a westerly direction and groundwater in the River Mimram catchment flowing to the south east, although the River Mimram groundwater catchment is locally affected by potable water abstractions located near Kings Walden which results in an easterly flow of groundwater.

6.4.6 The groundwater divide between the River Lee and River Mimram groundwater catchments is actually located underneath the existing airport, just to the west of the existing Long Stay Car Park area.

6.4.7 As part of the design work it has been necessary to undertake a detailed Hydrogeological Characterisation Report, provided as **Appendix 20.3** in Volume 3 to the PEIR. This has involved determining the local groundwater levels within the chalk aquifer under the Main Application Site from observed data, using on-site and off-site borehole data. This information has been used in combination with information extracted from the EA's groundwater model (Ref. 27). This information has established absolute maximum ground water levels of 134m AOD at the western extent of the proposed Expansion Area within the Main Application Site and 116m AOD and the eastern extent.

6.4.8 The Hydrogeological Characterisation Report provided as **Appendix 20.3** in Volume 3 to the PEIR also analyses the permeability characteristics of the chalk underlying the Main Application Site. Analysis within this report has been used to determine an appropriate permeability to use for design purposes is 2.37 x 10-5m/s. The equates to an infiltration rate of 0.085m/hr.

6.4.9 Groundwater flooding is caused when groundwater levels increase to such an extent that the water reaches the surface. This can be caused by changes in the groundwater regime related to increases in rainfall, reductions in groundwater abstraction and changes to flow paths. It is ultimately controlled by the interaction of rock with water bearing potential and the ground surface. Although this mechanism can activate overland flow paths in areas where the water bearing strata is not represented at the surface.

6.4.10 Information on the current status of groundwater has been obtained by reviewing the existing flood risk reports outlined in Paragraph 1.4.1.

6.4.11 The LBC LFRMS (Ref. 13) presents groundwater flood risk by using the susceptibility to groundwater flooding data set as developed by the British Geological Survey (BGS). This data set categorises areas of land the following way:

a. Limited potential for groundwater flooding to occur (green).
b. Potential for groundwater flooding of property situated below ground level to occur (amber).
c. Potential for groundwater flooding to occur at surface (red).

6.4.12 This demonstrates that the majority of Luton Borough, including the Main Application Site has ‘Limited potential for groundwater flooding to occur’.

6.4.13 CBC’s PFRA (Ref. 23) 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.

6.4.14 HCC’s PFRA (Ref. 18) and LFRMS (Ref. 16) 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.

6.4.15 Furthermore, the HCC PFRA (Ref. 18) 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.

6.4.16 The event in Kimpton is of relevance to the Proposed Development as the Main Application Site lies within the groundwater catchment of the Mimram. Therefore, additional information on groundwater flood risk provided in this report.

6.4.17 In the winter of 2000-2001 in Kimpton, the River Kym, the line of which had been historically dry, re-emerged and followed its historical route which is thought to be along a line which now includes two of the roads in the village. The water had to be routed by various means through the village to join the River Mimram further down the valley. In an account of the event there is a note that the river also reappeared for a short while in 1947, this instance was associated with the sudden thaw that caused extensive flooding across the country during the winter so may have been related to overland flow rather than groundwater emergence.

Highway interventions and Off-site Car Parks

6.4.18 The majority of the highway interventions locations are underlain by the Lewes Nodular Chalk with Clay with Flints superficial deposits. However, the following locations are underlain by the deposits that characterise the River Lee Valley and the dry valleys i.e. Holywell Nodular Chalk Formation and the New Pit Chalk Formation bedrock overlain by head deposits:

a. Windmill Road/Manor Road;
b. Windmill Road/Kimpton Road;
c. A1081 New Airport Way/B653/Gipsy Lane;
d. Wigmore Lane/Crawley Green Road;
e. Eaton Green Road/Wigmore Lane;
f. Windmill Road/Manor Road/St Mary's Road/Crawley Green Road gyratory;
g. A1081 New Airport Way/A505 Kimpton Road/Vauxhall Way;
h. Car Parks P1 and P2; and
i. A505 Moormead Hill/B655 Pirton Rd/Upper Tilehouse Street (Located in Hitchin).

6.4.19 This places them in the same hydrogeological regime as the Main Application Site in terms of aquifer status and relative groundwater flow direction.

6.4.20 However, the geological and hydrogeological characteristics of the other two interventions located in Hitchin are outlined below:

a. A602 Park Way/A505 Upper Tilehouse Street – The bedrock at this location is the Holywell Nodular Chalk Formation and the New Pit Chalk Formation. These chalk formations are overlain by glaciofluvial deposits. The chalk formations are still part of the Principal Aquifer, while the superficial deposits are not encountered in the Main Application Site nor the offsite works in Luton. These superficial deposits are designated a Secondary A aquifer.
b. A602 Park Way/Stevenage Road – The bedrock at this location is the Gault Formation. This is comprised of mudstone units and is indicated to be unproductive strata. This is overlain by the glaciofluvial deposits, which are part of the Secondary A aquifer.

6.4.21 Detailed analysis has not been undertaken to determine groundwater levels for the off-site works due to the nature and scale of the Proposed Development. This data is not required to complete the assessment nor does its absence compromise the validity of the assessment.

7 FLOOD RISK ASSESSMENT

7.1.1 The assessment of flood risk has considered the phasing of construction and operation as outlined in **Chapter 4** in Volume 2 of the PEIR. However, this FRA focuses on the potential operational flood risk impacts. Construction related flood risk impacts are addressed by the measures described in the Draft Code of Construction Practice (CoCP) provided as **Appendix 4.2** in Volume 3 of the PEIR.

7.2 Fluvial Flood Risk

7.2.1 Flooding from rivers, streams and other natural inland watercourses is usually caused by prolonged or intense rainfall generating high rates of surface water runoff throughout the catchment. This overwhelms the capacity of the fluvial system as a flood flow and as a result, flood flow spills into available floodplain storage areas.

Main Application Site

7.2.2 The Main Application Site is at low risk of fluvial flooding (see **Section 4.1**) therefore no further assessment or engineering design for any of the phases was required and is not considered further in this report.

Highway Interventions and Off-site Car Parks

7.2.3 The following works are in close proximity to the River Lee:

a. Windmill Road/Manor Road;

b. Windmill Road/Manor Road/St Mary's Road/Crawley Green Road gyratory; and

c. A1081 New Airport Way/B653/Gipsy Lane

7.2.4 The works proposed in this area are limited in scope and scale and will not affect the existing channel or any existing floodplain storage. Therefore, no likely significant effects were identified, and these works are not considered any further in terms of their impact on fluvial flooding in this report. However, the appropriate level of engagement with the EA will be required at the detailed design stage and flood risk activity environmental permits are likely to be required where activities are within 8m of main river. The LLFA should also be engaged at detailed design to ensure local surface water flood risk issues are also addressed appropriately.

7.3 Surface water flood risk

7.3.1 Surface water or pluvial flood risk is associated with overland flow routes. This is a description for water flowing over the ground surface, which has yet to enter

a natural drainage channel, an artificial drainage system or the natural substrate. It is the result of very intense short lived rainfall events prolonged periods of wet weather when drainage systems are at capacity or the ground is already saturated. This can result in the inundation of low-lying areas. It is also related to sewer flooding, excessive groundwater and infrastructure failure.

Main Application Site

7.3.2 The key flood risk consideration of this Proposed Development in terms of flood risk is related to the management of surface water throughout the assessment Phases, as defined in **Chapter 5** in Volume 2 of the PEIR, and how this could affect the airport and adjacent areas.

Phase 1

7.3.3 At Phase 1 changes to the existing drainage network are required to facilitate the construction of proposed design features. These are described below, and any resulting flood risk issues identified.

7.3.4 In its current configuration the northern section of the existing long stay car park is assumed to discharge to the Northern Soakaway, the rest of this car park discharges to the Central Soakaway. As part of Phase 1, this area is to be repurposed but will remain as hardstanding. However, this area will continue to discharge to the Northern Soakaway. The remaining section of the long stay car park will become Car Park P5 and will continue to discharge to the Central Soakaway. This reduces the area contributing to the Central Soakaway by 64,400 m^3.

7.3.5 The majority of the area proposed for Car Park P4 and the additional aircraft stand, located south of the existing stands is currently part of catchment SW1 and as such discharges to the existing Central Soakaway. The proposals in the Drainage Design Statement (**Appendix 20.4**) indicate that this is to be discharged to the existing public surface water sewerage system operated and maintained by Thames Water, which ultimately discharges to the River Lee. This area is located within the River Lee catchment and so on a catchment balance perspective this will reunite a section of the catchment with the river. However, agreement will be sought from Thames Water to ensure their sewerage network has sufficient capacity. With this agreement in place there are no flood risk considerations associated with this proposal.

7.3.6 Additional hardstanding is created by the formation of Car Park P6 which is located to the east of the existing airport footprint and will be located on top of the existing landfill in Wigmore Valley Park. It is proposed to discharge the surface water from this car park to the public surface water sewer network operated and maintained by Thames Water. This connects to the Thames Water soakaway feature, which then infiltrates surface water to the underlying aquifer and feeds the River Mimram groundwater catchment. This arrangement maintains the existing water balance and ensures no flood risk considerations are caused at Phase 1 in association with Car Park P6.

7.3.7 The drainage design proposals for the new aircraft stands located south of the long stay car park are to direct surface water from this area to the existing

Central Soakaway. On the whole, this area is currently undeveloped and not served by formal drainage, therefore in its current configuration surface water falling on this area will likely infiltrate naturally to the underlying aquifer. Therefore, the utilisation of the central soakaway as the receptor for surface water from this area will maintain the overall water balance as water will not be transferred from one catchment (groundwater or surface water) to another. In addition, the strategy outlined in the Drainage Design Statement **(Appendix 20.4)** reduces the overall catchment contributing to the Central Soakaway. This takes account of the resizing of the existing long stay car park and incorporation of the area of land proposed for the new aircraft stands south of the long stay car park. Therefore, there are no flood risk considerations associated with this element of the design.

Phase 2a

7.3.8 At Phase 2a the proposed surface and foul water management system will be implemented which will include a WTP and two infiltration tanks. A large tank for 'untreated' surface water and a smaller tank for treated effluent. During normal operation all surface water collected will be diverted to the large untreated infiltration tank. However, a real time water quality monitoring network will be installed. If this system identifies potentially polluting matter the surface water will diverted to a large attenuation tank and then onto the WTP and discharged to the smaller infiltration tank as treated effluent. Details of the system and plan drawings are available in the Drainage Design Statement provided as **Appendix 20.4** in Volume 3 to the PEIR.

7.3.9 Surface water generated by the existing airport stands to the north and west of T1 (which represents the Airport Way catchment) will continue to flow to the public sewerage network, operated and maintained by Thames Water. This ensures that there are no flood risk considerations associated with the existing Airport Way catchment as a result of the Proposed Development at this stage.

7.3.10 In terms of flood risk the key changes implemented by the proposed drainage strategy are:

a. Following the construction of the WTP and the infiltration tanks, the existing surface water catchments that currently discharge to the existing central soakaway (i.e. SW1 and SW22) will be diverted to the new untreated infiltration tank (or the WTP and the smaller treated effluent infiltration tank during times when contaminants are detected).

b. Surface water generated by the hardstanding associated with T2 and Car Park P6 to the north of the terminal building will be directed to the 'untreated infiltration' tank. Surface water generated by the area proposed for T2 currently discharges to the existing Northern Soakaway. The area proposed for Car Park P6, above the landfill in Wigmore Park, currently drains to the north east and so contributes to the River Mimram catchment (ground and surface water).

c. Surface water generated by the proposed aircraft stands to the south of T2 and the new taxiways will also be collected and, in general, sent to the new infiltration tank (or the WTP and the smaller infiltration tank

during times when contaminants detected). As outlined for Phase 1, the majority of this area is currently undeveloped and not served by formal drainage, therefore in its current configuration surface water falling on this area will likely infiltrate naturally to the underlying aquifer within the Mimram groundwater catchment.

d. Surface water generated by Car Parks P7 and P8 will also be directed to the untreated infiltration tank, however, these areas will be connected to the water quality monitoring system and so surface water will be directed to the WTP and the smaller infiltration tank during times when contaminants are detected. This area is currently undeveloped and so currently surface water will infiltrate naturally to the underlying aquifer within the Mimram groundwater catchment.

e. The south west end of the existing runway (SW4) currently discharges to the public surface water sewerage system operated and maintained by Thames Water via the on-site Airport Way catchment. Surface water generated by this area is to be directed to the WTP and onto the smaller infiltration tank at times when the water quality monitoring system identifies that contaminants. If contaminants are not detected, surface water will continue to discharge to Airport Way and onto the public surface water sewerage system operated and maintained by Thames Water.

7.3.11 The strategy for the Main Application Site replaces the central soakaway with the two infiltration tanks located further to the east (the large untreated tank and the smaller treated effluent infiltration tank). The strategy also reduces surface water inputs to the Northern Soakaway by directing the water from the location of T2 to the untreated tank.

7.3.12 As the proposed infiltration tanks are all located within the same groundwater cell (Mimram groundwater catchment) as the existing soakaways, the proposals are not changing the overall surface or groundwater catchment balance. Therefore, there are no off site surface water flood risk considerations as a result of the Phase 2a proposals and so no flood risk impacts or effects have been identified in this phase.

7.3.13 In addition, the proposed surface water management strategy has been designed so that the infrastructure provided is able to collect and convey the 1% AEP rainfall event, with a 40% uplift in rainfall intensity to account for predicted changes in rainfall pattern caused by climate change, from each area of hardstanding to the infiltration tanks (this event is referred to as the 1% AEP + CC in all other instances in this report). This will prevent uncontrolled flows of surface water across the Proposed Development within the Main Application Site and will protect the more vulnerable facilities from inundation. This ensures that there will not be any surface water flood risk impacts or effects in the Main Application Site as a result of the Proposed Development.

7.3.14 The proposed water quality monitoring system will divert surface water to a large storage tank located adjacent to the WTP. This will occur when concentrations of specific pollutants exceed trigger levels. The water in the tank will then be gradually released to the WTP and the treated effluent will flow to

the smaller treated effluent infiltration tank. The storage available has been sized based on a 1% AEP + CC with a two hour duration. This provides the airport with a high degree of resilience against inundation, even when polluting matter is detected and requires treatment. This seeks to ensure that there will not be any surface water flooding impacts and effects even when the treatment of surface water quality is considered.

7.3.15 The addition of surface water catchment SW4 to the proposed WTP and onto the treated effluent infiltration tank has the potential to transfer surface water from a surface water catchment to a groundwater catchment. However, as this transfer will only occur during contamination events the frequency and duration of these changes is not considered to represent a flood risk consideration that requires further assessment or mitigation.

7.3.16 A potential groundwater flood risk consideration has been identified resulting from these proposals due to local groundwater mounding within the untreated infiltration basin and the potential impact to the areas local to the infiltration basin and downstream receptors. This is discussed further in **Section 7.5**.

Phase 2b

7.3.17 The changes from Phase 2a to Phase 2b involve an increase in the scale of development in the Expansion Area. This involves additional aircraft stands, additional car parking and the reconfiguration of the area north of T2 to incorporate New Century Park and Car Park P6. All these changes increase the area contributing surface water to the untreated infiltration tank (or the WTP and the smaller treated effluent infiltration tank during times when contaminants are detected).

7.3.18 As outlined for Phase 2a, the proposed infiltration tanks are all located within the same groundwater cell as the receiving catchment (Mimram groundwater catchment). In addition, the proposed on-site drainage infrastructure is able to collect and convey the 1% AEP + CC, from each area of hardstanding to the infiltration tanks. This will prevent uncontrolled flows of surface water across the airport and will protect the more vulnerable facilities from inundation. This design also provides a high degree of resilience against inundation, even when polluting matter is detected and requires treatment. This seeks to ensure that there will not be any on surface water flood risk impacts or effects.

7.3.19 The potential impacts on the groundwater regime, as with Phase 2a , are explored in **Section 7.5**.

Highway interventions and Off-site Car Parks

7.3.20 Surface water management strategies for the highway interventions and off-site works, including the AAR, will be developed in advance of construction where additional hardstanding is required.

7.3.21 The surface water management strategies will be developed in accordance with contemporary standards of sustainable drainage design to ensure no increase in surface water runoff up to the for the 1% AEP + CC storm event. In addition,

existing surface water flooding issues will also be taken into consideration. This will be undertaken in consultation with the LLFA.

7.3.22 The surface water management strategies have the potential of affecting the design solutions at the following location where the RoFSW data set identifies existing surface water flooding issues and will be of specific relevance to interventions along Wigmore Lane and Vauxhall Way which are CDA locations as identified by LBC in their SWMP.

a. Windmill Road/Manor Road;
b. Windmill Road/Manor Road/St Mary's Road/Crawley Green Road gyratory;
c. Hitchin Road/Ramridge Road;
d. A1081 New Airport Way/B653/Gipsy Lane;
e. Proposed airport access road (Airport Access Road)/A1081 Airport Way /Percival Way;
f. M1 Junction 10;
g. Wigmore Lane/Crawley Green Road;
h. Eaton Green Road/Wigmore Lane;
i. Eaton Green Road/Frank Lester Way;
j. A1081 New Airport Way/A505 Kimpton Road/Vauxhall Way;
k. Eaton Green Road/Lalleford Road;
l. A505 Moormead Hill/B655 Pirton Rd/Upper Tilehouse Street; and
m. A602 Park Way/Stevenage Road.

7.4 Infrastructure failure

7.4.1 Flooding can occur as a result of failure of infrastructure design to retain or transmit water. Retaining features can include formal features such as dams or flood defences but can also include features such as embankments, which in some locations can hold back flood waters. Flooding can also occur in the event of water supply and sewerage infrastructure failure.

Main Application Site

7.4.2 The existing pond and soakaway features along Eaton Green Road that are embanked have the potential to cause localised flooding if these features were to fail.

7.4.3 The existing overland flow routes from Eaton Green Road to the Main Application Site are represented by the RoFSW data set, shown within Area B on **Inset 4.3**. This demonstrates potential for a localised area to be affected in the event of the Northern Soakaway failing. If such a failure did occur the receptor would be car parking, roads and commercial/industrial buildings. These receptors reflect all stages, although during Phase 2 and 3 the existing car

parks, road and buildings will be replaced. However, the risk of failure of this asset is considered of very low probability as it is a maintained asset.

7.4.4 In the event of failure of the existing on-site sewerage or water supply networks the RoFSW data set indicates that water may accumulate around T1. The risk of failure and the impact of failure caused by this source of flooding is not changed by the Proposed Development.

7.4.5 The RoSWF data set also indicates that in the event of failure of existing airport water supply or sewerage infrastructure, water will flow east and naturally accumulate in the Expansion Area of the Proposed Development. At Phase 1 this will affect the adjacent agricultural field, in Phase 2 this will affect the construction area that will later become the Car Park P7, the WTP, the infiltration tank, the fuel storage facility and other ancillary services. The WTP and the fuel farm are considered essential infrastructure that could be disrupted by flooding. Therefore, the proposed drainage infrastructure in this area has considered this type of asset failure and will be constructed to safeguard the operability of essential infrastructure up to and including the design standard (1% AEP +CC). Therefore, there are no residual flood risk considerations associated with this source of flooding.

7.4.6 It should also be noted that the risk of failure is increased during construction. However, the contractor will employ methods and procedures to safe guard the integrity of buried and other utility assets and will also have procedures in place to mitigate flooding in the event of a failure while works are being undertaken. These are outlined in the Draft CoCP provided as **Appendix 4.2** in Volume 3 of the PEIR.

Highway interventions and Off-site Car Parks

7.4.7 In the event of main water supply or sewer failure in proximity to the proposed off site works, water emerging from a damaged pipe or sewer will reflect the flow paths and areas of accumulation identified in the RoFSW data set. This means the flow and accumulation of water is most likely to be experienced at the following off site work locations:

a. Windmill Road/Manor Road;
b. Windmill Road/Manor Road/St Mary’s Road/Crawley Green Road gyratory;
c. Hitchin Road/Ramridge Road;
d. A1081 New Airport Way/B653/Gipsy Lane;
e. Proposed airport access road (Airport Access Road)/A1081 Airport Way /Percival Way;
f. M1 Junction 10;
g. Wigmore Lane/Crawley Green Road;
h. Eaton Green Road/Wigmore Lane;
i. Eaton Green Road/Frank Lester Way;
j. A1081 New Airport Way/A505 Kimpton Road/Vauxhall Way;

k. Eaton Green Road/Lalleford Road;

l. A505 Moormead Hill/B655 Pirton Rd/Upper Tilehouse Street; and

m. A602 Park Way/Stevenage Road.

7.4.8 This will also be taken into consideration during the detailed design stage to ensure that surface water drainage provision takes this source of flooding into account.

7.5 Groundwater Flood Risk

Main Application Site

Phase 1

7.5.1 There are no groundwater flood risk impacts or effects caused by Phase 1 of the Proposed Development.

Phase 2a and 2b

7.5.2 The proposed surface water management strategy for Stages 2a and 2b diverts surface water from a large area of land to the untreated infiltration tank (assuming contaminated material is not detected by the proposed water quality monitoring system) and so diverts a large volume and rate of water to a new infiltration tank. The tank has been designed to be able to store up to 75,000m^3 and the maximum discharge rate reaching the infiltration tank has been calculated as 847l/s for the 1% AEP + CC. This has been calculated using the IH124 method for small catchments (Ref. 28) and assumes a combined total for all the catchments contributing to the untreated infiltration basin, which represents a reasonable worst case assumption.

7.5.3 Groundwater analysis and modelling has been undertaken to determine the local impact of this rate of water reaching the tank when the groundwater level is at the calculated 1% AEP maximum.

7.5.4 This indicates that groundwater mounding will occur but overtopping of the tank will only occur after 15 hours. This is considered to give the Main Application Site a high level of resilience against extreme rainfall during extreme groundwater conditions. This analysis does not take account of any of the on-site storage such as the pipe network and the attenuation tanks, which increases the resilience of the system.

7.5.5 Overtopping of the attenuation basin would potentially cause overland flow to be generated and localised pooling in the agricultural field downstream of potentially in excess of 50mm. However, this is considered a very low risk event, outside the normal design event parameters and as such will not be reported in terms of an impact and effect but is presented as a demonstration of the resilience of the system being proposed.

7.5.6 Another groundwater risk that has been considered is the dispersal of the groundwater mound, generated during this scenario, and its impact downstream.

7.5.7 Assuming the dispersal of the groundwater mound downgradient is gradual and reflective of the calculated permeabilities, the risk of the mound being responsible for elevating groundwater levels in locations such as Kimpton is considered very low. This is based on the time it will take for the water to reach the downstream location, with the chalk attenuating the groundwater flow downstream.

7.5.8 However, the risk of the Main Application Site affecting conditions at Kimpton could increase if there is an accelerated dispersal rate. This could occur if a fracture flow pathway becomes active. Generally, this type of pathway is not common in the chalk and there is no indication that this pathway exists at the Main Application Site. However, measures are proposed in advance of construction to assess this risk further and allow mitigation to be deployed if required. These measures are not exhaustive but outline how the potential risks can be confirmed and mitigated:

a. additional ground investigation at site of infiltration basin to confirm permeability characteristics and determine existence of fractures. This is to include geophysical survey;
b. undertake site visit and desk study of the conditions at Kimpton to improve understanding of linkages between Main Application Site and this area of historic flood risk;
c. reconfigure shape of infiltration basin, if required, to avoid areas of fracturing detected by the ground investigation and geophysical studies; and
d. engineer local ground permeability if required in response to ground investigation to help attenuate flow.

Highway interventions and Off-site Car Parks

7.5.9 No groundwater flood risk issues have been identified with any of the highway intervention or off site works.

8 SUMMARY AND CONCLUSIONS

8.1.1 This FRA has assessed flood risk from all sources of flooding for the Main Application Site and the off-site works across all phases of the Proposed Development.

8.1.2 This has determined that the Main Application Site is not affected by fluvial flooding.

8.1.3 Detailed assessment of the offsite works is not required in terms of fluvial flood risk, although the highway interventions at Windmill Road/Manor Road and Windmill Road/St Mary's Road/Crawley Green Road Gyratory are located in close proximity to the River Lee and so this will be considered at the construction stage in accordance with the Draft CoCP in terms of flood risk activity environmental permitting.

8.1.4 There are no surface water flooding considerations for the works, at any assessment phase, within the Main Application Site. This is because there are no cross catchment transfers of surface water and the proposed drainage strategy, designed to accommodate the 1% AEP + CC storm event will safeguard existing and proposed buildings and infrastructure.

8.1.5 A surface water management strategy will be developed for the proposed AAR prior to construction. The proposed drainage strategy would accommodate the 1% AEP + CC storm event will safeguard existing and proposed buildings and infrastructure.

8.1.6 Surface water management strategies for the other highway interventions and off site works will be developed in advance of construction where additional hardstanding is required. It will not be necessary to implement any additional surface water management infrastructure at locations where hardstanding is not increased.

8.1.7 The surface water management strategies will be developed in accordance with contemporary standards of sustainable drainage design to ensure no increase in surface water runoff up to the for the 1% AEP + CC storm event. In addition, existing surface water flooding issues will also be taken into consideration. This will be undertaken in consultation with the LLFA, taking account of existing surface water flooding issues.

8.1.8 The impact of failure of existing infrastructure has been assessed. These assessments have been undertaken and conclude that the provisions in the proposed drainage strategy provide a resilient system that takes account of infrastructure failure.

8.1.9 The proposed surface water management strategy for Phases 2a and 2b diverts a large volume and rate of surface water to a proposed untreated infiltration tank. Groundwater analysis and modelling has been undertaken to determine the local impact of this rate of water reaching the basin when the groundwater level is at the calculated 1% AEP maximum.

8.1.10 This indicates that groundwater mounding will occur but overtopping of the basin will only occur after 15 hours. This is considered to give the airport a high

level of resilience against extreme rainfall during extreme groundwater conditions.

8.1.11 Assuming the dispersal of the groundwater mound downgradient is gradual and reflective of the calculated permeabilities, the risk of the mound being responsible for elevating groundwater levels in locations such as Kimpton is considered very low. This is based on the time it will take for the water to reach the downstream location, with the chalk attenuating the groundwater flow downstream.

8.1.12 Overall, this assessment has not identified any flood risk consideration related to the Proposed Development at any part of the Application Site, in any of the three assessment phases that result in an impact that would result in a significant effect, when the normal standards of design (1% AEP + CC) are applied.

GLOSSARY AND ABBREVIATIONS

Term	Definition
AAR	Airport Access Road
AEP	Annual Exceedance Probability
AOD	Above Ordnance Datum
AWB	Artificial Water Bodies
BGS	British Geological Society
CBC	Central Bedfordshire Council
CoCP	Code of Construction Practice
DCO	Development Consent Order
DMRB	Design Manual for Roads and Bridges
EA	Environment Agency
ES	Environmental Statement
EU	European Union
Expansion Area	The area of Proposed Development to the east of the existing airport within the Main Application Site where works are proposed to take place.
FRA	Flood Risk Assessment
FWMA	Flood and Water Management Act
HCC	Hertfordshire County Council
HEWRAT	Highways England Water Risk Assessment Tool
HWMB	Heavily Modified Water Bodies
LBC	Luton Borough Council
Luton Rising	A trading name for London Luton Airport Limited
LLAOL	London Luton Airport Operation Limited
LLFA	Lead Local Flood Authority
NPPF	National Planning Policy Framework
PEIR	Preliminary Environmental Information Report
PFRA	Preliminary Flood Risk Assessment
PINS	Planning Inspectorate
RBD	River Basin District
RBMP	River Basin Management Plan
ROFSW	Risk of Flooding from Surface Water
SFRA	Strategic Flood Risk Assessment
STW	Sewage Treatment Works
SuDS	Sustainable Urban Drainage Systems

Term	Definition
SWMP	Surface Water Management Plan
WFD	Water Framework Directive
WTP	Water Treatment Plant

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