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London Luton Airport Expansion

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**5.02 Appendix 17.1 Preliminary Risk Assessment of Land
Contamination - Part A**

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The Planning Act 2008

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**London Luton Airport Expansion Development Consent
Order 202x**

**5.02 ENVIRONMENTAL STATEMENT APPENDIX 17.1 PRELIMINARY
RISK ASSESSMENT OF LAND CONTAMINATION - PART A**

| | |
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1 INTRODUCTION

1.1 Scope and objectives

1.1.1 This Preliminary Risk Assessment (PRA) of land contamination has been undertaken by Luton Rising (a trading name of London Luton Airport Limited) (the applicant) to support the application for a Development Consent Order (DCO) for the expansion of the airport, the Proposed Development. The type and scale of the airport expansion proposal meets the thresholds to be classified as a Nationally Significant Infrastructure Project (NSIP) for the purposes of the Planning Act 2008. Therefore, an application will be made to the Secretary of State for Transport for development consent.

1.1.2 The overall aim of the report is to provide an assessment of the potential contamination at the site, through a desk-based review of readily available information.

1.1.3 This report meets the requirements of a PRA as defined by current UK guidance, 'Land contamination risk management (LCRM) How to assess and manage the risks from land contamination' (Ref. 1) previously Contaminated Land Report (CLR11) (Ref. 2) and includes the following:

- a. A description of published geological/hydrogeological features of the area;
- b. A review of the historical land uses and contamination potential;
- c. A review of readily available statutory and public information that may inform contamination potential;
- d. A review of available site investigation reports to inform ground conditions;
- e. A conceptual site model (CSM) that reviews the potential contaminants of concern and provides a qualitative assessment of the likely risks to the identified receptors; and
- f. Recommendations for investigation, monitoring and other further works.

1.2 Structure of the report

1.2.1 The structure of this PRA report is as follows:

- a. **Section 1** – Provides an overview of the scope and objectives of this report.
- b. **Section 2** – Describes the existing site and its surroundings and provides a broad overview of the Proposed Development.
- c. **Section 3** – Describes the available data on which this study is based.
- d. **Section 4** – Provides a detailed description of the Proposed Development and the likely interaction with the soils and groundwater at the site.

- e. **Section 5** – Provides a review of the desk study information in the context of the Proposed Development.
- f. **Section 6** – Provides a detailed review of ground conditions based on information from previous investigations.
- g. **Section 7** – Provides a detailed review of the hydrogeological conditions of the regional area and the Proposed Development.
- h. **Section 8** – Provides a discussion of potential contaminative conditions at the Proposed Development and adequacy of the available data.
- i. **Section 9** – Presents the development of the initial conceptual site model (CSM) derived from the information presented in Chapters 4-8 and a qualitative assessment of the potential risks.
- j. **Section 10** – Conclusions and recommendations.

2 SITE DETAILS

2.1 Site location

2.1.1 The area included in the application for development consent is located approximately 3.5 km east of Luton town centre and is centred around the airport at National Grid Reference (NGR) 513400, 221800. **Figure 1** of this document shows the location and extent of the Application Site boundary.

2.2 The Proposed Development

2.2.1 The Application Site covers approximately 474 hectares (ha). The majority of this land lies to the east of the existing airport, but also included are areas of the existing airport, runway and isolated land parcels north and west of the airport where road infrastructure will be upgraded.

2.2.2 The Proposed Development builds on the current operational airport with the construction of a new passenger terminal and additional aircraft stands on land owned by the applicant located to the northeast of the runway. This will take the overall passenger capacity from 18 million passengers per annum (mppa) to 32 mppa. In addition to the above and to support the initial increase in demand, the existing infrastructure and supporting facilities will be improved in line with the phased growth in capacity of the airport.

2.2.3 For the purpose of assessment there are three assessment phases, Phase 1, Phase 2a and Phase 2b, which are referred to throughout the ES. The proposed masterplans for the assessment phases are presented in **Figures 2a, 2b and 2c** of this document and present the works which are assumed to be brought forward for each phase.

2.2.4 A detailed description of the Proposed Development is provided at **Chapter 4** of the Environmental Statement [**TR020001/APP/5.01**].

2.2.5 The Proposed Development is split into four distinct geographical components:

- a. Main Application Site;
- b. Off-site Car Parks;
- c. Off-site Highway Interventions; and
- d. Off-site Planting.

2.2.6 For reporting purposes these areas have been further subdivided into smaller areas, as detailed below and identified on **Figure 3** of this document:

- a. Main Application Site into Existing Airport Land, LLAOL Contractor's Compound, the proposed Airport Access Road (previously known as Century Park Access Road (CPAR)) and Area A – Former Landfill, Area B – Land West of Winch Hill Lane and Area C – Land East of Winch Hill Lane.

- b. Off-site Car Parks into Areas D – Off-site Car Park North and E – Off-site Car Park South.

2.3 Current land use

2.3.1 The current land uses of each of the areas of the Proposed Development and the surrounding area are provided in **Table 2.1** below and shown on **Figure 4** of this document.

Table 2.1: Current land use of each area and the surrounding areas.

| Sub division | Approx. Size Ha | Within Area | Surrounding Area |
|------------------------------|-----------------|---|---|
| Main Application Site | | | |
| Existing Airport Land | 175 | The airport infrastructure consists of a terminal building, runway with associated taxiways, stands, aprons and hangars, maintenance facilities and airport related offices. A fire station is located in the southwest of the terminal building. The associated business park to the north and west of the main airport area also accommodates a range of aircraft and airport production and maintenance businesses, including two fuel depots. A number of car parks for short-, mid- and long-term stay are provided for airport users. The Tidy Tip (formally called the Eaton Green Civic Amenity Site) is located at the western boundary with Area A. | Eaton Green Road and Darley Road mark the northern perimeter of the Main Application Site area (Existing Airport Land and Areas A, B and C) and a balancing pond maintained by Thames Water is adjacent Area A at the northern boundary. Fifty metres north of Eaton Green Road are offices/commercial buildings and a large residential estate. North of Darley Road is a golf course/arable land and farm buildings. Winch Hill Lane, runs north to south, between Areas B and C. Agricultural land forms the north east, eastern and southern boundaries. |
| LLAOL Contractor's Compound | | The south eastern area of the airport (see Figure 4 of this document) is a compound used by the operator's contractor for storage of various items including construction arisings from Terminal 1 improvements. In the east is the fire training ground. | At the south west boundary are industrial /commercial activities. West of the site is further car parking which runs parallel to Vauxhall Way, beyond |

| Sub division | Approx. Size Ha | Within Area | Surrounding Area |
|-----------------------------|-----------------|---|--|
| | | South of this are two existing airport soakaways (known as the central soakaway). The north east balancing pond is on the boundary with Area B. | which are the remaining operations of the Vauxhall Factory. Small industrial units also form sections of the north west boundary between President's Way and Eaton Green Road. |
| Airport Access Road | 65 | Existing carriageways; President's Way and Percival Way to the east, with industrial /commercial land on the central section of proposed carriageway and undeveloped land along the western section along Dairyborn escarpment. The eastern section of the proposed Airport Access Road is on the landfill and is part of Wigmore Valley Park (WVP), see Area A below. | |
| A – Former Landfill | 40 | This area comprises public open space, known as Wigmore Valley Park (WVP) and car parking. Sports pitches are present in the north eastern part of the area. The long-term car park for the airport is present in the west of the area. In the northwest is another car park (operated by TUI). The central and southern part of the site are a County Wildlife Site (CWS). | |
| B – Land West of Winch Hill | 96 | The northwest part of this area forms part of WVP. Within this area is a community centre, skateboard park, children's playground and allotment gardens as well as public open space, scrub and woodland areas. The rest of the area comprises | |

| Sub division | Approx. Size Ha | Within Area | Surrounding Area |
|-----------------------------|-----------------|---|--|
| | | agricultural land with a coppice and small woodland in the south, designated as ancient woodland. Winch Hill Farm and New Winch Hill Cottages are located on the eastern boundary on Winch Hill Lane. | |
| C – Land East of Winch Hill | 36 | Predominately arable land with some hedgerows/trees. There is a woodland area present which bisects the site. Two agricultural barns are located at the western boundary and a large residential property 'Winch Hill House' to the south of these. The National fuel delivery pipeline passes underground north east to south west through Area C. | |
| Off-site Car Parks | | | |
| D – Off-site Car Park North | 4 | This area comprises a large earthwork platform aligned north to south across the central and eastern areas, the platform is currently occupied by a trailer park for storage of heavy goods vehicle (HGV) trailers. A car park and vehicle servicing area are located along the north western area, at a lower level to the trailer park area, commensurate with the adjacent public highway. | Bounded on all sides by roads: to east is the A1081 (New Airport Way), with local access roads (Vauxhall Road) to the west and south and an access road to a car dealership at the northern boundary. Beyond Vauxhall Road to the south lies the Midland Mainline railway line and to the west further industrial buildings and to the east of the airport runway. |
| E – Off-site Car Park South | 1 | The site was recently used as a storage compound by the contractor working on the MPT. Part of the site is covered with hardstanding | The north eastern boundary is formed by Midland Mainline railway line, with the A1081 (New Airport |

| Sub division | Approx. Size Ha | Within Area | Surrounding Area |
|---------------------------------------|-----------------|--|--|
| | | and two structures are also present from historical use by Vauxhall Motor Company. | Way) to the south east of the site. An access road coming off Parkway Road lies to the north western boundary and the southern boundary is formed by the slip road to the A1081. North east of the site is Area D, north west is a car park for Luton Airport Parkway Station beyond which are commercial activities, south of the site are wooded and landscaped grounds associated with Luton Hoo Hotel, Golf and Spa, which lie north and south of the River Lea. |
| Off-site Planting | | | |
| Hedgerow Enhancements | - | Field boundaries to agricultural land, north and northeast of the main site area. One area is to the south of the site along field boundaries from Chiltern Hall and an access track to Someries Castle. | Agricultural land. |
| Off-site Highway Interventions | | | |
| Minor junction improvements | - | Highway Intervention areas currently comprise a series of asphalt carriage ways, pavement and landscaping to road verges. Most junctions are located to the north, west and southwest of the site within a 2km radius, with three junctions located in Hitchin 9km to the north east of the site. See Table | Residential and commercial properties bound the areas of off-site Highway Interventions. Apart from the junctions A1081 London Road North and South and M1 junction 10 which are bordered by greenfield /undeveloped land. |

| Sub division | Approx. Size Ha | Within Area | Surrounding Area |
|---------------------|------------------------|---|-------------------------|
| | | 4.2 of this document for further detail. | |

3 DATA SOURCES

3.1 Study area

3.1.1 A search area was created which covered the Proposed Development plus up to 2km buffer from the Order Limits depending on the potential contamination source or sensitive receptor under consideration, see **Section 3.1.2** below. The search area was used to obtain data from a number of sources; both publicly available online sources and purchased bespoke data sets, see **Section 3.2** of this document. Additionally there are a large number of reports and site investigations relating to the existing airport and surrounding area, the most relevant of which have been reviewed for this report and are detailed in **Table 5.6** of this document.

3.1.2 Guidance contained within R&D Publication 66 (Ref. 3) states that off-site features typically within an area up to 250m from the indicative development boundary should be considered within the hazard identification stage of site assessment. However, features of greater distances should be considered if they have the potential to affect a greater distance (dependant on the form of potential contamination and likely pathways). The distances used are noted below and are for the Main Application Site and Off-site Car Parks as this is the location of the most significant earthworks:

- a. Environmental permits and pollution incidents up to 250m;
- b. Historical land uses up to 250m;
- c. Landfills up to 1km;
- d. Sites of ecological significance/environmental designations to 2km; and
- e. Aquifers, groundwater abstractions and surface water features up to 2km.

The wider hydrogeological regime is discussed in **Section 7** of this document.

3.1.3 The buffer to the Off-site Planting and Off-site Highway Intervention areas is limited to 250m for current and historical land uses and current and historical waste management facilities /landfills as only very shallow soils will be disturbed in these areas by the works. The nature of the works also means there will be no potential for pathways to be formed to off-site hydrological and hydrogeological features and therefore these receptors have not been considered.

3.2 Publicly available sources

3.2.1 The following published information sources have been reviewed:

- a. Geological Survey of England and Wales 1:50,000 Geological Map (Leighton Buzzard) Solid and Drift, Sheet 220 (Ref. 4).
- b. Geological survey of Great Britain (England and Wales) Geological Map - Hitchin 221 (Solid and Drift) 1:50,000 series (Ref. 5).
- c. Geology of the country around Hitchin. Memoir for 1:50,000 geological Sheet 221 (England and Wales) (Ref. 6).

- d. British Geological Survey Onshore GeoIndex (Ref. 7);
- e. Groundsure Reports and associated historical mapping, see **Appendix A** of this document).
- f. The Environment Agency Website – ‘What’s in Your Backyard?’ (Ref. 8);
- g. DEFRA Data Services Platform (Ref. 9).
- h. Multi Agency Geographical Information for the Countryside (MAGIC) maps (Ref. 10).
- i. Groundsure Data viewer (Ref. 11).

3.3 Previous studies

3.3.1 Reports which have been reviewed for the PRA are listed in **Table 3.1** below. The most notable findings from these are reported in **Sections 6, 7 and 8** of this document. The reports cover the Main Application Site and are not inclusive of the Off-site Car Parks (Areas D and E), Off-site Highway Interventions or Off-site Planting areas.

Table 3.1: Previous studies.

| Author | Date | Report Title |
|--------------------------------------|------|---|
| Fugro Engineering Services (Ref. 12) | 2003 | East Luton Corridor Improvements for Luton Borough Council |
| Burks Green (Ref. 13) | 2004 | Harrods Aviation, LLA Hangar 202, Apron and Taxiway Link, Foundation Works Risk Assessment |
| Terrence O’Rourke (Ref. 14) | 2004 | Hangar 202, Apron and Taxiway Link London, Luton Airport Planning Supporting Statement |
| Wardell Armstrong (Ref. 15) | 2004 | Southside and City Developments Ltd. Vauxhall Motors Site, Luton, Bedfordshire. Initial Phase Site Investigations, Preliminary Hydrogeological Assessment (Amended December 2004) |
| Wardell Armstrong (Ref. 16) | 2004 | Southside and City Developments Ltd. Vauxhall Motors Site, Luton, Bedfordshire. Preliminary Review of Available Data |
| Wardell Armstrong (Ref. 17) | 2004 | Southside and City Developments Ltd. Vauxhall Motors Site, Luton, Bedfordshire. Supplementary Ground Investigation Report (Existing Vehicle Release Facility) |
| RSA Geotechnics Limited (Ref. 18) | 2004 | Harrods Aviation, LLA Hangar and Taxiway Extension at Luton Airport, Preliminary Factual Report |
| Casella Stanger (Ref. 19) | 2004 | Harrods Aviation Limited, LLA Hangar 202, Apron and Taxiway Link, Review of Environmental Reports |

| Author | Date | Report Title |
|--|---------------|--|
| Wardell Armstrong (Ref. 20) | 2005 | Southside and City Developments Ltd. Vauxhall Motors Site, Luton, Bedfordshire. Ground Investigation Report |
| Wardell Armstrong (Ref. 21) | 2005 | Southside and City Developments Ltd. Vauxhall Motor Site, Luton, Bedfordshire, Supplementary Ground Investigation Report (Existing Vehicle Release Facility) |
| WSP Environmental Limited (Ref. 22) | 2006 | Phase 1 Environmental Assessment (Project Odyssey) London Luton Airport |
| Vertase F.L. I (Ref. 23) | 2006 | Contract Completion Report, Napier Park, Luton |
| Wardell Armstrong (Ref. 24) | 2007 | Explore Investments Ltd. Napier Park, Kimpton Road, Luton. Groundwater Risk Assessment |
| URS (Ref. 25) | 2007 | East London Corridor Improvements, Geotechnical Report for Luton Borough Council |
| Mott Macdonald (Ref. 26) | 2008 | Veolia Water Projects, London Luton Airport, Surface Water Drainage, Asset Management Plan Report |
| Wardell Armstrong (Ref. 27) | 2008 | Explore Investments Limited, Stirling Place (Former Kimpton distribution centre) Kimpton Road, Luton, Bedfordshire, Ground Investigation Report |
| Wardell Armstrong (Ref. 28) | 2008- 2012 | Various validation reports for Zones 1-6 of Napier Park |
| Wardell Armstrong (Ref. 29) | 2012 | Letter report to Environment Agency on Groundwater Monitoring at Napier Park and Stirling Place |
| AECOM (Ref. 30) | 2012 | Foundation Works Risk Assessment Replacement Hangar and Cargo Compound Signature Flight Support |
| Soil Engineering (Ref. 31) | 2012 | Signature Flight Support London Luton Limited, Report on a Ground Investigation for Luton Airport FBO |
| AECOM (Ref. 32) | 2012 | Geotechnical & Geo-Environmental Interpretative Report |
| AECOM (Ref. 33) | 2012 | Phase 1 Geotechnical & Geo-Environmental Desk Study |
| Delta Simmons Environmental Consultants Limited | 2012 | Preliminary Site Investigation Report for Proposed Taxiway Foxtrot |

| Author | Date | Report Title |
|--|-------------|---|
| (Ref. 34) | | |
| RSK Environment Limited (Ref. 35) | 2012 | RPS Group Limited, Ocean Sky Jet Building, Luton Airport, Geoenvironmental and Geotechnical Ground Investigation |
| Waterman (Ref. 36) | 2013 | Napier Park and Stirling Place Environmental Statement |
| Ivy House (Ref. 37) | 2013 | Materials Management & Remediation Verification Report |
| Crossfield Consulting (Ref. 38) | 2013 | New ramp, Adjacent to Stand 80 |
| Mott MacDonald (Ref. 39) | 2014 | London Luton Airport Operations Limited, Phase 1 Geotechnical and Geo-environmental Desk Study |
| Mott MacDonald (Ref. 40) | 2014 | London Luton Airport Operations Limited, London Luton Airport Surface Water Drainage Strategy |
| Mott MacDonald (Ref. 41) | 2015 | London Luton Airport Expansion, Contamination Risk Assessment Report – Phase 1 Development |
| Concept Site Investigations (Ref. 42) | 2015 | London Luton Airport Operations Limited, Luton Airport Terminal Extension, Site Investigation Report |
| Mott MacDonald (Ref. 43) | 2017 | London Luton Airport Expansion, Contamination Risk Assessment Report, Phase 2 and 3 Development (Condition 17) |
| Concept Site Investigations (Ref. 44) | 2017 | London Luton Airport Operations Limited, Geo-Environmental GI, Site Investigation Report |
| Pell Frischmann (Ref. 45) | 2016 | Luton Airport Perimeter Road Preliminary Sources Study Report |
| Structural Soils Limited (Ref. 46) | 2017 | London Luton Airport Limited, Landfill, Factual Report on Ground Investigation |
| Structural Soils Limited (Ref. 47) | 2017 | London Luton Airport Limited, Century Park, Factual Report on Ground Investigation |
| Arup (Ref. 48) | 2017 | London Luton Airport Limited, Century Park Development Airport Way, Contamination Preliminary Risk Assessment – Former Eaton Green Landfill |
| Structural Soils Limited (Ref. 49) | 2017 | Luton Borough Council, Century Park Access Road, Factual Report on Ground Investigation |

| Author | Date | Report Title |
|------------------------------------|-------------|---|
| Arup (Ref. 50) | 2017 | London Luton Airport Limited, Century Park Development, Airport Way – Landfill Area, Contamination Quantitative Risk Assessment |
| Arup (Ref. 51) | 2017 | Luton Airport Mass Passenger Transit System, Land Contamination Preliminary Risk Assessment |
| Structural Soils Limited (Ref. 52) | 2017 | London Luton Airport Mass Passenger Transit System, Ground Investigation Phase 1: Factual Report |
| Arup (Ref. 53) | 2017 | Luton Airport Mass Passenger Transit System, Land Contamination Quantitative Risk Assessment |
| Geotechnics Ltd (Ref. 54) | 2018 | Century Park Access Road, Additional Works, Factual Report |
| Arup (Ref. 55) | 2018 | London Luton Airport Limited, Century Park, Airport Way, Play and Skate – Contamination Desk Study |
| Arup (Ref. 56) | 2018 | London Luton Airport Limited, London Luton Airport Expansion Ground Investigation Strategy |
| AECOM (Ref. 57) | 2018 | London Luton Airport Limited, Luton Hangar 24 Ground Investigation, Factual Ground Investigation Report |
| Arup (Ref. 58) | 2018 | London Luton Airport Limited, Proposed Airport Potential Parking Sites, Review of Ground and Construction Issues |
| Arup (Ref. 59) | 2018 | London Luton Airport Limited, Hangar 24, Ground Investigation Interpretative Report |
| GL Hearn (Ref. 60) | 2018 | Environmental Statement (Volume 1: Non-Technical Summary) New Century Park Luton |
| GL Hearn (Ref. 61) | 2018 | Volume 2: Environmental Statement – Addendum, Land adjacent to Luton Airport: New Century Park |
| G L Hearn (Ref. 62) | 2018 | Planning Statement Addendum, New Century Park |
| AECOM (Ref. 63) | 2019 | London Luton Airport Limited, Luton Airport Landfill, Main Ground Investigation – Factual Report |
| Mott MacDonald (Ref. 64) | 2019 | London Luton Airport, Taxiway Foxtrot Verification Report |

3.4 Liaison with regulatory bodies and other organisations

3.4.1 A number of organisations and regulatory bodies were contacted as part of previous work (Ref. 48) (Ref. 51) undertaken for part of the site. These included:

- a. Environmental Health, Waste and Planning Departments and Place and Infrastructure at Luton Borough Council;

- b. Environment Agency;
- c. Bedfordshire Archives and Records Service;
- d. Environmental Health Department at Central Bedfordshire Council;
- e. Luton Borough Council – Residential Regulatory Manager;
- f. Central Bedfordshire Council – Environmental Health Practitioner;
- g. North Hertfordshire District Council – Information and Asset Officer; and
- h. Historic England.

3.4.2 Copies of correspondence are provided in **Appendix B**. A summary of the responses is presented in **Section 5**. Both are available in this document.

4 PROPOSED DEVELOPMENT

4.1 Overview of development proposal

4.1.1 This chapter presents a detailed description of the Proposed Development and the likely associated earthworks within each of the areas. The extent of earthworks within each of the areas is important in assessing the potential risk to receptors from contamination. A description of the Proposed Development is described below in **Table 4.1**.

4.1.2 The Proposed Development will be delivered in line with the phased growth in the capacity of the airport, the assumed general layout for each assessment phase is shown in **Figure 2a, 2b and 2c** of this document.

Table 4.1: Summary of Proposed Development and associated earthworks.

| Development Area | Proposed Development | Likely earthworks |
|-----------------------------|---|--|
| Existing Airport Land | <p>Terminal 1 Improvement of existing terminal area including refurbishment of Terminal 1, departure lounge extension, extension to baggage hall, south pier and canopy and a new apron and stands.</p> <p>A section of the Luton Direct Air to Rail Transit (Luton DART)¹ extension will also be constructed by cut and cover.</p> <p>Relocation of the fire training ground with its associated facilities to the south of the runway.</p> <p>Relocation of staff car park.</p> <p>New 33kV substation</p> <p>SMR tower</p> | <p>Earthworks include piling for the new pier and excavation of Made Ground and natural soils for the section of Luton DART.</p> <p>Construction of decked car park.</p> <p>Relocation of the fire training ground is likely to require minor earthworks for construction of the soakaway and associated drainage.</p> |
| LLAOL Contractor's Compound | <p>Apron, piers, stands, taxiways, engine run up bay and attenuation tank.</p> | <p>Earthworks will be required to create an aviation platform to tie-in with the existing airport levels.</p> <p>Made Ground and natural soils to be excavated and relocated to southern end of Area A to surcharge the landfill prior to development.</p> |

¹ a new cable-hauled fast passenger transit connecting Luton Airport Parkway station to the airport (the announcement of an official opening date will be made in early 2023).

| Development Area | Proposed Development | Likely earthworks |
|---------------------|---|---|
| | | <p>Creation of temporary stockpiles of materials suitable for reuse in construction and landscaping.</p> <p>Construction of the airside platform with engineering fill (chalk) excavated from Area B.</p> |
| Airport Access Road | <p>Construction of new carriageway / duelling of existing carriageway to create a new link road from Airport Way to Terminal 2 (T2) with connections to a series of new access and on-airport distributor roads for T2 and Green Horizons Park (formerly New Century Park).</p> | <p>Earthworks will be required to create the new link road including excavation to create cuttings and construction of reinforced earth embankment.</p> <p>Excavation of landfill material where road is located in Area A.</p> |
| A – Former Landfill | <p>North</p> <p>Green Horizons Park developments; offices, hotels, warehouses and car parking.</p> <p>Airport infrastructure car parking, new road infrastructure including eastern section of Airport Access Road and landscaping.</p> <p>Attenuation tank.</p> | <p>Excavation of landfill material for provision of Airport Access Road and minor access roads and to create development platform.</p> <p>Piling through the landfill into underlying chalk for foundations to proposed buildings and infiltration tank.</p> |
| | <p>South</p> <p>New terminal building.</p> <p>Piers, apron, stands and taxiways.</p> <p>Extension to the Luton DART to the new terminal and new station.</p> <p>Energy centre, coach station and car parking.</p> | <p>Major earthworks to create a development platform to tie-in with the existing airport levels – excavation, processing and relocation of landfill wastes/Made Ground to extend landside platform east of landfill and for the Luton DART tunnel and station.</p> <p>Import of engineering fill (chalk) from Area B for development platform.</p> <p>Surcharging of landfill with stockpiled soils excavated from LLAOL Contractor’s compound.</p> <p>Piling through the landfill into underlying chalk for foundations.</p> |

| Development Area | Proposed Development | Likely earthworks |
|----------------------------------|---|--|
| B – Land West of Winch Hill Lane | Ancillary airport buildings. Aprons and stands. Fuel Storage Area and pipeline. Carparking. Water treatment plant, attenuation tank and infiltration tank, drainage infrastructure. WVP community centre, allotment gardens and parkland will be retained. Relocated public parkland. | Major excavation of clay and chalk to provide site-won engineering materials for the airside development platform. Piling into underlying chalk for foundations. Excavation of natural ground for provision of access road and car parks. Excavation for construction of the fuel farm and installation of the pipeline connection to the National fuel delivery pipeline. Some landscaping works will be required for preparing the land to be suitable for re-provision of public parkland. Creation of temporary stockpiles of materials suitable for reuse in construction and landscaping. |
| C – Land East of Winch Hill Lane | Creation of infiltration basin (below ground infiltration tank). | Excavation for infiltration basin. Excavation and connection to National fuel delivery pipeline. Creation of temporary stockpiles of materials suitable for reuse in construction and landscaping. |
| Off-site Car Parks | | |
| D - Off-site Car Park North | Car park | Potential for resurfacing, re-levelling |
| E – Off-site Car Park South | Car park. | Construction of a multi-storey car park. |

4.1.3 The application for development consent includes proposed off-site improvements to enhance the local highways network and accommodate increased traffic volumes. The locations of the proposed improvements are shown in **Figure 5** of this document and the illustrated on the drawings appended to the **Traffic Assessment** provided as part of the application for development consent [TR020001/APP/7.02]. The proposals are summarised in **Table 4.2** below:

Table 4.2: Description of proposed Off-site Highway Interventions.

| Location | Description |
|---|--|
| Eaton Green Road / Lalleford Road | Mini roundabout to be replaced with a three-arm signalised junction. Minor kerb line amendments are necessary along Eaton Green Road and Lalleford Road. All works contained within the highway boundary. |
| Eaton Green Road/Frank Lester Way | Roundabout replaced with a signalised junction, Frank Lester Way made one-way northbound. |
| Eaton Green Road / Wigmore Lane | Roundabout to be replaced with a four-arm signalised junction with on-demand pedestrian crossing facilities. Reconfiguration of the existing Eaton Green Road carriageway to provide two entry and two exit lanes from the Wigmore Lane junction, with widening to the south of Eaton Green Road into existing verge areas. Mini roundabout at Wigmore Lane and ASDA access road junction replaced with three arm signalised junction. Works would tie into the Airport Access Road which runs to the south east with a four-arm signalised junction with on-demand pedestrian crossing. |
| Wigmore Lane / Crawley Green Road/Raynham Way | Two roundabouts are to be replaced by four arm signalised junctions with on-demand pedestrian crossing facilities. Local carriageway widening and realignment is proposed along Wigmore Lane within the existing highway boundary. Realignment of Twyford Drive is proposed into existing grass verge areas. |
| Eaton Green Roundabout | Partial signalisation. Widening of Vauxhall Way to dual carriageway to be completed as part of LBC East Luton Study. |
| Crawley Green Road / Lalleford Road | Mini roundabout to be replaced with a three-arm signalised junction. |
| Windmill Road / Kimpton Road | Minor widening of the carriageway and kerb realignment to convert the mini-roundabout into a three-arm signalised junction. |
| Windmill Road / Manor Road / St Mary's Road / Crawley Green Road | Widening, reconfiguration and signalisation of roundabout. Widening of the circulatory carriageway to provide four lanes. Kerb line amendments along Windmill Road to provide a two-lane diverge from the roundabout. Widening of subway portal; to accommodate four lanes. |
| A1081 New Airport Way / B653 / Gipsy Lane/Kimpton Road/Vauxhall Way (Areas D and E) | Reconfiguration to the A1081 to provide three lanes in both directions through the signalised junction. Widening of Airport Way with dedicated left turn land provided to Kimpton Road. |

| Location | Description |
|---|---|
| A1081 / London Road (North) | Minor amendments to kerb lines on the east of the roundabout to provide a dedicated exit lane onto the A1081 eastbound. Partial signalisation of the roundabout on two of the arms. |
| A1081 / London Road (South) | Partial signalisation of junction and new road markings. |
| M1 J10 | <p>Widening to the northbound off-slip to provide a third lane on the approach to the roundabout, with the widening accommodated in existing verge and embankment and signalised junction.</p> <p>Northbound exit into M1 carriageway widening to southwest with existing farm access bridge demolished and rebuilt.</p> <p>Amendments to white lining on western circulatory carriageway to provide five circulating lanes, with this widening accommodated in the existing landscaped area on the inside of the roundabout. Amendments to the exit from the roundabout onto the A1081, to allow three lanes to diverge from the roundabout contained within existing carriageway.</p> <p>Southbound off slip signalised, amendment to white lining.</p> <p>Minor carriageway widening to provide left lane turn diverge onto M1 South.</p> <p>Southbound on slip, amendments to white lining.</p> |
| Hitchin Junctions | |
| A602 Park Way / Upper Tilehouse Street | Minor widening to the roundabout entries on Upper Tilehouse Street and Park Way to increase the length of the two lane entry. |
| A505 Offley Road /Upper Tilehouse Street | Minor widening and realignment of Upper Tilehouse Street entry. |
| A602 Park Way / Stevenage Road/Hitchin Hill | Minor widening to the roundabout entries on Hitchin Hill, Stevenage Road and Park Way to increase the length of the two lane entry. |

5 DESK STUDY INFORMATION

5.1 General

5.1.1 This section provides a description of the Proposed Development and surrounding areas based on the study area described above in **Section 3.1**; including topographical detail, information from site surveys, historical development and physical and environmental setting.

5.2 Topography

- 5.2.1 The airport is located on an elevated escarpment area that forms part of a scarp slope of the Chilterns Hills. The existing airport land is typically flat and lies at an elevation range between 154m above ordnance datum (AOD) and 155m AOD. The land rises to the west of Percival Way to an elevation of approximately 160m AOD at the Proposed Development boundary. The land then falls sharply to the car park at Vauxhall Way to an elevation of 130m AOD.
- 5.2.2 The ground levels vary in the south eastern area of the airport, used by the LLAOL contractor, due to the ongoing storage of soils excavated as part of airport improvement works.
- 5.2.3 The area to the east of the existing airport is characterised by a series of dry valleys which were formed during the last glacial period, see **Figure 6** of this document.
- 5.2.4 Two dry valleys cross the Main Application Site. A former landfill (Eaton Green Landfill) covers Area A and fills part of the head of one of the dry valleys. The former landfill has an undulating surface of elevation between 150m AOD and 155 m AOD with the southern part being particularly uneven and the ground level to the south and east dropping off steeply. The elevation at the bottom of the dry valley adjacent to the landfill is approximately 130m AOD.
- 5.2.5 There is a plateau between the two dry valleys, which runs through Areas B and C. At the north western corner of Area B ground levels are around 150m AOD. This gently slopes to the southeast to around 139m AOD in Area C.
- 5.2.6 Areas D and E and associated road junctions are situated on the side of the River Lee valley. Area D has a raised earthwork plateau in the south of the site, which covers approximately 2.4ha of the area and is at a significantly higher level than the surrounding areas at 127m AOD. New Airport Way, adjacent to the west is at a level of 120m AOD, and Vauxhall Road to the east is at a level of 107m AOD. There is an access ramp which runs along the southern and eastern boundary of Area D which leads to the plateau area. The northern portion gently slopes from east to west, from approximately 114.5m AOD to 110m AOD.
- 5.2.7 Area E comprises three distinct earthwork platforms decreasing in height from east to west; the approximate levels are 114m AOD, 110m AOD and 107m AOD respectively.

5.2.8 The area comprising the Off-Site Planting, north and northeast of the site is situated within a series of small valleys. The valley spine traverses to the east at an elevation of 120m AOD. The topography typically rises to the north up to an elevation of 150m AOD.

5.2.9 Topography for each Off-site Highway Intervention area has been summarised in **Table 5.1** below.

Table 5.1: Summary of topography for Off-site Highway Interventions.

| Location | Distance to the airport | Description |
|--|-------------------------|--|
| Eaton Green Road / Lalleford Road | 0.47km N | This is a small “T” junction between Eaton Green Road and Lalleford Road and lies at an elevation of 153m AOD. |
| Eaton Green Road / Frank Lester Way | 0.5km N | This is a three-arm roundabout between Eaton Green Road and Frank Lester Way Road and lies at an elevation of approximately 154m AOD |
| Eaton Green Road / Wigmore Lane | 0.64km N | Two roundabouts linking Eaton Green Road and Wigmore Lane. The northern area of the site lies at an elevation of 143m AOD and gently slopes south to an elevation of 140m AOD. |
| Eaton Green Road Roundabout | 0.2m NW | A roundabout linking Eaton Green Road and Vauxhall Way, at approximate elevation of 119m AOD. |
| Wigmore Lane / Crawley Green Road | 0.76km N | Two roundabouts linking Crawley Green Road and Wigmore Lane. The northern area of the site lies at an elevation of 145m AOD and gently slopes south to an elevation of 143m AOD. |
| Crawley Green Road / Lalleford Road | 1km N | A small modified “T” junction between Crawley Green Road and Lalleford Road with access onto Fermor Crescent. The site lies at an elevation of 154m AOD. |
| Windmill Road / Kimpton Road | 1.2km W | A small “T” junction between Windmill Road and Kimpton Road and lies at an elevation of 105m AOD. |
| Windmill Road / Manor Road / St Mary's | 2km W | A roundabout linking St Marys Road, Manor Road, Windmill Road and Crawley Road and lies at an elevation of 105m AOD. |

| Location | Distance to the airport | Description |
|---|-------------------------|---|
| Road / Crawley Road | | |
| A1081 / London Road (North) | 3.2km SW | A roundabout linking New Airport Way to London Road. The site lies at an elevation of 160m AOD. |
| A1081/ London Road (south) | 3.2km SW | Three-arm roundabout linking London Road to New Airport Way, elevation is approximately 150m AOD. |
| M1 J10 | 3.9km SW | M1 Junction 10 access and egress. The northern area of the site lies at an elevation of 154m AOD which rises to the south up to 160m AOD and gradually decreases further south to 153m AOD. |
| Hitchin Junctions | | |
| A602 Park Way / A505 Upper Tilehouse Street | 9.7km NE | Four-way roundabout linking Old Park Road, Payne's Park and Upper Tilehouse Street. The site lies at an elevation of 72m AOD. |
| Moormead Hill / B855 Pinton Road / Upper Tilehouse Street | 9.6km NE | Junction between Moormead Hill, Pinton Road and Upper Tilehouse Street and lies at an elevation of 77m AOD. |
| A602 Park Way / Stevenage Road | 9.5km NE | A five-way roundabout between Park Way, Stevenage Road and Hitchin Hill. The site lies at an elevation of 85m AOD in the north and gradually rises to 87m AOD to the south. |

5.3 Site walkover

5.3.1 As part of previous work undertaken by Arup (Ref. 48) (Ref. 51) several site walkovers and visits have been undertaken. Walkovers of the existing airport land have been undertaken for certain areas due to security restrictions. These are summarised in **Table 5.2** below. Site visit records, including photographs are presented in **Appendix C** of this document.

5.3.2 Site walkovers for the Off-site Planting and Off-site Highway Intervention areas have not been undertaken.

Table 5.2: Summary of key observations from Arup site walkovers and site visits.

| Date | Area | Key Observations |
|-----------------------|------------------------|--|
| 25 October 2015 | A – Former Landfill | <ul style="list-style-type: none"> a. The former landfill area was noted to be at a higher elevation than the surrounding area. It was noted to have a good grass coverage, with trees and bracken around the outside edges of the site. b. On the north eastern slope of the landfill some yellowing of the grass was noted, no other vegetation stress or die back was observed. c. Adjacent to the northwest boundary of the site was a community centre and conference facility, Skate Park and children’s playground. To the north of these there was a structure within a wooded area, most likely a gun turret from World War II. d. A small area of allotments was present approximately 100 m east of the community centre. e. The surface soil of the landfill was noted to be slightly clayey in place, which may represent capping material placed on the landfill. f. The north of the landfill is predominately flat; a football pitch is present in this area. The south of the landfill has a more undulating surface and is at a higher elevation than the northern part. g. Some water logging was noted, primarily in the south of the landfill. In this area large puddles were observed up to several metres in diameter, with some areas noted to be particularly marshy with reed type vegetation. The water logging of the surface in places may suggest areas of differential settlement. h. Chalky material was exposed at the surface in some areas in the south of the landfill. i. An old oil drum was noted at the surface in the south of the landfill area. j. The landfill drops off steeply to the southeast, at the base of the slope several waste objects were noted to be present at the surface which may have originated from the former landfill including tyres, glass bottles, oil drums and car parts. k. A series of manhole covers were present in the north of the landfill in a linear formation with concrete surrounds. |

| Date | Area | Key Observations |
|-------------------------|---|---|
| | | <p>These were noted to be a possible leachate collection system or drainage.</p> <ul style="list-style-type: none"> <li data-bbox="555 405 1423 510">l. The areas around the manhole covers and also refuse bins suggest that settlement of approximately 0.5 m - 1 m may have occurred in the north of the landfill. <li data-bbox="555 528 1423 633">m. In the southwest of the landfill, it was noted that water was running off the adjacent area to the south into the site. <li data-bbox="555 651 1423 835">n. The Luton Airport long stay car park in the west of the site was built over part of the former landfill and was noted to have some potential differential settlement as indicated by the undulating surface. Ponding of water was also noted in areas of the car park. |
| 14 September 2016 | B – Land West of Winch Hill Lane | <ul style="list-style-type: none"> <li data-bbox="555 869 1423 1048">a. A bridleway was noted to cross the far western side of the Country Park, parallel to a mature woodland. The bridleway and woodland were on a broad bund of gravelly Made Ground 0.5 m – 1.0 m higher than the land adjacent. This separates the park and former landfill. <li data-bbox="555 1066 1423 1171">b. The land was agricultural to the east and south of the bridleway. A large open field with recently harvested bean crop was noted with large amounts of topsoil visible. <li data-bbox="555 1189 1423 1261">c. The shallow dry valleys within the site were visible, cutting the terrain. <li data-bbox="555 1279 1423 1350">d. Occasional shallow depressions were evident across the landscape. <li data-bbox="555 1368 1423 1473">e. Towards the northern edge of site, the flints in the topsoil appeared smaller and more rounded than on the south side of the dry valley. <li data-bbox="555 1491 1423 1563">f. Within the dry valleys, no obvious wetland vegetation was present. <li data-bbox="555 1581 1423 1760">g. Four boreholes were noted on the western boundary with the landfill site. Three of these were within a field and appeared unserviceable with damaged headworks. One borehole encountered slightly further west appeared locked and serviceable. |
| 25 October 2015 | LLAOL Contractor's Compound | <ul style="list-style-type: none"> <li data-bbox="555 1798 1423 1935">a. A fire training area was noted at the west of the site with approximately 30% hardstanding with the remaining area grassed. Standing water was noted within the grassed area. |

| Date | Area | Key Observations |
|-----------------|-----------------------------|--|
| | | <ul style="list-style-type: none"> b. Excavated soils were noted to be stored within the contractor compound area to the south of the long stay car park. c. Mobile plant was present directly south of the long stay car park, undertaking some earthworks filling. |
| 19 October 2016 | Existing Airport Land | <ul style="list-style-type: none"> a. Five separate locations along the proposed Luton DART alignment were visited: Airport Fire station, an area to the north east of the airport runway, mid- stay car park, short-stay car park and the area of the proposed Luton DART Parkway station in Stirling Place (North of Luton Airport Parkway Railway station). Access to the whole of the existing airport area was not possible because of airport restrictions. b. Chemical storage tanks were noted adjacent to the fire station present on the airport site. c. The boundary of the airport is secured with a chain link fence, the hard-standing present and grassed areas were in good condition. d. The area to the north east of the airport runway and the embankment above New Airport Way was visited. Various items of waste were noted on the surface of the embankment, including plastic and metal fragments. These were also noted in the areas of animal borrows, suggesting that poor quality material may have been used in the construction of the embankment. e. The airport runway is built up approximately 5m above the rest of the site. f. A sweet phenolic odour was noted, possibly emanating from industrial buildings to the north west. |
| 9 November 2016 | LLAOL Contractor's Compound | <ul style="list-style-type: none"> a. Significant amount of earth was noted to be stockpiled in the LLAOL contractor compound adjacent to the former landfill site. This was noted to have increased significantly from the previous visit on 25 October 2015. Lorries were noted to be bringing further material into the compound area. The material appeared to be originating from the area of Terminal 1 improvements at the airport. b. LLAOL contractor compound was visited, the stockpiled earth was noted to be close to the former landfill boundary but not encroaching on to it. Visual inspection of the material did not indicate any visual or olfactory evidence of contamination. |

| Date | Area | Key Observations |
|--------------|----------------------------------|--|
| | | <ul style="list-style-type: none"> c. Within LLAOL compound area, plant associated with asphalt production was noted. Contractor personnel on-site during the visit advised that this has been present for a significant amount of time and was no longer in use. d. Various other stockpiles of soil and items associated with the airport were noted within the compound area. e. Looking east from the contractor compound is the fire training area. This contains airplane fuselages and tanks (contents unknown). |
| 19 June 2019 | C – Land East of Winch Hill Lane | <ul style="list-style-type: none"> a. The area is predominately arable farmland planted with wheat crop. The landing lights for the airport and two disused agricultural sheds are also present. b. Topography is undulating. c. Two overhead electricity cables are present within the area, one in the north between Winch Hill Lane to Darley Road, and another running along Winch Hill Lane, from Winch Hill Farm to Winch Hill House. |
| | D – Off-site Car Park North | <ul style="list-style-type: none"> a. The area is presently used as trailer and coach parking on an earthworks platform covering the south eastern and central areas, Vauxhall fleet management facilities located along the western boundary. b. A Vauxhall Car Showroom and workshop is located at the northern site boundary. c. Hardstanding is present widely across the site, with landscaping on boundaries and embankment slopes. d. A substation is located adjacent to the car showroom. e. Various types of fencing are present on the site boundaries, generally in good condition. |
| | E – Off-site Car Park South | <ul style="list-style-type: none"> a. Area comprises hardstanding (concrete/asphalt in average/poor condition) across 4 levels. With a central access road bisecting each level. Platforms are retained by brick walls and embanked earth. b. Site is currently operated by contractors working on the MPT, as overflow car parking and construction material storage. Cabins are present in the northwest. c. Site is bounded by metal paling fence and concrete post and chain-link fencing. d. Small stockpiles of Made Ground are present at the boundary of the site. |

5.4 Site history

- 5.4.1 Four Groundsure reports were obtained which have been used as sources of historical mapping for the site (**Appendix B** of this document), the maps date from 1879 to 2020. A detailed review of the observations from the historical maps is provided in **Appendix D** of this document and excerpts of historical maps illustrating the main developments on the Main Application Site in **Figures 7a 7b, 7c, and 7d** and **Figures 8a, 8b, 8c and 8d** of this document below which cover Areas D and E.
- 5.4.2 In addition, as part of Arup's previous reports (Ref. 48) (Ref. 51) a number of historical photographs were obtained from Historic England which cover Areas A and B. The review and interpretation of images and aerial photographs undertaken is provided in **Appendix E** of this document, this focusses on the landfilling activities in Area A, but also shows the development of the Percival Works on the Existing Airport Land.
- 5.4.3 Mapping for the period of WWII may be absent or incomplete particularly given the significance of the role that Vauxhall Motor Works and the airport played during the war. Therefore, mapping records may not reflect all historical development which has taken place.
- 5.4.4 A summary of the key changes across the site area is provided below in **Table 5.3** further detailed analysis is presented in **Appendix D** of this document. The location of the potentially contaminative uses both historical and current are identified on **Figure 9** of this document. The significance of these are discussed further in **Section 8**.

Table 5.3: Site development summary.

| Area | Summary |
|------------------------------|---|
| Main Application Site | |
| Existing Airport Land | <ul style="list-style-type: none"> a. The earliest mapping (1879) shows the site was largely agricultural and woodland with Eaton Green Farm present in the northwest of the site. b. By 1899-1900 Spittlesea Hospital for Infectious Diseases is present in the west of the site. c. On the edition from 1938 a collection of buildings is recorded toward the northern boundary, likely to be the Percival Works which are noted on aerial photography from this time (Appendix D of this document). Records indicate that the Percival Works were established in 1933 and are likely not to be shown on maps for military/security reasons, it is understood to have closed in mid 1960s, aerial photography from 1973 show former works buildings to have been cleared in the northwest of the site, this is shown on the OS mapping from 1985. d. Airport was first noted on the maps dating from 1960, although the infrastructure; terminal, runways and taxiways were not shown. |

| Area | Summary |
|---------------------------|---|
| | <p>However, it is known to have been open and operational during World War II and is likely to not be shown on maps for military/security reasons. Mapping for the eastern extent of the site still shows agricultural land. The development includes buildings labelled as “works” with smaller buildings placed within bunded areas.</p> <ul style="list-style-type: none"> e. By 1960 land to west of Spittlesea Hospital along the boundary was noted as worked ground likely due to earthworks related to the Vauxhall Works building which had been constructed at this time approximately 100m west. f. The 1971 edition shows Luton Airport and runway, a series of units, possibly hangars are indicated across the north western area and a building with large tanks toward the central western area, possibly fuel storage area. The Spittlesea Hospital area had been redeveloped, the worked ground west of the hospital had been developed with a series of small buildings and bunded areas noted as a works, possibly sewage works. g. By 1993 the airport is indicated to have expanded with additional taxiways. h. An area in the northwest formerly occupied by the Percival works was redeveloped with new industrial units by 1991. i. Between 2002 and 2020 T1 building was extended to its current form with two piers to the east of the building and additional aprons and taxiways. Further activities associated with the airport such as hotels and new works buildings occurred in the southwest of the site during this time. j. Recent developments at the existing airport (2016-2019) have included enhancements to Terminal 1 and addition of a new taxiway and aircraft stands to the east of the terminal. This included Taxiway Foxtrot which required excavation of a small area of landfill in the northeast corner of the taxiway, the verification report for remediation works in this area (Ref. 64) indicates that capping materials from the landfill were excavated and reused within the Proposed Development, after verification of its chemical quality and a small volume of landfill waste was disposed off-site. All residual potential contaminant linkages were assessed as low risk. |
| LLAOL Contractor Compound | <ul style="list-style-type: none"> a. Historical mapping shows this area as agricultural land until 1960 when it is identified as airport land. Falconer’s Hall is present in the northwest of the site from the earliest mapping (1879) until 1925. b. Aerial imagery shows features present (known to be soakaway ponds (Ref. 26) in the centre of the site in 1971, later labelled as tanks in 1993 mapping. |

| Area | Summary |
|---------------------|--|
| | <ul style="list-style-type: none"> c. In 1971, a drain is shown on mapping and in 1975 earthworks associated with the runway are shown. d. 1972 aerial photographs show an area (known to be an Engine Run Up Bay) in the southwest corner of the site. Photographs also show the fire training ground present on the northern boundary of the site, adjacent to Areas A and B in 1990. This feature is never formalised on published mapping. e. Several soakaways are located in this area; central soakaway, north east storage pond and fire training ground storage pond. |
| Airport Access Road | <ul style="list-style-type: none"> a. Earliest mapping (1879) shows the length of the site to comprise of agricultural land. Spittlesea Wood is located across the area toward the western end and a brick and tile works with associated clay pit, lime kiln and brick kiln present just off the northern site boundary toward the centre of the proposed alignment. b. By 1900 Spittlesea Hospital (infectious diseases) is located at the western boundary at the western end of the proposed route, a sewage farm is opposite approximately 50m to the east. An old gravel pit is located at the eastern end adjacent to Eaton Green Road. The brick and tile works is no longer shown. c. 1922-1925, a building belonging to Spittlesea Hospital has been built at the western end of the route, and off-site the sewage works has expanded to the north with a large number of filter beds located approximately 50m from the western site boundary. d. No significant development occurs until 1938 when Percival Aircraft Works is present across the central extent of the site. Further development of the Spittlesea Hospital has also occurred. e. By 1960 additional works buildings are recorded in the central area of the proposed route. An area of worked ground is shown in the western extent, likely associated with the construction of the large Vauxhall building on the former sewage works which has necessitated significant changes to the landform. A small area of rough ground is recorded at the eastern extent, on the Eaton Green Landfill. f. Spittlesea wood and hospital have been redeveloped with commercial industrial buildings by 1975, a works is noted at the western boundary at the western end of the proposed route, possibly a sewage works, many of the former Percival works buildings have been redeveloped. Further changes to the landform with a large embankment indicated along the western boundary with the Vauxhall works. A large engineering works is noted in the central area of the site. Eaton Green landfill has expanded and lies across the eastern extent of the site. The airport, terminal building and runway are noted to the southeast. |

| Area | Summary |
|----------------------------------|---|
| | <p>g. 1985 to 1991, works buildings are redeveloped and additional units added to the western end of the site and a car park to the central area. The large engineering unit in the central area has been redeveloped with several smaller units and Presidents Way is now noted. The landfill is no longer recorded.</p> <p>h. In 2001 the possibly sewage works at the western end of the site had been cleared and by 2010 the area has been redeveloped with a works unit.</p> |
| A – Former Landfill | <p>a. The earliest available map (1879) indicates the site was predominately agricultural land.</p> <p>b. Whilst Ordnance Survey (OS) maps do not show the site in use as a landfill until 1960, aerial photography reviewed as part of Arup PRA (Ref. 48) suggests that some filling had already taken place by 1941 in the southwest of the site.</p> <p>c. During and after WWII the landfill appeared to be connected with the former Percival Works (aircraft manufacturing) located offsite to the west via a track.</p> <p>d. Expansion south from the original infilling had occurred by 1960 mapping. The 1969 aerial imagery indicated several vertical pipe structures in the line of the valley floor, potentially connected to a culvert in the base of the valley.</p> <p>e. Although not shown on the historical mapping, the aerial photography indicates a scrap yard present on the western boundary of the site from approximately 1969-1976 (current location of Tidy Tip).</p> <p>f. The mapped data and aerial imagery show the majority of the site was landfilled by 1975, the filling continued until the early 1990s. The site was landscaped between 2000 and 2002 to resemble its current condition.</p> <p>g. Long-term car park was initially constructed in 2002 and was extended over the landfill area to the south in 2009 and across the western area in 2013.</p> |
| B – Land West of Winch Hill Lane | <p>a. The earliest available map dated 1879, indicates this area was agricultural land divided into field blocks. Winch Hill Farm and associated buildings were located in the east of the parcel either side of Winch Hill Lane.</p> <p>b. The woodland in the south of the area are the remains of Winch Hill Wood, which was reduced in size following construction of the airport as shown on the 1975 OS map along with earthworks associated with the runway off-site, to the south. This a designated ancient woodland.</p> |

| Area | Summary |
|---------------------------------------|--|
| | c. The Wigmore Valley Park Community Centre, car park and playground had been developed in the north eastern area by 2002. The allotment gardens were also noted at this time. |
| C – Land East of Winch Hill Lane | The historical mapping indicates this area has been agricultural land from the earliest maps, with minor changes to field boundaries. |
| Off-site Car Parks | |
| D – Off-site Car Park North | <ul style="list-style-type: none"> a. The south of the site was used as a rifle range from 1900 to 1962. b. 1924 mapping shows the site as partly used by the Vauxhall Motor Works. c. In 1947 it was shown as used for parking. d. The 1955 mapping shows a significant earthworks platform has been constructed. This was modified and extended in 1961 and reduced in size and reprofiled in 2002. e. Buildings are shown in the north of the site on 2010 mapping. f. Adjacent site uses have included a rail line, roads, sewage farm and depots. |
| E – Off-site Car Park South | <ul style="list-style-type: none"> a. Mapping shows the site remained undeveloped until 1941 when earthwork mounds were shown on-site, although the purpose of these is unknown. b. Several structures are present on the 1947 mapping, with the earthwork platforms shown on 1960s mapping. c. Adjacent site uses have included a rail line, sewage farm, allotments and roads. |
| Off-site Planting | |
| Off-site Planting | <ul style="list-style-type: none"> a. Earliest mapping (1880) shows Cockernhoe Brick and Tile Works 200m to the north of the most northerly hedgerows. The Brick and Tile Works are shown to be disused by 1901. b. There is limited coverage in 1924 and 1962 mapping however the Brick and Tile works are no longer present on 1970 mapping. c. The remaining land uses are indicated to be agricultural and/or woodland until present day. |
| Off-site Highway Interventions | |
| Eaton Green Road/ Lalleford Road | Earliest mapping (1880) shows the site to comprise of a road surrounded by agricultural land. By the 1960s development has |

| Area | Summary |
|---|--|
| | occurred within the surrounding area including the presence of the Percival Aircraft Works which is located adjacent to the site. |
| Eaton Green Road/Frank Lester Way | Eaton Green Road is present on the earliest mapping (1879) Frank Lester Way was not developed until 1960, at which time works units belonging to the Percival works were identified to either side. The roundabout was added in 2001. |
| Eaton Green Road/Wigmore Lane | Earliest available mapping (1879) indicates the site has always been carriageway. Off-site potential contaminative uses include the former Eaton Green Landfill at the southern site boundary from 1970 and light commercial buildings including a petrol station are shown to have been developed adjacent and to the north by 1980. |
| Eaton Green Roundabout | Earliest mapping (1880) indicates the site was agricultural land with Eaton Green Road at the south west boundary. The roundabout was constructed by 1985, no other potentially contaminative activities have occurred on site. The motor works and a sewage farm (redeveloped with car parking by 1980s) were located within 250m to the south west and south respectively. |
| Wigmore Lane/Crawley Green Road | Earliest mapping (1880) shows the site comprises a crossroads between Wigmore Lane and Eaton Green Road, surrounded by fields. A small chalk pit is present in 1901 mapping and by 1960 mapping a small building has been constructed. 1970 mapping shows a small filter bed to have been constructed adjacent to the north west. By the 1980s the surrounding area has been developed into residential properties and the current roundabout had been constructed. |
| Crawley Green Road/Lalleford Road | Earliest mapping (1880) shows the site to comprise a road following the current Crawley Green Road through the northern area. The surrounding area consists of open fields. The road has been developed by the 1960s into a "T" junction between Crawley Green Road and Lalleford road with access to Fermor Road. Additional residential buildings are developed around the road in the 1970s and 1980s |
| Windmill Road / Kimpton Road | Earliest mapping (1879) shows the site to comprise of a road and underpass beneath a rail embankment which intersects the site in the east. 1970 mapping shows that the site has been raised slightly to accommodate a large Motor Vehicle Works to the west. By 2002, the most southern rail line has been dismantled and converted to a dedicated bus route. Numerous activities were recorded in the surrounding area including sewage works (east and west), dyeing and bleaching works and brass and iron foundry (north), depot and abattoir and depot and laundry building (north). Vauxhall Motor Works (east) and unidentified works to the west. |
| Windmill Road / Manor Road / St Mary's Road / | By 1901 residential properties had been constructed within the site boundary. The south eastern extent of the site is shown to overlap a Dyeing and Bleaching Works. The 1920 mapping shows additional residential properties within the site boundary. By the 1960s some of the residential properties have been replaced by car parks and by the |

| Area | Summary |
|--|---|
| Crawley Green Road | 1980s the existing roundabout is shown to have been constructed. Activities in the surrounding area include a boiler engineering works, rail lines, cemetery, brass and iron foundry, sewage works, dyeing and bleaching work, depot, laundry building, hat factory. |
| A1081/London Road (north) | Earliest mapping (1880) shows the site to consist of open fields with London Road and Kidney Wood forming the north eastern boundary. Limited development is shown to occur until the 1960s when a roundabout has been constructed within the northern extent of the site linking the A1091 and M1 link road through the centre of the site. 2015 aerial imagery shows the roundabout to have been reconfigured into the current road alignment. |
| A1081/London Road (south) | The site is indicated to be agricultural land on the earliest mapping (1879), London Road is approximately 100m to the east, Newlands Farm is at the south west boundary and a small chalk pit approximately 50m south. By 1960 the A1081 connection from M1 to London Road has been constructed approximately 180m north. The 2020 edition shows the A1081/London Road (south) junction to be constructed with link to A1081, previous alignment of London Road to west now local access road. |
| M1 J10 | Earliest mapping (1879) shows the site to largely comprise of open fields. The southern area of the site extends into Pepperstock. A small unnamed road intersects the north western extent of the site. A graveyard is present 150m northwest of the site in St Andrew's church yard. The M1 motorway and link road is shown to have been constructed by the 1960s. 2015 aerial imagery shows the M1 link road in the east to have been replaced by A1081 New Airport Way. |
| Hitchin Junctions | |
| A602 Park Way/A505 Upper Tilehouse Street | Earliest mapping (1880) show the site to consist of a road junction lined with residential and commercial properties. Potentially contaminated land present within 50m to 100m of the site between 1880s and 2013 were from an iron foundry and three garages all of which have been redeveloped, only residential developments have been present on-site. The 1990s mapping shows the road has been modified to its current alignment. |
| A505 Moormead Hill Offley Road/B655 Pirton Road/Upper Tilehouse Street | Earliest mapping (1880) shows the site to consist of Tilehouse Street and two unnamed roads. The site is lined with residential properties along the southern boundary and a timber yard along the northern boundary. The surrounding land use is largely open fields to the north, west and south with residential areas to the east. The 1920s mapping shows the timber yard to have been replaced by allotment gardens, which were later developed with residential properties in the 1960s. A garage was present adjacent the site to the east between 1960 and 2007, it was developed with residential properties in 2015. |

| Area | Summary |
|---|--|
| B656 Hitchin Hill / A602 Park Way / Gosmore Road Roundabout | <p>Earliest mapping (1879) shows the north eastern extent of the site to comprise of London Road and one other unnamed road which is bordered by allotment gardens. The remainder of the site comprises of open fields. Clay pits and a Brick Field with kilns are present 130m to the north east. By the 1920s a single building is shown to have been constructed in the centre of the site.</p> <p>The 1960 mapping shows additional residential properties to have been developed throughout the site. London Road and Stevenage Road are shown to have been realigned and widened. The Brick Fields are shown to have been infilled and indicated as a recreation ground. The 1990 mapping shows the residential properties to have been demolished and the current roundabout to have been constructed linking London Road, Stevenage Road, Gosmore Road and Park Way.</p> |

5.5 Environmental setting

5.5.1 The environmental setting is important to understand as it determines the sensitivity of the site and potential sources of contamination. A summary of the environmental setting of the Proposed Development area is compiled below in **Table 5.4**. The information has been abstracted from Groundsure reports and publicly available registers listed above in **Section 3.2**.

Table 5.4: Summary of the environmental setting of the development area.

| Environmental data set | Environmental feature | Details |
|---|-----------------------|---|
| Published Geology (Figure 10 – Main Application Site, Figure 11 – Off-site Highway Interventions, of this document) | Made Ground | Made Ground is known to be present or anticipated in all areas of the site apart from Off-site Planting and agricultural land in Areas B and C. |
| | Superficial | <p>Head Deposits underlie the Existing Airport (LLAOL Contractor's Compound), Airport Access Road, Area B, Area C and Off-site Planting. Clay with Flints are recorded beneath the Existing Airport Land, Airport Access Road, Area B and Area C. Lowestoft Formation (Till) is recorded underlying Area B and Glaciofluvial deposits beneath the Off-site Highway Interventions - Hitchin Junctions.</p> <p>Note: superficial deposits are absent in Areas D and E – Off-site Car Parks.</p> |

| Environmental data set | Environmental feature | Details |
|-----------------------------|-----------------------|--|
| | Bedrock | <p>Lewes Nodular and Seaford Chalk formation are recorded across the Proposed Development.</p> <p>There are isolated bands of the Holywell Nodular and New Pit Chalk Formation underlying the Lewes Nodular and Seaford Chalk Formation. In addition, the following bedrock strata are also present at these locations:</p> <p>Gault Formation – Mudstone underlies A602 Park Way junction.</p> <p>Lambeth Group (sand silt and clay) overlying the Chalk Group are recorded underlying the south western area of M1 Jcn10.</p> |
| Mining and natural Cavities | Mining | <p>The Proposed Development is not in an area affected by coal mining or shallow mining hazards.</p> <p>Non-coal mining areas are identified across the site for extraction of chalk. In Area A one unspecified working is recorded which relates to the former landfill area.</p> |
| | Ground workings | <p>Area A – the whole of Area A is identified as the location of a refuse heap.</p> <p>Area B – A small unspecified quarry is recorded in the centre of this area.</p> <p>Airport Access Road – former landfill (Area A) is located within the eastern extent of the proposed road.</p> <p>Off-site Highway Interventions:</p> <p>Eaton Green Road/Wigmore Lane – Former landfill is present adjacent to the south east. Made Ground (undivided) is noted across the area.</p> <p>Windmill Road junction - Made Ground (undivided) recorded within the eastern area.</p> <p>A602 Park Way at Hitchin - Infilled ground noted 60m northeast</p> |

| Environmental data set | Environmental feature | Details |
|---|----------------------------------|---|
| | | coinciding with Fynesford Court Landfill. |
| | Natural cavities | Fifteen solution pipes are located 100m north of Area A and three solution pipes in the north eastern part of Area D – Off-Site Car Park North. |
| Radon | - | The site is not within a radon affected area (less than 1% above action level), and therefore radon protection measures are not required. |
| Hydrogeology (Figure 12 of this document) | Aquifer designation ¹ | <p>Chalk groups (Lewes Nodular, Seaford, Holywell Nodular and New Pit Chalk formations) are all Principal Aquifers.</p> <p>Glaciofluvial Deposits and Lambeth Group are Secondary A aquifers.</p> <p>Head Deposits and Till are Secondary undifferentiated.</p> <p>Clay with Flints and Gault Formation are not designated as aquifers.</p> <p>The existing airport lies within the Lea groundwater catchment (as defined by the Environment Agency). The south east area of the airport, Areas A, B, C and Off-site Planting areas, east of the groundwater divide, are within the Mimram groundwater catchment. Further detail on the hydrogeological conditions is described in Section 7 of this document.</p> |
| | Source Protection Zones (SPZ) | The Main Application Site and Off-site Highway Interventions generally lie within an SPZ3 (Total catchment) with the following exceptions: Areas D and E and Gipsy Lane/Airport Way Off-site Highway Intervention are not within an SPZ, and the Off-site Highway Interventions Windmill Road/Crawley Green Road and Windmill Road/Kimpton Road are in SPZ1 (Inner zone) and SPZ2 (Outer zone), respectively. |

| Environmental data set | Environmental feature | Details |
|---|-----------------------|---|
| | Groundwater | <p>The regional groundwater flow direction is anticipated to be south easterly, however, the nearest potable water supply at Kings Walden (approximately 3 km north east of the landfill) appears to be influencing a more easterly flow direction (east north east). A flow divide is located to the south and west of the landfill site (Area A) beyond which groundwater flows in a south westerly direction beneath the existing airport toward the River Lea.</p> <p>The maximum groundwater levels are estimated to range from 134m AOD in the centre of the divide to 112m AOD in the dry valleys to the east. (Ref. 50)</p> |
| Hydrology (Figure 12 and Figure 13 of this document) | | <p>There are no watercourses within the Main Application Site. In the wider Proposed Development, the River Lea flows in culvert beneath an Off-site Highway Intervention area; (Windmill Road) in a southerly direction, it is also within 80m of Windmill Rd/Kimpton Road in culvert and approximately 200m south west of Area E – Off-site Car Park South.</p> <p>Other surface water features on-site include:</p> <p>Area A – Thames Water Compound storage pond and Thames Valley Drain (TVD) (also referred to as the Thames Water overflow pipe) which takes overflow from the Thames Water Compound storage pond. The discharge point is unknown.</p> <p>Area B – Eastern Soakaway Existing Airport (LLAOL contractor’s compound) – central soakaway (comprising 2 ponds), north east storage pond, fire training ground storage pond.</p> <p>Existing Airport Land - northern soakaway (at Eaton Green Road</p> |

| Environmental data set | Environmental feature | Details |
|--|-----------------------|---|
| | | <p>boundary) and south east soakaway (south of runway)</p> <p>Surface water features off-site: A small filter bed adjacent to the north west boundary of Wigmore Lane/Crawley Road Off-site Highway Intervention and an unnamed drain 50m north of A1081 (north), along London Road.</p> |
| Flooding ² | | <p>Very low risk of flooding across all site areas (less than 0.1%) from rivers or the sea.</p> <p>Generally, a very low risk from surface water flooding is noted across the Proposed Development area, however this increases to medium to high along topographical low points in the valley bottoms in the eastern area of the site and also Area E which is at a topographical low point. Areas of surface water flooding are also associated with the north and east aprons on the existing airport.</p> |
| Abstraction (Figure 12 of this document) | Groundwater | <p>Two active abstraction licences are recorded within 2km of the main area of Proposed Development; 1.5km west for general use relating to secondary category (medium loss) operated by IBC Limited, and 1.5km north east, a potable water supply operated by Affinity Water Limited.</p> <p>A search was undertaken with Local Authorities for private water abstractions within the 2km buffer (see Appendix B of this document for copies of correspondence), a further four abstractions were identified:</p> <ol style="list-style-type: none"> a. 1.85km south west (for commercial and domestic purposes); b. 1.7km south (potable water supply operated by Affinity Water); |

| Environmental data set | Environmental feature | Details |
|------------------------|--------------------------------|---|
| | | <p>c. 1.9km north east, private water supply; and</p> <p>d. 1.5km southeast, private water supply.</p> |
| | Surface water | No abstractions within 2km of the Main Application Site. |
| Environmental permits | Licensed industrial activities | <p>Three environmental permits are recorded to the Main Application Site: Part A (1), London Luton Airport medium combustion plant , Part A(2)/B; GKN Aerospace: Coating Process (Part B) and Airline Services: Dry Cleaning (Part B).</p> <p>Three environmental permits are recorded off-site from the Main Application Site; 91m west Kez's Dry Cleaners (Part B), 132m north west Shell Luton Airport: Unloading of petrol into storage at service stations and 140m north at Asda: Unloading of petrol into storage at service stations.</p> |
| | Dangerous or hazardous sites | <p>None within Areas A to E, Off-site Highway Interventions or Off-site Planting. Two are recorded to the existing Airport Land; a Control of Major Accident Hazards (COMAH) lower tier site licenced to Shell UK Oil Products Ltd for storage of Jet A-1 fuel within 4 storage tanks and a Regulated Explosive Site, GKN Aerospace Transparency Systems (King's Norton) – licensed under Manufacture and Storage of Explosives Regulations 2005 (MSER).</p> |
| | Discharge consents | <p>Twelve discharge consents to groundwater have been identified within the study area, for a variety of purposes including domestic properties, the existing London Luton Airport (soakaways) and commercial activities.</p> |
| Waste Disposal | Historical | Landfills on-site: |

| Environmental data set | Environmental feature | Details |
|------------------------|-----------------------|--|
| | | <p>Eaton Green landfill (Area A) operated by Luton County Borough Council³ 1937- 1978. The landfill is no longer under a permit. Aerial photography and historical mapping suggest it was in use until the early 1990s. Waste types include: inert, industrial, commercial, household and liquid sludge. A detailed review of the records pertaining to the landfill was undertaken previously for the proposed Century Park development in 2017 (Ref. 48). This indicated the landfill does not appear to be as extensive as the recorded Environment Agency boundary. The extent of the former landfill is shown on Figure 9 of this document.</p> <p>Landfills off-site include: Wandon End Farm (400m north of Area A), operational between 5 August 1991 and 31 January 1993, accepting inert waste. Fynesford Court (near to Hitchin junctions, closest is A602/Stevenage Road 130m southeast), brick and clay pit, redeveloped as a recreation ground in the 1960s and part of the area was developed as a community care centre by the 1990s.</p> |
| | Current | <p>On-site: Existing Airport Land – Tidy Tip, a local authority refuse and recycling facility, permitted under Environmental Permitting Regulations (England and Wales) Regulations 2016 (Ref. 65).</p> <p>Off-site: A landfill is recorded 31m west of the Main Application Site, Vauxhall Airport Way (Kimpton Lane).</p> |
| Pollution Incidents | - | None recorded within the Main Application Site which caused an <i>impact</i> , and no significant incidents |

| Environmental data set | Environmental feature | Details |
|--|--------------------------------|--|
| | | recorded in the study area within the last 5 years to land or water. |
| Ecology/ Environment | Nitrate vulnerable zones (NVZ) | The site is within a NVZ as designated by DEFRA. |
| | Designations | <p>On-site:</p> <p>Area A – a CWS is located within the south east area of WVP.</p> <p>Area B – an ancient and semi-natural woodland designation in the south east.</p> <p>Within 2 km of the site:</p> <p>Off-site Planting – ancient, replanted woodland – 500m east.</p> <p>No further ecological or geological designations have been identified.</p> |
| Unexploded Ordnance (UXO) | - | <p>Various UXO reports have been obtained for preliminary studies of the Proposed Development the overall risk is summarised below:</p> <p>The airport, LLAOL Contractor's Compound and Area A - Very High. However, it should be noted that where works are to be undertaken within post war fill material/Made Ground this is considered Low Risk.</p> <p>The Airport Access Road – Low to Medium risk</p> <p>Area B – Low Risk</p> <p>Area C – not covered, by existing reports but likely to be Low Risk</p> <p>Areas D and E – Low to Moderate risk</p> <p>Off-site Planting – Low risk</p> <p>Off-Site Highways Interventions – all Low to Moderate or Moderate Risk except for Hitchin junctions which are all Low Risk</p> |
| <p>Notes:</p> <p>¹ Definition of aquifer designations:</p> <p>a. Principal aquifers - these are the most important aquifers. They are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually</p> | | |

| Environmental data set | Environmental feature | Details |
|------------------------|-----------------------|--|
| | | <p>provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale.</p> <p>b. Secondary A - permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.</p> <p>c. Secondary B - predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering.</p> <p>d. Secondary Undifferentiated - where it has not been possible to attribute either category A or B to a rock type.</p> <p>² UK Government website – Long term flood risk information (accessed 12/2020)</p> <p>³Luton County Borough Council was abolished in 1974 and succeeded by LBC and CBC who are unitary authorities</p> |

5.6 Regulatory consultation

5.6.1 A number of regulatory bodies and other relevant organisations have been contacted (Ref. 48) (Ref. 51). The purpose was to obtain records of the former Eaton Green Landfill (Area A). Enquiries were also made regarding private water supplies with Local Authorities whose areas fall within the 2km buffer. A summary of their written responses is provided in **Table 5.5** below along with copies of correspondence in **Appendix B** of this document.

Table 5.5: Summary of written responses obtained from enquiries with Regulators and other organisations regarding former Eaton Green Landfill.

| Organisation | Records Obtained | Details |
|--|------------------|--|
| Environmental Health Department at Luton Borough Council | ✘ | Informed by Alan Burke (EHO) that the Council no longer have any records relating to the landfill. At one point gas monitoring was undertaken but records have since been lost. |
| Strategic Waste Manager at Luton Borough Council | ✘ | No records available, advised to contact Central Bedfordshire Council who may hold records. |
| Former worker at Eaton Green Landfill | ✓ | Anecdotal evidence of the types of material placed, period of placement and site controls in place including cover materials. Copy of interview provided in Appendix B of this document. |
| Planning Department at Luton Borough Council | ✓ | Copies of selected site investigation reports provided through planning portal and hard copies reviewed at Luton Borough Council's offices. A review of these reports is provided in Appendix D of this document. |

| Organisation | Records Obtained | Details |
|---|------------------|--|
| | | Advised that records over 10 years were no longer held by the Council. |
| Environmental Health Department at Central Bedfordshire Council | ✘ | No records available. |
| Environment Agency | ✓ | <p>Information was provided in response to enquiry, which included the following:</p> <ul style="list-style-type: none"> a. The site closed in 1978; b. The Environment Agency hold no information on gas/groundwater monitoring or gas control measures. However, their records indicate gas control measures were put in place; c. A map of the depth to groundwater; d. The Environment Agency hold no records of enforcement action on the landfill site; e. Nearby groundwater abstraction records; and f. A summary of information on groundwater investigations undertaken within 1km of Luton Airport. <p>In addition, a copy of the Atkins Report on Vale of St. Albans Groundwater Model was obtained from the Environment Agency.</p> <p>Comments were also provided on a draft version of an Arup report for the New Century Park (now Green Horizons) Development (copy of comments is provided in Appendix B of this document). The Environment Agency raised a concern that the site may have received waste from the Luton Laporte chemical works which was operational at the time landfilling occurred.</p> |
| Historic England | ✓ | Historical aerial photographs obtained (see Appendix C of this document) |
| Bedfordshire Archives and Records Service | ✓ | <p>An archivist search of records was requested. No site investigation reports are held but there are meeting notes and letters which make reference to the site (copies in Appendix B of this document). Limited relevant information was located but the report of the County Surveyor dated 1978 indicates that there was unlikely to be any segregation or</p> |

| Organisation | Records Obtained | Details |
|--------------|------------------|---|
| | | sorting of waste materials, practice at the tip was that there was an area where members of the public disposed of their waste which was then bulldozed into the tip. |
| KBR | ✘ | This company was formerly Haliburton Environmental UK. The company was contacted by email and telephone as a site investigation report by Haliburton was produced in the 1990s on the former landfill site, no response received. A copy was unable to be located from other sources. |
| LBC | ✓ | Contact via email in February 2020. A Private water supply search was completed and confirmed there are no private water supplies in LBC area |
| NHBC | ✓ | The council was contacted via email and telephone in February 2020. All private water supply records were provided for NHBC Local Authority area, with grid references, no further data available. |
| CBC | ✓ | Contact was made via email in February 2020. Private water supply records were supplied which are located within the 2km search buffer around the Main Application Site. Data supplied included grid reference, detail of operator and abstraction rate and water quality, where available. |

5.7 Review of previous reports

5.7.1 A number of previous investigations have been undertaken in the vicinity of the airport. The main findings of the reports are summarised in **Table 5.6** below. These reports have been reviewed in detail in **Appendix F**. The previous investigation locations are shown in **Figure 14** of this document.

Table 5.6: Review of key previous reports.

| Report Title | Date | Location | Summary of scope/findings |
|---|------|---|--|
| Burks Green. Foundation work risk assessment report | 2004 | Area A- North western edge of the former landfill | This report provides a foundation risk assessment for Hangar 202, apron and taxiway on the north western edge of the former landfill. The ground investigation (GI) confirmed the presence of up to approximately 10m of commercial, domestic and construction waste within the landfill below the Hangar 202 site. Elevated levels of methane and carbon dioxide were recorded, requiring a methane gas barrier |

| Report Title | Date | Location | Summary of scope/findings |
|---|------------|---|--|
| | | | and a passive ventilation system to be included in the design. The proposed foundation solutions recommended included: precast concrete piles driven into the chalk, stone columns to the depth of landfill and dynamic compaction. |
| Casella Stanger. Review of Environmental Reports LLA 202, Apron & Taxiway Link. Report No:C03607 | April 2004 | Area A - North western edge of the former landfill | This report included findings from previous reports in order to inform the future development plans for Hangar 201. Previous investigations reported the presence of Clay with Flints below the base of the landfill. Waste thicknesses found were up to 13.5m with a capping layer of 1m – 3m identified on top of the waste. Elevated concentrations of methane and carbon dioxide were noted with gas protection measures advised for Hangar 201. Elevated soil concentrations of cyanide and total polyaromatic hydrocarbons (PAHs) were recorded at depth within the fill material. Groundwater samples showed exceedances of dissolved hydrocarbon. High levels of iron, manganese and total petroleum hydrocarbon (TPH) noted within the groundwater were attributed to borehole construction materials and spillages into the drainage system. |
| WSP Environmental Limited. Phase 1 Environmental Assessment (Project Odyssey) London Luton Airport. Project Number 12220076/001 | April 2006 | Existing Airport and Area A - Long stay car park - western edge of the former landfill. | A Phase 1 Environmental Site Investigation on the existing airport undertaken by WSP for 'Project Odyssey'. This included an extension to Car Park E which is the long stay car park, situated on the western edge of the former landfill. GI in the western edge of the former landfill indicated the waste extends to 21m below ground level (bgl). Elevated concentrations of lead were recorded within soil samples. Contaminants in the groundwater comprised phenols, nitrate, chloride, sulphate and mineral oils. This report suggested that the groundwater in the bedrock was being impacted by the landfill but the presence of Clay with Flints had prevented metals from leaching from the landfill. |

| Report Title | Date | Location | Summary of scope/findings |
|--|-------------|--|--|
| AECOM Phase 1 Geotechnical and Geo-Environmental Desk Study Report | May 2012 | Area A-North western part of landfill, north of long stay car park | Desk Study focussing on a development comprising a cargo hangar and a fixed base operation (FBO) area, the document reviews various sources of material. The report reviewed previous investigations undertaken at Luton airport and its surroundings, including reports on the former landfill. The southeast corner of the cargo hangar lies partially within the extent of the former landfill. |
| AECOM. Geotechnical and Geo-environmental interpretative report | Sept 2012 | Area A-North western part of landfill, north of long stay car park | AECOM reviewed two sites within the airport, comprising of a cargo hangar and a FBO. The south eastern corner of the cargo hangar lies within the boundary of the former landfill. Up to 3.35m of Made Ground was encountered at the cargo hangar site, no mention is made of landfill waste being encountered. A possible dissolution feature was noted within the chalk. Localised asbestos was encountered within the Made Ground. |
| Delta Simmons Environmental Consultants Limited. Preliminary Site Investigation for proposed Taxiway Foxtrot | Aug 2012 | Area A-South western part of former landfill | A preliminary site investigation was undertaken within the extent of the former landfill for Taxiway Foxtrot. The investigation found waste to be predominantly well decomposed, with some parts of the landfill waste comprising more granular materials suggesting construction & demolition rather than household waste in those areas. Occasional visual/olfactory evidence of hydrocarbon contamination was encountered. No groundwater or leachate was encountered during the investigation; however, the landfill waste was described as damp/moist in some locations. The report also identifies two stands of Japanese knotweed totalling an area of around 30-40m ² |
| Ivy House Materials Management & Remediation Verification Report. Signature | Dec 2013 | Area A-North western part of landfill, north of | The report details the remediation activities to develop a new FBO within the boundary of the former landfill. It details segregation of materials dependant on material waste category. Subsequent verification was undertaken to ensure no significant risk to |

| Report Title | Date | Location | Summary of scope/findings |
|---|----------|--|---|
| FBO, Luton Airport | | long stay car park | controlled waters or human health remained. |
| Mott MacDonald, London Luton Airport Operations Ltd, Phase 1 Geotechnical and Geoenvironmental Desk Study | Jan 2014 | Existing Airport / Area A/ LLAOL Contractor's Compound | <p>Preliminary Risk Assessment for proposed airport extensions to terminal buildings, extensions to existing mid and long term car parks, new taxiway (foxtrot), extension to existing taxiway (alpha) and aprons and new multi-storey car park linked to the terminal building. The report includes a summary of ground conditions, current and historical land uses, environmental setting of the site and review of previous site investigations and historical mapping. It was recorded that the fire-training ground had been subject to remediation works in 2003 to address petroleum hydrocarbon and Perfluorooctane sulfonate (PFOS) contamination.</p> <p>Potential sources of contamination identified included:</p> <p>LLAOL Contractor's Compound; fuel tanks and cement and asphalt works, an electrical substation and fuel tank to the south of the fire training ground and a fuel tank and fire-fighting foam containers in the fire training ground.</p> <p>Existing Airport Land: numerous de-icing tanks, fuel farm, industrial commercial activities, historical sewage works.</p> <p>Moderate risks were identified to River Lea/Luton Hoo Lakes and Principal chalk aquifer, with low risks to human health receptors. Risks could be adequately mitigated through design and construction techniques and remediation. GIs were recommended to support the planning application and update data gained from previous GIs.</p> |
| Pell Frischmann, Luton Airport Perimeter, Preliminary Sources Study Report (PSSR) | 2016 | Airport Access Road | Pell Frischmann undertook a PSSR for the proposed Airport Access Road, a 3km long section of dual carriageway to connect New Airport Way with the Enterprise Zone, running along a similar alignment to the existing routes of Percival Way and President Way. The report summarises the geology, geomorphology, hydrological and |

| Report Title | Date | Location | Summary of scope/findings |
|---|--------------|--|---|
| | | | geoenvironmental aspects of the site as well as the historical development of the area. A conceptual site model (CSM) was developed which identified several pollutant linkages associated with a moderate or moderate to high risk and recommended GI be completed. |
| Mott MacDonald Contamination Risk Assessment Report | March 2017 | Area A- London Luton Airport land | Mott Macdonald undertook a contamination risk assessment for the area of the Terminal 1 expansion works, this included LLAOL Contractor's Compound. The report summarised the findings of an earlier desk study (Ref. 39). A GI was completed, and the results assessed and interpreted. The report identified minimal contamination of the materials for excavation, comprising cohesive Made Ground materials derived from the underlying Clay with Flints Formation, and concluded there were no significant contamination risks to human health or controlled waters associated with the material when compared to contemporaneous assessment criteria. The reports were considered sufficient for the discharge of the relevant condition by the Local Planning Authority. |
| Arup. Luton Airport Mass Passenger Transit System. Land Contamination Preliminary Risk Assessment | January 2017 | Adjacent to Areas D and E, Existing Airport Land | This report is a desk-based assessment of the contamination risks associated with the route of the Mass Passenger Transit (MPT) System (Luton DART) which runs from Luton Parkway Station to Terminal 1 at the airport (the announcement of an official opening date will be made in early 2023). A CSM was produced identifying potential contaminant linkages (PCLs) which may pose a risk to future development, including risks from ground gases/vapours and risks to the underlying Chalk Aquifer. Potential geotechnical constraints/risks to the development were identified. A comprehensive GI was recommended to determine the geoenvironmental and geotechnical risks and inform the design of the development. |
| Structural Soils. London Luton | 2017 | Adjacent to Areas D | This is a factual GI report undertaken along the proposed MPT route. This was a |

| Report Title | Date | Location | Summary of scope/findings |
|--|------------------|---|--|
| <p>Airport MPT Ground Investigation Phase 1: Factual Report on Ground Investigation.</p> | | <p>and E, Existing Airport Land</p> | <p>preliminary GI based on the findings of the PRA (2017) (Ref. 52) and consisted of 16 cable percussion boreholes, 7 of which were extended by rotary drilling, 1 rotary cored borehole, 8 trial pits, 1 hand dug pit and 3 hand dug trial trenches. The GI recorded Made Ground of variable composition along the route, with the thick deposits encountered near to Luton Parkway Station up to 7.5m. Clay with Flint deposits were absent in the area of Parkway Station, where the Made Ground is directly underlain by the Chalk bedrock. However, in the area of the existing airport Clay-with-Flint deposits overly the Chalk and are present up to 8m in thickness.</p> |
| <p>Arup. Luton Airport Mass Passenger Transit System. Land Contamination Quantitative Risk Assessment.</p> | <p>June 2017</p> | <p>Adjacent to Areas D and E, Existing Airport Land</p> | <p>The aim of this report was to build on the findings of the Preliminary Risk Assessment (PRA) to inform the MPT development. It presents a quantitative contamination risk assessment relating to human health, ground gas and groundwater, as well as characterisation of the waste and analysis of leachate, soil and groundwater quality. The following was noted:</p> <ul style="list-style-type: none"> a. There were no exceedances in the soil or groundwater when compared to the relevant human health generic assessment criteria (GACs). Therefore, no remediation was required at the site with respect to human health. No asbestos fibres were detected in the soil samples submitted to the laboratory for testing; b. Assessment of the ground gas results indicated a low risk according to CIRIA C665 (Ref. 66). The worst case measurement resulted in a classification of characteristic situation (CS1) conditions, very low risk. However, it was a recommendation that consideration was given to possible preferential pathways associated with the former |

| Report Title | Date | Location | Summary of scope/findings |
|--|------------------|---|--|
| | | | <p>Eaton Green landfill 90m east of the existing airport; and</p> <p>c. Concentrations of several contaminants in soils and groundwater exceeded the generic controlled waters criteria. Therefore, further assessment of these contaminants was required by undertaking a detailed quantitative risk assessment (DQRA).</p> <p>The controlled waters DQRA was undertaken using the Environment Agency remedial targets worksheet. Overall the quantitative risk assessment indicated the identified PCLs were low risk and no remediation was required at the site with respect to contamination.</p> |
| <p>Arup. Century Park Development Airport Way, Contamination Preliminary Risk Assessment – Former Eaton Green Landfill</p> | <p>June 2017</p> | <p>Area A - former Eaton Green Landfill</p> | <p>The report was a desk-based assessment of the risks associated with the Century Park development of the area occupied by the former Eaton Green landfill based on available historical information and a site walkover. A CSM was produced identifying PCLs which may pose a risk to future development, including risks from ground gases/vapours and risks to the underlying Chalk Aquifer. Potential geotechnical constraints/risks to the development were also identified. A comprehensive GI was recommended to determine the geoenvironmental and geotechnical risks and inform the design of the development.</p> |
| <p>Structural Soils Limited. Century Park, Factual Report on Ground Investigation</p> | <p>June 2017</p> | <p>Areas A, B and south eastern area of Existing Airport excluding landfill</p> | <p>This is a factual GI report undertaken on the land situated east of the former landfill (within Area B), to inform the Century Park development. This was a preliminary site investigation based on the findings of the Arup PRA (2017). The GI encountered Made Ground in LLAOL Contractor's Compound, south of the former landfill up to 6m in thickness. Across the wider Century Park development, the investigation found Clay with Flints with varying thickness between 0.3m and 8.2m overlying chalk to completion of the holes,</p> |

| Report Title | Date | Location | Summary of scope/findings |
|--|-----------|--|--|
| | | | the Clay with Flints was absent in the base of the dry valley. |
| Structural Soils Limited. Century Park Access Road, Factual Report on Ground Investigation | June 2017 | Section of Airport Access Road located in Areas A, B and Existing Airport Land | This is a factual GI report undertaken for the Airport Access Road by Structural Soils for Pell Frischmann in 2016. Locations were located along the proposed road alignment which crosses the north of the former landfill, and through WVP core area in Areas A and B. No formal human health or groundwater risk assessment was completed on the findings, for the section of proposed road off the former landfill. |
| Structural Soils Limited. Landfill Factual Report on Ground Investigation | June 2017 | Area A- Former Eaton Green Landfill | This is a factual GI report undertaken on the landfill to inform the Century Park development. This was a preliminary GI based on the findings of the PRA (2017) (Ref. 49) The GI recorded landfilled wastes up to 20m thickness over the landfilled area. This was underlain by Clay with Flints (sides of valley only), generally 3m but up to 15m in places. Structureless Chalk was noted beneath the superficial deposits, wastes were placed directly onto the chalk at the base of the landfill. No evidence of a basal 'liner' layer to the landfill was noted. |
| Arup. Century Park Development Airport Way – Landfill Area, Contamination Quantitative Risk Assessment | Sept 2017 | Area A- Former Eaton Green Landfill | The aim of this report was to build on the findings of the Preliminary Risk Assessment (PRA) to inform the Century Park development. It presents a quantitative contamination risk assessment relating to human health, ground gas and groundwater, as well as characterisation of the waste and analysis of leachate, soil and groundwater quality. The following was noted: <ul style="list-style-type: none"> a. Testing did not suggest a significant variation in chemistry between the different eras of filling; b. Significant depth of 'cover' material noted but no engineered cap; c. Perched waters were not found; groundwater levels were below the base of the landfill; |

| Report Title | Date | Location | Summary of scope/findings |
|---|----------|--|--|
| | | | <ul style="list-style-type: none"> d. Leachate analysis results suggest the waste has aged to a low gassing and leachate potential state; e. Methane and carbon dioxide concentrations were higher in the northern part of the landfill, with low levels of methane (<0.1 v/v) detected outside the landfill boundary; f. Asbestos was identified at three borehole locations, but fibres were below the limit of detection <0.001%; g. The results indicated the chemistry of the landfill presents a low risk to future site users assuming a clean cover system to remove potential pathways and protect the development from odours and the poor physical properties of the waste; h. Detailed groundwater analysis and modelling was undertaken, concluding that overall there is little evidence that the landfill is causing significant contamination of the groundwater; i. Providing appropriate techniques are used during construction to prevent downward migration of contaminants, it is unlikely that the new development will result in significant contamination of the groundwater; and j. Recommendations were made for further GI of the landfill area, including groundwater and gas monitoring to confirm the findings of the assessment and refine the CSM. |
| AECOM. Luton Hangar 24 Ground Investigation. Factual Ground | Feb 2018 | Area A and Existing Airport Land- Area of Tidy Tip and TUI car | This is a factual GI report undertaken to inform the construction of a new maintenance facility comprising garage space, offices and workshops. Further investigation was undertaken south of the |

| Report Title | Date | Location | Summary of scope/findings |
|--|------------|---|---|
| Investigation Report | | park, north western corner of the former landfill | site to inform on the design for a new entry roadway into the Tidy Tip. |
| Arup. Hangar 24 Ground Investigation Interpretative Report | July 2018 | Area A and Existing Airport Land - Area of Tidy Tip and TUI car park, north western corner of the former landfill | The interpretative report was based on the Aecom (2018) GI. The report concluded there is no evidence that the area currently occupied by the TUI car park was ever part of the former landfill. The GI found limited thickness of Made Ground beneath the majority of the car park and what was found was typical of the formation of a hardstanding. Historical maps and other records suggest the Tidy Tip site was a 'scrapyard' within the landfill area and that the bunds that form part of the Hangar 24 site were formed when the scrapyard was cleared and levelled to form the tip site. Slightly elevated ground gases at concentrations equivalent to CS ₂ (low risk) were encountered. Based on the proposed development no remediation of the site was considered to be required with respect to human health or controlled waters. |
| Arup. London Luton Airport Expansion Ground Investigation Strategy. | March 2018 | Area A-former Eaton Green Landfill | This report sets out the strategy for further GI of the landfill. The GI strategy was based on the findings of the Arup (2017) DQRA report for the Green Horizons Park development. The report set out the requirements for investigation of the potential pollutant linkages (PCLs) identified in the DQRA. |
| GL Hearn, Environmental Statement (Volume 1: Non-Technical Summary) Green Horizons Park Luton and Volume 2: Environmental Statement – Addendum, Land Adjacent to Luton | 2018 | Airport Access Road | The Environmental Statement (ES) reports the findings of the Environmental Impact Assessment (EIA) undertaken to identify the likely significant effects arising from the Green Horizons Park development. The ES Chapter 17 [TR020001/APP/5.01] covers the ground conditions and contamination along the route. The Area located on the former landfill was based on the Arup (2017) Century Park DQRA described above, areas of localised contamination were identified at locations off the landfill, notable findings were: |

| Report Title | Date | Location | Summary of scope/findings |
|--|------------|----------------------|--|
| Airport: Green Horizons Park | | | <p>a. Localised asbestos contamination within the Made Ground; and</p> <p>b. Substantial Made Ground deposits encountered in the vicinity of Airport Way</p> <p>The ES concluded following suitable mitigation there were no significant effects.</p> |
| Geotechnics Century Park Access Road Additional Works. Factual Report. | Aug 2018 | Airport Access Road | <p>This is a factual GI report undertaken to supplement information along the proposed Airport Access Road undertaken by Geotechnics Ltd for Opus International Consultants in August 2018. Exploratory locations were advanced in two distinct areas between the A505 Airport Way and Proctor Way and also at the junction of Eaton Green Road and the access road to the Tidy Tip. The presence of hydrocarbon odours, discolouration and the presence of membranes and geotextiles were observed across areas of the scheme.</p> |
| AECOM. Luton Airport Landfill Main Ground Investigation – Factual Report | April 2019 | Area A-Landfill area | <p>This is a factual GI report undertaken to inform the works associated with the expansion of the airport based on the Arup (2018) GI Strategy. Investigation locations were more closely spaced since this was a main GI, with some off-site locations included to assess off-site conditions. Preliminary findings, where relevant, have been included in this report.</p> <p>Comprehensive interpretation of this GI is presented in the generic quantitative risk assessment (GQRA) (Ref. 67) and DQRAs (Ref. 68) (Ref. 69), see Appendices 17.2, 17.3 and 17.4 of the ES [TR020001/APP/5.02].</p> |

5.8 Additional relevant surveys

CCTV survey

- 5.8.1 A CCTV survey was completed in January 2018, which has identified the manhole covers in the north of Area A provide access to a Thames Water storm relief sewer. This is an overflow to the Thames Water balancing pond located at the northern site boundary.

- 5.8.2 This feature is aligned northwest to southeast across Area A, see **Figure 13** of this document. The outfall point of the drain has not been proven, access could not be gained to the terminal manholes. The part of the pipe surveyed within Area A was laid between 15.9m bgl (at its northern extent) and 21.77m bgl (at the most southerly surveyed point). The drain is 750mm in diameter and was dry at the time of surveying. The condition of the drain worsens to the south, with evidence of cracks, fractures and encrustation.

Ecological site walkover

- 5.8.3 An ecological site walkover was completed across the WVP area only prior to the most recent GI commencing in April 2018. The walkover identified areas of high botanical interest including orchids and calcareous grassland. Invasive species (Japanese knotweed) was identified at six locations.

6 GROUND CONDITIONS

6.1 Introduction

- 6.1.1 This section outlines the geological setting of the Luton area, the ground conditions beneath the Proposed Development and the ground model which has been developed. It also outlines the ground conditions and the hydrogeological regime specific to the Existing Airport Land, Areas A to E and Airport Access Road. The known contaminative conditions of each area are also described, along with identifying any potential contaminants expected from the historical uses.
- 6.1.2 No GI has been completed for the off-site Highway Interventions, Off-site Car Parks and Off-site Planting and a ground model has not been developed for these areas. However, likely contaminative conditions have been summarised in **Section 6.9** below based on the available information.

6.2 Ground model

- 6.2.1 A 3-dimensional ground model has been developed of the area in order to assist the understanding of the site. It has been collated from the following data sources:
- a. Photogrammetry data at 5m resolution;
 - b. Topographical survey of the site;
 - c. Historical aerial photographs;
 - d. Historical maps;
 - e. Data from GI undertaken at the site; and
 - f. Information collected during GI on the type of waste material within the landfill.
- 6.2.2 The model is an interpretation of the ground conditions based on the available data. It will be subject to alteration and refinement as more detail becomes available, e.g. further GI. The ground model is shown in **Figure 15** below of this document and focusses on the main area of proposed development in the east of the Main Application Site.

6.3 Stratigraphic sequence

- 6.3.1 The GIs undertaken across the site broadly confirm the published geology, the generalised stratigraphic sequence is presented in **Table 6.1** below.

Table 6.1: Summary of ground conditions encountered across the Proposed Development from GIs.

| Material Name | Typical Description | Typical Thickness (m) |
|---------------|---|---|
| Topsoil | Generally stiff gravelly sandy clay. The gravel | Average of 0.3m in 'undeveloped' areas (B & C). |

| Material Name | Typical Description | Typical Thickness (m) |
|-----------------------|--|--|
| | comprises flint, chalk, brick, concrete and clinker. | |
| Made Ground (General) | Typically, arisings from past airport projects, but also includes the construction of car parks, aprons, taxiways and yard areas. | Generally, <1.0m but locally thicker: Up to 6 m to the immediate south of the landfill. 20m at western end of Airport Access Road on the top of the slope to the Dairyborn escarpment. Other localised areas up to 15m thick. |
| Landfill Material | Approximately 4.5 million m ³ mixed domestic, commercial and construction/demolition waste deposited between the 1930s and 1980s, directly on underlying chalk. Surface soils on the landfill were noted to be slightly clayey in places, which may represent capping material placed on the landfill but it does not appear to be an engineered cap consistent with current standards. | Between 4m at the edges and 20m at the centre. |
| Dry valley deposits | Clay associated with the weathering of material in the valley sides and floor. | 2m within the valley bottom. |
| Head deposits | Clay associated with the weathering of material in the valley sides and floor. | 2 m (up to 5 m in places) in the valleys. |
| Clay with flints | Highly plastic clay containing flint gravel | 3m on the valley sides and crest (up to 16.5m in places). Absent in the valley areas. |
| Upper Chalk | Chalk – weathered near the surface. | Typically up to 70m (Ref. 5), full thickness not proven. |

6.4 Made Ground

6.4.1 Generally Made Ground across most of the Proposed Development is <1m in thickness, with the exception of the following areas:

- a. **Existing Airport Land** – thickness of Made Ground varied between 0.25m and up to 3.32m, generally comprising surface hardstanding

(asphalt/concrete) or topsoil in landscaped areas underlain by sub-base of type 1 fill material overlying slightly sandy slightly gravelly silty clay with variable proportions of anthropogenic materials, including concrete, asphalt, brick, tile granite and clinker.

- b. **Existing Airport - LLAOL Contractor's Compound** - a significant volume of Made Ground has been placed in the area to the south of the landfill, locally up to 10m thick. This material is typically the arisings from developments across the airport. It is understood that this material is being temporarily stored in this area (Ref. 50). Fill material was imported as part of the development of the runway and levelling of the area.
- c. **Airport Access Road** – a significant depth of Made Ground encountered at Airport Way up to 20.0m associated with the Dairyborn escarpment.
- d. **Area A** - the former landfill covers most of Area A, with waste depths of >20m above the base of the valley. The nature of the landfill material is discussed in **Sections 6.4.2 to 6.4.5** and **Table 6.2** and **Table 6.3** all of which can be found in this document.
- e. **Area D Off-site Car Park North** - historical mapping suggests a significant amount of fill has been imported onto Area E to form an earthwork platform; the platform was built out from the existing slope. The volume of the material deposited is estimated to be 62,000m³, with a maximum fill depth of 15m. Aerial photography indicates that this fill is likely to date from the mid-1950s and is predominately chalky in nature. The origin of this material is unknown, however, the aerial photography suggests excavations were occurring in a number of areas in the vicinity of the site at the time of its deposition.
- f. **Area E Off-site Car Park South** - historical mapping, aerial photography and current topography suggests that up to 10m of fill has been placed in parts of the site. The age and origin of the material is unknown but aerial photography and historical mapping suggest it may have been placed during the 1940s.

Area A – landfill waste

- 6.4.2 The Arup New Century Park Quantitative Risk Assessment report (Ref. 50) contains a detailed assessment of the landfill. It concluded that the landfill was in operation between at least 1941 to the early 1990s and was operated as an unlined landfill with waste sitting directly onto the chalk with no engineered capping layer.
- 6.4.3 3D modelling undertaken as part of the Arup NCP QRA report (Ref. 50) has indicated there is approximately 4.5 million m³ of waste present within the landfill. The waste is unsorted and uncompacted, as evidenced by settlement at the surface within WVP and Long Stay Car Park.
- 6.4.4 An estimate of composition and volume of infilled material has been modelled (Ref. 50), a summary of which is provided in **Table 6.2** below and **Figure 16** of this document.

Table 6.2: Period of filling, estimated volume and typical components of the landfill material.

| Period of filling | Estimated volume in landfill (m ³) | Typical components of this era of filling |
|-------------------|--|--|
| Pre 1947 | 200,000 | Ash/fines, wood, metal, fabric, rubber, ceramic, brick and glass. |
| 1947-1955 | 400,000 | Ash/fines, wood, metal, fabric, rubber, ceramic, brick and glass. |
| 1955-1961 | 1,500,000 | Ash/fines, wood, metal, fabric, rubber, ceramic, brick and glass. |
| 1961-1972 | 900,000 | Ash/fines, wood, metal, fabric, rubber, ceramic, brick and glass. Later 60's waste includes plastic components |
| 1972-1982 | 1,500,000 | Brick, tile, concrete, polystyrene, paper, plastic, cans and food waste, cardboard, metal, rubber and glass. |
| Total | 4,500,000 | |

6.4.5 The ground investigation data and work undertaken as part of the Arup Green Horizons Park QRA (Ref. 50) indicated that there are several types of waste material present. **Table 6.3** below indicates the main categories of landfill material present.

Table 6.3: Landfill material descriptions.

| Type of material | Category | Description |
|------------------|-----------------------------------|--|
| Daily cover | Non-chalky cover fill | Material has been classified as non-chalky cover fill, if it has limited waste content, i.e. fragments of brick and concrete, and has minimal chalk content. It has been found across the site. |
| | Chalky cover fill | Material has been classified as chalky cover fill, if it has limited waste content, i.e. fragments of brick and concrete, and has significant chalk content. It has been found across the site at variable depths. |
| Waste | Construction and demolition waste | Significant brick, concrete cobble content, in rare cases it has been noted to contain rebar. |
| | Industrial waste | Waste material with significant clinker or slag, or high percentage composition of wood, metal and fabric infers an industrial nature. |
| | Old domestic waste | Waste material which is predominately ashy in nature with limited or no plastic component. |

| Type of material | Category | Description |
|------------------|-----------------------|---|
| | Recent domestic waste | Waste material that contains household waste but has significant plastic content, and limited ashy waste. It has been encountered widely across the site between 152.25 mAOD and 137.39 mAOD. In places interspaced between non-chalk cover fill. |

6.5 Dry Valley Deposits

6.5.1 These deposits have been mapped by the British Geology Survey (BGS) and are anticipated to be present in the Valley Bottoms throughout the Proposed Development. The 2016 ground investigations (Ref. 46) (Ref. 46) (Ref. 48) confirmed their presence within the valley bottom in Area B, between 0.7m and 2.1m thick.

6.6 Clay with Flints

6.6.1 This formation overlies the Chalk Group. It is a residual soil formed by the solution weathering of the chalk. The Clay with Flint formation comprises stiff reddish brown slightly sandy gravelly clay with a medium cobble content. The gravel is angular to rounded and comprises flint gravel and occasional chalk.

6.6.2 The Clay with Flints varies in thickness across the development area. It is mainly present on the plateau (typically 3-5m) and valley sides and absent from the base of the valley. Previous GI has indicated it is typically 3.7m thick across the Proposed Development area but has been recorded up to 15m thick. This reflects the irregular dissolution contact between the Clay with Flints and the Chalk group.

6.7 Chalk

6.7.1 The solid Geology beneath the site comprises the Upper Cretaceous Chalk Group, typical thickness is up to 70m (Ref. 5), full thickness at the site has not been proven by GI. The condition of the chalk encountered beneath the Proposed Development area is variable. GI undertaken in Areas A and B indicated that in the upper levels of the chalk the material was heavily weathered, generally recovered as structureless sandy very silty gravel or sandy gravelly silt.

6.7.2 The chalk material recovered was occasionally recorded as having yellowish brown staining on what are considered to be natural fracture surfaces. Soft grey marl bands were also recovered from within the chalk.

6.8 Solution features

6.8.1 Solution features are formed by the dissolution of the Chalk as a result of chemical weathering. These features are present at the interface between the Clay with Flints formation and the Chalk. As such, these are predominately present where Clay with Flints formation is present such as the plateau and

valley side. Solution features are present at the interface between the Clay with Flints formation and the Chalk but less frequent in the base of the valley.

6.8.2 There are 15 solution pipes recorded located 100m north of Area A and three recorded solution pipes located in the north eastern part of Area D (Ref. 11).

6.8.3 It is difficult to detect solution features via GI, as they are discrete features, however the GI undertaken to date suggests these features are deeper and more frequent in the valley sides than the base of the valley.

6.9 Contamination conditions - evidence from previous work

Existing Airport Land

6.9.1 Several ground investigations have been completed across the existing airport land for previous developments. These did not identify any particular soil contamination sources, however it has been noted that during historical groundwater monitoring elevated concentrations of various metals, sodium, chloride and pesticides were noted (Ref. 39). The particular soil and groundwater conditions in the area of the Proposed Development works have been extracted and described below.

- a. The assessment records pH to be slightly alkaline, TPH concentrations were detected above the Limit of Detection (LOD) within Made Ground and superficial geology however did not exceed the adopted assessment criteria (LQM/CIEH for a commercial land use, Ref. 70);
- b. Dibenz(a,h)anthracene and Benzo(a)pyrene were recorded as above the adopted assessment criteria in two samples at shallow depth;
- c. Volatile Organic Compounds (VOCs) were typically recorded as below the LOD except for Bromobenzene, cis-1,3-dichloropropene, dibromochloromethane and Hexachlorobutadiene. Mott MacDonald report these compounds as not exceeding the adopted assessment criteria;
- d. In the Mott MacDonald Phase 1 Report, 2015 (Re. 41) PFOA and PFOA were included in the soils analysis suite, these contaminants are reported as being locally identified at elevated concentrations; and
- e. Asbestos was detected in four samples of Made Ground. The asbestos was identified as chrysotile (loose fibres and insulation lagging). Quantification testing was not undertaken.

Groundwater chemistry

- f. Leachate testing undertaken on Made Ground and superficial strata records exceedances of drinking water standards (DWS) and environmental quality standards (EQS) for sulphate, ammoniacal nitrogen, cadmium, lead, zinc and fluoranthene. Chromium (III) was recorded as exceeding EQS only.
- g. Groundwater samples recorded exceedances of DWS for barium, iron and sulphate with mercury exceeding EQS only. Total Petroleum Hydrocarbon Criteria Working Group (TPHCWG) Aliphatic bands inclusive of C10 to C35 were recorded as exceeding DWS. Mott

MacDonald comment that TPH concentrations decrease throughout the monitoring period and suggest the concentrations are reflective of a short pulse of contamination through their monitoring infrastructure.

- h. Isolated instances of PFOS in groundwater and surface water were also noted.
- i. To confirm that the overlying Made Ground was not the source of TPH in groundwater Mott MacDonald undertook a level 1 Remedial Target Methodology (RTM) risk assessment which confirmed that TPH from soils are not adversely affecting the chalk aquifer.

Ground gases

- j. The assessment indicates that the worst-case characteristic situation for each borehole monitored is CS1. No flow was observed during most rounds and the results indicate the standpipes monitored were not actively gassing. Mott MacDonald recommended additional monitoring to confirm this.
- k. Methane was not detected above 0.0% v/v and CO₂ concentrations ranged between 0.0%v/v to 7.9% v/v.

LLAOL Contractor's Compound and Fire-Training Ground

Soil chemistry

- a. Site levels and conditions within this area are fluctuating due to the ongoing earthworks within the airport area.
- b. Elevated concentrations of PAH and TPH were detected in the soils at one location within this area.
- c. PFAS and PFOAS are likely in this area and are further discussed in the GQRA (Ref. 67), see **Appendix 17.2** of the ES [TR020001/APP/5.02].
- d. The ground investigation results to date (Ref. 46) (Ref. 43) suggest low levels of contaminants. Some ACMs were identified within stockpiled materials.

Groundwater chemistry

- e. Groundwater analysis undertaken (Ref. 48) indicated exceedances of generic screening criteria for some contaminants in the groundwater including nitrate and nitrite.

Ground gases

- f. Slightly elevated concentration of ground gases were noted during the Structural Soils 2017 GI (Ref. 46) (Ref. 49), within this area where a significant thickness of Made Ground is present.
- g. The monitoring results indicate the maximum concentration of methane detected was 9.3% v/v and the maximum concentration of carbon dioxide was 3.3% v/v. There was low or negligible standpipe emission flow rates, with maximum positive flow detected being 0.2 l/hr.

Airport Access Road

- 6.9.2 The section of the Airport Access Road (AAR) from Airport Way to Percival Way was part of a planning application submitted for Green Horizons Park. This area was subject to two previous site investigations, (Ref. 49) and (Ref. 54) the soil analysis results from which have never been formally assessed. An indication of the likely significant impacts was included in the **Chapter 17** of the Environmental Statement **[TR020001/APP/5.01]** for Green Horizons Park (Ref. 61) which indicated there were localised asbestos contamination within the Made Ground and substantial Made Ground deposits encountered in the vicinity of Airport Way. The ES concluded following suitable mitigation there would be no significant effects but indicated additional ground investigation was required.
- 6.9.3 Indication of contamination extracted from the GI reports were:
- The presence of hydrocarbon odours, discolouration and the presence of membranes and geotextiles were observed across areas of the scheme; and
 - Asbestos was identified as loose fibres at seven locations in the Made Ground (out of 51 samples tested) across the area, generally as chrysotile at concentrations between <0.001 to 0.002%. Amosite fibres and board were identified in two samples at concentrations of 0.002% and 6.622% respectively. No visual ACMs were identified.
- 6.9.4 The eastern end of Airport Access Road is located on the former landfill (Area A) for purposes of risk assessment and ease of reporting the landfill is viewed as a single entity and therefore this area of the Airport Access Road has been included with the former landfill assessment.

Area A Former Landfill

Waste types and chemistry

- Detailed analysis of the waste characterisation from the Aecom 2018 GI (Ref. 63) is provided in the GQRA (Ref. 67), see **Appendix 17.2** of the ES **[TR020001/APP/5.02]**. Observations from the forensic examination of samples of the waste taken during GI indicates that it is principally domestic, commercial and construction/ demolition waste types and is predominately non-organic in nature i.e. soils, construction waste.
- The waste was noted to be well degraded and predominately dry, with no leachate encountered during both the Structural Soils (Ref. 46) and Aecom GIs (Ref. 63).
- A number of contaminants were present within the landfill waste material including metals, PAHs, VOCs and inorganic compounds.
- A specialist survey for radionuclides was undertaken as part of the recent GI works (Ref. 63). This survey indicated the levels observed were consistent with the expected natural background levels.

Groundwater chemistry

- e. Groundwater analysis undertaken (Ref. 50) indicated exceedances of generic screening criteria for some contaminants in the groundwater including; heavy metals, hydrocarbons, PAHs, chlorinated solvents and ammoniacal nitrogen.

Asbestos

- f. Asbestos containing materials (ACMs) were noted within the former landfill, but no significant accumulations were encountered; and
- g. The Structural Soils 2016 (Ref. 52) investigation identified asbestos within three borehole locations, but fibres were below the limit of detection (LOD) (<0.001%). Further testing of 129 samples was undertaken in the recent Aecom GI (24), of these 80% were below the LOD (<0.001%). Six samples were identified to have asbestos content which exceeded the hazardous waste threshold of 0.1%.

Landfill gases and VOCs

- h. Spot monitoring of gas concentrations and flows has been undertaken during the Structural Soils GI (Ref. 46), recent Aecom GI (Ref. 63) and as part of monthly monitoring undertaken over 12 months (2017 to 2018).
- i. The monitoring results from the Structural Soils (Ref. 46) and Aecom GI (Ref. 63) indicate that high concentrations of bulk landfill gases (carbon dioxide and methane) have been recorded within the waste. Methane was detected in the range of 0 to 76.1% v/v and carbon dioxide in the range of 0 to 31.4% v/v. Hydrogen sulphide concentrations ranged between 0 to 9 ppm. However, there was low or negligible standpipe emission flow rates, with maximum positive flow detected being 0.9 l/hr.
- j. The gas readings in boundary wells also recorded low concentrations and flows.
- k. Continuous gas monitoring was undertaken during the Aecom GI (Ref. 63) and was broadly consistent with the spot readings; and
- l. Very low or negligible in-ground concentrations of trace VOCs were encountered in the Aecom GI (Ref. 63).

Area B Land West of Winch Hill

Soil chemistry

- a. The Structural Soils 2017 investigations (Ref. 46) (Ref.49) in this area indicated generally low levels of contaminants are present, with detection of some pesticides associated with agricultural use.

Groundwater chemistry

- b. Groundwater analysis undertaken within Area B (Ref. 48) indicated exceedances of generic screening criteria for some contaminants in the groundwater; iron, manganese, ammoniacal nitrogen, nitrate and nitrite.

Ground gases

- c. The GI data to date does not indicate any elevated ground gases within this area.
- d. The monitoring results from the Structural Soils (Ref. 46) (Ref.49) investigations indicate the maximum concentration of methane detected was 0.2% v/v and the maximum concentration of carbon dioxide was 3.7% v/v. There was low or negligible standpipe emission flow rates, with the maximum positive flow detected being 0.6 l/hr.

Area C Land East of Winch Hill

- a. No available GI data on contaminant concentrations within this area.

Off-site Car Parks Areas D and E

6.9.5 There is no available GI data on contaminant concentrations within these areas. However, a ground investigation of adjacent land to the west at Stirling Place/Napier Park formerly areas of the Vauxhall Motor Works did identify poor background water quality in the area with groundwater flow predominately to the south toward the River Lea. GIs approximately 100m north west, concluded there was no risk to human health from soil and groundwater contamination, a low risk was concluded to groundwater, no remediation being required.

Off-site planting

6.9.6 No GI or assessments have been undertaken within the area Off-site Planting. Based on the historical review, the nearest potential source of contamination was a brick and tile works approximately 200m to the north and was shown to be disused by 1901. It is considered that there is little contamination potential from this potential source to the areas of Off-site Planting.

Off-site highway interventions

6.9.7 No available GI data for soil or groundwater chemistry in these areas

6.10 Contamination conditions - contaminants of concern

6.10.1 Based on the desk study information in **Section 5** and the ground conditions detailed above, a summary of the potential/identified contaminants of concern (CoC) associated with the current and historical use of the Development Area and surrounding areas up to 250m are detailed in **Table 6.4** and **Table 6.5** of this document, respectively. Where appropriate, Industry Profiles (Ref. 71) have been used to provide an indication of likely contaminants. The location of the features referred to are shown in **Figure 9** of this document.

Table 6.4: Potential contaminants on-site based on historical/current activities.

| Source | Areas Affected | Potential Contaminants |
|-----------------|----------------|--|
| Former landfill | A | Landfill gas (mainly methane and carbon dioxide), volatile organic compounds |

| Source | Areas Affected | Potential Contaminants |
|---|--|---|
| | | (VOCs), putrescible and biodegradable matter, asbestos, metal, metalloids and their compounds, leachate (metals and inorganic compounds), chlorinated solvents, hydrocarbons, inorganic compounds, formaldehyde, radionuclides, perfluorooctanoic acid (PFOA) and PFOS. |
| Car Park – potential spillages | Existing Airport Land, Areas A, D and E and Off-site Highway Interventions | Fuels (petrol, diesel): naphthalene, tetraethyl lead, methyl tertiary butyl ether (MTBE), tetramethyl lead, TPH, benzene, toluene, ethylbenzene, xylenes (BTEX), PAHs. Heavy metals, metals and metal compounds. Anti-freeze: ethylene glycol. |
| General – Made Ground | Areas A and B, Existing Airport Land, LLAOL Contractor's Compound, Airport Access Road, Off-site Highway Interventions | TPH, oils, benzene, PAHs. |
| Allotments | Area B | Ash, metals, pesticides/herbicides, PAHs |
| Agricultural Land | Areas B and C | Metal, metalloids and their compounds, herbicides and pesticides and asbestos. |
| Airport activities – Asphalt and cement works | LLAOL Contractor's Compound | Metals, metalloids, inorganics, asbestos, solvents, PAHs, phenols, polychlorinated biphenyls (PCBs), hydrocarbons. |
| Airport activities – Fire training ground | | Firefighting agents: allophanates, carbamates, hydrolysed proteins, glycols, ether alcohols, perfluorinated compounds-PFOA and PFOS Fuel storage: Hydrocarbons including fuels and oils, TPH, PAHs, benzene, toluene, ethylbenzene and xylenes (BTEX) and metals. |
| Airport activities – Run Up bay | | Hydrocarbons, metals, phenols |
| Electrical substations | | Hydrocarbons, metals, PCBs. |
| Airport activities (including tanks) | Existing Airport Land | Anti-freeze and de-icing agents: |

| Source | Areas Affected | Potential Contaminants |
|---|---|---|
| | | <p>Monoethylene glycols, diethylene glycols, propylene glycols, urea, calcium acetates, magnesium acetates.</p> <p>Organic solvents: ketones, methanol, aliphatic and aromatic hydrocarbons, esters, chlorinated compounds.</p> <p>Paints and associated solvents and thinners: polyurethanes, xylene, toluene, methyl ethyl ketone, methyl isobutyl ketone.</p> <p>Hydrocarbons i.e. Jet fuel, diesel (operating plant)</p> <p>Acids/bases, PAHs, PCBs and inorganic compounds</p> |
| Scrap yard | Area A | <p>Fuels (petrol, diesel): naphthalene, tetraethyl lead, methyl tertiary butyl ether (MTBE), tetramethyl lead, TPHs, benzene, PAHs.</p> <p>Heavy metals, metals and metal compounds.</p> <p>Anti-freeze: ethylene glycol.</p> <p>Asbestos</p> |
| Aircraft manufacturing (Percival works) | Existing Airport Land and Airport Access Road | Organic solvents chlorinated (i.e. trichloroethene) and non-chlorinated (i.e. alcohols, benzene, ketones, toluene), metals and metal compounds, fuels and other oils (i.e. aviation fuels, fuel oil, hydraulic fluids, lubricating oil), PCBs, cyanides, acids, asbestos, radionuclides (tritium and radium) which may have been used in the dials |
| Depot | | Dependent on use and type of depot, may include fuel and other oils |
| Sewage farm | Airport Access Road | Metals, metalloids, inorganic compounds, acids/alkalis, organic compounds, PCBs, micro-organisms (pathogens), methane, carbon dioxide, hydrogen sulphide, asbestos |
| Motor works | Area D | Metals, metalloids, acids/alkalis, PAHs, fuels and oils, solvents, chlorinated solvents, asbestos, hydrocarbon, PCBs, organics, chlorinate and non-chlorinated solvents |
| Rifle range | | Metals, in particular lead |

| Source | Areas Affected | Potential Contaminants |
|--------------------------|----------------|--|
| Imported earthworks fill | Areas D and E | Dependent on material source – potential contaminants could include asbestos, metals, organic compounds, PAHs and hydrocarbons |

Table 6.5: Potential contaminants off-site, within 250m based on historical/current activities.

| Source | Potential Contaminants |
|---|---|
| Motor Works | Metals, metalloids, acids/alkalis, PAHs, fuels and oils, solvents, chlorinated solvents, asbestos, hydrocarbon, PCBs, organics, chlorinate and non-chlorinated solvents. |
| Railway | Ash, ballast, fuel, oils, antifreeze liquids (ethylene glycol), metals, PCBs, greases, organic solvents, asbestos, creosote, inorganic compounds. |
| Sewage farm | Metals, metalloids, inorganic compounds, acids/alkalis, organic compounds, PCBs, micro-organisms (pathogens), methane, carbon dioxide, hydrogen sulphide, asbestos. |
| Depot | Dependent on use and type of depot, may include fuel and other oils. |
| Service Garage / Fuelling Station | Hydrocarbons including fuels and oils (TPH, PAHs and BTEX compounds). |
| Engineering Works (various non-descript) | Metals, metalloids, inorganic compounds, acids/alkalis, fuels and oils, solvents, chlorinated solvents, asbestos. |
| Foundry (metal works) | Metals, metalloids, acids/alkalis, fuels and oil (TPH and BTEX), PAHs, solvents and chlorinated solvents. |
| Dyeing and Bleaching Works | Metals, metalloids, acids/alkalis, fuels and oil (TPH and BTEX), solvents and dioxins. |
| Cemetery / Burial Grounds / Abattoir | Micro-organisms, pathogens. |
| Former landfill (Waste Types Unknown) | Landfill gas, VOCs, putrescible and biodegradable matter, asbestos, metal, metalloids and metal compounds, chlorinated solvents, non-chlorinated solvents, hydrocarbons, inorganic compounds. |
| Allotments | Ash, metals, pesticides/herbicides, PAHs |
| Fire Stations | <u>Firefighting agents:</u> allophanates, carbamates, hydrolysed proteins, glycols, ether alcohols. PFOA and PFOS. <u>Fuel storage:</u> hydrocarbons including fuels and oils, TPH, PAHs, (BTEX) and metals. |
| Electrical substations / Electricity Generation Station | Hydrocarbons, metals, PCBs. |

7 HYDROGEOLOGICAL CONDITIONS

7.1 General

7.1.1 Groundwater level and chemical quality monitoring has been undertaken during 2018/2019 to characterise the hydrogeological conditions beneath and in the vicinity of the former landfill.

7.1.2 The following sections provide an overview of the hydrogeological conditions for the Proposed Development. A detailed hydrogeological conceptual model has been developed (Ref. 72) which, along with literature sources provide the basis for the following sections.

7.2 Aquifer properties

7.2.1 The main water bearing strata in the region is the Chalk which is designated a Principal aquifer. The Chalk Group forms the most important aquifer unit within the Thames Basin, supplying water for public consumption and supporting river flows within Chalk bournes (intermittent streams flowing from a spring, characteristic of the Chilterns and North Downs).

7.2.2 The ability of groundwater to flow (transmissivity) within Chalk is complex, the Chalk is a dual-porosity, dual permeability aquifer. The matrix provides the storage and the fractures provide permeable pathways (Ref. 73). Most of the flow in the chalk in the area is likely to occur in a few dilated fractures, typically occurring at or within the top 30m of the Chalk through dissolution enhanced features in the chalk. Flow within the Chalk is influenced by the presence of these solution features which can lead to interlinkages between groundwater catchments (Ref. 74). Literature has noted the following important features of the fractures which affect the hydraulic properties of the chalk (Ref. 75):

- a. The fracture density is generally thought to peak at about 20m bgl; productive fractures decrease with depth. It is generally accepted that productive fractures are restricted to the upper few tens of meters of the aquifer (circa 50m);
- b. Fractures are both horizontal and vertical;
- c. The fractures can be termed primary and secondary fissures. Primary are the ubiquitous narrow fractures which have a typical hydraulic conductivity of the order of 0.1 m/d (1.2×10^{-6} m/s) and contribute a transmissivity of 20m²/d to the aquifer. The secondary fractures are the solution enlarged fractures and they contribute the remaining transmissivity of the aquifer, often more than 1000m²/d. The transmissivity of the matrix is generally negligible;
- d. The matrix of the chalk does not contribute directly to the permeability, but it has an important role in providing water to the fractures;
- e. The areas of highest transmissivity generally tend to be beneath valleys, with the highest values in the unconfined chalk;

- f. Aquifer properties are also strongly controlled by lithology, with hard bands of chalk rock having increased permeability as a result of associated fracturing;
- g. It is further complicated by the weathered top of the chalk, which is often referred to as 'putty chalk', where the chalk is structureless and forms a clayey silt. This material can have significantly lower hydraulic conductivity reducing the transmissivity of the aquifer. The travel time within the putty chalk horizon is estimated to be between 2-15 times slower than in the main Chalk (Ref. 74); and
- h. Falling head and borehole soakaway tests undertaken in the chalk during the Structural Soils 2017 (20) (21) (22) GI works indicated a permeability ranging from 2.28×10^{-4} m/s and 7.66×10^{-9} m/s, which are within the range reported within the literature.

7.3 Regional flow

- 7.3.1 The hydrogeological map of the area (Ref. 76) and monitoring of regional groundwater levels in the area indicates that the regional flow within the Chalk of the northern Thames Basin is predominately towards the southeast 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.
- 7.3.2 The Hertfordshire numerical groundwater model (Ref. 76) also shows the dominant direction of regional flow across the entire model extent to be to the south east, following the dip of the Chalk from the recharge point of the Chiltern Hills to the confined aquifer under London. Along the northern extent of the model, groundwater divides are common.
- 7.3.3 The Proposed Development lies on the divide between two groundwater catchment areas; the Upper Lea Catchment and the Mimram Catchment. The groundwater divide is located approximately along the eastern boundary of the existing airport.
- 7.3.4 To the west of the groundwater divide, in the vicinity of the airport the groundwater flows in a south westerly direction towards the River Lea. To the east of the groundwater divide, the flow system is likely to be locally modified by abstraction of groundwater from the Chalk aquifer. The nearest potable water supply borehole is located approximately 1.5km northeast from the Main Application Site boundary at Kings Walden. A second potable water abstraction (Nine Wells) is located at Whitwell, approximately 4.5km east of the Main Application Site and 5.3km east of the former landfill. Both may create a more easterly flow direction than the south easterly regional flow (Ref. 78). Similarly the Lea Catchment is influenced by local abstractions and groundwater flow is in a westerly direction

7.4 Groundwater levels and variability

Regional groundwater levels

- 7.4.1 Groundwater levels from Environment Agency observation boreholes (OBHs) within 3km of the Proposed Development have been used to form an understanding of the groundwater levels in the region. The location of these OBHs, the groundwater levels and the variability over time are shown in **Figure 17a** and **17b** of this document.
- 7.4.2 The outputs from the Environment Agency monitoring boreholes fit with the conceptual understanding of the chalk groundwater system in the area. Groundwater levels are highest to the west; Putteridge Bury and Luton observation boreholes both show groundwater levels around 110m AOD, whereas those in the Village Pump at Preston to the east of this site are approximately 90m AOD. Groundwater levels in the river valleys at monitoring locations Lilley Bottom and Mimram 1 (Mimram 1 demonstrates levels in the river) are noticeably lower than those located in the interfluves.
- 7.4.3 Overall the months with higher groundwater levels (February to June) tend to also show the largest range between maximum and minimum levels.
- 7.4.4 At low groundwater levels (December 1997) the groundwater levels range from 100m AOD (~20m bgl) at the eastern boundary of the site to approximately 105m AOD (~50m bgl) in the centre of the groundwater divides. At high groundwater levels (April 2001) the groundwater levels range from 110m AOD (~10m bgl) at the eastern boundary to approximately 120m AOD (~35m bgl) in the centre of the groundwater divides. There is more variation in groundwater levels towards the centre of the groundwater divide within the interfluves, than at the edges of the site, and therefore a steeper hydraulic gradient (both east and west) exists across the site during times of high groundwater levels. This would suggest that the likely seasonal range in groundwater levels around the Proposed Development area is 15m where the groundwater divides are situated underneath the existing airport, decreasing to 5m fluctuations in groundwater within the dry valley to the east.

Groundwater levels at the proposed development

- 7.4.5 Groundwater data provided by the Environment Agency (Ref. 72) indicates there are large fluctuations in the water level and groundwater flow direction beneath the airport that may be influenced by nearby groundwater abstractions. A groundwater monitoring programme from 2006-2007 (Ref. 77) recorded groundwater levels in the White Chalk subgroup beneath the airport at approximately 120m AOD (25m bgl) in the centre of the airport decreasing to 101m AOD (approximately 60m bgl) at the western boundary.
- 7.4.6 Groundwater level monitoring has been undertaken in a network of boreholes, over various periods between 2016-2019 within the main area of new development east of the existing airport. Groundwater level measurements have been taken from these boreholes over the last two years (approximately every two to three months). Data from November 2016 to March 2019 was available at the time of writing this report. In addition, post fieldwork

groundwater monitoring was undertaken in a series of boreholes (GW201-GW207) following the recent GI from August 2018- March 2019. This included locations up and down gradient of the former landfill. The location of the groundwater monitoring boreholes are shown on **Figure 17a** of this document.

7.4.7 The groundwater monitoring has indicated the following about the groundwater levels within the Proposed Development area:

- a. Groundwater levels recorded between May 2016 and May 2017 showed little variation (<5.0 m). However, the results from more recent monitoring; January to August 2018 highlighted a maximum variation of 10.94m in BH04 (western part of Area A) compared with a maximum variation to the east (Area B) of 4.47m. The data supports the Vale of St Albans model outputs (Ref. 73) suggesting that the likely seasonal range in groundwater levels around the airport expansion is 10m to 15m underneath the existing airport site, decreasing to 5m variation within the dry valley;
- b. Groundwater monitoring undertaken for the MPT, indicates that groundwater in Areas D and E (Off-site Car Parking) is likely to be shallow (4-7m bgl); and
- c. It was noted that ARP6-LFBH05 (located in LLAOL Contractor's Compound) recorded the highest groundwater levels at 118.68m bgl in March 2017. The groundwater levels recorded at this location are consistently higher than the levels recorded beneath Area A. It is possible that the groundwater levels in this borehole are being influenced by the presence of the central soakaway, which are artificially increasing the levels of water in this borehole, creating a mounding effect.

8 SUMMARY AND DISCUSSION

8.1.1 This section brings together all the information from the desk study, ground conditions and hydrogeology to inform a discussion of the potential risks from land contamination within the Proposed Development area.

8.2 Adequacy of data

8.2.1 A review of the data collected and an assessment of its adequacy to inform the application for development consent, with respect to contamination issues, has been undertaken, this is presented in **Table 8.1** below. It has been noted where additional GI is likely to be required after DCO for the detailed design stage.

Table 8.1: Summary of data and adequacy.

| Area | Available data |
|-----------------------|--|
| Existing Airport Land | <p>The GIs undertaken at the existing airport were designed to address previous proposed developments, there has not been complete coverage of the airport. In recent years the investigations reviewed include 2014 and 2016 Concept Site Investigations reported by Mott MacDonald (2017). Soil Engineering 2012 (Ref. 31) MPT GI (Ref. 51), RSK (2012) (Ref. 35) Aecom (2015) (Ref. 57).</p> <p>The GIs have not identified any accumulations of contamination that might act as sources for a contaminant linkage and no remediation works have been undertaken. It is noted that generally groundwater samples taken from beneath the airport were contaminated with hydrocarbons, metals and pesticides (Ref. 41).</p> <p>The areas currently proposed for redevelopment are included in the Mott MacDonald report (Ref. 41). Contaminants have been reported above the LOD but generally not exceeding adopted assessment criteria. Localised exceedances of two PAHs have been recorded. The report concluded that groundwater is impacted above drinking water standards (DWS) and some environmental quality standards (EQS) and that several contaminants in the soil have leaching potential. The data would be considered sufficient for works involving breaking of hardstanding and minor excavations within the area however, for piling works, a foundation works risk assessment would be recommended to ensure that piled foundations do not create pathways or mobilise contamination within the chalk aquifer. The data is sufficient for the requirements of the application for development consent but additional investigation may be required for detailed design.</p> |

| Area | Available data |
|-----------------------------|--|
| LLAOL Contractor's Compound | <p>Two GIs have been undertaken within this area: the 2017 Structural Soils investigation and the 2016 Concept investigation, reported in the 2017 Mott MacDonald report, giving an approximate grid spacing of 117m. Much of the data relates to the western half of this area, with limited data available for the eastern half. An assessment was undertaken by Mott MacDonald for data adjacent to the west of this area which concluded there were no significant contamination risks to human health or controlled waters associated with Made Ground materials on-site. Test results have identified occasional ACMs in the stockpiled material. It is concluded that the available data is sufficient for the purposes of the application for development consent.</p> |
| Airport Access Road | <p>Three GIs cover the eastern area of the proposed Airport Access Road within the landfill, these are considered as part of Area A. The section of the road in Area B is considered to be covered by the Structural Soils Ground Investigation at Century Park (Ref. 47) and is sufficiently characterised.</p> <p>The Structural Soils (2017) (Ref. 46) and Geotechnics (Ref. 54) GIs cover the western and central extent of the proposed road. Chemical testing was completed but never formally assessed, although the ES Chapter for Green Horizons Park (Ref. 61) [TR020001/APP/5.01] indicates there are no significant contamination sources, additional GI was recommended.</p> <p>It is noted that the Pell Frischmann PSSR (Ref. 45) identified the sewage farm at the western end of the proposed road alignment as a potential contamination source, however analysis of bacteriological pathogens was not included, a tank area was also proposed for investigation, however the scheduled exploratory holes were not completed.</p> <p>The spacing of GI holes was generally acceptable although there was a gap toward the centre of the proposed route. It is therefore considered that sufficient data is available for the application for development consent but some additional GI will be required at detailed design.</p> |
| Area A – Former Landfill | <p>Multiple GIs have been undertaken within this area, with the most recent investigation in 2019 (Ref. 52). This has generated a GI spacing of approximately 50m across the landfill for ground gas monitoring locations and 150m for groundwater monitoring locations. This is consistent with recommended sampling grids for a main site investigation and has been based on a robust GI strategy. The sampling locations have good spatial, lateral and vertical distribution, encompassing all the</p> |

| Area | Available data |
|--------|---|
| | <p>main eras of waste deposition. A significant number of soil (1219 samples), groundwater and leachate (328 samples) and gas/VOC samples (96 samples) have been undertaken and analysed to industry standards providing a comprehensive data set for the area.</p> <p>A considerable amount of gas monitoring has been undertaken which has included:</p> <ol style="list-style-type: none"> a. twelve months' worth of spot gas monitoring (concentrations measured at monthly intervals from boreholes); b. continuous gas monitoring in five boreholes across the landfill during the 2019 GI (which have taken continuous readings over a 3-month period); and c. samples of bulk and trace gases to determine the constituents and volumes of gases within the landfill. <p>The investigations undertaken to date provide a good understanding of the general composition of the waste, groundwater, leachate and landfill gas conditions within this area, and is therefore sufficient to assess the potential risks for the application for development consent.</p> |
| Area B | <p>Two GIs have been undertaken within this area, providing reasonable coverage of recent data (approximately 90m grid). Soil and groundwater sampling and testing were completed and monitoring for ground gases undertaken. This area does not have a history of contaminative uses; however it will form a key area for site won materials for the Proposed Development. Therefore, this sampling grid is considered sufficient to broadly characterise the soil and groundwater in this area.</p> |
| Area C | <p>No previous GI was obtained for this area. However, the available information indicates that there have been no significant contaminative land uses. Therefore, this area is considered to be greenfield land and does not require geoenvironmental investigation.</p> |
| Area D | <p>There is no GI data available for this area, but ground conditions are likely to be similar to those encountered in nearby Napier Park and Stirling Place developments, which were part of the former Vauxhall Motor Works. Area D did not form a main part of the Vauxhall Motor Works manufacturing area and no tanks are shown on the historical maps. Therefore, it is not anticipated that significant contamination is likely to be present within this area but there may be occasional areas of localised</p> |

| Area | Available data |
|--------------------------------|---|
| | contamination from the historical uses of the site and its current use as a trailer park and car parking. This information is sufficient to assess potential risks to the Proposed Development for the application for development consent, however, further GI is likely to be required prior to construction to confirm the contamination conditions. |
| Area E | The earthworks platform was constructed during the 1940s from material of unknown origin or quality, therefore, there is the potential for this material to be a source of contamination. It is not anticipated that significant contamination is likely to be present within this area but there may be occasional areas of localised contamination associated with the fill material used for earthworks. This information is sufficient to assess potential risks to the Proposed Development for the application for development consent, however, further GI is likely to be required prior to construction to confirm the contamination conditions. |
| Off-site Planting | Based on the historical review, no sources of contamination would be identified within the Off-site Planting areas. The nearest possible source was a Brick Works 200m to the north which is shown to be disused by 1901 and is currently a woodland. It is concluded that this area has no significant contamination potential. |
| Off-site Highway Interventions | No GIs have been undertaken within these areas. |

8.3 Summary of contamination risks within proposed development

8.3.1 The location and extent of potential sources of contamination in relation to the Proposed Development are shown in **Figure 9** of this document and described below.

General conditions in surrounding area

- 8.3.2 Local contamination of the groundwater beneath Luton Airport by hydrocarbons and de-icing agents has been recorded (Ref. 40).
- 8.3.3 Historically, significant earthworks to build development platforms associated with the airport have been undertaken, including the runway area. The material used in the earthworks pre-dates current guidance on land contamination and is of unknown chemical quality.
- 8.3.4 Groundwater at Luton is known to be of poor quality because of a “low level halo” of solvent contamination due to the legacy of industrial sites within the area. (Ref. 78).

Conditions within the proposed development

Existing Airport Land

- 8.3.5 Investigations around the existing airport terminal building, car parks and fixed base operations to the eastern boundary of the airport have not identified any significant contamination sources in soils or groundwater. No remediation works have been required for previous airport developments. No significant contamination is therefore anticipated in the areas of proposed development on the Existing Airport Land.

LLAOL Contractor's Compound

- 8.3.1 This area is currently used for several different activities. Site levels are fluctuating due to the ongoing earthworks within part of the site. A number of GIs have been undertaken covering this area. An investigation undertaken in 2015 for Mott MacDonald (Ref. 43) analysed soil samples from five locations. Concentrations of TPH above the limited of detection and elevated concentrations of PAH above adopted assessment criteria were identified within Made Ground in one location only, adjacent to the landfill.
- 8.3.2 Consultations with the Environment Agency during the DOC process has identified the Fire training area as a potential source of PFAS and PFOA in groundwater. This issue has been addressed as part of recent groundwater monitoring for the landfill GI and is discussed further in the GQRA (Ref. 67), see **Appendix 17.2** of the ES **[TR020001/APP/5.02]**.
- 8.3.3 Slightly elevated concentrations of ground gases were noted during the Structural Soils 2017 GI (Ref. 46), within this area where a significant thickness of Made Ground is present.

Airport Access Road

- 8.3.4 The Percival Works was present to the northern boundary of the existing airport and was located over a section of the proposed Airport Access Road at President's Way. Other potentially contaminative activities along the route include; former sewage works and general engineering works.
- 8.3.5 Two investigations have been completed along the proposed link road (Ref. 49) (Ref. 54). The eastern areas have been assessed as part of Areas A and B, being located on the landfill and WVP respectively. The analysis for the soils from the central and western sections have not previously been subject to formal assessment, this has been completed as part of the GQRA (Ref. 67), see **Appendix 17.2** of the ES **[TR020001/APP/5.02]**. Significant depths of Made Ground were recorded at the Airport Way end associated with Deerborn Escarpment and asbestos was recorded at a few locations along the route. The ES Chapter submitted for the **Green Horizons Park development [TR020001/APP/5.01]** indicates no significant impacts likely due to recorded contamination concentrations, additional GI was recommended (Ref. 61).

Area A – Former Landfill

- 8.3.6 The review of desk study information indicated the main area of potential contamination within the proposed scheme is the former Eaton Green landfill present in Area A. A significant part of the Proposed Development will be within this area including the new terminal building and Green Horizons Park developments.
- 8.3.7 The review of available information on the former landfill and the findings of the Arup QRA (Ref. 50) indicate the following:
- a. The site has been used for waste disposal from circa 1940s – 1980s, with the major period of filling during the 1950s/1960s;
 - b. The extent of filling is less than the existing Environment Agency boundary, with the north eastern portion showing no evidence of being filled with waste;
 - c. Previous GI suggests the landfill is principally domestic/commercial waste, with very little industrial type wastes encountered;
 - d. ACMs were noted within the former landfill, which is expected due to the age of the landfill but no significant accumulations were encountered;
 - e. There is the potential for radionuclides to be present in the waste materials if luminous aircraft dials from the nearby Percival Works were disposed there. However, testing in the 2018 GI undertaken by Aecom (Ref. 63) suggests the levels observed were consistent with the expected natural background levels;
 - f. Observations during the 2017 Green Horizons Park ground investigation (Ref. 49) and the leachate analysis suggests the waste could be described as well degraded domestic waste but there is still a significant amount of organic material remaining;
 - g. The Arup QRA (Ref. 50) indicates the chemistry of the landfill presents little risk to future site users and the groundwater monitoring provides little evidence the landfill is causing significant contamination of the groundwater. However, the QRA recommended further GI and monitoring was undertaken order to confirm this assessment; and
 - h. The preliminary assessment undertaken as part of the Arup Green Horizons Park QRA (Ref. 50) indicated elevated concentrations of methane and carbon dioxide but low flow rates. Overall the measurements typically indicated CS2 (low risk) or CS3 (moderate risk) scenario with CS4 (moderate to high risk) encountered on one occasion. The results are consistent with an ageing landfill which is not generating significant volumes of gas.
- 8.3.8 Groundwater levels at site would not intercept the base of the former landfill at approximately 130m AOD. The highest modelled groundwater level is approximately 127m AOD based on Environment Agency 2001 OBHs. However, the Proposed Development will involve piling through the landfill into the chalk and in some instances into the saturated zone.

The potential impacts of this activity will require a foundation works risk assessment and careful management during the works.

- 8.3.9 The solution features in the area such as enlarged joints and solution pipes are important within the unsaturated zone because they may provide conduits for the rapid transport of contaminants from the surface to groundwater thus bypassing the attenuation capacity of the soil and unsaturated zones.
- 8.3.10 Further GI undertaken in 2018 provided information on the following:
- a. Chemistry of the landfill, in particular the industrial waste in the older landfilled materials beneath the Long Stay Car Park to complete the assessment of risk to human health;
 - b. Further information on the characteristics of the landfill to determine likely presence of obstructions, types and proportions of wastes and check for radionuclides;
 - c. Information to inform foundation design, including likely settlement rates, concrete classification, earthworks methodologies and percentage of reusable materials;
 - d. Fully characterise the landfill gas regime to meet CIRIA guidance (Ref. 66), inform the design of gas protection measures for proposed buildings and control measures to prevent off-site migration;
 - e. Weathering and solution of the top of the chalk; and
 - f. Additional information to determine the groundwater regime: groundwater levels, seasonal variation, flow direction, source and extent of contamination, evidence for migration of contaminants from the landfill to surrounding areas, evidence of off-site sources.
- 8.3.11 The GI work has been completed and interpretation of the data is presented in the GQRA (Ref. 67) [TR020001/APP/5.02].

Area B

- 8.3.12 This area of the Proposed Development has no significant history of contaminative use based on the available information.
- 8.3.13 The GIs completed in 2016 by Structural Soils (Ref. 47) across Area B show very limited Made Ground within the WVP core and generally 300mm topsoil was encountered at the surface in undeveloped areas. The Clay with Flints deposit was present at the crest and granular deposits present in the base of the valleys. The soil analysis undertaken did not indicate any elevated concentrations of contaminants.
- 8.3.14 Groundwater analysis undertaken within Area B indicated exceedances of generic screening criteria for some contaminants; iron, manganese, ammoniacal nitrogen, nitrate, nitrite. Although elevated levels of ammoniacal nitrogen, nitrate and nitrite could indicate the presence of landfill leachate break out, these determinants can also occur naturally, associated with agricultural land uses.

- 8.3.15 Ground gases were generally recorded at low concentrations; methane below limits of detection and up to 4% v/v carbon dioxide, suggesting the migration of gases from the landfill to this area is not occurring.

Area C

- 8.3.16 No previous GI has been undertaken in this area. However, a review of the historical data indicates that this area is greenfield and has only ever been agricultural land. Therefore, no potential sources of contamination are considered to be present in this area.

Area D

- 8.3.17 The historical mapping indicates that site was partly used by the Vauxhall Motor Works from 1924. In 1947 it was shown as used for parking. The 1955 mapping shows a significant earthworks platform constructed, the aerial photography indicates that this fill was predominately chalky in nature. The origin of this material is unknown, however, the aerial photography suggests excavations were occurring in a number of areas in the vicinity of the site at the time of its deposition.
- 8.3.18 There is no GI data available for this area but ground conditions are likely to be similar to those encountered in nearby Napier Park and Stirling Place developments, which were part of the former Vauxhall Motor Works. The GI and assessment work undertaken for Napier Park indicated that significant hydrocarbon contamination was encountered in areas associated with storage and the main manufacturing areas. In other parts of the site occasional areas of localised contamination were encountered. Area D did not form a main part of the Vauxhall Motor Works manufacturing area and no tanks are shown on the historical maps. Therefore, it is not anticipated that significant contamination is likely to be present within this area but there may be occasional areas of localised contamination from the historical uses of the site.

Area E

- 8.3.19 The site was not shown as developed until 1941 when earthwork mounds were shown on-site, although the purpose of these is unknown. Several structures are present on the 1947 mapping, with the earthwork platforms shown on 1960s mapping.
- 8.3.20 The earthworks platform was constructed during the 1940s from material of unknown origin or quality, therefore, there is the potential for this material to be a source of contamination. It is not anticipated that significant contamination is likely to be present within this area but there may be occasional areas of localised contamination associated with the fill material used for earthworks and its recent use for car parking.

9 CONCEPTUAL SITE MODEL AND PRELIMINARY RISK ASSESSMENT

9.1 UK framework

9.1.1 Current UK guidance recommends a phased risk-based approach to the assessment of soil contamination, based on the developing and updating of a conceptual site model (CSM). The current best practice for risk assessment methodology is detailed in the Environment Agency's Land Contamination Risk Management guidance (Ref. 1). This process starts with Stage 1: Risk assessment which comprises; a Preliminary Risk Assessment, this can be followed by a GQRA if identified as required in the PRA and potentially a DQRA depending on the findings of the GQRA.

9.1.2 The CSM is a representation of the relationships between possible contaminant sources, pathways and receptors to support the identification and assessment of potential contaminant linkages (PCL) and an assessment of known contaminant linkages, where identified from existing information. The model comprises identification of:

- a. **Sources:** the key pollutant hazards associated with the site;
- b. **Receptors:** the key targets at risk from the sources; and
- c. **Pathways:** the means by which the contaminant can cause harm to the receptor.

9.1.3 All three elements must be present for a potential risk to exist.

9.1.4 Where PCLs are identified, a preliminary risk assessment is carried out to assess the likelihood that each potential linkage exists and to decide whether these pose potentially unacceptable risks to identified receptors and require further assessment. The potential risk of each PCL has been based on consideration of:

- a. **The likelihood of an event (probability)** – takes into account both the presence of the hazard and receptor and the integrity of the pathway.
- b. **The severity of the potential consequence** – takes into account both the potential severity of the hazard and the sensitivity of the receptor.

9.1.5 The risk has been classified using the categorisation and description of risk levels in **Table 9.1** and **Table 9.2** below, taken from NHBC (Ref. 3).

Table 9.1: Categorisation of risk.

| Probability (Likelihood) | Consequence | | | |
|--------------------------|-------------------|-------------------|-------------------|---------------|
| | Severe | Medium | Mild | Minor |
| High likelihood | Very high risk | High risk | Moderate risk | Low risk |
| Likely | High risk | Moderate risk | Moderate/Low risk | Low risk |
| Low Likelihood | Moderate risk | Moderate/Low risk | Low risk | Very low risk |
| Unlikely | Moderate/Low risk | Low risk | Very low risk | Very low risk |

Table 9.2: Description of risk levels.

| Terms | Description |
|----------------|--|
| Very high risk | There is a high probability that severe harm could arise to a designated receptor from an identified hazard at the site without appropriate remediation action. |
| High risk | Harm is likely to arise to a designated receptor from an identified hazard at the site without appropriate remediation action. |
| Moderate risk | It is possible that without appropriate remediation action harm could arise to a designated receptor. It is relatively unlikely that such harm would be severe, and if any harm were to occur it is more likely that such harm would be relatively mild. |
| Low risk | It is possible that harm could arise to a designated receptor from an identified hazard. It is likely, that if any harm was realised any effects would be mild. |
| Very low risk | The presence of an identified hazard does not give rise to the potential to cause harm to a designated receptor. |

9.2 Preliminary risk assessment

9.2.1 The Proposed Development options have been outlined in **Section 4** of this document. A risk assessment and conceptual site model (CSM) have been prepared for each area based on potential contamination sources and development proposals. The assessment of risk draws upon the information and conclusions of previous reports, as detailed in **Section 5** above.

9.2.2 It is assumed that site conditions on Area C will be similar in nature to those recorded in Area B as currently no intrusive investigation has been completed in this area. It also considers the anticipated earthworks/construction methodology e.g. large-scale earthworks/piled foundations, as applicable, to the area in question.

9.2.3 The outline CSM developed for each area and the PRA of each PCL are presented in **Appendix G** of this document.

9.3 Summary of potential contaminant linkages (PCLs)

9.3.1 The PRA identified a large number of PCLs, some of which require further detailed assessment. A summary of the PCLs identified as moderate to high risk requiring further assessment is provided in **Table 9.3** below.

9.3.2 **Appendix G** should be consulted for a full list of PCLs and qualitative assessment of the risks.

Table 9.3: Summary of Moderate to High Risk PCLs.

| Area | Proposed Development | Receptor | Potential Contaminant Linkage (PCL) | Qualitative Assessment of Risk |
|------------------------------------|---|---------------------------|---|--------------------------------|
| Existing Airport Land | Minor improvements to the existing terminal. New apron and stands. Construction of technical building. Section of Luton DART extension. Relocation of the fire training ground with its associated facilities to the south of the runway. Rainwater harvesting tanks and emergency water supply tanks. | Human health | Inhalation of airborne contaminants by construction workers from Made Ground during construction. | Moderate |
| | | | Deep excavations impact UXO with risk to construction workers, public/terminal buildings. | Moderate |
| | | Buildings/ Infrastructure | Direct contact with contaminated soils/ groundwater. | Moderate |
| LLAOL Contractor's Compound | Apron, piers and stands, taxiways. | Human health | Inhalation of airborne contaminants by construction workers from Made Ground during | Moderate |

| Area | Proposed Development | Receptor | Potential Contaminant Linkage (PCL) | Qualitative Assessment of Risk |
|---------------------------------|---|----------------|---|--------------------------------|
| | | | construction works. | |
| | | | Installation of piles impact UXO with risk to construction workers/public/airport operatives. | High |
| Airport Access Road | Construction of a new access road. | Human health | Direct contact with Made Ground e.g. dermal, and/or accidental ingestion by construction workers. | Moderate |
| | | | Inhalation of airborne contaminants by construction workers from Made Ground during construction. | Moderate |
| | | Infrastructure | Direct contact with contaminated soils/ Groundwater. | Moderate |
| Area A – Former Landfill | North Ancillary airport developments including technical services building Green Horizons Park development includes: | Human Health | Migration of ground gases from former landfill into future development. | Very High |
| | | | Migration offsite to adjacent residential properties/ existing airport buildings of ground gases from former landfill through | Moderate |

| Area | Proposed Development | Receptor | Potential Contaminant Linkage (PCL) | Qualitative Assessment of Risk |
|------|---|--|---|--------------------------------|
| | Buildings such as offices and hotel. Car parking, new road infrastructure and landscaping. | | preferential pathways. | |
| | | | Inhalation of airborne contaminants by adjacent site users (e.g. residential housing, existing Luton Airport) from Made Ground/Former Landfill during construction works. | High |
| | Inhalation of airborne contaminants by construction workers from Made Ground/Former Landfill during construction works. | | Moderate | |
| | Driving of piles impact UXO with risk to construction workers/public/airport operatives. | | High to Moderate | |
| | Controlled waters | | Driving of contaminants downwards to Principal Chalk Aquifer during any future piling. | Moderate |
| | | Migration of contaminants via preferential pathways to | Moderate | |
| | South A new terminal building. Apron, piers, stands and taxiways Extension to the Luton DART to the new terminal and new station. | | | |

| Area | Proposed Development | Receptor | Potential Contaminant Linkage (PCL) | Qualitative Assessment of Risk |
|---|--------------------------------|-------------------|---|--------------------------------|
| | | | Principal aquifer. | |
| | | | Lateral migration of contaminants in groundwater to controlled waters. | Moderate |
| | | Buildings | Direct contact with aggressive ground conditions. | Moderate |
| Area B – Land West of Winch Hill | No Moderate to High Risk PCLs. | | | |
| Area C – Land East of Winch Hill | No Moderate to High Risk PCLs. | | | |
| Off-site Car Parks | | | | |
| Area D - Off-site Car Park North | Car park | Human health | Inhalation of airborne contaminants by construction workers from Made Ground during construction works. | Moderate |
| | | Controlled waters | Leaching of contaminants in soil to Principal Chalk Aquifer. | Moderate |
| | | Infrastructure | Direct contact with contaminated soils/ groundwater. | Moderate |
| Area E – Off-site Car Park South | Multi-storey Car park | Human health | Inhalation of airborne contaminants from Made Ground by | Moderate |

| Area | Proposed Development | Receptor | Potential Contaminant Linkage (PCL) | Qualitative Assessment of Risk |
|-----------------------------------|----------------------|-------------------|---|--------------------------------|
| | | | construction workers from Made Ground during construction works. | |
| | | Controlled waters | Leaching of contaminants in soil to Principal Chalk Aquifer. | Moderate |
| | | | Driving of contaminants downwards to Principal Chalk Aquifer during any future piling in soils and groundwater. | Moderate |
| | | Infrastructure | Direct contact with contaminated soils/ Groundwater. | Moderate |
| Off-site Sources | | | | |
| All areas of Proposed Development | | Controlled waters | Lateral migration of contamination in groundwater onto site from off-site sources. | Moderate |

10 CONCLUSIONS AND RECOMMENDATIONS

10.1 Conclusions

10.1.1 A desk-based assessment of the potential risks associated with the Proposed Development has been undertaken using a range of data sources including historical information, regulatory database and findings of previous ground investigations and quantitative risk assessment. The current masterplan for the Proposed Development is a two-terminal solution, which will include the creation of a second terminal, extension to the existing apron and relocation of car parking to the east and north of the new terminal building. This will involve extensive earthworks and re-engineering of a section of former landfill which is present adjacent to the existing airport.

10.1.2 A summary of all PCLs identified is presented in **Appendix G** of this document and the conclusions are provided below for each area.

Existing Airport Land

10.1.3 The airport is currently occupied by the terminal, stands, aprons, taxiways, hangars, runway and car parking. The proposed works are to upgrade the existing building and construct a new apron and stand and a section of the Luton DART extension. The fire training ground will be relocated from the LLAOL Contractor's Compound to the south of the runway. New rainwater harvesting tanks will be installed and emergency water supply tanks at various locations.

10.1.4 Previous GI and assessments as summarised in **Table 5.6** of this document indicate the following:

- a. Site investigations have not identified any substantial contamination sources and no remediation works have been undertaken;
- b. Overall the GI results show low levels of contaminants in the Made Ground soils which present low risk to site users;
- c. GI data does not indicate any elevated ground gases within this area suggesting that migration of gases from the former landfill to this area is not occurring;
- d. Elevated concentrations of hydrocarbons, metals and pesticides above relevant standards were noted beneath existing airport in the groundwater; and
- e. The Proposed Development includes relocation of the existing fire training ground, to a new location south of the airport runway and taxiways. No previous GIs have been undertaken in the area, however the information gathered for the PRA indicates there to be unlikely to be contamination in this area and the potential risk would be low.

10.1.5 On this basis the contamination potential associated with the existing airport land has been given a risk rating of **low to moderate**.

LLAOL Contractor's Compound

- 10.1.6 This area is currently the airport fire training ground and an area used by LLAOL contractor as a compound area for storage of various items, including construction arisings from Terminal 1 improvements. In the south of this area is the existing airport soakaway (central soakaway).
- 10.1.7 This area will form part of the airport airside expansion including new apron, piers and stands, attenuation tank and emergency water supply tank.
- 10.1.8 The preliminary risk assessment has identified that overall potential contamination in this area presents a **low to moderate/low** risk to the Proposed Development for the following reasons:
- a. The ground investigation results to date suggest low levels of contaminants which present little risk to future site users;
 - b. Some ACMs were identified within stockpiled materials which will require management during earthworks;
 - c. Slightly elevated concentration of ground gases were noted during the Structural Soils 2017 GI, where a significant thickness of Made Ground is present. The concentrations were not considered to present a risk to future development. Further, all Made Ground is to be excavated and treated for reuse, any unsuitable materials which could present a gas source will be removed i.e. wood;
 - d. Verification of the materials will be required in these areas when they are excavated prior to reuse; and
 - e. There is likely to be low risk to future users given that this area will be covered with hardstanding and will largely be an earthworks platform formed from clean natural materials.
- 10.1.9 A **moderate** risk has been identified to construction workers which will require mitigation through adopting good site practices and use of Personal Protective Equipment (PPE).

Airport Access Road

- 10.1.10 The link road includes section of new build and upgrading of existing road, the earthworks are likely to generally be limited to shallow excavations but will include deeper cuttings and construction of embankments as the road will be constructed up from existing ground levels.
- 10.1.11 The new build sections will pass through industrial land and an undeveloped area which was previously a sewage works.
- 10.1.12 The assessment of GI data for the eastern section which crosses Area A and B has been assessed as part of these areas. The GI completed across the central and western section requires a formal risk assessment and a generic assessment is included in the GQRA, on this basis current risk assessment indicates **low to moderate** risk.

- 10.1.13 Asbestos has been identified which will require further assessment and appropriate controls during groundworks.

Area A - Former Landfill

- 10.1.14 This area currently comprises public open space (WVP), a CWS is located in the southern area. The Long-Term Car Park for Luton Airport is present in the west of the area and the northwest is another car park (operated by TUI).
- 10.1.15 The north of this area is proposed to be redeveloped for Green Horizons Park including buildings such as offices, hotels, car parking, associated new road infrastructure and landscaping. The southern part of this area will form part of the airport expansion including a new terminal building, apron, piers, stands, taxiway, extension to the Luton DART to the new terminal and new station.
- 10.1.16 The review of desk study information indicated the main area of potential contamination within the Proposed Development is the former Eaton Green landfill. A significant part of the Proposed Development will be within this area including the new terminal building.
- 10.1.17 The PRA has identified a number of PCLs that require further assessment as follows:

Human health

- 10.1.18 Analysis within previous reports of the GI results to date suggest the chemistry of the landfill presents a low risk to future site users assuming a clean cover system to remove potential pathways. This is assessed further in the GQRA (Ref. 67) and DQRA for human health (Ref. 68), **Appendices 17.2 and 17.3** of the ES [TR020001/APP/5.02].
- 10.1.19 ACMs were noted within the former landfill, however, no significant accumulations were encountered. Further assessment will be required of the most recent GI data to understand the potential risk in relation to the construction works and land use scenarios associated with the proposed airport expansion.

Controlled waters

- 10.1.20 Overall, the groundwater monitoring data which has been previously assessed as part of the Arup Green Horizons Park QRA (Ref. 50) provides little evidence that the landfill is causing significant contamination of the groundwater. This suggests that, providing appropriate mitigation techniques are used during construction to prevent downward migration of contaminants, it is unlikely that the new development will result in significant contamination of the groundwater.
- 10.1.21 Leachate and groundwater monitoring results from the recent GI require further detailed assessment to confirm the initial findings from the Arup Green Horizons Park QRA.

Ground gas

- 10.1.22 Within the area of the former landfill a significant amount of monitoring has been undertaken, including:

- a. Twelve months' worth of spot gas monitoring (i.e. levels measured at monthly intervals from boreholes);
- b. Continuous gas monitoring in five boreholes across the landfill during the recent GI (which have taken continuous readings over a 3-month period); and
- c. Samples of bulk and trace gases to determine the constituents and volumes of gases within the landfill.

10.1.23 The preliminary assessment (Ref. 50) indicated elevated concentrations of methane and carbon dioxide but low flow rates. Overall the measurements typically indicated CS2 or CS3 scenario with CS4 encountered on one occasion. The spot monitoring readings are generally consistent with an ageing landfill which is not generating significant volumes of gas. However, it is considered likely that any future development will require gas protection measures. Currently there is no indication of significant off-site migration of landfill gases.

10.1.24 Further detailed assessment is required to understand the gassing conditions after work is undertaken to remodel the landfill. The gas management measures will need to be integrated with the geotechnical and structural design of the buildings and pavements, and with the requirement to minimise surface water infiltration into the underlying waste.

Geotechnical

10.1.25 A risk to buried structures (foundations, services) from aggressive ground conditions and landfilled wastes/leachates in Area A have been identified, which can be addressed by appropriate design to select suitable foundation materials/concrete classification. Further physical conditions likely to present a potential risk to any development, include large obstructions, settlement, and solution features, also require assessment.

Area B (Land West of Winch Hill)

10.1.26 This area is currently largely undeveloped, with the northwest part of this area forming part of WVP. Within this area is a community centre, skateboard park, children's playground and allotment gardens as well as public open space, scrub and woodland areas. The rest of the area comprises agricultural land with a coppice and small woodland in the south, designated as ancient woodland. Winch Hill Farm and New Winch Hill Cottages are located on the eastern boundary on Winch Hill Lane.

10.1.27 As part of the redevelopment proposals the existing WVP community centre and allotment gardens will be retained. In the remaining part of the area it will be car parking, fuel farm and fuel pipeline, water treatment plant, infiltration tank and relocated parkland.

10.1.28 Potential for contamination in groundwater to impact the Principal aquifer has been identified as a Moderate/Low risk which has been further assessed in the DQRA for controlled waters (Ref. 69) **Appendix 17.4** of the ES **[TR020001/APP/5.02]**. However, overall the PRA has identified that overall

potential contamination in this area presents a **very low to low risk** to the Proposed Development for the following reasons:

- a. The site has no previous significant contaminative uses based on the review of available information;
- b. The GI results to date suggest low levels of contaminants across Area B (Ref. 46) which present little risk to future site users;
- c. Groundwater analysis undertaken within Area B indicated exceedances of generic screening criteria for some contaminants in the groundwater; iron, manganese, ammoniacal nitrogen, nitrate, nitrite. Although elevated levels of ammoniacal nitrogen, nitrate and nitrite could indicate the presence of landfill leachate break-out, these determinants can also occur naturally, associated with agricultural land uses. Further assessment of the potential impacts from the former landfill in area A on other areas of the Proposed Development is required;
- d. GI data to date does not indicate any elevated ground gases within this area, suggesting there is no source of ground gas and migration of gases from the landfill to this area is not occurring. However, care should be taken during the design and assessment phases of the development to ensure that no preferential pathways are created from Area A; and
- e. Area B will be a key area for site won materials for the Proposed Development. The sampling undertaken to date is considered sufficient to broadly characterise the soil and groundwater conditions to inform the excavation and reuse of the material.

Area C (Land East of Winch Hill)

- 10.1.29 This area is currently predominately arable land with some hedgerows/trees.
- 10.1.30 The area will be used for the creation of an infiltration basin (below ground infiltration tank), fuel connection pipeline and replacement open space.
- 10.1.31 Area C has no known previous significant contaminative uses based on the review of available information. The site is considered greenfield and has only ever been agricultural land. The preliminary risk assessment has identified that overall potential contamination in this area presents a **very low to low risk**.

Off-site Car Parks – Areas D and E

- 10.1.32 Area D is currently partly occupied by a trailer park and car parking with a small area used for servicing cars. Area E was most recently used for car parking and storage of construction materials. Part of the site is covered with hardstanding and two unidentified structures are also present associated with the site's previous use by Vauxhall Motors.
- 10.1.33 Both Areas D and E are proposed to be redeveloped for off-site airport car parking, including a multi-storey car park in Area E.
- 10.1.34 The PRA has identified that overall potential contamination in this area presents a **low to moderate** risk to the Proposed Development for the following reasons:

- a. GI has not been undertaken within these areas, however, fill of unknown quality has been used to create earthworks platforms at these sites. A review of the desk study information suggests that ground conditions may be similar to the surrounding areas. It is not anticipated that significant contamination is likely to be present within these areas but there may be occasional areas of localised contamination from the historical uses of the sites; and
- b. These areas are proposed to be off-site car parking and therefore will be largely hardstanding. The presence of hardstanding will prevent future users coming into contact with potential contaminants in the underlying soils.

Off-site planting

10.1.35 Hedgerow enhancements are proposed for the Off-site Planting areas which currently comprise of open fields and existing woodland. The PRA has not identified any PCLs in this area.

Off-site highway interventions

10.1.36 No GI has been completed in the Off-site Highway Intervention areas, the desk study information indicates there is unlikely to be significant contamination present and given the proposed earthworks and continued use as highways the overall risk to future site users is assessed as **very low to low**.

Further work required and recommendations

10.1.37 **Table 10.1** below has recommendations based on the findings of the assessment.

Table 10.1: Recommendations and further work.

| Area | Further work/recommendations |
|-----------------------|---|
| Existing Airport Land | <p>No further GI or risk assessment is required for the contaminated land assessment but may be required to inform detailed design.</p> <ul style="list-style-type: none"> a. The overall risk of contamination has been determined as low to moderate. b. Risks identified can be addressed at detailed design stage with additional testing of materials and employment of mitigation and control measures during construction including adherence to the Construction Code of Practice (CoCP) Appendix 4.2 of the ES [TR020001/APP/5.02]. c. Additional GI is recommended to cover the areas of proposed earthworks to reduce the uncertainty identified in the CSM for the detailed design. d. An assessment of aggressive ground conditions in accordance with BRE SD1 (Ref. 79). |

| Area | Further work/recommendations |
|-----------------------------|--|
| LLAOL Contractor's Compound | <p>No further GI or risk assessment is required for the contaminated land assessment but may be required to inform detailed design.</p> <ol style="list-style-type: none"> a. Risks identified can be addressed at detailed design stage with additional testing of materials and employment of mitigation and control measures during construction including adherence to the CoCP Appendix 4.2 of the ES [TR020001/APP/5.02]. b. Construction works should include measures to ensure that preferential pathways for gases from the landfill are not created, as well as to detect, and if necessary treat, any existing features such as drains and other utilities that might be providing a preferential pathway for gases from the former landfill in Area A. <p>Verification of soils will be required prior to reuse.</p> |
| Airport Access Road | <p>Further risk assessment is required</p> <ol style="list-style-type: none"> a. The overall risk of contamination has been determined as Low to Moderate. b. The results from previous investigations should be assessed and summarised to inform risk to human receptors and controlled waters. c. Additional GI will required to address some of the contamination sources identified which have not been addressed by the GIs to date and to obtain information on the leachability of the soils, with regard to proposed infiltration drainage, see below. This should be completed prior to construction. d. It is recommended that geoenvironmental input is sought for the drainage strategy to manage the risks of positive drainage interacting with contaminated material affecting the underlying aquifer. e. The eastern section of the Airport Access Road has been considered within the remedial strategy developed for Area A. |
| Area A – Former Landfill | <p>Further risk assessment is required including:</p> <ol style="list-style-type: none"> a. Detailed assessment of the 2018/2019 investigation, see GQRA (Ref. 67) and DQRAs (Ref. 68)(Ref. 69) [TR020001/APP/5.02]. b. Detailed assessment to understand the gassing conditions after work is undertaken to remodel the landfill, including a gas assessment to understand the future gas generation. |

| Area | Further work/recommendations |
|----------------------------------|---|
| | <ul style="list-style-type: none"> c. Detailed consideration of the gas management measures for the Proposed Development buildings. d. Complete full characterisation of the landfill waste based on the additional data gathered during the recent 2018/2019 GI which informs the detailed assessment of the potential risks to groundwater and also to determine the potential for reuse of material. e. Development of remedial strategy for the re-engineering of the former landfill material to ensure that the potential risks associated with this material are assessed and controlled as to not present a risk to controlled waters or future users of the site. f. Reassessment of geotechnical risks to finalise any ground improvement techniques/foundation design prior to construction and used to further develop the earthworks strategy for the developments. g. No additional GI is recommended for this area. |
| Area B | <p>No further GI or risk assessment is required for the contaminated land assessment but may be required to inform detailed design.</p> <ul style="list-style-type: none"> a. Construction works should include measures to ensure that preferential pathways for gases from the landfill are not created, as well as to detect, and if necessary treat, any existing features such as drains and other utilities that might be providing a preferential pathway for gases from the former landfill in Area A. |
| Area C | <p>No further GI or assessment is required.</p> |
| Area D - Off-site Car Park North | <p>No further GI or risk assessment is required for the contaminated land assessment but may be required to inform detailed design.</p> <ul style="list-style-type: none"> a. The overall contamination risk is generally assessed as low to moderate, detailed assessment of risks is not required at this stage in the application for development consent. b. No significant contamination anticipated but GI should be undertaken prior to construction to confirm verify existing mitigation requirements and design measures. |
| Area E – Off-site Car Park South | <p>No further GI or risk assessment is required for the contaminated land assessment but may be required to inform detailed design.</p> <ul style="list-style-type: none"> a. The overall risk contamination is assessed as low to moderate, detailed assessment of risks is not required at this stage in the application for development consent. |

| Area | Further work/recommendations |
|--------------------------------|--|
| | <p>b. No significant contamination anticipated but GI should be undertaken prior to construction to confirm verify existing mitigation requirements and design measures.</p> |
| Off-site Planting | No further GI or assessment required. |
| Off-site Highway Interventions | <p>No further GI or risk assessment is required for the contaminated land assessment but may be required to inform detailed design.</p> <p>a. The overall risk for the Off-site Highway Interventions has been determined as Very Low to Low as the majority of the sites have shown little historical development. Furthermore, the works proposed are limited to the existing carriageways.</p> <p>b. However, breaking of hardstanding for the works is likely to expose Made Ground. Further GI would inform risk to construction workers who have been identified as the main receptors.</p> <p>c. An earthworks strategy would be developed detailing the removal, handling, storage and placement of soils for these areas. This strategy would form part of the earthworks specification at detailed design.</p> |

Other risks

- 10.1.38 The risks from UXOs are considered very high in Areas A and LLAOL Contractor's Compound based on a detailed UXO assessment (Ref. 80), Luton airport had a significant role in World War II and therefore potential UXO risks are expected. The risks can be mitigated by following best practice guidance on UXOs (Ref. 80 Ref. 81), site briefings, additional surveys and a watching brief in areas identified as having the potential for high risk of UXO identified from risk assessments undertaken to date. Further UXO desk based assessment will be required for Areas D and E prior to construction works since these are not currently covered by an assessment.
- 10.1.39 Water supply pipes are likely to be included as part of the scheme and a UKWIR assessment should be undertaken to ensure that pipe selection is suitably protective to prevent chemical attack and ingress of contaminants.
- 10.1.40 Ecological risks have been identified in the form of invasive plant species Area A. Further ecological risks should be considered over currently undeveloped areas: Areas B, C and parts of LLAOL Contractor's Compound and Areas D and E.
- 10.1.41 Construction workers have a high likelihood of coming into contact with contaminants in the Made Ground and landfill material. The potential risks can be reduced and or avoided through good construction site practices, method statements and safe systems of working, including high standards of hygiene and use of appropriate PPE.

GLOSSARY AND ABBREVIATIONS

| Term | Definition |
|----------------------|--|
| Abbreviations | |
| AAR | airport access road |
| ACM | asbestos containing material |
| AOD | above ordnance datum |
| BTEX | benzene, toluene, ethylbenzene, xylenes |
| BGS | British Geological Survey |
| BS | British Standard |
| CBC | Central Bedfordshire Council |
| CL:AIRE | Contaminated Land: Applications in Real Environments |
| CPAR | Century Park access road |
| CoCP | Code of Construction Practice |
| CoC | contaminants of concern |
| COMAH | Control of Major Accident Hazards |
| CIRIA | Construction Industry Research and Information Association |
| CLR | contaminated land report |
| CLEA | contaminated land exposure assessment |
| CSM | conceptual site model |
| CWS | County wildlife site |
| Luton DART | Luton Direct Air-Rail Transport |
| DCO | Development Consent Order |
| DEFRA | Department of Environment Food and Rural Affairs |
| DoWCoP | Definition of Waste Code of Practice |
| DQRA | Detailed Quantitative Risk Assessment |
| DWS | drinking water standards |
| EIA | Environmental Impact Assessment |
| EQS | environmental quality standards |
| ES | Environmental Statement |
| FBO | fixed base operation |
| GAC | generic assessment criteria |
| GQRA | Generic Quantitative Risk Assessment |
| GI | ground investigation |
| HI | hazard index |
| HGV | heavy goods vehicle |
| IPPC | Integrated Pollution Prevention and Control |
| LCRM | Land Contamination Risk Management |
| LOD | limit of detection |
| LR | Luton Rising (the Applicant) |
| LLAOL | London Luton Airport Operator Limited |
| LBC | Luton Borough Council |
| MSA | mineral safeguarding area |
| MPT | mass passenger transit |
| mppa | million passengers per annum. |
| MTBE | methyl tertiary butyl ether |

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| NHBC | National House Building Council |
| NGR | national grid reference |
| NSIP | nationally significant infrastructure project |
| NVZ | nitrate vulnerable zone |
| OBH | observation borehole |
| PAH | polyaromatic hydrocarbons |
| PCB | polychlorinated biphenyls |
| PCL | potential contaminant linkage |
| PFAS | per- and polyfluoroalkyl substances |
| PFOA | perfluorooctanoic acid |
| PFOS | perfluorooctane sulphonate |
| PPE | personal protective equipment |
| PRA | Preliminary Risk Assessment |
| PSSR | Preliminary Sources Study report |
| QRA | Quantitative Risk Assessment |
| RTM | remedial target methodology |
| SPZ | source protection zone |
| SVOC | semi-volatile organic compounds |
| TPH | total petroleum hydrocarbons |
| TPHCWG | total petroleum hydrocarbon criteria working group |
| TVD | Thames Valley Drain |
| UXO | unexploded ordnance |
| VOC | volatile organic compound |
| WVP | Wigmore Valley Park |

| Glossary | |
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| Above ordnance datum (AOD) | Above ordnance datum (AOD) is a vertical measurement used by ordnance survey as the basis for deriving altitudes on maps, usually by comparison with the mean sea level. |
| Application Site | The area covered by the proposed planning application boundary. |
| Aquifer | An aquifer is an underground layer of water-bearing permeable rock, rock fractures or unconsolidated materials (gravel, sand, or silt). |
| Code of Construction Practice (CoCP) | This document outlines the environmental management and mitigation requirements to be implemented throughout the construction period for the delivery of the Proposed Development. |
| Conceptual Site Model (CSM) | A representation of the characterisation of a site in diagrammatic and/or written form that shows the possible relationships between the contaminants, pathway and receptors. This helps to evaluate the potential risks that the site poses given the intended operations and future use of the site. |

| Glossary | |
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| Controlled waters | <p>These are fully defined in section 104 of the Water Resources Act 1991. Controlled waters include, in summary:</p> <ol style="list-style-type: none"> a. Relevant territorial waters which extend seaward for three miles from the low-tide limit from which the territorial sea adjacent to England and Wales is measured b. Coastal waters from the low-tide limit to the high-tide limit or fresh-water limit of a river or watercourse c. Inland freshwaters: natural and artificial lakes, ponds, reservoirs, rivers or watercourses above the fresh-water limit d. Natural and artificial underground rivers and watercourses e. Surface water sewers, ditches and soakaways that discharge to surface or groundwater it also includes those that may be currently dry f. Groundwaters – any waters contained in underground strata. |
| Department for Environment and Rural Affairs (Defra) | UK government department responsible for safeguarding the natural environment, supporting the food and farming industry, and sustaining a thriving rural economy. |
| Detailed assessment | Method applied to gain an in-depth appreciation of the beneficial and adverse consequences of the project and to inform project decisions. Detailed Assessments are likely to require detailed field surveys and/or quantified modelling techniques. |
| Development Consent Order (DCO) | A Development Consent Order (DCO) is the means of obtaining permission for developments categorised as Nationally Significant Infrastructure Projects. This includes energy, transport, water and waste projects. |
| Effect | Term used to express the result/consequence of an impact (expressed as the 'significance of effect'). |
| Emission | A material that is expelled or released to the environment. Usually applied to gaseous or odorous discharges to the atmosphere. |
| Enhancement | A measure that is over and above what is required to mitigate the adverse effects of a project. |
| Environment Agency | The Environment Agency is responsible for environmental protection and regulation in England and plays a central role in implementing the government's environmental strategy. The Environment Agency is the main body responsible for managing the regulation of major industry and waste, treatment of contaminated land, water quality and resources, fisheries, inland river, estuary and harbour navigations, and conservation and ecology. They are also |

| Glossary | |
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| | responsible for managing the risk of flooding from main rivers, reservoirs, estuaries and the sea. |
| Environment Agency Recorded Pollution Incidents | A record of pollution incidents to water, land and air held by the Environment Agency. |
| Environmental Impact Assessment (EIA) | DMRB LA101 – Introduction to environmental assessment defines EIA as: “Statutory process consisting of: <ul style="list-style-type: none"> a. Preparation of an Environmental Statement; b. Consultation; c. Examination by the competent authority of the information contained within the Environmental Statement; d. The reasoned (justified or evidenced) conclusion by the competent authority on the significant effects of the project on the environment; and e. The reasoned (justified or evidenced) decision by the competent authority to grant or refuse development consent”. |
| Environmental Statement (ES) | A statutory report (this document) produced by the developer including: <ul style="list-style-type: none"> a. A description of the project; b. A description of the likely significant effects of the project on the environment; c. A description of the features of the project and/or measures envisaged in order to avoid, prevent or reduce and, if possible, offset likely significant adverse effects on the environment; d. A description of the reasonable alternatives; e. A non-technical summary; and f. Any additional information relevant to the characteristics of a project. |
| Groundwater | Groundwater is the water present beneath Earth's surface in rock and soil pore spaces and in the fractures of rock formations. |
| Groundwater divide | The boundary between groundwater basins; defined by a line connecting the high points on the water table or other potentiometric surface. Groundwater flows away from a groundwater divide. |
| Hard standing | Ground improvement by the use of compacted stone or other materials which facilitates increased surface loading from vehicles or other plant. |
| Hazardous waste | Waste which displays one or more of the hazardous properties listed in Annex III of the Waste Framework Directive. |
| Impact | The change or action. Either beneficial or adverse. |

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| Inert materials | Inert material is material which is neither chemically or biologically reactive and will not decompose. Examples of this are sand, drywall, and concrete. This has particular relevance to landfills as inert materials typically require lower disposal fees than biodegradable waste or hazardous waste. |
| Limit of Detection (LOD) | The lowest contaminant concentration that can be detected by the apparatus used, usually dependent on the resolution of the equipment. |
| Leachate | A liquid that forms within waste accumulations such as landfills that contain increased concentrations of contaminants, specifically heavy metals, ammoniacal nitrogen and organic compounds. It is therefore hazardous and either must be indefinitely contained within the landfill or collected and suitably disposed of. |
| Local authorities | An administrative body in local government. The Proposed Development is situated within three authority boundaries: Luton Borough Council (LBC); North Hertfordshire District Council (NHDC); and Central Bedfordshire Council (CBC). |
| Made Ground | Made Ground is an area where the pre-existing (natural or artificial) land surface is raised or filled by artificial deposits consisting of materials such as refuse, demolition rubble etc. |
| Main Application Site | The airport site excluding off-site works. |
| Mitigation measure | Measure aiming at preventing/reducing an adverse environmental effect. |
| Nitrogen Vulnerable Zone (NVZ) | The EC Nitrate Directive (91/676/EEC) states that NVZs are areas of land that drain into polluted waters or waters at risk of pollution and which contribute to nitrate pollution. |
| Pollutant | A substance that pollutes something, especially water or the atmosphere. |
| Potable water | Water that is safe to drink/consume. |
| Potential contaminant linkage | The potential contaminant linkage determines how contaminant travels from the contaminant source to a receptor. |
| Preliminary Environmental Information (PEI) Report | The PEI Report was prepared in compliance with the EIA Regulations to enable the local community, any other interested person and stakeholders to understand the environmental effects of the Proposed Development and enable an informed response to the consultation. The document set out how each environmental topic area is being assessed, the potential environmental effects of the Proposed Development based on the information available at the time, and measures proposed to avoid or reduce such effects. This is to support consultees in developing an informed view of the likely significant environmental effects |

| Glossary | |
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| | of the Proposed Development, and allow them to provide additional information for inclusion in the EIA. |
| Proposed Development | The proposed expansion of Luton Airport with new terminal and stands and associated developments (as described in Chapter 4 of the ES [TR020001/APP/5.01]). |
| Receptor (sensitive) | A component of the natural, created, or built environment such as human |
| Residual effects | Those effects of the Proposed Development that cannot be mitigated following implementation of mitigation proposals. |
| Source protection zone (SPZ) | Source Protection Zones (SPZ) are defined around large and public potable groundwater abstraction sites. The purpose of SPZs is to provide additional protection to safeguard drinking water quality through constraining the proximity of an activity that may impact upon a drinking water abstraction. |
| Study area | Defined area surrounding the site in which is collected and analysed in order to set the site into its context. This varies as stated within each technical assessment. |
| Surface water | Water that collects on the surface of the ground. |
| Topography | The natural and man-made features of an area collectively. |
| Trace Components | Chemical constituents present in soil gas or air at trace levels derived directly from materials present in waste materials in the subsurface or from degradation of waste. |
| Unexploded ordnance (UXO) | Unexploded ordnance (UXO), unexploded bombs, or explosive remnants of war are explosive weapons that did not explode when they were employed and still pose a risk of detonation, sometimes many decades after they were used or discarded. |
| Volatile Organic Compounds (VOC) | Organic compounds that are volatile under normal environmental/atmospheric conditions. They may be found in the ground in a solid or liquid phase form as well as in a gaseous phase form. |
| Waste | Waste is defined in Article 3(1) of the European Waste Framework Directive 2008/98/EC (OJL 312/3) [Ref. 17.li] as any substance or object which the holder discards or intends or is required to discard. The term 'holder' is defined under article 3(6) as 'the waste producer or the natural or legal person who is in possession of the waste'. The waste 'producer' is defined under article 3(5) as 'anyone whose activities produce waste (original waste producer) or anyone who carries out pre-processing, mixing or other operations resulting in a change in the nature or composition of the waste'. Waste can be further classified as hazardous, non-hazardous or inert. |

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| Water quality | Water quality refers to the chemical, physical, and biological characteristics of water based on the standards of its usage. |
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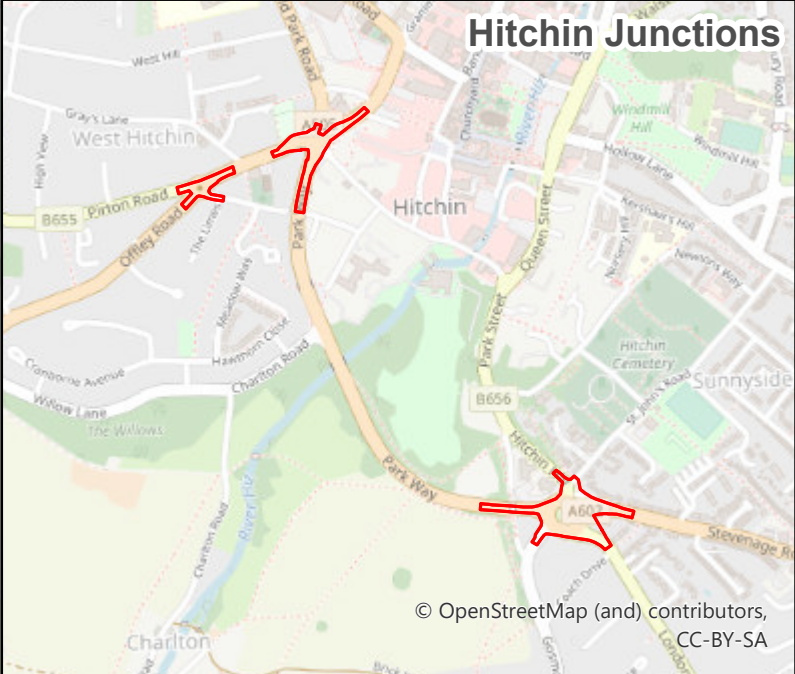
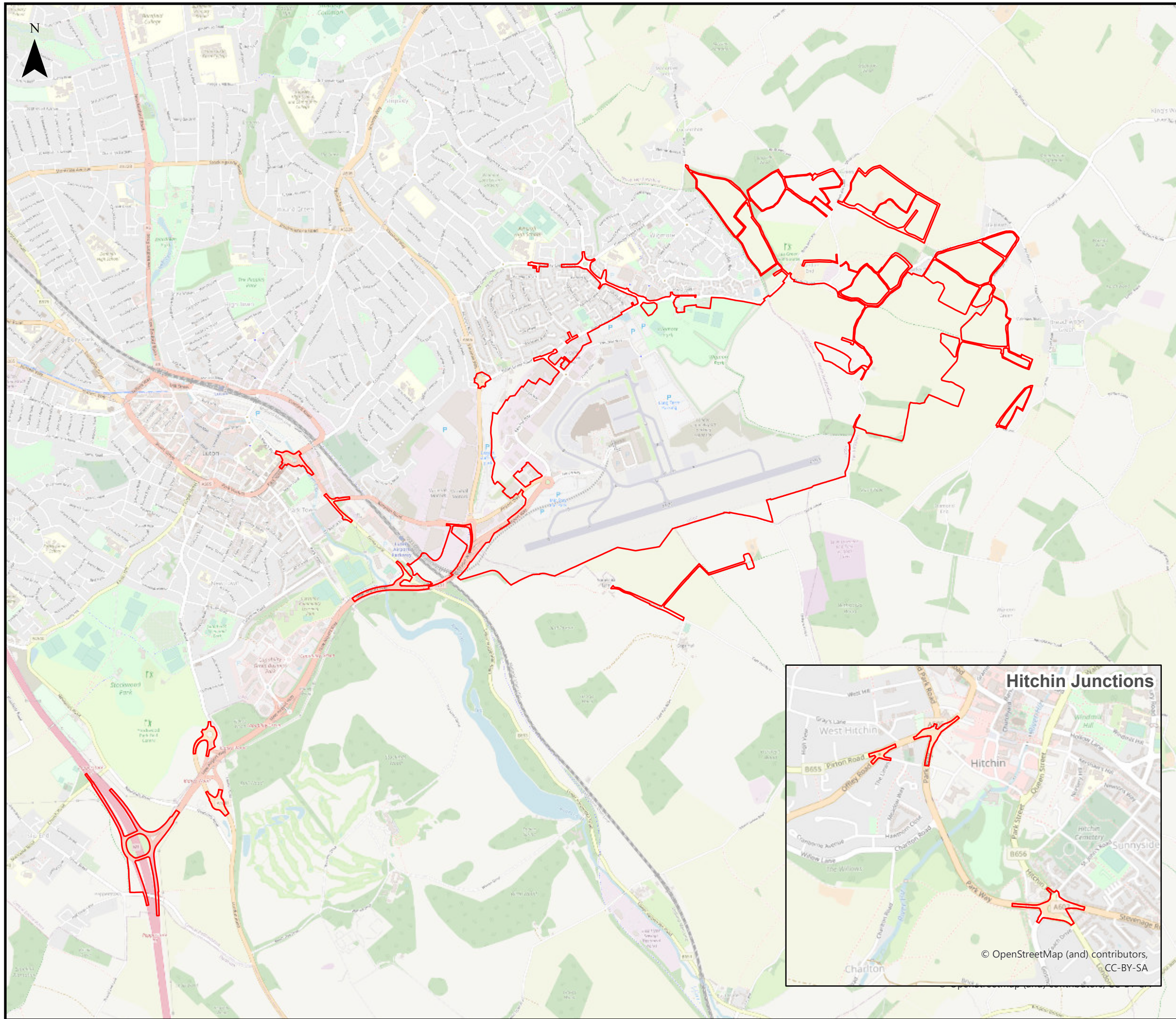
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FIGURES

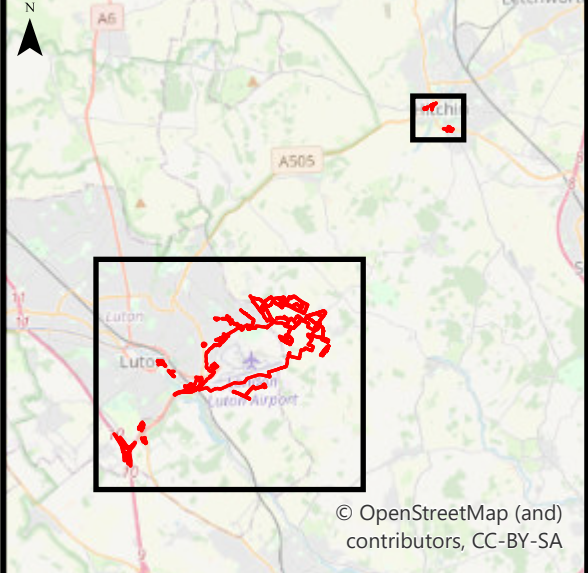


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 All structure positions are indicative. The proposed works will be subject to detailed design development. The changes will be within limits of deviation specified in the Development Consent Order.

Legend

Order Limits

| | | | | | |
|------------------|-------|---------|----------|----------|------|
| First Issue | AB | RB | CS | 26/08/22 | P02 |
| Revision History | Drawn | Checked | Approved | Date | Rev. |



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**London Luton Airport Expansion
 Development Consent Order**

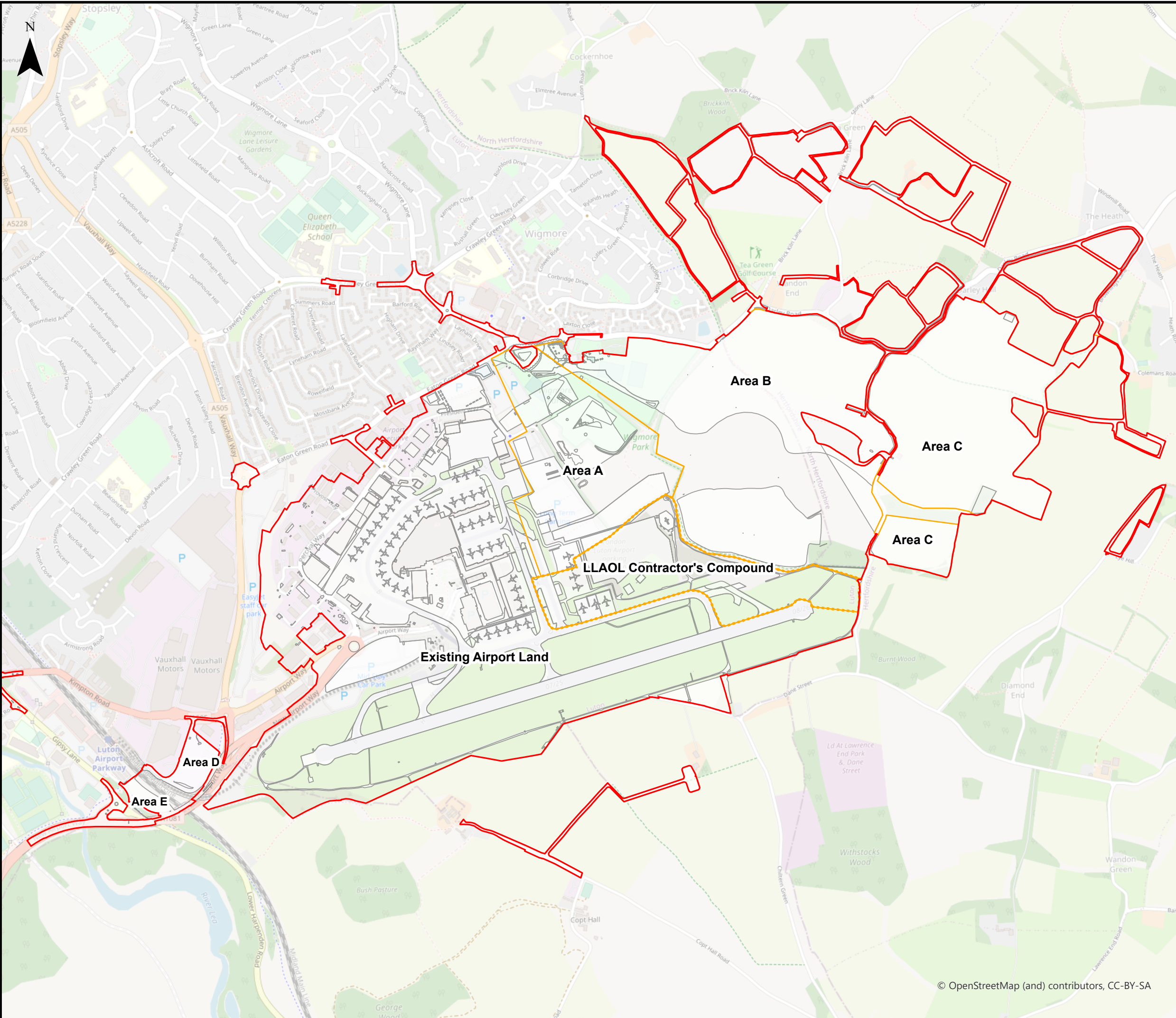
Drawing Title
**Figure 1
 Location of Proposed Development**

| | | | | | |
|---|---------------|----------------|------------------|-------------------|------------|
| Purpose of issue SUITABLE FOR INFORMATION | | | | Suitability S2 | |
| Drawn AB | Checked RB | Approved CS | Date 26/08/22 | Scale 1:25,000 | Size A3 |

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|----------------------------------|-----------------------------------|--|
| DCO Application Ref. TR020001 | APFP Regulation (APFP 5(2)(a)) | DCO Document Ref. TR020001/APP/5.03 |
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| Drawing Number LLADCO-3C-ARP-00-00-DR-YE-0129 | Revision P02 |
|--|-----------------|

Project - Phase - Originator - Asset/Zone - Sub Asset - Type- Discp. - Number



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All structure positions are indicative. The proposed works will be subject to detailed design development. The changes will be within limits of deviation specified in the Development Consent Order.

Legend

- Order Limits
- Site Subdivisions
- Airport Infrastructure Layout - Assessment Phase 1

| | | | | | |
|------------------|-------|---------|----------|----------|------|
| First Issue | AB | RB | TB | 26/09/22 | P02 |
| Revision History | Drawn | Checked | Approved | Date | Rev. |

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London Luton Airport Expansion Development Consent Order

Drawing Title
**Figure 2a
Proposed Masterplan - Assessment Phase 1**

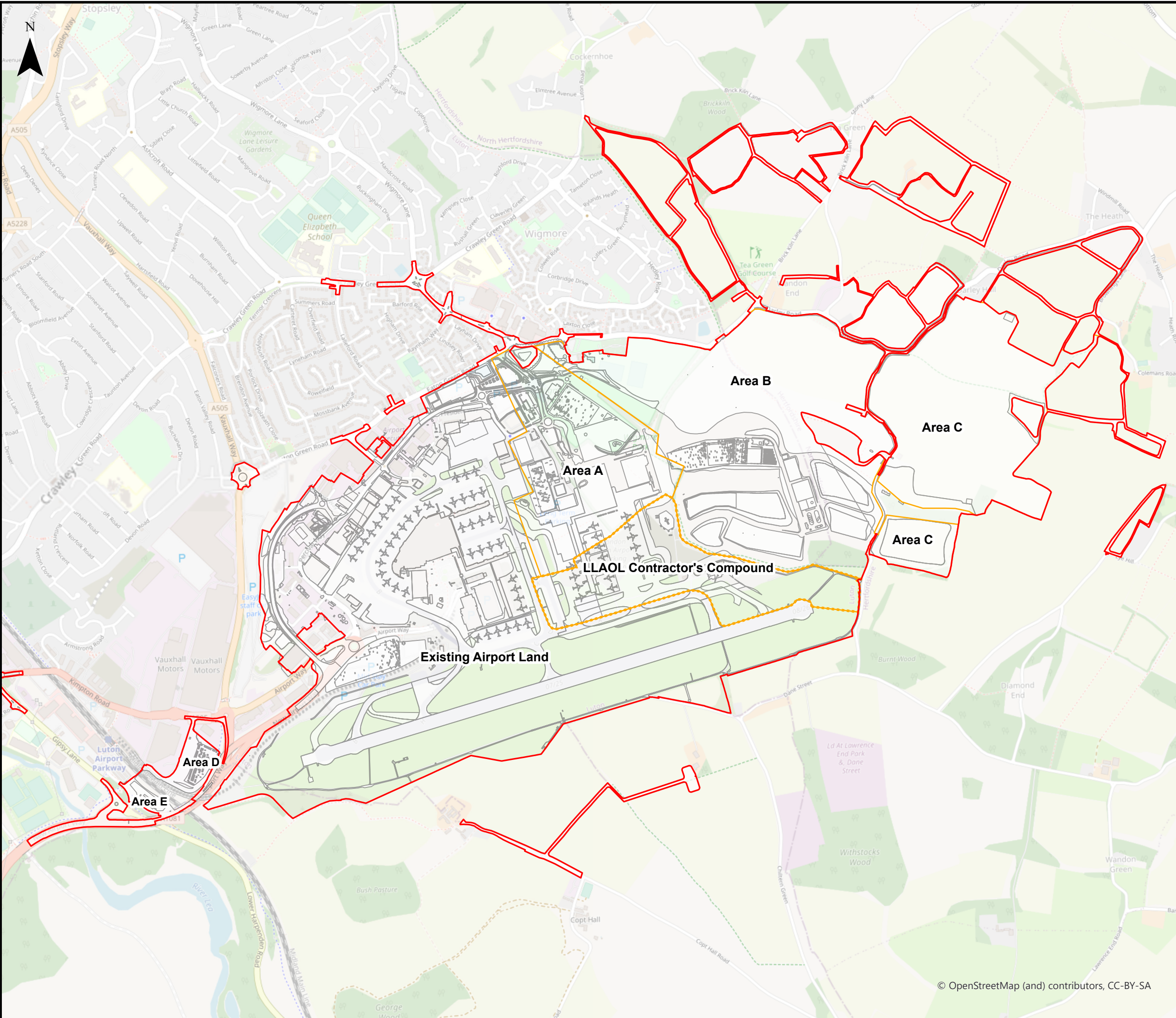
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| Purpose of issue SUITABLE FOR INFORMATION | | | | Suitability S2 | |
| Drawn AB | Checked RB | Approved TB | Date 26/09/22 | Scale 1:15,000 | Size A3 |

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| DCO Application Ref. TR020001 | APFP Regulation APFP 5(2)(a) | DCO Document Ref. TR020001/APP/5.03 |
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- Legend**
- Order Limits
 - Site Subdivisions
 - Airport Infrastructure Layout - Assessment Phase 2a

| | | | | | |
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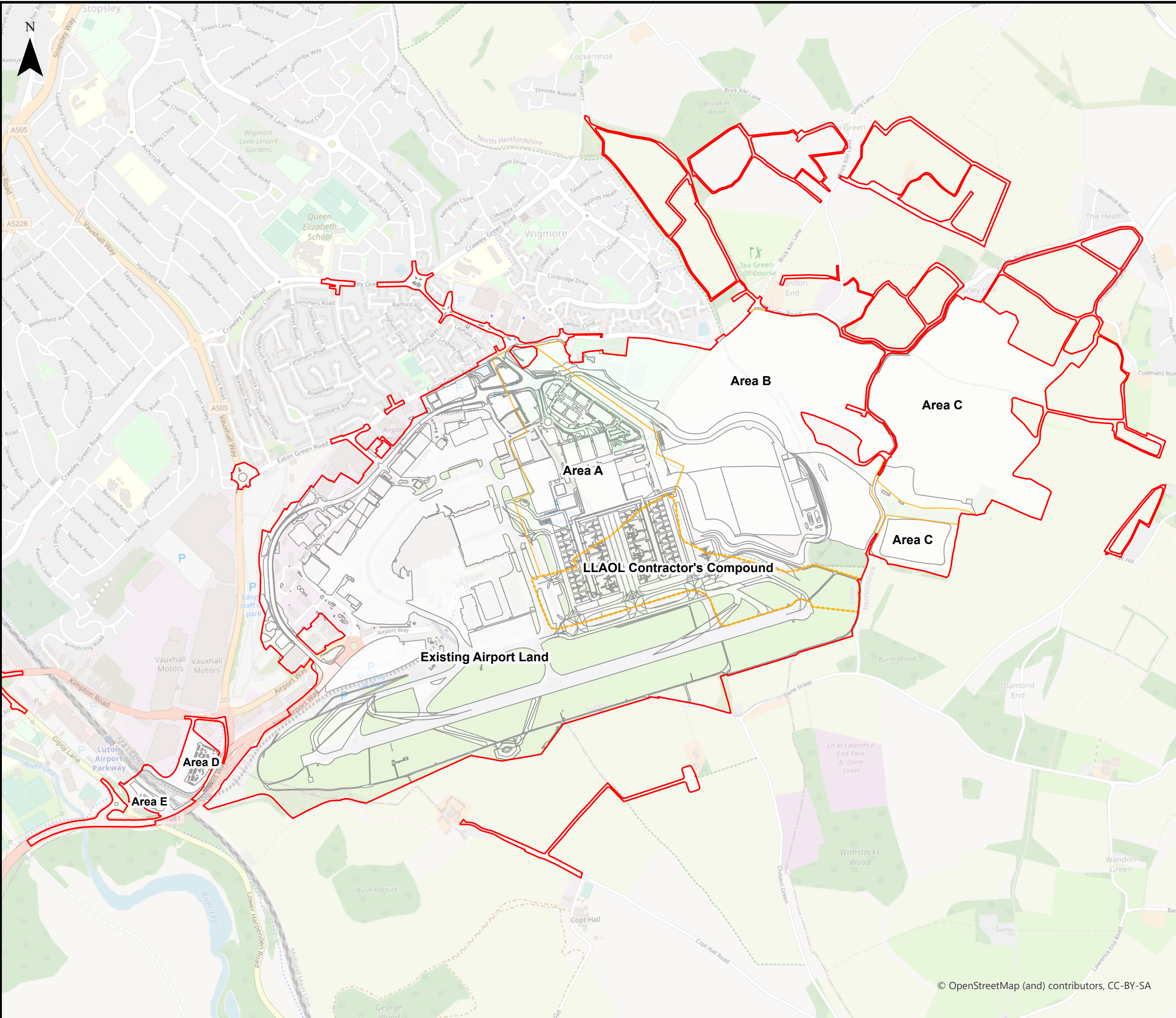
**London Luton Airport Expansion
 Development Consent Order**

Drawing Title
 Figure 2b
 Proposed Masterplan - Assessment Phase 2a

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| Purpose of issue SUITABLE FOR INFORMATION | | | | Suitability S2 | |
| Drawn AB | Checked RB | Approved TB | Date 26/09/22 | Scale 1:15,000 | Size A3 |

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| DCO Application Ref. TR020001 | APFP Regulation APFP 5(2)(a) | DCO Document Ref. TR020001/APP/5.03 |
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Legend

- Order Limits
- Site Subdivisions
- Airport Infrastructure Layout - Assessment Phase 2b

| | | | | | |
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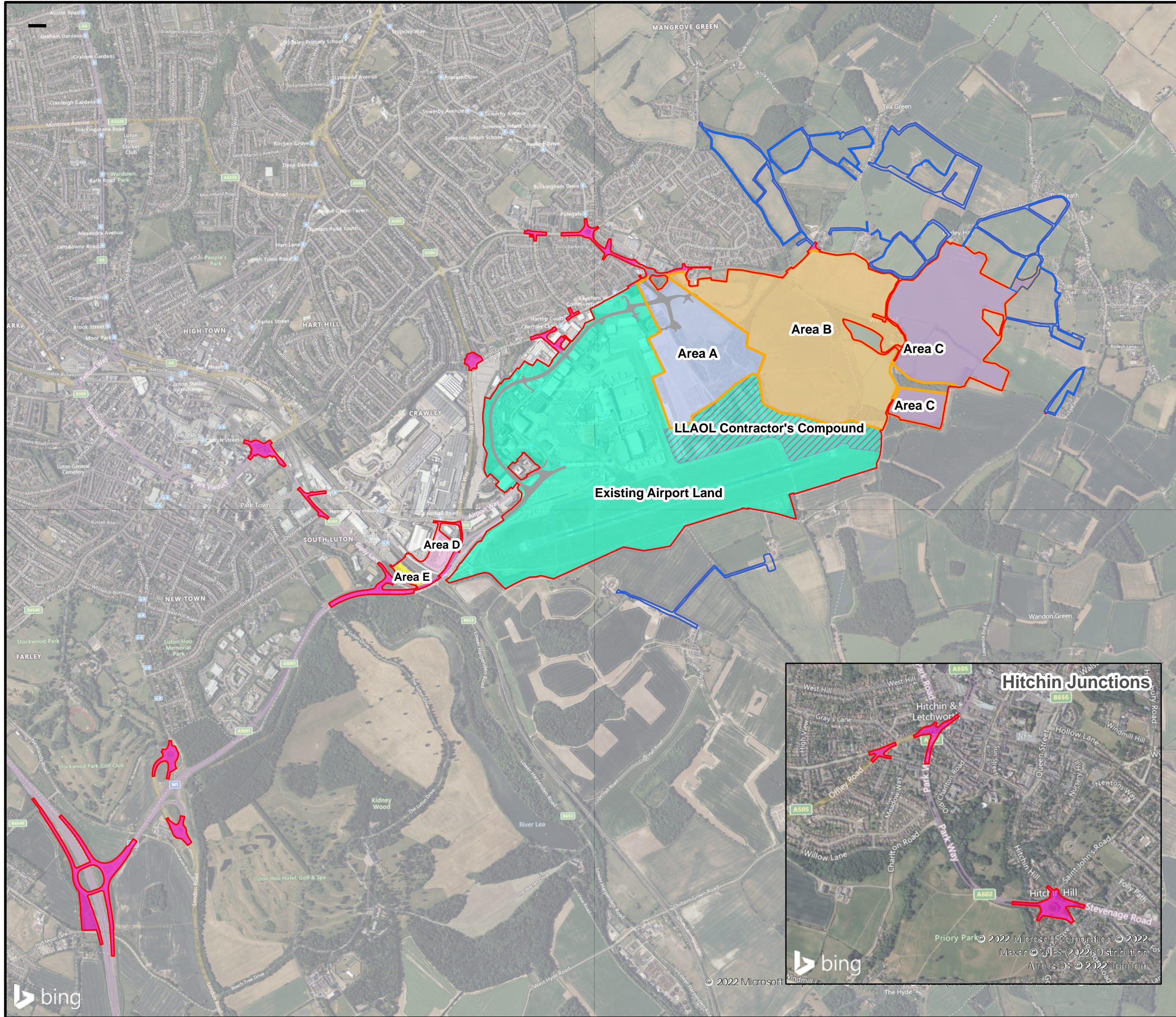
Drawing Title
 Figure 2c
 Proposed Masterplan - Assessment Phase 2b

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|---|---------------|----------------|------------------|-------------------|------------|
| Purpose of issue SUITABLE FOR INFORMATION | | | | Suitability S2 | |
| Drawn AB | Checked RB | Approved TB | Date 26/09/22 | Scale 1:15,000 | Size A3 |

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Legend

- Order Limits
- Off-site Planting
- Airport Access Road
- Site Subdivisions

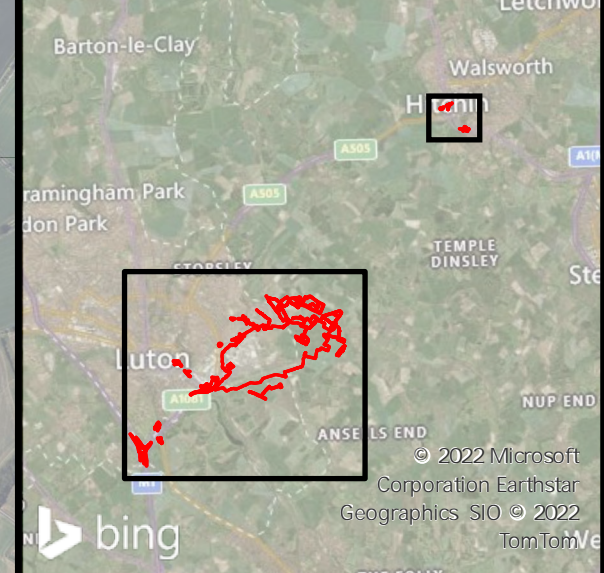
Main Application Site

- Existing Airport Land
- LLAOL Contractor's Compound
- Area A Former Landfill
- Area B Land West of Winch Hill Lane
- Area C Land East of Winch Hill Lane

Other Areas

- Area D Offsite Car Park North
- Area E Offsite Car Park South
- Off-site Highway Interventions

| | | | | | |
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Drawing Title

**Figure 3
Site Areas**

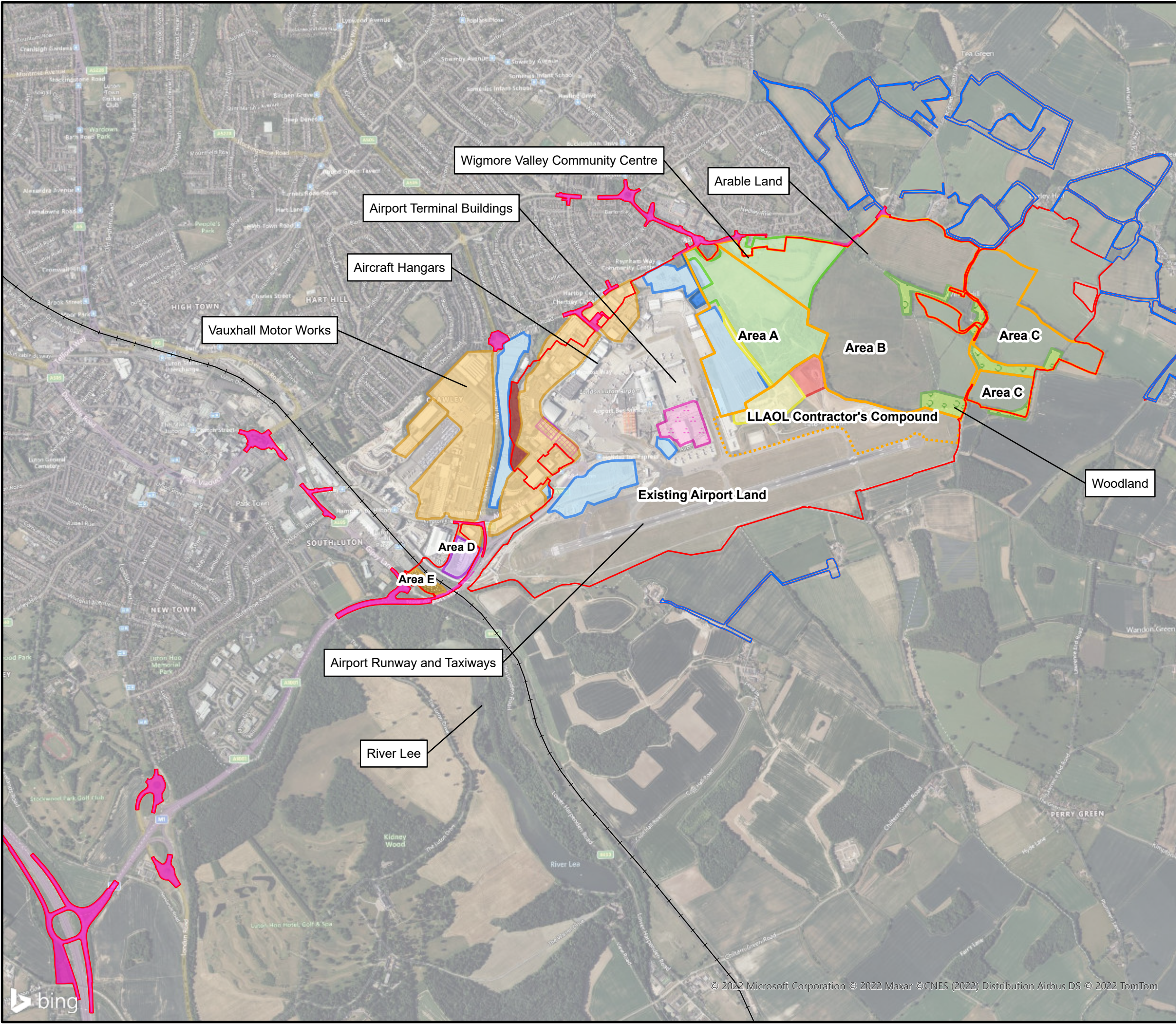
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| Purpose of issue | | Suitability | |
| SUITABLE FOR INFORMATION | | S2 | |
| Drawn | Checked | Approved | Date |
| AB | RB | TB | 26/08/22 |
| Scale | Size | | |
| 1:22,500 | A3 | | |

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| DCO Application Ref. | APFP Regulation | DCO Document Ref. |
| TR020001 | APFP 5(2)(a) | TR020001/APP/5.03 |

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| Drawing Number | Revision |
| LLADCO-3C-ARP-000DR-YE-0133 | P02 |
| Project - Phase - Originator - Asset/Zone - Sub Asset - Type - Discp. - Number | |

Legend

- Order Limits
 - Off-site Planting
 - Site Subdivisions
 - Off-site Highway Interventions
- Current Land Use**
- Car Parking
 - Commerical/Industrial
 - DART Construction Area
 - DART Contractor's Compound
 - Tidy Tip
 - Fire Training Area
 - Wigmore Valley Park
 - LLAOL Contractor compound
 - Trailer Park, Car Parking, Service Garage
 - Woodlands
 - Undeveloped Landscape
 - Fuel Depots
 - Existing Railway



| | | | | | |
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Drawing Title

Figure 4
Current Land Uses

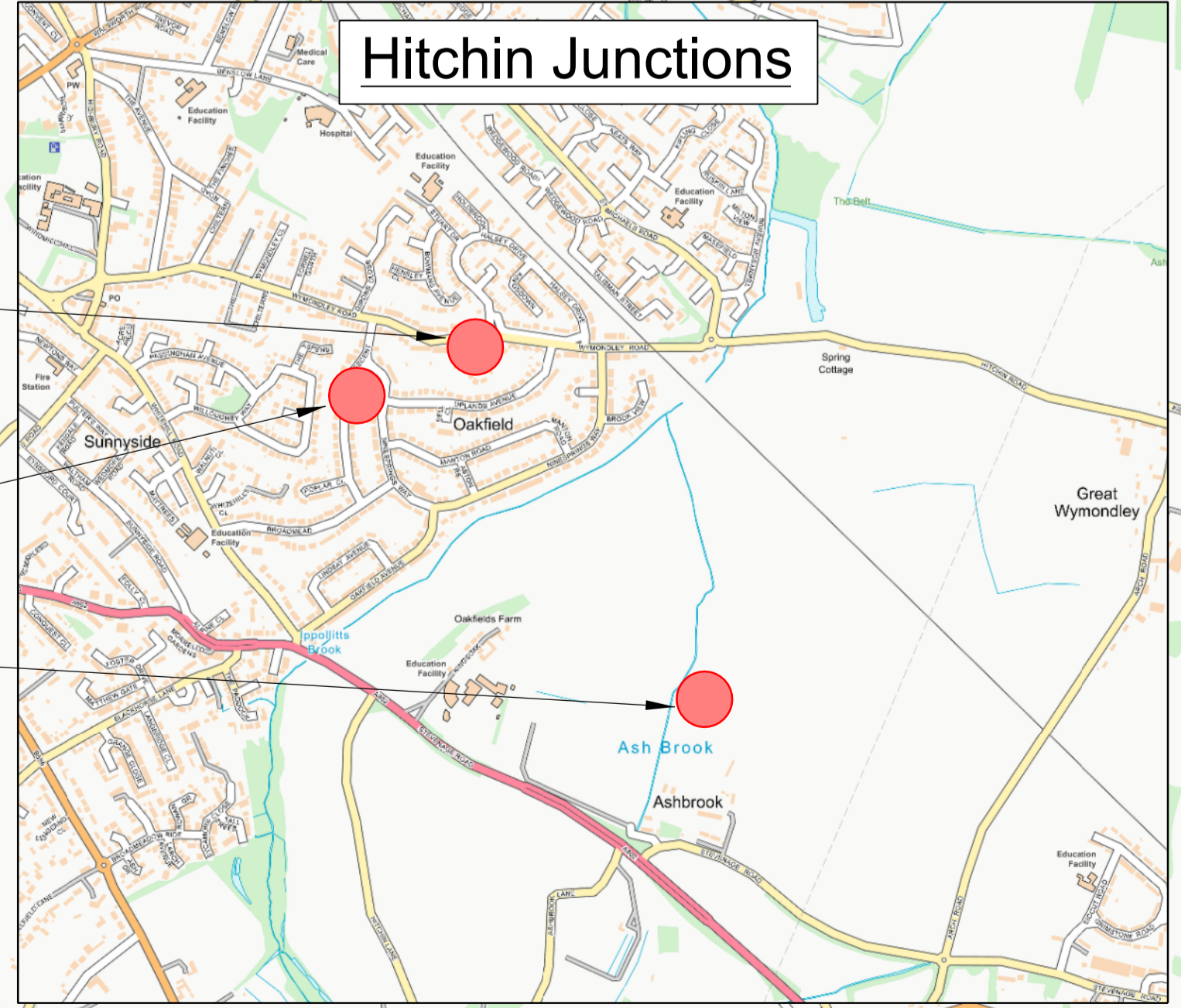
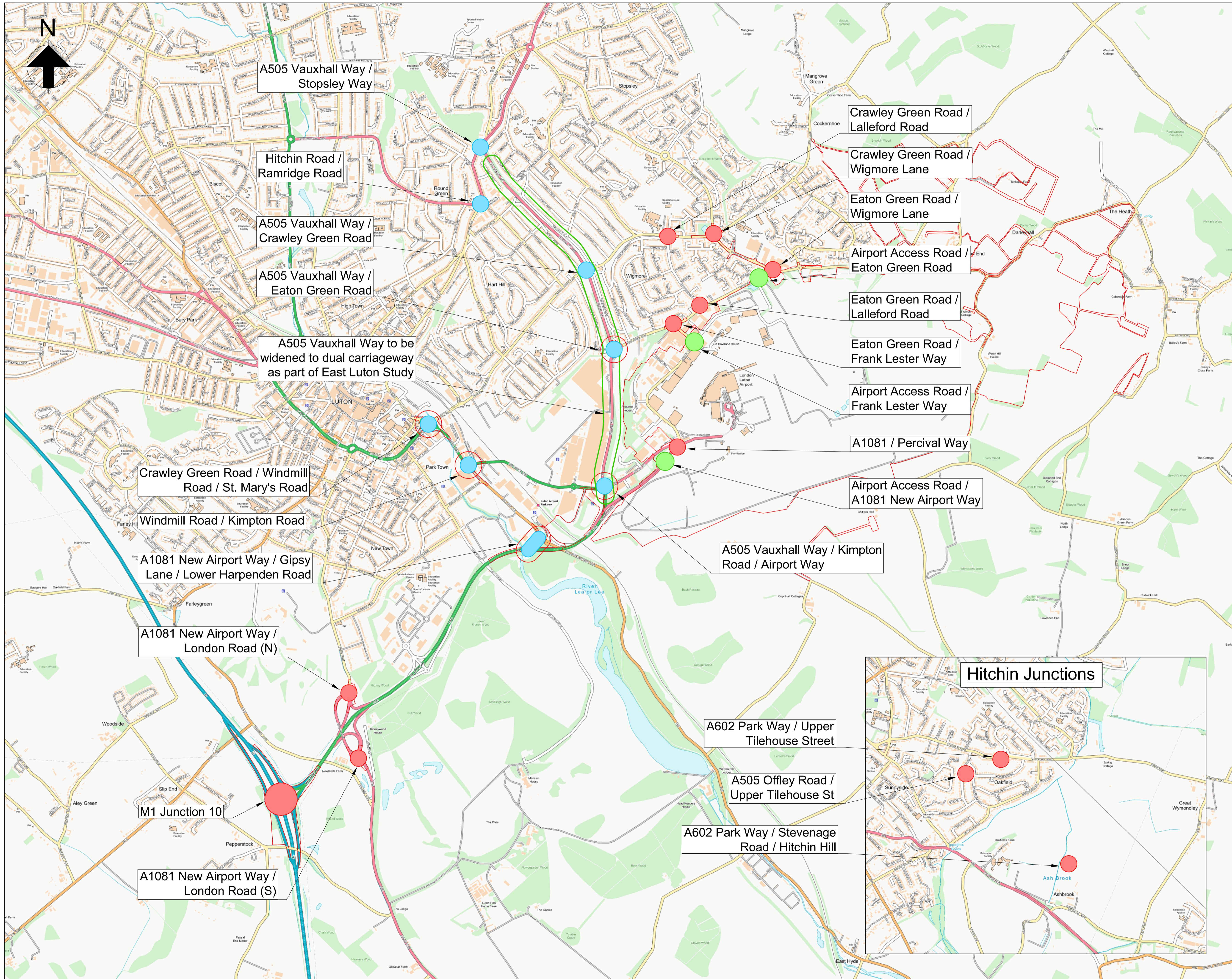
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| Purpose of issue | | | | Suitability | | |
| SUITABLE FOR INFORMATION | | | | S2 | | |
| Drawn | Checked | Approved | Date | Scale | Size | |
| AB | RB | CS | 26/08/22 | 1:20,000 | A3 | |

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| DCO Application Ref. | APFP Regulation | DCO Document Ref. |
| TR020001 | APFP 5(2)(a) | TR020001/APP/5.03 |

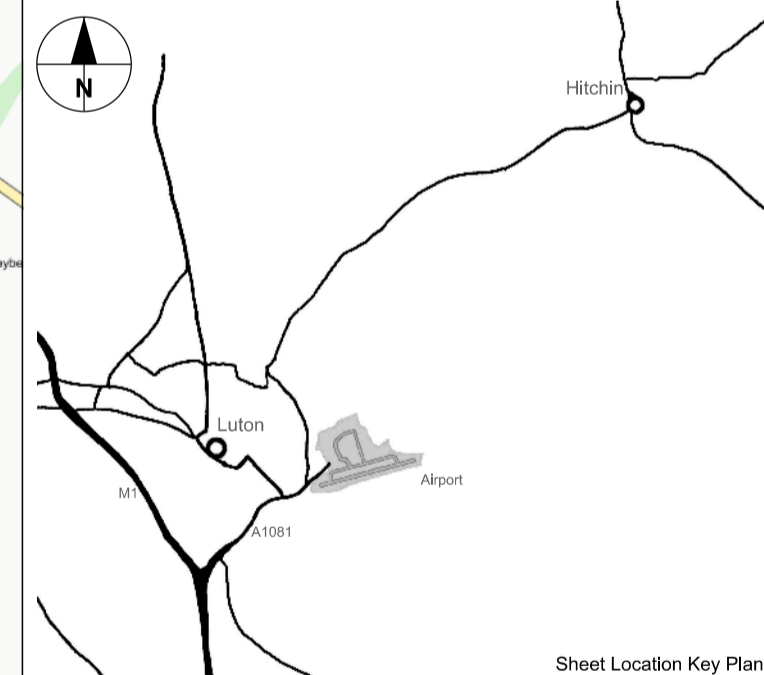
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|---|----------|
| Drawing Number | Revision |
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- Legend**
- Junctions requiring mitigation
 - Junctions forming part of East Luton Study
 - East Luton Study junctions requiring additional mitigation
 - New / improved junctions to be provided as part of Airport Access Road
 - The Order Limits



| Revision History | | | | |
|------------------|-------|--------------------|----------|------|
| Issue | Drawn | Checked / Approved | Date | Rev. |
| Issue | IJ | RB | 30/09/22 | P02 |
| Issue | IJ | RB | 16/12/21 | P01 |

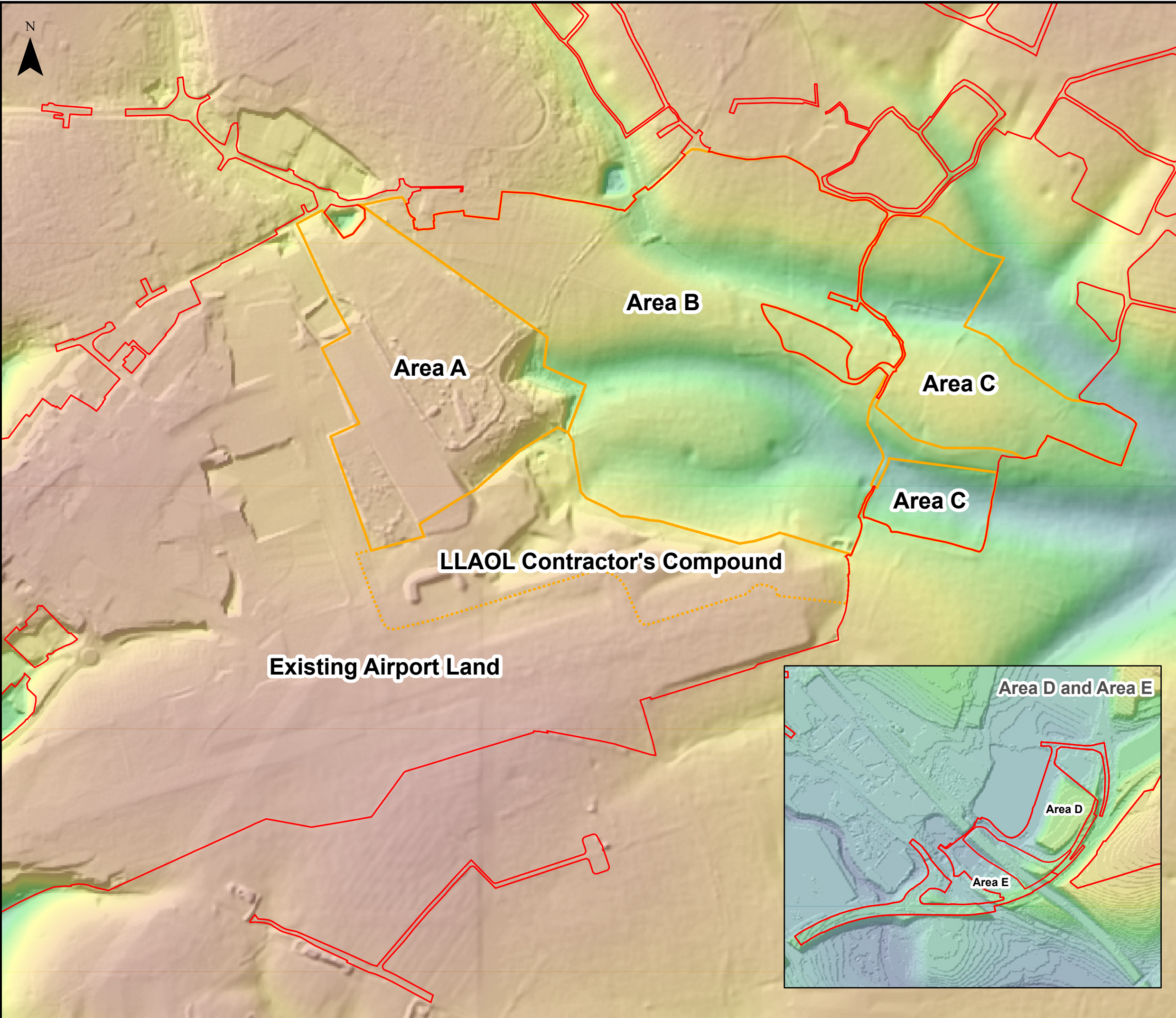


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Drawing Title
**Figure 05
 Highway Interventions**

| | | | | |
|---|---------|-----------------|-------------------|------------|
| Purpose of Issue | | | Suitability | |
| SUITABLE FOR COORDINATION | | | S2 | |
| Drawn | Checked | Approved | Date | Scale |
| IJ | RB | TB | 30/09/22 | 1:12500 A1 |
| DCO Application Ref. | | APFP Regulation | DCO Document Ref. | |
| TR020001 | | APFP 5(2)(a) | TR020001/APP/5.03 | |
| Drawing Number | | | | Revision |
| LLADCO-3C-ARP-00-00-DR-YE-0135 | | | | P02 |
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Legend

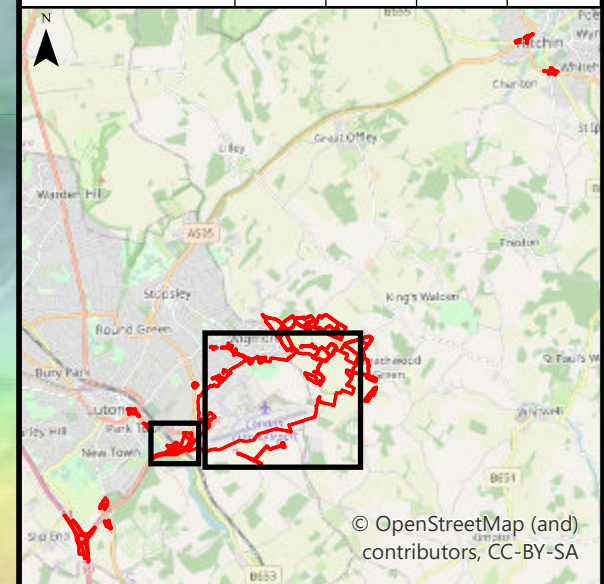
- Order Limits
- Site Subdivisions

Topography

High : 164 mOD

Low : 99 mOD

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| First Issue | AB | RB | TB | 26/09/22 | P02 |
| Revision History | Drawn | Checked | Approved | Date | Rev. |

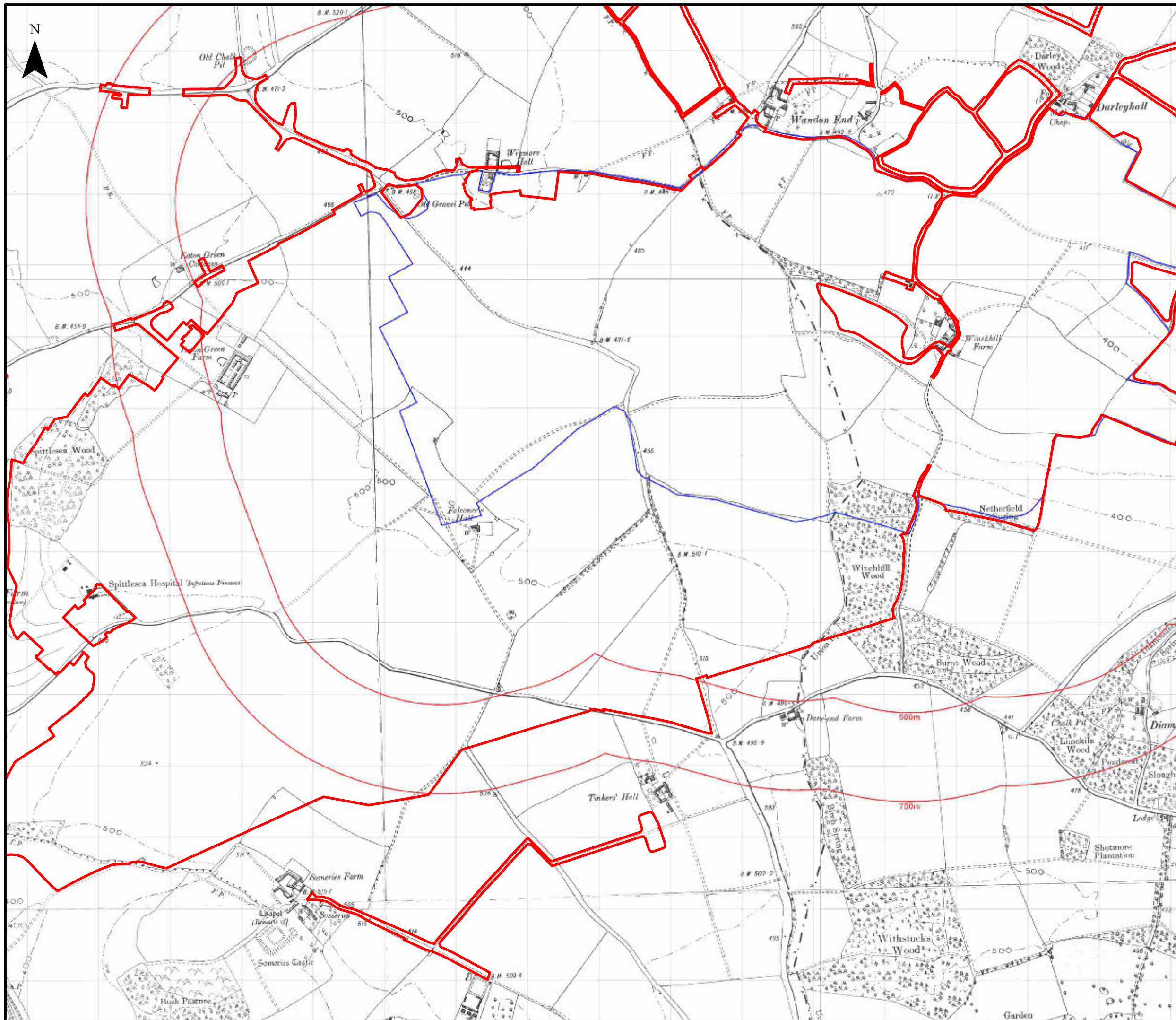


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Drawing Title
**Figure 6
 Topography**

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|---|---------------|---------------------------------|------------------|--|-----------------|
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Legend

- Order Limits
- Search Boundary

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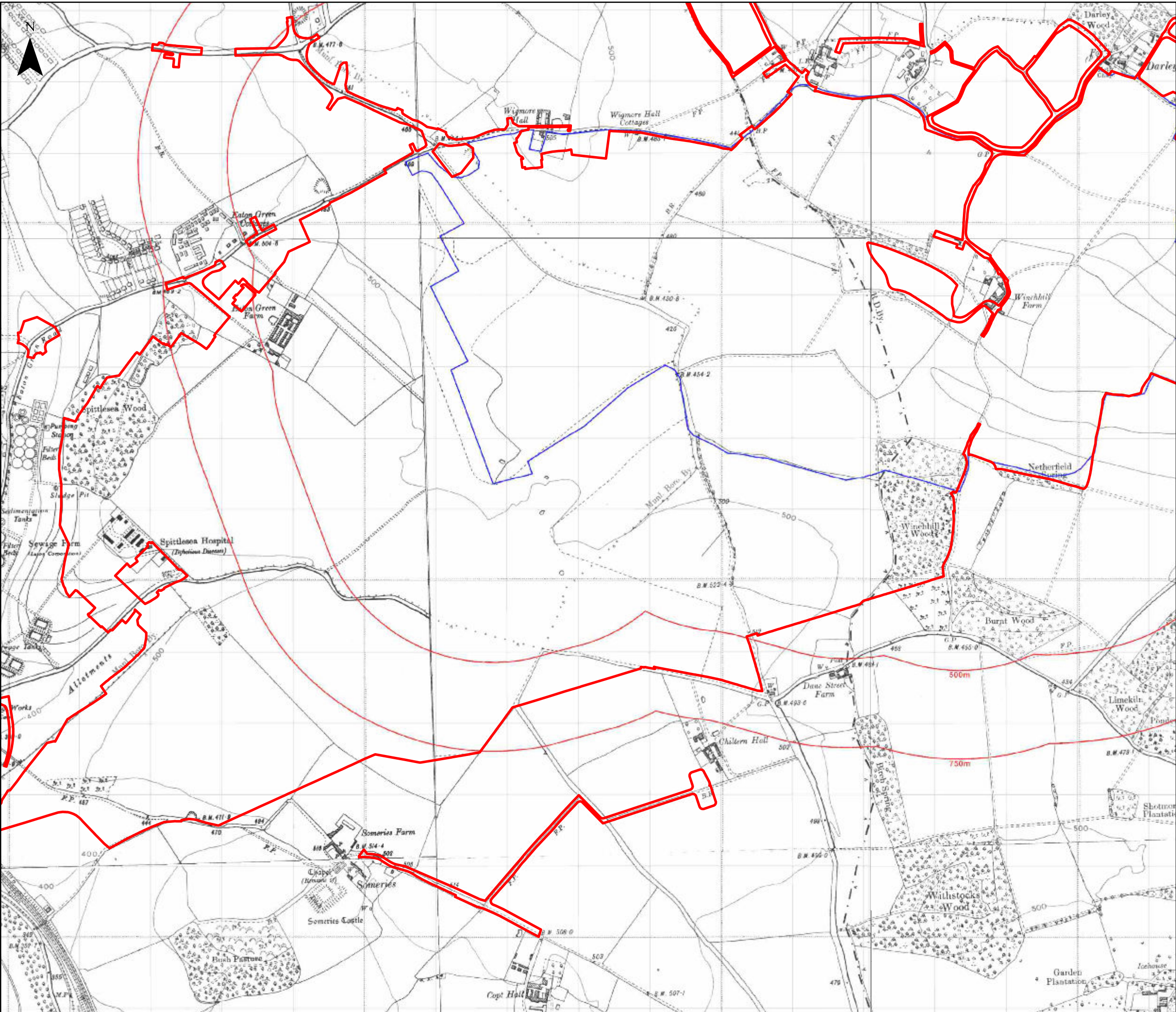
Drawing Title
**Figure 7a
 Historical Mapping (1900) Main Application Site**

| | | | | | |
|---|---------------|----------------|------------------|-------------------|------------|
| Purpose of issue SUITABLE FOR INFORMATION | | | | Suitability S2 | |
| Drawn AB | Checked RB | Approved TB | Date 23/09/22 | Scale 1:10,000 | Size A3 |

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| DCO Application Ref. TR020001 | APFP Regulation APFP 5(2)(a) | DCO Document Ref. TR020001/APP/5.03 |
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Legend

- Order Limits
- Search Boundary

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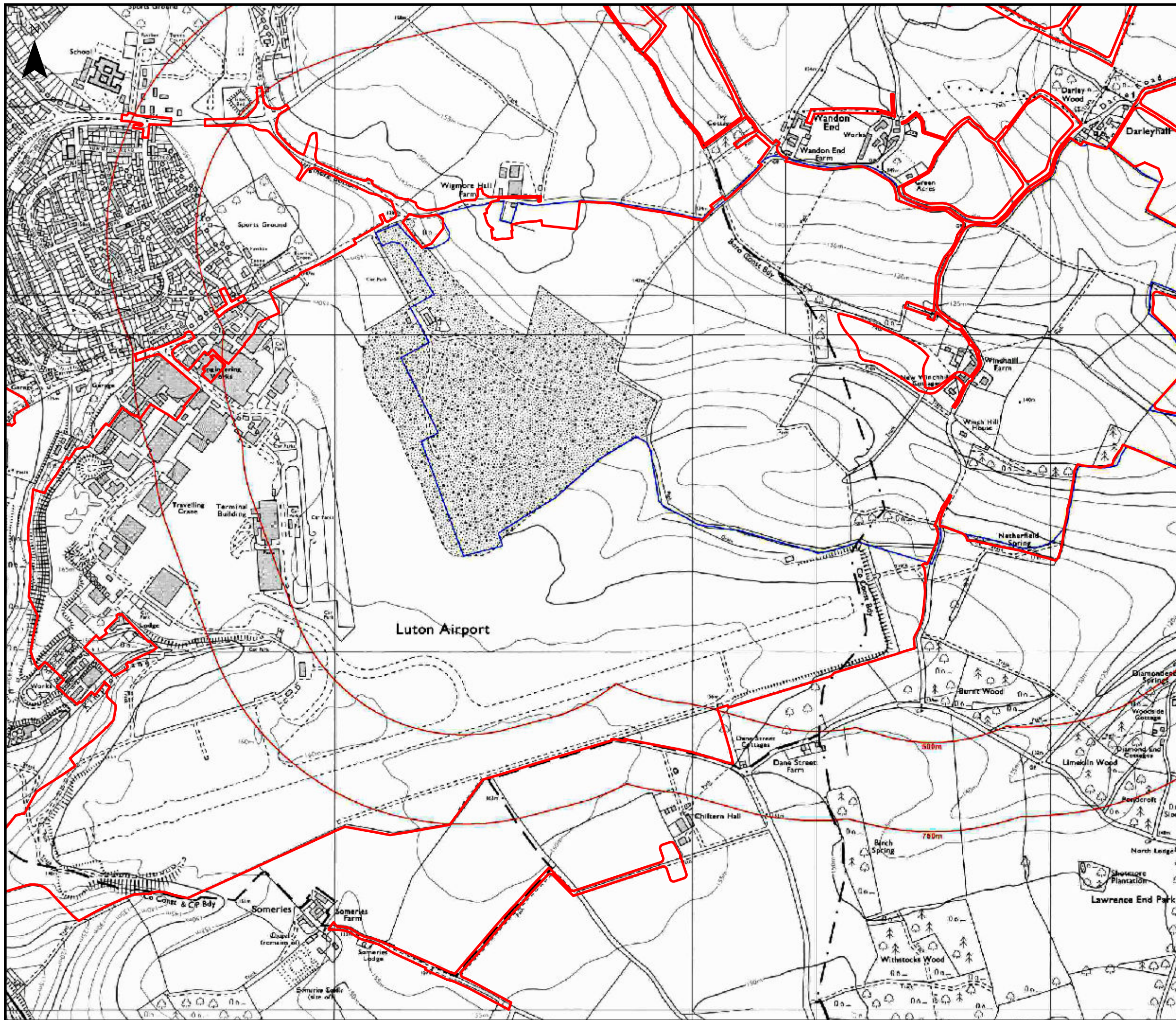
Drawing Title
**Figure 7b
 Historical Mapping (1947)**

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| Purpose of issue SUITABLE FOR INFORMATION | | | | Suitability S2 | |
| Drawn AB | Checked RB | Approved CS | Date 23/09/22 | Scale 1:10,000 | Size A3 |

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| DCO Application Ref. TR020001 | APFP Regulation APFP 5(2)(a) | DCO Document Ref. TR020001/APP/5.03 |
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Legend

- Order Limits
- Search Boundary

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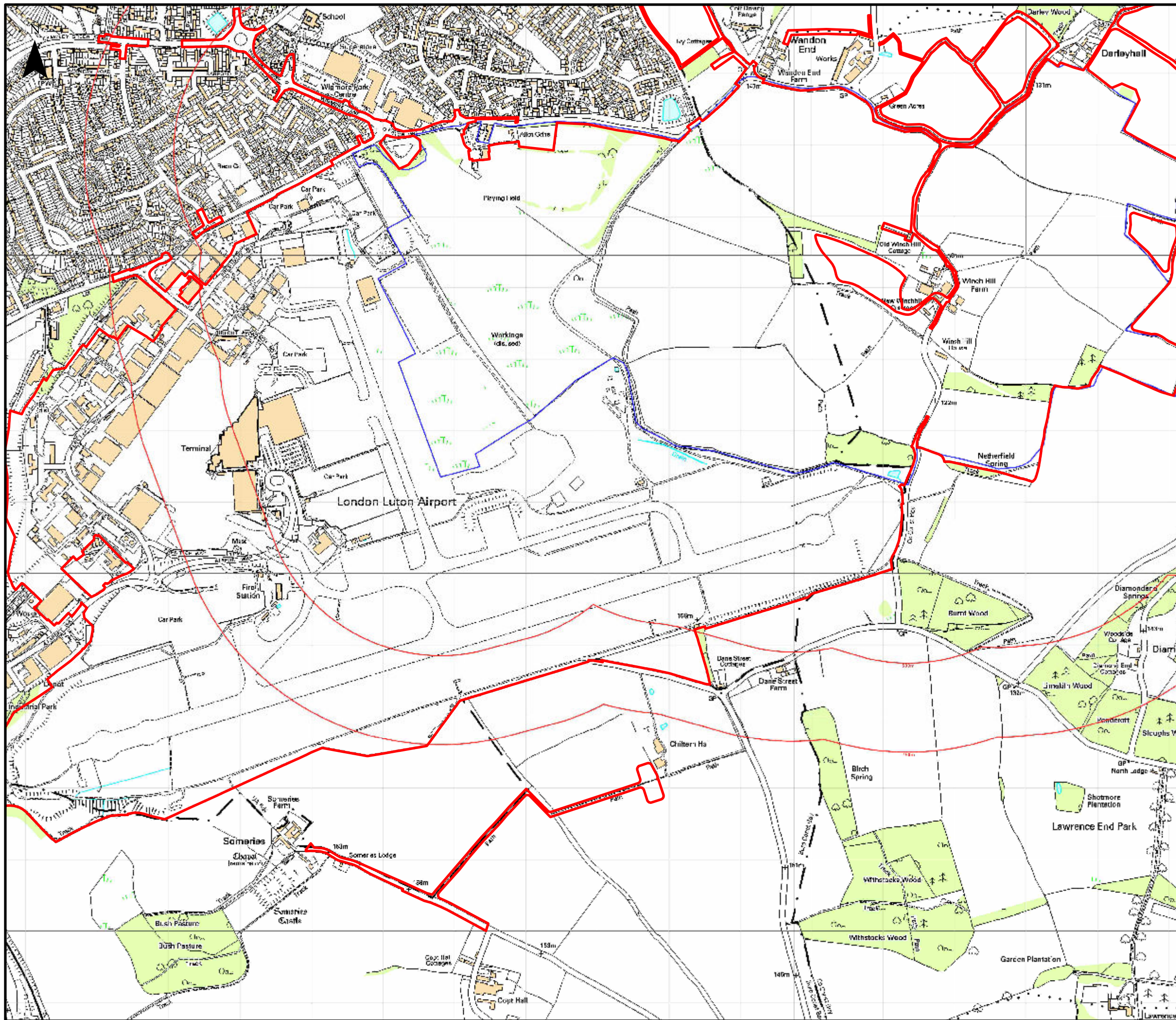
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Drawing Title
**Figure 7c
 Historical Mapping (1975)**

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| Drawn | Checked | Approved | Date |
| AB | RB | CS | 23/09/22 |
| Scale | 1:10,000 | Size | A3 |

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Legend

- Order Limits
- Search Boundary

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Drawing Title
**Figure 7d
 Historical Mapping (2002) Main Application Site**

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|---|---------|----------|----------|-------------------|------|
| Purpose of issue SUITABLE FOR INFORMATION | | | | Suitability S2 | |
| Drawn | Checked | Approved | Date | Scale | Size |
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Legend

- Order Limits
- Search Boundary

| | | | | | |
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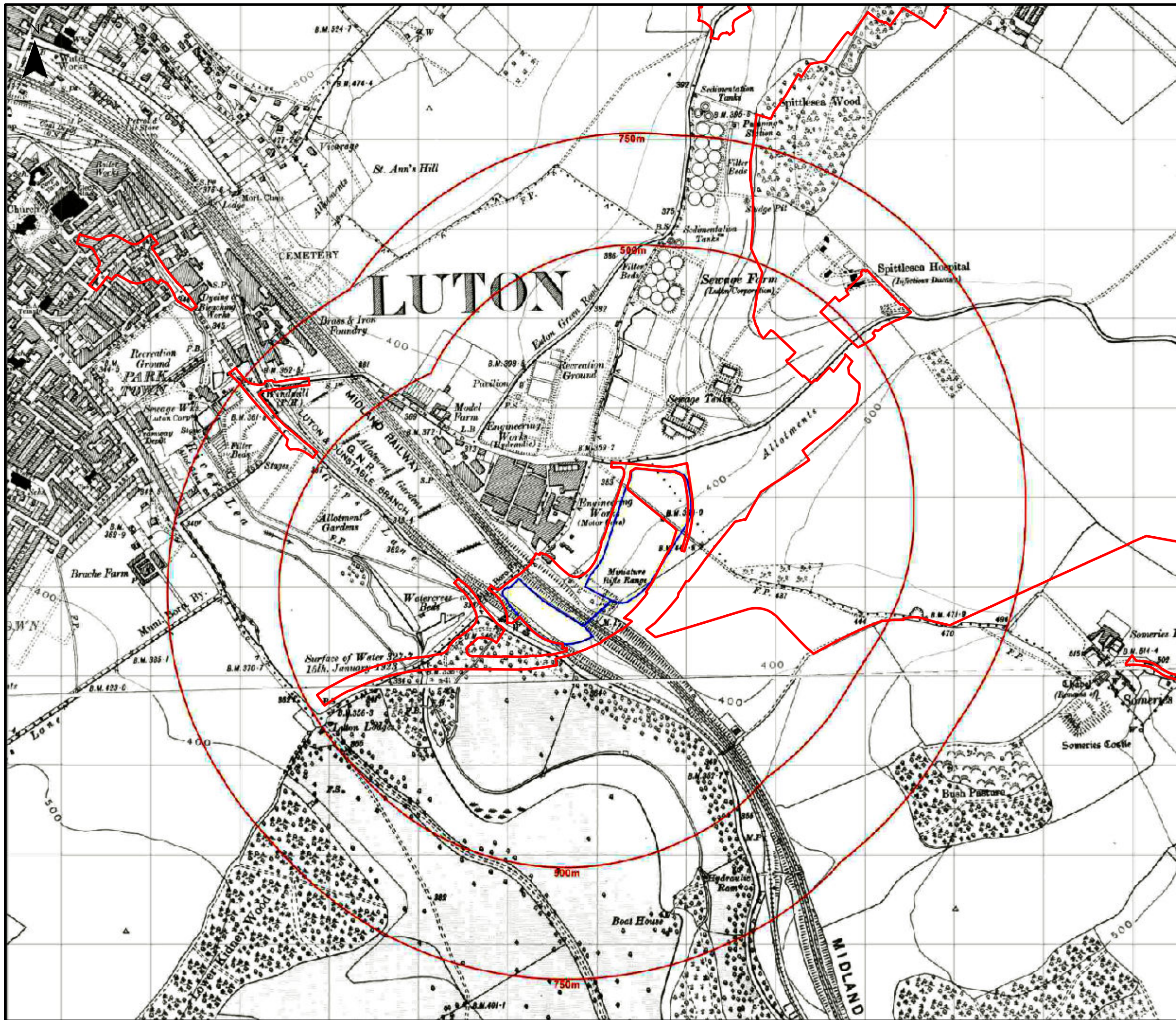
Drawing Title
**Figure 8a
 Historical Mapping (1879) Off-Site Car Parks**

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|---|---------------|----------------|------------------|-------------------|------------|
| Purpose of issue SUITABLE FOR INFORMATION | | | | Suitability S2 | |
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Legend

Order Limits

Search Boundary

| | | | | | |
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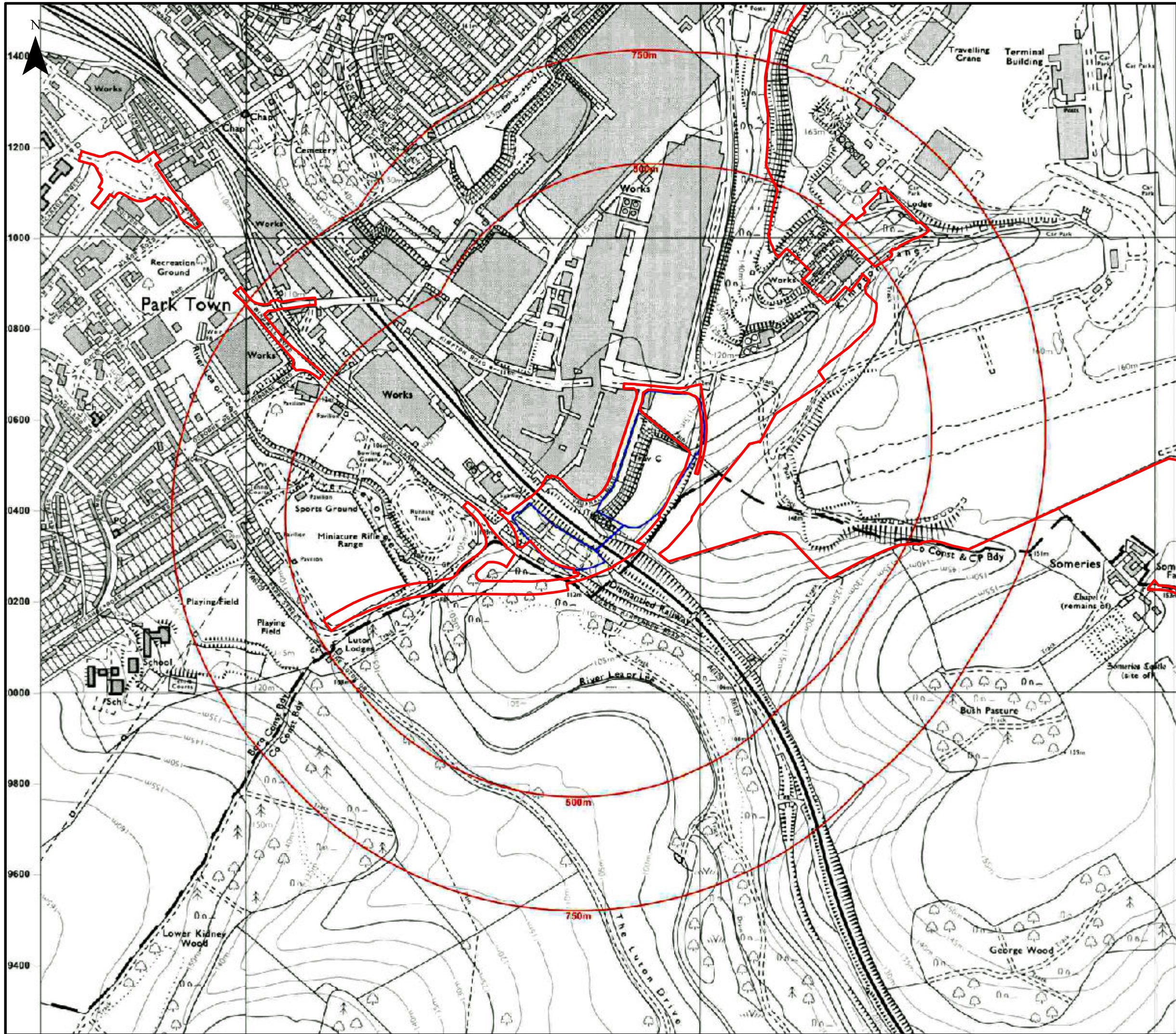
Drawing Title
**Figure 8b
Historical Mapping (1922) Off-Site Car Parks**

| | | | | | |
|---|---------------|----------------|------------------|-------------------|------------|
| Purpose of issue SUITABLE FOR INFORMATION | | | | Suitability S2 | |
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Legend

- Order Limits
- Search Boundary

| | | | | | |
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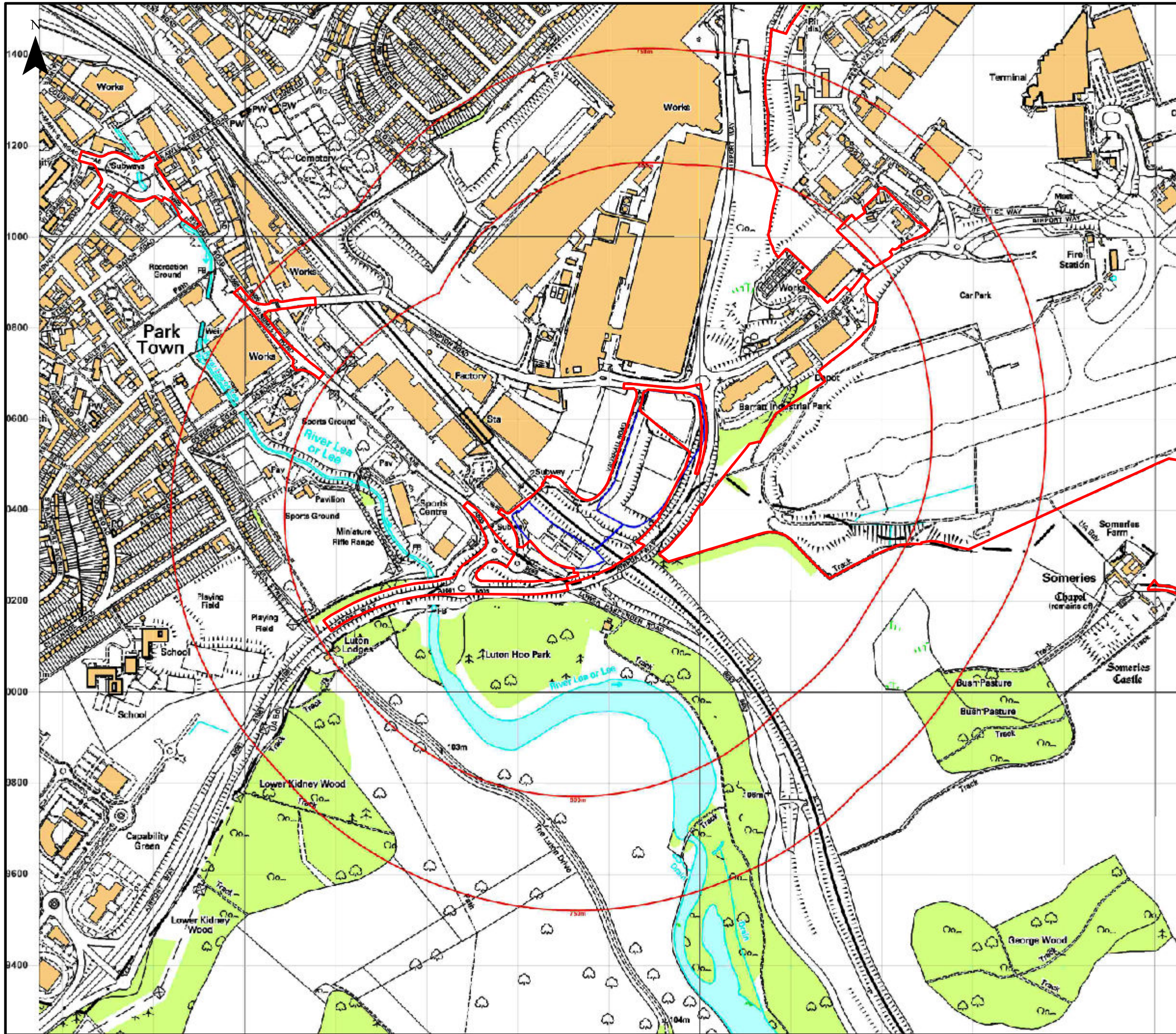
Drawing Title
**Figure 8c
 Historical Mapping (1977) Off-Site Car Parks**

| | | | | | |
|---|---------------|----------------|------------------|-------------------|------------|
| Purpose of issue SUITABLE FOR INFORMATION | | | | Suitability S2 | |
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Legend

- Order Limits
- Search Boundary

| | | | | | |
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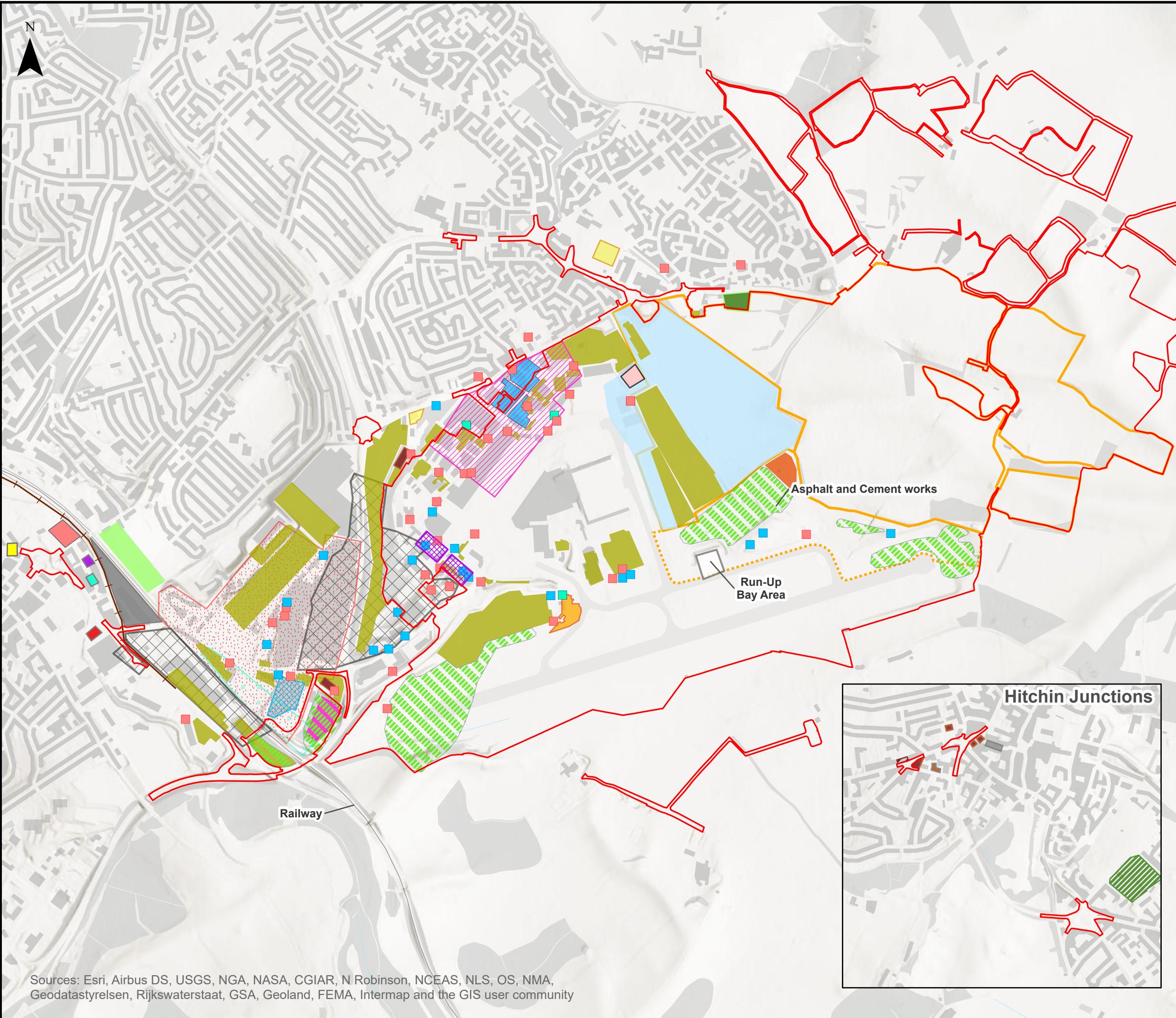
Drawing Title
**Figure 8d
 Historical Mapping (2002) Off-Site Car Parks**

| | | | | | |
|---|---------------|----------------|------------------|-------------------|------------|
| Purpose of issue SUITABLE FOR INFORMATION | | | | Suitability S2 | |
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| Drawing Number LLADCO-3C-ARP-00-00-DR-YE-0144 | Revision P02 |
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Project - Phase - Originator - Asset/Zone - Sub Asset - Type- Discp. - Number

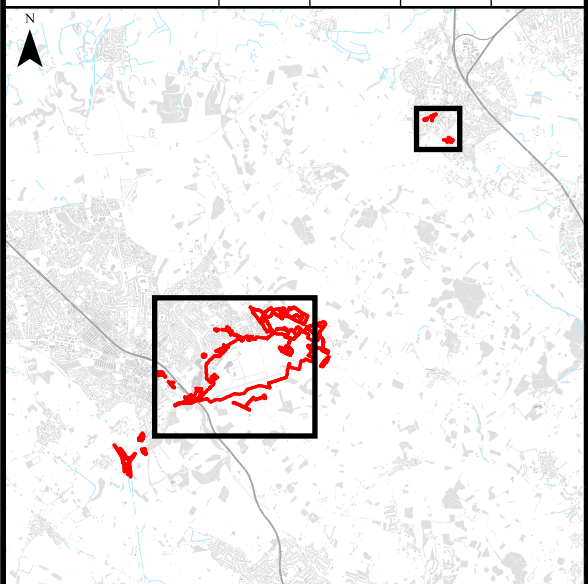


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| Legend | |
|---------------------|---------------------------------------|
| [Red outline] | Order Limits |
| [Blue outline] | Off-site Planting |
| [Yellow outline] | Site Subdivisions |
| [Black line] | Former Railway |
| [Red square] | De-icing Tanks |
| [Red square] | Electrical Substation |
| [Blue square] | Fuel Tanks |
| [Red square] | Historical Motor Works |
| [Green square] | Historical Rifle Range |
| [Grey square] | Historical Sewage Farm/Tanks |
| [Red square] | Historical Boiler Works |
| [Yellow square] | Electricity Generating Station |
| [Brown square] | Burial Ground |
| [Green square] | Potential Infilled Ground |
| [Green square] | Cemetery |
| [Green square] | Historical Dyeing and Bleaching Works |
| [Red square] | Historical Abattoir |
| [Grey square] | Historical Iron Foundry |
| [Purple square] | Historical Laundry |
| [Hatched square] | Historical Timber Yard |
| [Green square] | Allotments |
| [Green square] | Car Park |
| [Orange square] | Fire Station |
| [Orange square] | Fire Training Ground |
| [Light blue square] | Former Landfill |
| [Purple square] | Fuel Depots |
| [Brown square] | Garage |
| [Green square] | Made Ground / Earthwork Fill |
| [Blue square] | Miscellaneous Works |
| [Pink square] | Percival Works |
| [Yellow square] | Petrol Station |
| [Blue square] | Print Works |
| [Grey square] | Run-Up Bay Area |
| [Pink square] | Tidy Tip |
| [Pink square] | Trailer Park |

| | | | | | |
|------------------|-------|---------|----------|----------|------|
| First Issue | AB | RB | TB | 26/09/22 | P02 |
| Revision History | Drawn | Checked | Approved | Date | Rev. |



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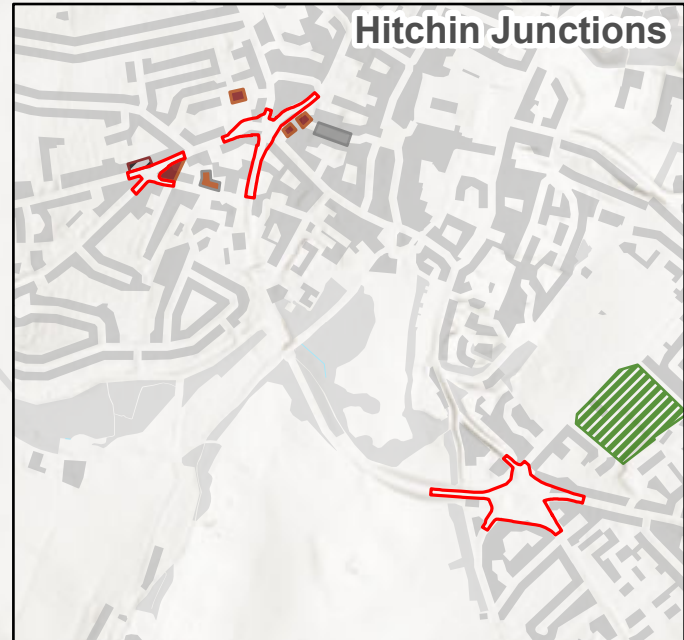
**London Luton Airport Expansion
 Development Consent Order**

Drawing Title
**Figure 9
 Potential Sources
 of Contamination**

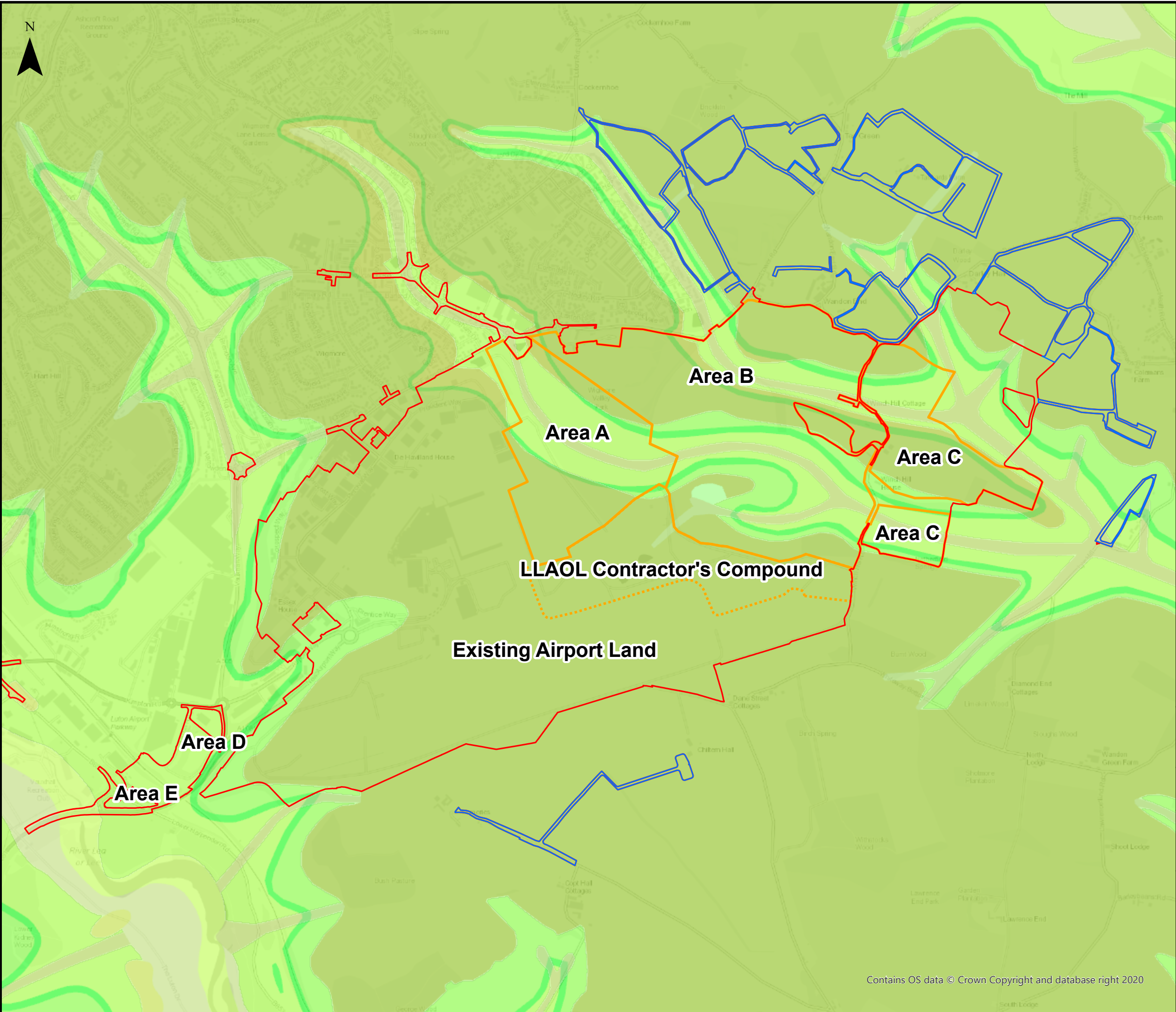
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| Purpose of issue SUITABLE FOR INFORMATION | | | | Suitability S2 | |
| Drawn AB | Checked HP | Approved TB | Date 26/09/22 | Scale 1:15,000 | Size A3 |

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| DCO Application Ref. TR020001 | APFP Regulation APFP 5(2)(a) | DCO Document Ref. TR020001/APP/5.03 |
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| Drawing Number LLADCO-3C-ARP-00-00-DR-YE-0145 | Revision P02 |
|--|-----------------|



Sources: Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community



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Legend

- Order Limits
- Off-site Planting
- Site Subdivisions

Bedrock

- Holywell Nodular Chalk formation
New Pit Chalk Formation and undifferentiated
- Zig Zag Chalk Formation
- Lewes Nodular Chalk and Seaford Chalk Formation undifferentiated
- Gault Formation - Mudstone
- West Melbury Marly Chalk Formation
- Lambeth Group - Clay, Silt and Sand

Superficial

- Alluvium
- Clay with flints
- Glaciofluvial Deposits
- Head
- Till
- River Terrace Deposits

| | | | | | |
|------------------|-------|---------|----------|----------|------|
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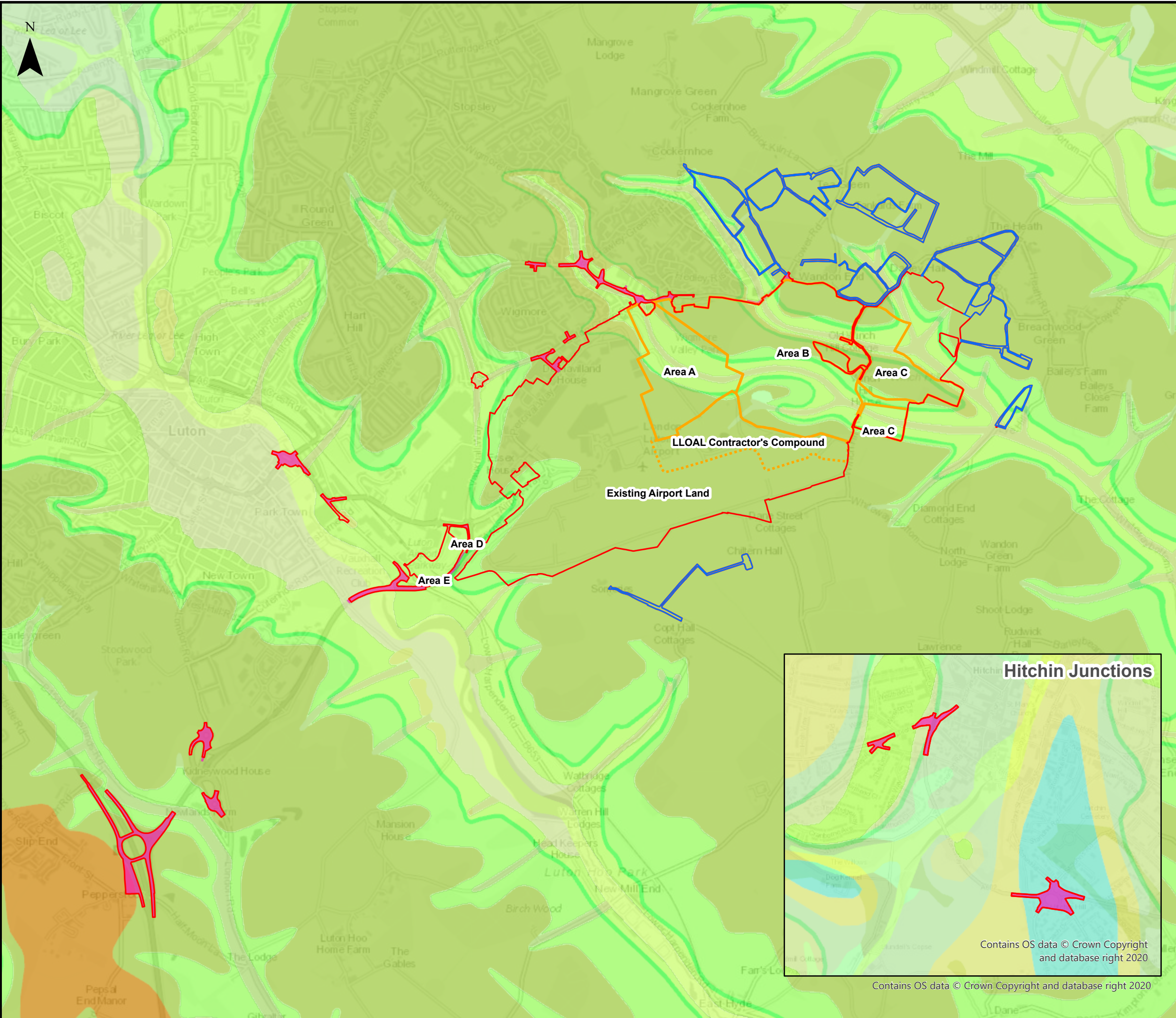
Drawing Title: **Figure 10 Geology**

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|---|---------------|----------------|------------------|-------------------|------------|
| Purpose of issue SUITABLE FOR INFORMATION | | | | Suitability S2 | |
| Drawn AB | Checked RB | Approved TB | Date 26/09/22 | Scale 1:15,000 | Size A3 |

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| DCO Application Ref. TR020001 | APFP Regulation APFP 5(2)(a) | DCO Document Ref. TR020001/APP/5.03 |
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| Drawing Number LLADCO-3C-ARP-00-00-DR-YE-0146 | Revision P02 |
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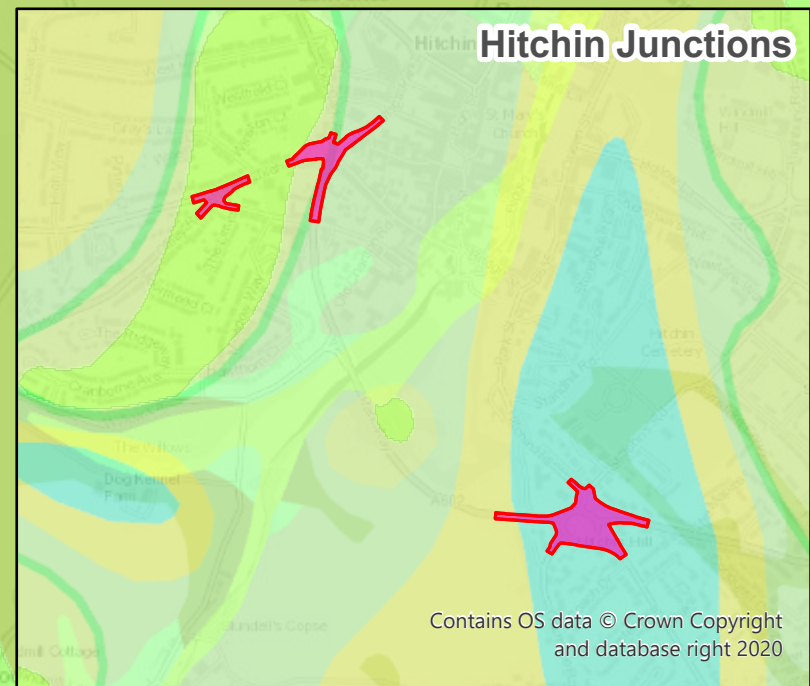
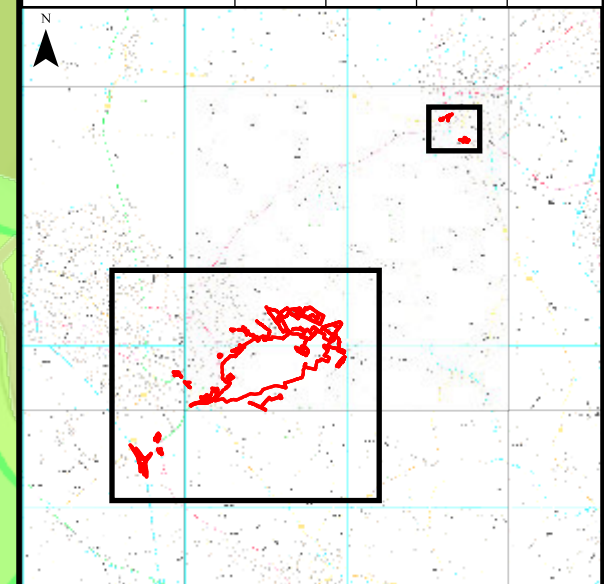


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- Legend**
- Order Limits
 - Off-site Planting
 - Site Subdivisions
 - Off-site Highway Interventions
- Bedrock**
- Holywell Nodular Chalk Formation New Pit Chalk Formation and undifferentiated
 - Zig Zag Chalk Formation
 - Lewes Nodular Chalk and Seaford Chalk Formation undifferentiated
 - Gault Formation - Mudstone
 - West Melbury Marly Chalk Formation
 - Lambeth Group - Clay, Silt and Sand
- Superficial**
- Alluvium
 - Clay with flints
 - Glaciofluvial Deposits
 - Head
 - Till
 - River Terrace Deposits

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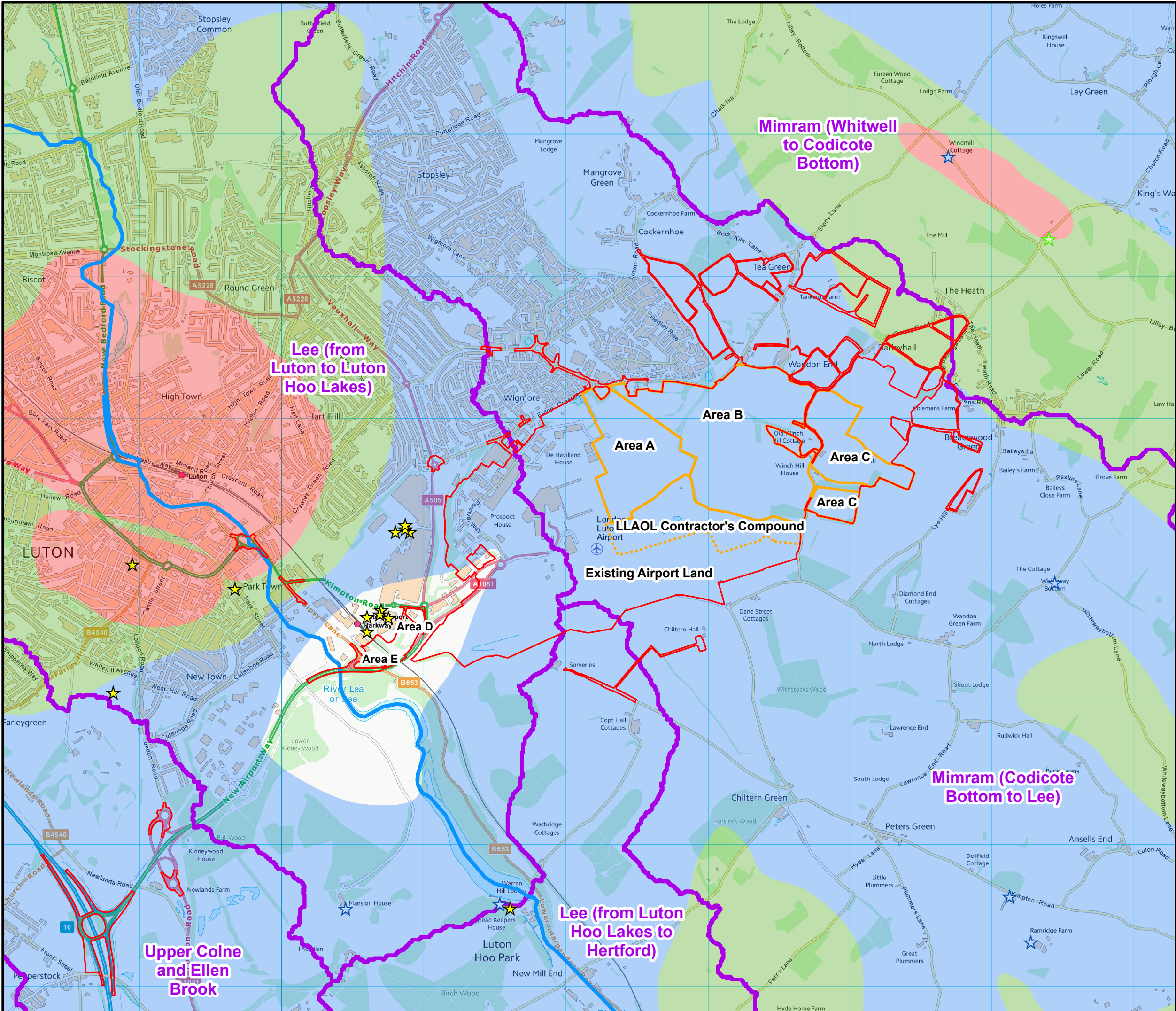
Drawing Title
 align="center">Figure 11
 Geology Off-site Highway Interventions

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|---|---------------|----------------|------------------|-------------------|------------|
| Purpose of issue SUITABLE FOR INFORMATION | | | | Suitability S2 | |
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| DCO Application Ref. TR020001 | APFP Regulation APFP 5(2)(a) | DCO Document Ref. TR020001/APP/5.03 |
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Legend

- Order Limits
- Site Subdivisions
- Watercourse
- ★ Affinity Water potable supply
- ★ Licensed groundwater abstractions
- ★ Private groundwater abstractions
- Waterbody Catchment Areas

Source protection zones

- Inner zone
- Outer zone
- Total catchment

| | | | | | |
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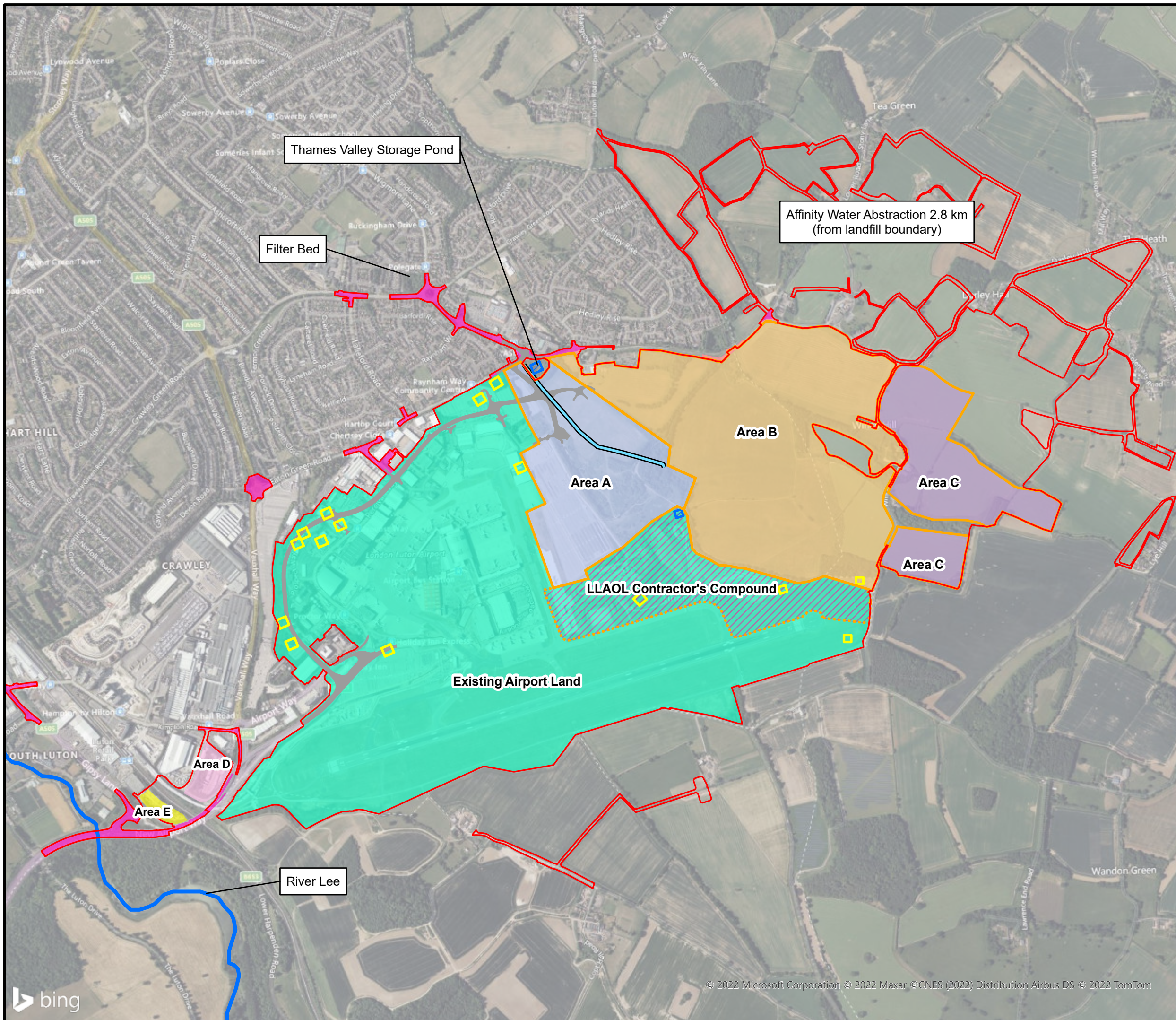
Drawing Title

Figure 12
 Hydrology & Hydrogeology

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|--------------------------|---------|----------|----------|-------------|------|--|
| Purpose of issue | | | | Suitability | | |
| SUITABLE FOR INFORMATION | | | | S2 | | |
| Drawn | Checked | Approved | Date | Scale | Size | |
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| DCO Application Ref. | APFP Regulation | DCO Document Ref. |
| TR020001 | APFP 5(2)(a) | TR020001/APP/5.03 |

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| LLADCO-3C-ARP-00-00-DR-YE-0148 | P02 |
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Legend

- Order Limits
 - Site Subdivisions
 - Soakaway
 - Thames Valley Storage Pond
 - Thames Valley Drain
 - Airport Access Road
 - River Lee
- Main Area of New Development**
- Existing Airport Land
 - LLAOL Contractor's Compound
 - Area A Former Landfill
 - Area B Land West of Winch Hill Lane
 - Area C Land East of Winch Hill Lane
- Other Areas**
- Area D Offsite Car Park North
 - Area E Offsite Car Park South

| | | | | | |
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| First Issue | AB | RB | TB | 26/09/22 | P02 |
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Drawing Title

Figure 13
Existing Water Features

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|--------------------------|---------|----------|----------|-------------|------|--|
| Purpose of issue | | | | Suitability | | |
| SUITABLE FOR INFORMATION | | | | S2 | | |
| Drawn | Checked | Approved | Date | Scale | Size | |
| AB | RB | TB | 26/09/22 | 1:15,000 | A3 | |

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| DCO Application Ref. TR020001 | APFP Regulation APFP 5(2)(a) | DCO Document Ref. TR020001/APP/5.03 |
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| Drawing Number LLADCO-3C-ARP-00-00-DR-YE-0149 | Revision P02 |
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- Legend**
- Order Limits
 - Site Subdivisions
 - ◆ AECOM 2019 Luton Airport Landfill
 - ◆ AECOM 2018 Luton Hangar 24
 - ◆ Structural Soils 2017 Century Park Access Road
 - ◆ Structural Soil 2017 Landfill and Century Park
 - ◆ Concept Site 2015 Luton Airport Terminal Extension
 - ◆ Delta Simmons 2012 Taxiway Foxtrot
 - ◆ Soil Engineering 2012 Luton Airport FBO
 - ◆ RSK 2012 Ocean Sky Building and Short Stay Car Park
 - ◆ Wardell Armstrong 2008 Stirling Place
 - ◆ RSA 2004 LLA Hangar and Taxiway Extension
 - ◆ Fugro 2003
 - ◆ British Geological Society

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Drawing Title Figure 14
Previous Ground Investigation (GI)
Locations

| | | | | | | |
|--------------------------|---------|----------|----------|-------------|------|--|
| Purpose of issue | | | | Suitability | | |
| SUITABLE FOR INFORMATION | | | | S2 | | |
| Drawn | Checked | Approved | Date | Scale | Size | |
| AB | RB | TB | 26/09/22 | 1:15,000 | A3 | |

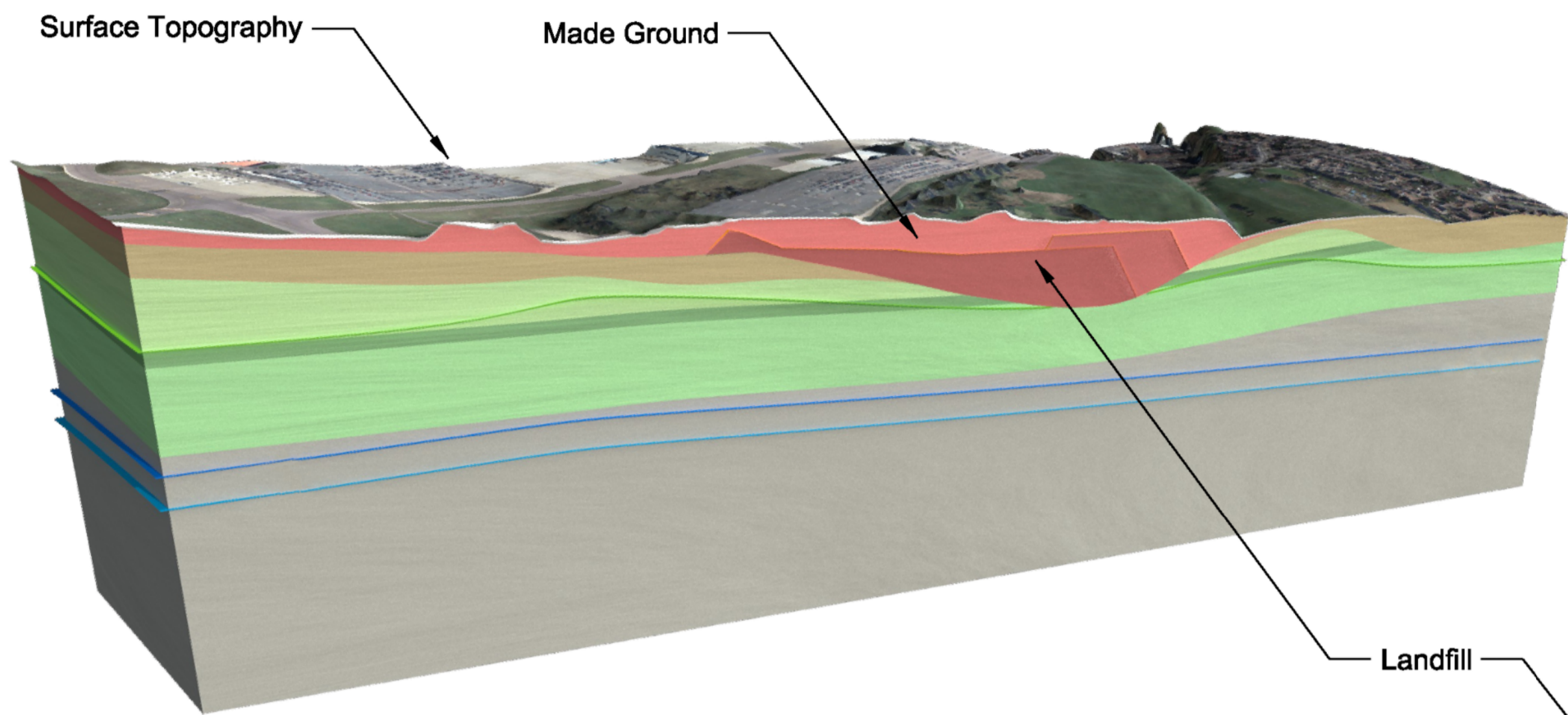
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| DCO Application Ref. | APFP Regulation | DCO Document Ref. |
| TR020001 | APFP 5(2)(a) | TR020001/APP/5.03 |

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|---|----------|
| Drawing Number | Revision |
| LLADCO-3C-ARP-00-00-DR-YE-0150 | P02 |
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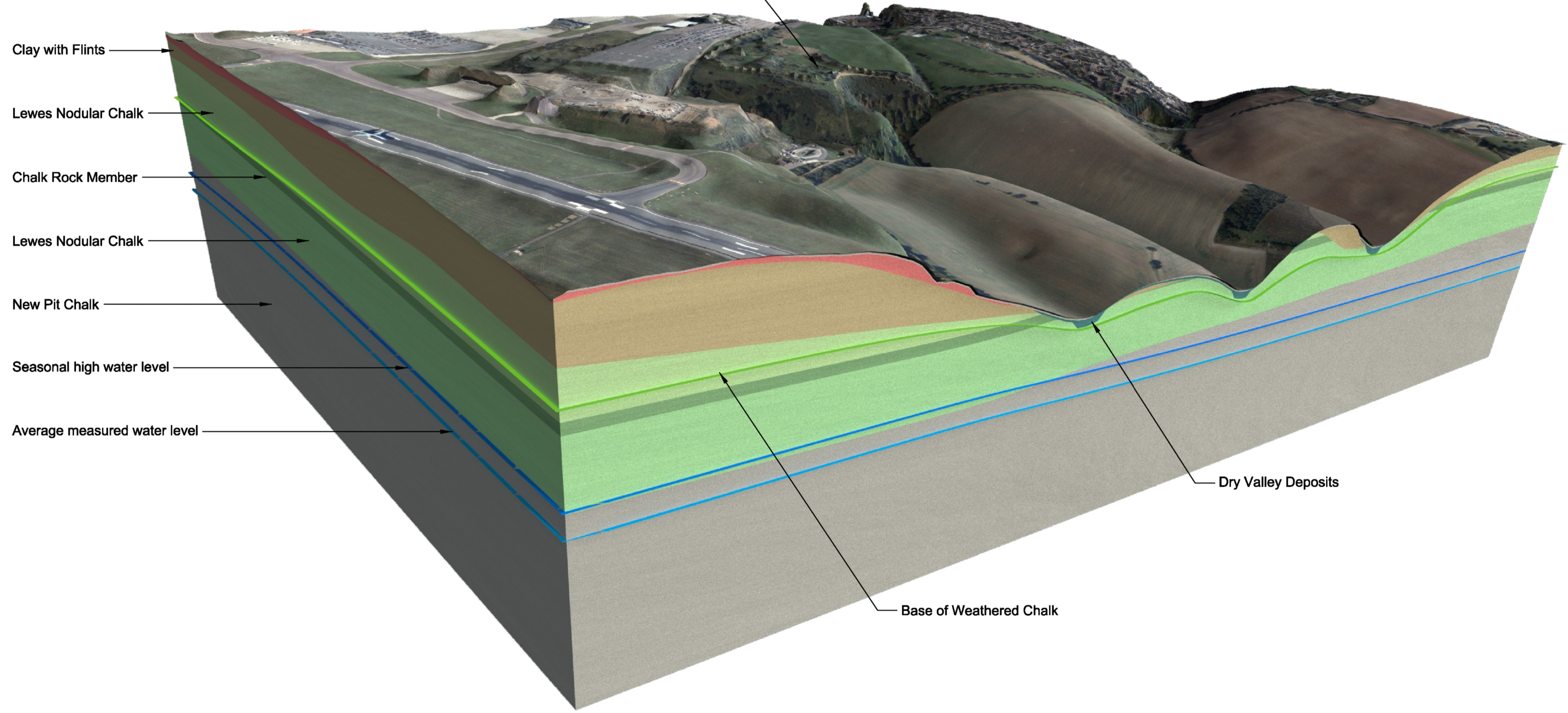
Notes

1. Do not scale from this drawing.
2. These drawings are primarily intended to be viewed electronically. Some details may not be clear or visible on a printed version.
3. Strata and other levels have been drawn from interpolated 3D models of various boundaries logged in trial pits and boreholes, topographical data and data from geological maps etc. It is intended to provide a guide as to likely ground conditions and as such should be regarded as indicative. It is recommended that design decisions made on the basis of this information are confirmed by investigation.
4. Bing Maps Aerial - © 2021 Microsoft Corporation © 2021 Maxar ©CNES (2021) Distribution Airbus DS



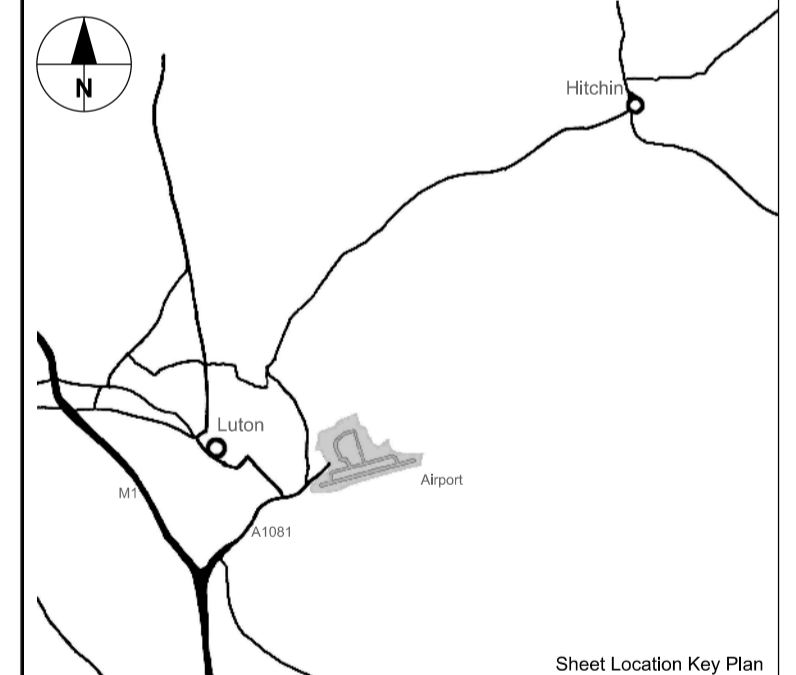
Top Left Section Cut

Below Centre Section Cut



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| Issue | IJ | RB | TB | 30/09/22 | P02 |
| Issue | IJ | RB | TB | 16/12/21 | P01 |

| Revision History | | Checked | Date | Rev. |
|------------------|----------|---------|------|------|
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Drawing Title
**Figure 15
 Ground Model**

| | | | | | |
|---|---------|-----------------|----------|-------------------|----------|
| Purpose of issue | | | | Suitability | |
| SUITABLE FOR COORDINATION | | | | S2 | |
| Drawn | Checked | Approved | Date | Scale | Size |
| IJ | RB | TB | 30/09/22 | NTS | A1 |
| DCO Application Ref. | | APFP Regulation | | DCO Document Ref. | |
| TR020001 | | APFP 5(2)(a) | | TR020001/APP/5.03 | |
| Drawing Number | | | | | Revision |
| LLADCO-3C-ARP-00-00-DR-YE-0151 | | | | | P02 |
| Project - Phase - Originator - AssetZone - Sub Asset - Type - Discp. - Number | | | | | |