



Jaguar Land Rover

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# FLOOD RISK ASSESSMENT

Body In White South Extension, Halewood





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Body in White South Extension, Halewood

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**PROJECT NO. 70091479**

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**DATE: JULY 2022**

WSP

Opus House

Yale Business Village

Wrexham Technology Park

Wrexham

WSP.com



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| Checked by     | S.Gilliland      |            |            |
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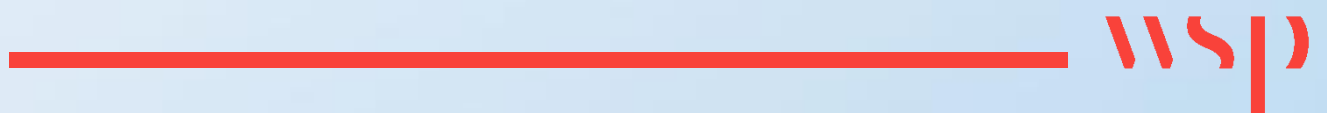
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# INTRODUCTION



# 1. INTRODUCTION

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## 1.1 BACKGROUND

- 1.1.1. WSP UK Ltd (WSP) has been commissioned by Jaguar Land Rover to prepare a Flood Risk Assessment (FRA) to support a planning application for a proposed manufacturing and storage space at the existing Jaguar Land Rover site in Halewood, Merseyside. The 'Site', as referred to in this report is located at Ordnance Survey (OS) National Grid Reference SJ 44557 83706. Site features are described in more detail in Section 2 of this report.
- 1.1.2. This Flood Risk Assessment (FRA) has been carried out in line with the requirements of the National Planning Policy Framework (NPPF), the Planning Practice Guidance (PPG) and with data obtained from the Environment Agency (EA) and information available on the British Geological Survey (BGS) website.
- 1.1.3. The NPPF sets out the framework for planning decisions made by local, regional, and national government and the EA. The NPPF advises that an FRA is required for all developments in Flood Zones 2<sub>1</sub>, 3a<sub>2</sub> and 3b<sub>3</sub> and for all development sites in Flood Zone 1 that are 1 hectare or greater.
- 1.1.4. The aim of this assessment is to establish the flood risk associated with the site with regards to flood risk from rivers, the sea, surface water runoff from land, sewers, groundwater and artificial sources. The objectives are summarised as follows:
- Establish whether the existing and proposed development is likely to be affected by current or future flooding;
  - Assess the potential impacts of the development on flood risk elsewhere;
  - Determine any necessary mitigation measures required to manage flooding issues at the site in a sustainable way;
  - Provide supporting information for the site surface water drainage strategy.

## 1.2 INFORMATION PROVIDED

- 1.2.1. The following information was provided by the Client for use in this study:
- Jaguar Land Rover Site Location Plan;
  - Jaguar Land Rover Existing Site Layout Plan;
  - Jaguar Land Rover Existing Site Drainage Plan.

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<sup>1</sup> Flood Zone 2 (medium probability) comprises land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% - 0.1%) or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% - 0.1%) in any year.

<sup>2</sup> Flood Zone 3a (high probability) comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability from the sea (>0.5%) in any river.

<sup>3</sup> Flood Zone 3b (functional floodplain) comprises land where water has to flow or be stored in times of flood.

1.2.2. The following documents have been used to gather information for this FRA:

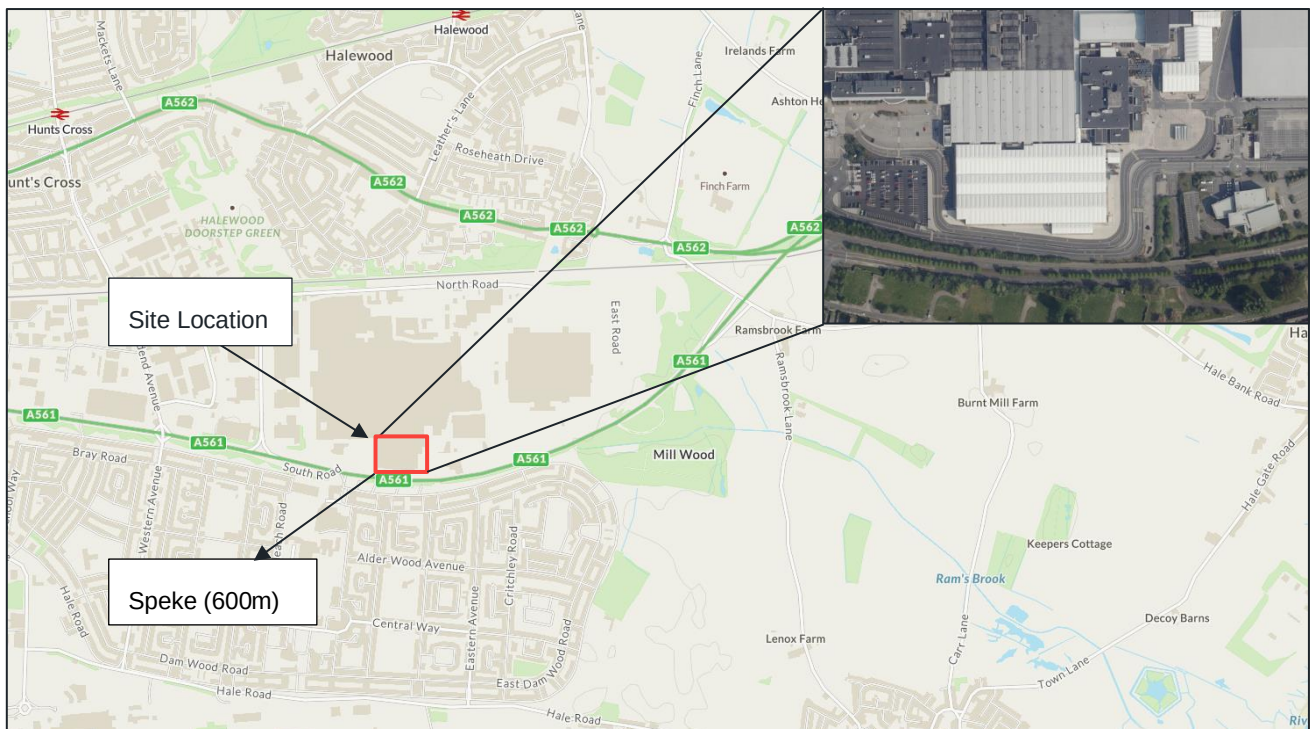
- Knowsley Council Preliminary Flood Risk Assessment, 2011 (PFRA);
- Knowsley Council Strategic Flood Risk Assessment, 2012 (SFRA);
- Knowsley Council Local Flood Risk Management Plan, 2017 (LFRMP);
- EA Flood Risk Maps for Planning, June 2022;
- DEFRA MAGIC MAP, June 2022;
- British Geological Survey web-based mapping, June 2022;
- Landis Institute Soilscales web-based mapping, June 2022.

## 2 EXISTING SITE

### 2.1 GENERAL

- 2.1.1. The Jaguar Land Rover UK site is centred at National Grid Reference SJ 44557 83706 (E: 344557, N: 383706) and is located off South Road in Halewood, Merseyside. The existing site is irregular in shape and has an approximate area of 33 hectares (ha). The proposed development is approximately 1.91 hectares (ha) which is covered by this FRA. The site previously housed a temporary tent structure which existed since 2017 as approved under planning application 16/00452. The tent aided Body in White operations providing 14,696 sqm of manufacturing and storage space (Use Classes B2/B8). Planning permission has now lapsed, which has meant the temporary structure was removed in 2021. The slab used to house the temporary structure remains in situ.
- 2.1.2. The site is surrounded on all sides by industrial uses associated with Jaguar Land Rover operations. The site is bounded by South Road which runs adjacent to the application site facilitating access to the wider Jaguar Land Rover complex. An existing car park is found to the site's immediate west, which consists of 17 spaces, including 4 disabled parking spaces and electrical charging points.
- 2.1.3. Direct access to the site is provided via the existing highway network circulating the site, with direct connections to the A561 Speke Boulevard and the A562 Higher Road via Old Hutte Lane.
- 2.1.4. The closest residential properties are on Clough Road/Alderfield Drive, approximately 200m south of the sites. It is separated from the site by the Speke Boulevard and significant landscape buffers provided to the north of these existing properties.
- 2.1.5. The site location plan is shown in Figure 2-1:

**Figure 2-1 - Site Location Plan (Source - OS Mapping, June 2022)**



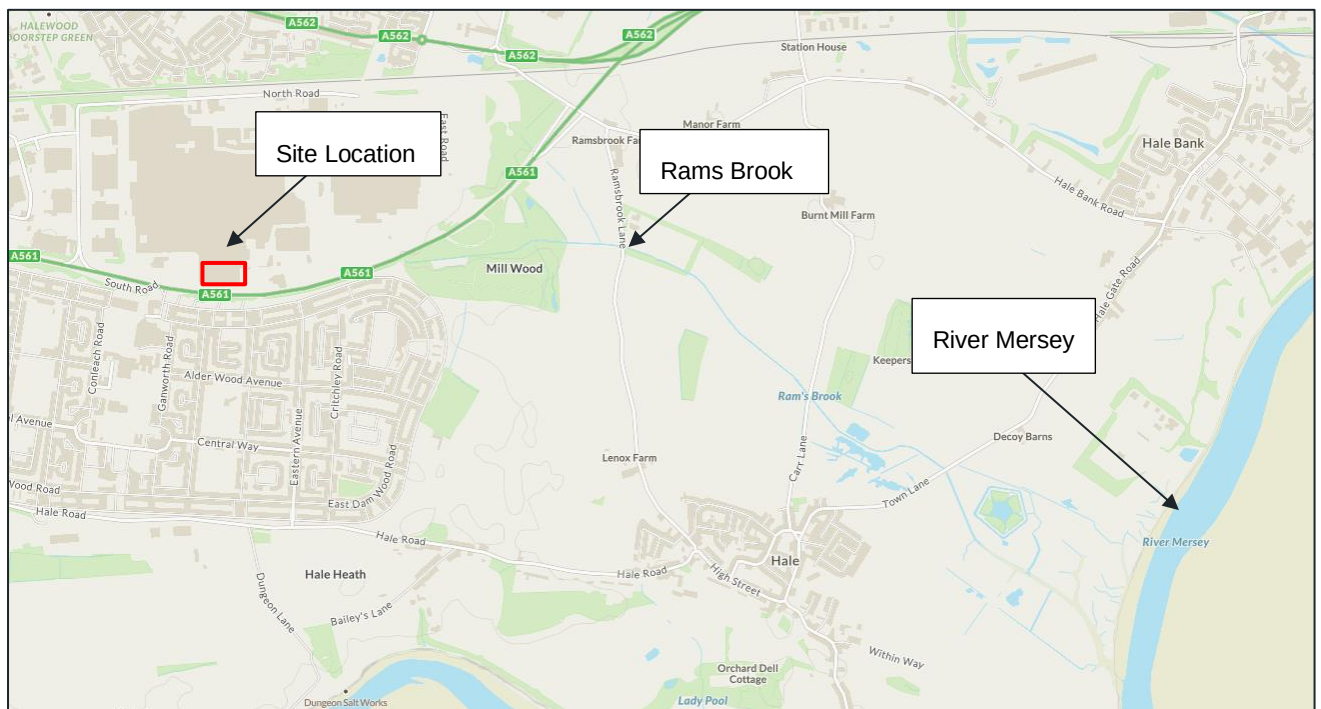
## 2.2 TOPOGRAPHY

- 2.2.1. A review of LiDAR (sourced from EA web service) indicates the site has a general level of 23.8mAOD (Above Ordnance Datum). The land to the east of the site falls to 15mAOD and the land to the west rises to 35mAOD.

## 2.3 HYDROLOGY

- 2.3.1. Rams brook is classified as a Statutory Main River which is managed by the Environment Agency and is located approximately 600m east of the site.
- 2.3.2. The watercourse is culverted beneath the A561 Speke Boulevard and flows in a south westerly direction where it discharges into the River Mersey approximately 4km away.
- 2.3.3. Figure 2-3 shows the location and proximity of the watercourses

**Figure 2-2 - Existing Watercourse Location (Sourced - OS Mapping, June 2022)**



## 2.4 GEOLOGY AND HYDROLOGY

- 2.4.1. A review of available geological and hydrogeological data on the British Geological Survey (BGS) was undertaken as part of this report in order to establish an understanding of the underlying geology and hydrogeology at the site. The geology present at the site is summarised in Table 2-1.

**Table 2-1 – Geological Summary**

| Geology         | Geological Description                                         | Source                             |
|-----------------|----------------------------------------------------------------|------------------------------------|
| Bedrock Geology | Permian Rocks (undifferentiated) – Sandstone and Conglomerate. | British Geological Survey (online) |

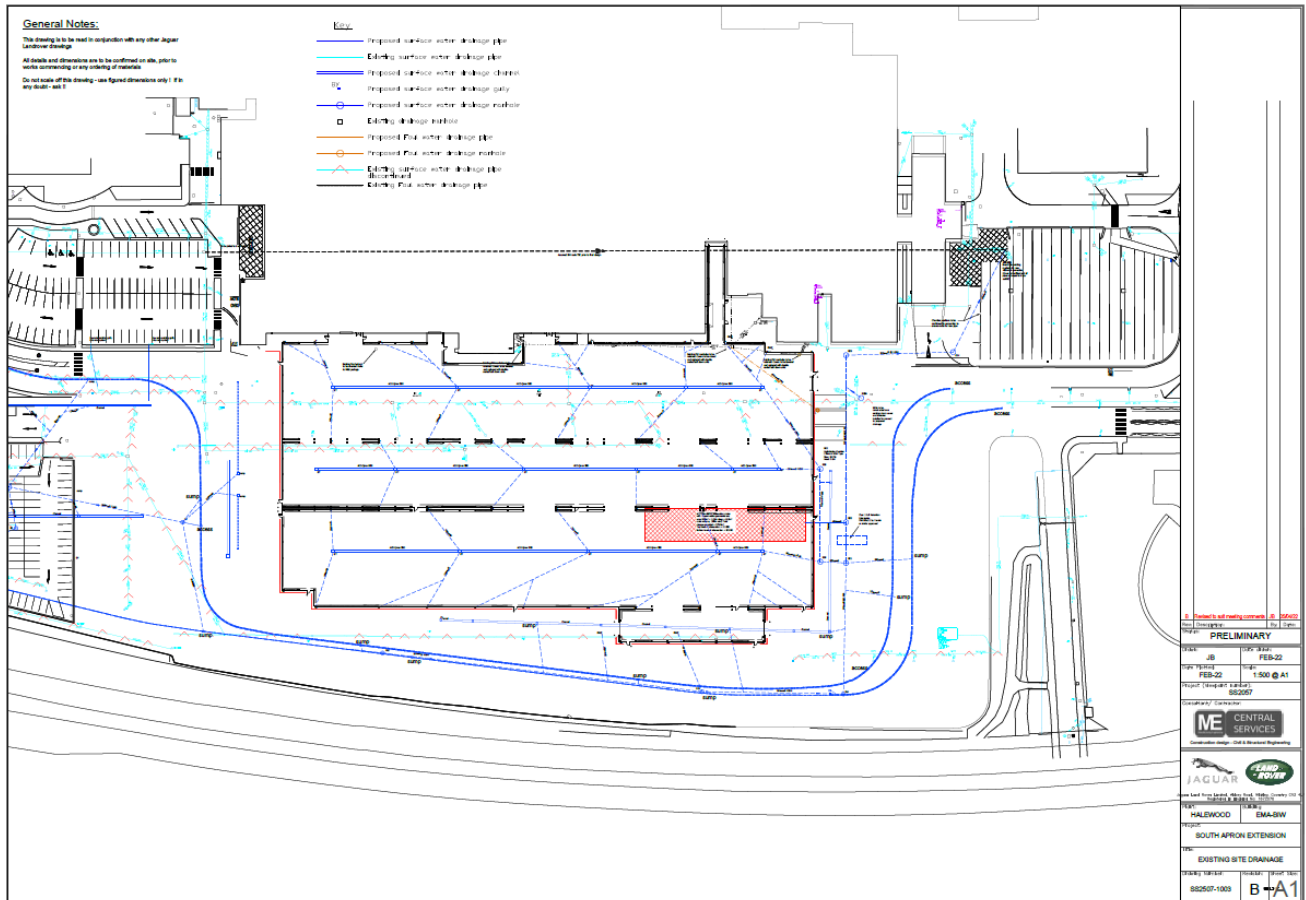
|                     |                                                                                                                                                                                                                                                                                                                                                                              |                                 |
|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
|                     | <p>Sedimentary Bedrock formed approximately 251 to 299 million years ago in the Permian Period. Local environment previously dominated by rivers.</p> <p>Triassic Rocks (undifferentiated) – Sandstone and Conglomerate. Sedimentary Bedrock formed approximately 200 to 251 million years ago in the Triassic Period. Local environment previously dominated by rivers.</p> |                                 |
| Superficial Geology | Till – Diamicton. Superficial Deposits formed up to 3 million years ago in the Quaternary Period. Local environment previously dominated by ice age conditions.                                                                                                                                                                                                              | British Geology Survey (online) |
| Soil Type           | Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils.                                                                                                                                                                                                                                                                                          | Soilscapes (Landis.org.uk)      |

- 2.4.2. The site is underlain by a bedrock Principal Aquifer. The BGS defines a Principal Aquifer as “having significant quantities of drinking water, and water for business needs. They may also support rivers, lakes and wetlands”.
- 2.4.3. The site is underlain by superficial Secondary (undifferentiated) Aquifer. The BGS defines a Secondary (undifferentiated) Aquifer as “aquifers where it is not possible to apply either a Secondary A or B definition because of the variable characteristics of the rock type. They only have a minor value”.
- 2.4.4. The site is in an area of Medium to Low vulnerability to groundwater pollution. Therefore, appropriate pollution treatment mitigations for surface water runoff will be required.
- 2.4.5. The site is not within an EA Groundwater Source Protection Zone as currently published on the DEFRA Magic Map web-based service.

## 2.5 EXISTING DRAINAGE NETWORKS

- 2.5.1. An existing site drainage survey has been provided by the Client (Drawing Number: SS2507-1003) and is shown in Figure 2-3. The site currently has an existing surface water drainage system which will be adapted to support the proposed manufacturing and storage space.

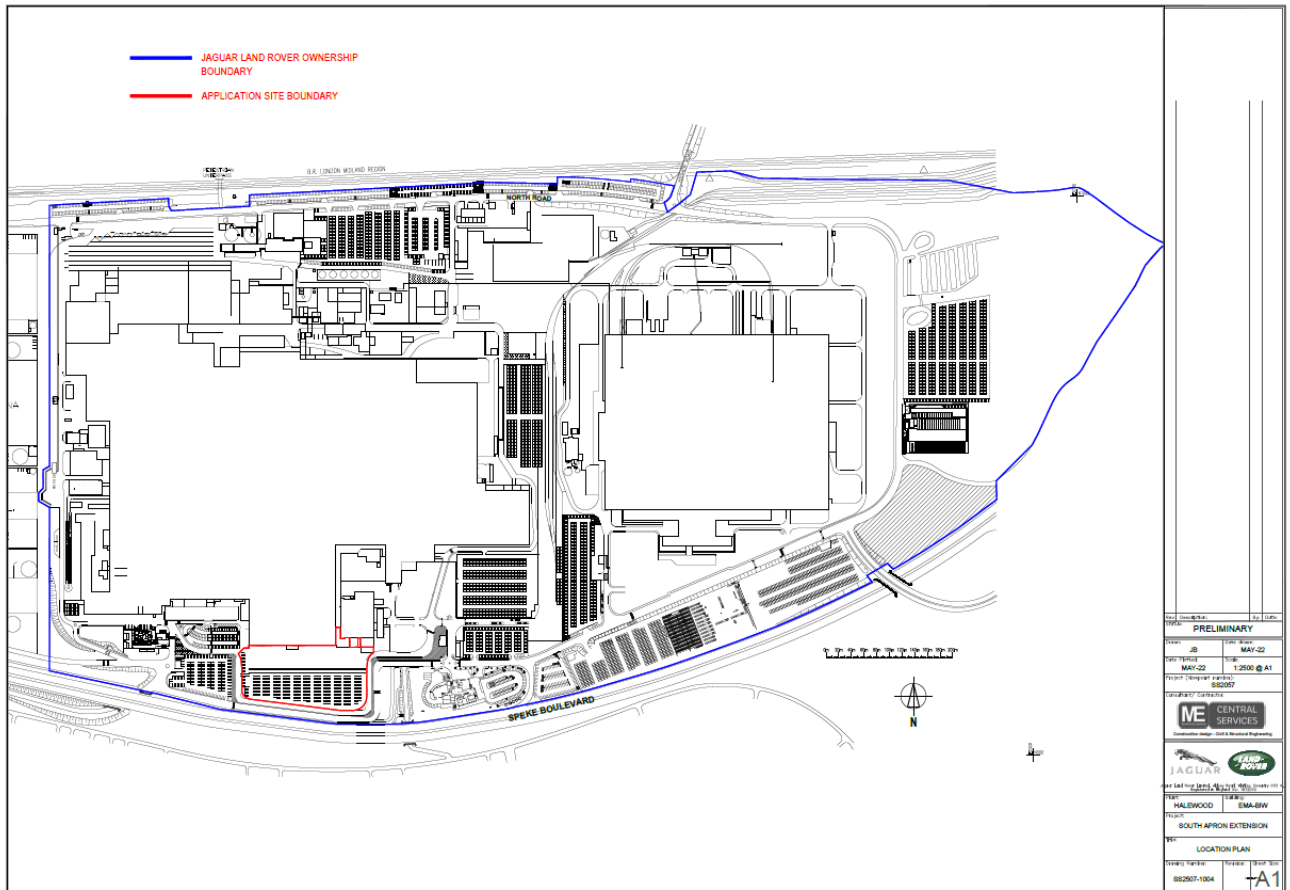
Figure 2-3 - Existing Site Drainage Networks



### 3 PROPOSED DEVELOPMENT

- 3.1.1. The proposed development will facilitate the workings and construction of a new manufacturing and storage space.
- 3.1.2. The site previously housed a temporary tent structure which existed since 2017 as approved under planning application 16/00452. The tent aided Body in White operations providing 14,696 sqm of manufacturing and storage space (Use Classes B2/B8). Planning permission has now lapsed, which has meant the temporary structure was removed in 2021. The slab used to house the temporary structure remains in situ.
- 3.1.3. It is understood that the proposed development will consist of a large two-storey manufacturing and storage space unit on the site to the south of the main facility.
- 3.1.4. The proposed development (application boundary) for the site is shown in Figure 3-1.

**Figure 3-1 - Proposed Development Site**



- 3.1.5. Based upon the development plans provided by the Client, the approximate impermeable area of the proposed development covered by this application is in the region of 1.91 hectares (ha). The impermeable area on site will not increase with the construction of the new development as the site area is currently fully impermeable.

## 4 NATIONAL PLANNING POLICY FRAMEWORK

### 4.1 FLOOD ZONE DEFINITION

- 4.1.1. Table 4-1 shows the various flood zones as defined in the NPPF PPG. These flood zones refer to the probability of river and sea flooding, ignoring the presence of any flood defences. A review of the NPPF Flood Zone Classification table indicates that the development site is located within Flood Zone 1.

**Table 4-1 – NPPF Flood Zone Classification**

| Classification | Description                                                                                                                                                                                                                                                                                                                                                                               | Probability        |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| Flood Zone 1   | This zone comprises of land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%).                                                                                                                                                                                                                                                                | Low Probability    |
| Flood Zone 2   | This zone comprises of land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% - 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% - 0.1%) in any year.                                                                                                                                                     | Medium Probability |
| Flood Zone 3a  | This zone comprises of land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.                                                                                                                                                                                | High Probability   |
| Flood Zone 3b  | This zone comprises of land where water has to flow or be stored in at times of flooding. The identification of functional floodplain should take into account of local circumstances but land which would flood with an annual probability of 1 in 20 (5%) or greater in any year or is designed to flood in an extreme (0.1%) flood, should provide a starting point for consideration. | High Probability   |

### 4.2 FLOOD RISK VULNERABILITY

- 4.2.1. In the NPPF PPG, developments are classified according to their 'Flood Risk Vulnerability' as presented in the extract from the NPPF PPG in Table 4-2. The site development proposals are classified as 'Less Vulnerable' under the NPPF PPG as it includes 'Buildings used for shops, financial, professional, and other services.

**Table 4-2 – Flood Risk Vulnerability (Source – NPPF)**

**Essential Infrastructure**

- Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk.
- Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood.
- Wind turbines

**Highly Vulnerable**

- Police stations, ambulance stations and fire stations and command centres and telecommunications installations required to be operational during flooding.
- Emergency dispersal points
- Basement dwellings
- Caravans, mobile homes, and park homes intended for permanent residential use
- Installations requiring hazardous substances consent. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as essential infrastructure)

**More Vulnerable**

- Hospitals
- Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels.
- Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs, and hotels.
- Non-residential uses for health services, nurseries, and educational establishments.
- Landfill and sites used for waste management facilities for hazardous waste.
- Sites used for holiday or short-let caravans and camping.

**Less Vulnerable**

- Police, ambulance, and fire stations which are not required to be operational during flooding.
- Buildings used for shops, financial, professional, and other services.
- Restaurants and cafes, hot food takeaways, offices, general industry, storage and distribution, non-residential institutions not included in more vulnerable, and assembly and leisure.
- Land and buildings used for agriculture and forestry.
- Waste treatment
- Minerals working and processing
- Water treatment works which do not need to remain operational during times of flood
- Sewage treatment works

**Water Compatible**

- Flood control infrastructure
- Water transmission infrastructure and pumping stations
- Sewage transmission infrastructure and pumping stations
- Sand and gravel working
- Docks, marinas, and wharves
- Navigation facilities
- Ministry of Defence defence installations
- Ship Building, repairing, and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location
- Water based recreation
- Lifeguard and coastguard stations
- Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms.
- Essential ancillary sleeping or residential accommodation for staff required by uses in this category.

### 4.3 APPROPRIATE DEVELOPMENT

- 4.3.1. The appropriate uses and FRA requirements for land in each flood zone is described in the NPPF PPG.
- 4.3.2. From the NPPF PPG, the proposed development site is 'Less Vulnerable' and is located within Flood Zone 1. Applying the flood risk vulnerability and flood zone 'compatibility' table in the NPPF PPG (extract from NPPF PPG is shown in Figure 4-1) shows that the proposed development is appropriate in this location and that the Exception Test is not required for this development proposal.

**Figure 4-1 - Flood Risk Vulnerability and Flood Zone 'Compatibility' (Source - NPPF)**

| Flood risk vulnerability classification (see table 2)                               |                               | Essential infrastructure | Water compatible | Highly vulnerable       | More vulnerable         | Less vulnerable |
|-------------------------------------------------------------------------------------|-------------------------------|--------------------------|------------------|-------------------------|-------------------------|-----------------|
| Flood zone (see table 1)                                                            | Zone 1                        | ✓                        | ✓                | ✓                       | ✓                       | ✓               |
|                                                                                     | Zone 2                        | ✓                        | ✓                | Exception Test required | ✓                       | ✓               |
|                                                                                     | Zone 3a                       | Exception Test required  | ✓                | ✗                       | Exception Test required | ✓               |
|                                                                                     | Zone 3b functional floodplain | Exception Test required  | ✓                | ✗                       | ✗                       | ✗               |
| <b>Key:</b> ✓ Development is appropriate.<br>✗ Development should not be permitted. |                               |                          |                  |                         |                         |                 |

## 5 FLOOD RISK ASSESSMENT

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### 5.1 PREVIOUS STUDIES

#### **Knowsley Council Preliminary Flood Risk Assessment, 2011 (PFRA)**

5.1.1. The Knowsley Council PFRA has the following aims and objectives:

- Set up governance arrangements and develop partnerships;
- Establish a methodology and develop partnerships for collation and sharing of data relating to past and future floods and their consequences;
- Assess historical local flood events and their impact and consequences;
- Assess potential future flood events and their impact and consequences;
- Review the “indicative” Flood Risk areas provided by the Environment Agency;
- Explain any amendments to the “indicative” Flood Risk areas and justify the creation of new areas.

#### **Knowsley Council Strategic Flood Risk Assessment, 2012 (SFRA)**

5.1.2. The Knowsley Council SFRA states the following:

- Development at an unacceptable risk of flooding will not be permitted. Where a development would be in an area of flood risk, the applicant will be required to:
  - Submit evidence to establish that the development could not be practicably located within an area of lower or no flood risk;
  - Submit a flood risk assessment, which will fully assess the risks of flooding associated with the development in accordance with the requirements of Planning Policy Guidance note 25 “Development and Flood Risk”.
- Development will not be permitted if it may cause an unacceptable risk of flooding elsewhere;
- Mitigation measures will be required, where necessary, to manage flood risk associated with or cause by new development. These should:
  - Be derived from a flood risk assessment;
  - Be fully described in the planning application;
  - Be fully funded – including for the provision of long-term maintenance as part of the development;
  - Contribute to the biodiversity of the Borough.
- New development will not be permitted unless a Sustainable Drainage System is incorporated into the overall design. Exceptions may be made where it can be demonstrated that:
  - The Sustainable Drainage System would be likely to cause either significant land or water pollution;
  - The site’s ground conditions would preclude the use of a Sustainable Drainage System;
  - The proposed Sustainable Drainage System could cause damage to adjacent buildings or sites;

#### **Knowsley Council Local Flood Risk Management Plan, 2017 (LFRMP)**

5.1.3. The Knowsley Council LFRMP has the following aims and objectives:

- To develop a collective understanding of the local flood risk within Knowsley to a sufficient level whereby studies and schemes can be identified, and to put in place long-term plans to manage these risks and to make sure that other plans take account of them.
- To work in partnership with other risk management authorities, key stakeholders, partners, organisations and the community, to reduce the risk of flooding to communities, the economy and the environment from all sources.
- To support the delivery of flood-appropriate sustainable development and ensure that the guiding principles for sustainable development are applied and inappropriate development is avoided in existing and future areas at risk of flooding.
- To increase public awareness of the effects of climate change and the implications for an increase in flood risk, engage with people specifically at risk of flooding, to empower them and encourage them to accept their flood risk, to become more resilient communities by taking action to manage and/or mitigate the risks that they face
- To support and assist those bodies responsible for improving the detection, forecasting, and issue of warnings of flooding. Plan for and coordinate a rapid response to flood emergencies and promote faster recovery from flooding.
- Where viable, build, maintain and improve local flood risk management infrastructure and systems to mitigate or reduce the likelihood of harm to people and damage to the economy; environment (natural, historic, built, and social), and society as a whole.

5.1.4. Table 5-1 summarises the flood risk for Halewood based on data available in the SFRA Level 1 and SFRA Level 2 mapping.

**Table 5-1 – SFRA Flood Risk Data**

| Source        | Summary of Flood Risk                                                                                                                                                                                 |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Sea           | The River Mersey is a tidally influenced watercourse and is located approximately 4km southeast of the proposed development. Therefore, the risk to the site from coastal flooding is considered low. |
| River         | The site location is within Flood Zone 1 and the nearest watercourse is Rams Brook. This is located approximately 600m east of the site and therefore the flood risk is considered low.               |
| Surface Water | The site is at medium to low risk of surface water flooding (more than 0.1% chance of flooding). Therefore, the risk of flooding from surface water is considered low.                                |
| Sewers        | To be confirmed.                                                                                                                                                                                      |
| Groundwater   | The site has between a 25% to 50% risk of groundwater emergence. Therefore, the risk of groundwater flooding to the site is medium.                                                                   |
| Artificial    | There are no canals or reservoirs within the vicinity or surrounding areas of the site. Therefore, the risk of flooding from artificial sources is considered negligible.                             |

## 5.2 HISTORIC FLOODING

5.2.1. Historic flooding in Halewood is mainly attributed to localised areas of fluvial flooding from the River Mersey.

- 5.2.2. A review of the PFRA and SFRA historic mapping indicate that there have been two incidences of historic flooding within Ram's Brook. These events occurred 2km downstream from the site.
- 5.2.3. There are no known flooding incidents which have affected the direct areas of the development.

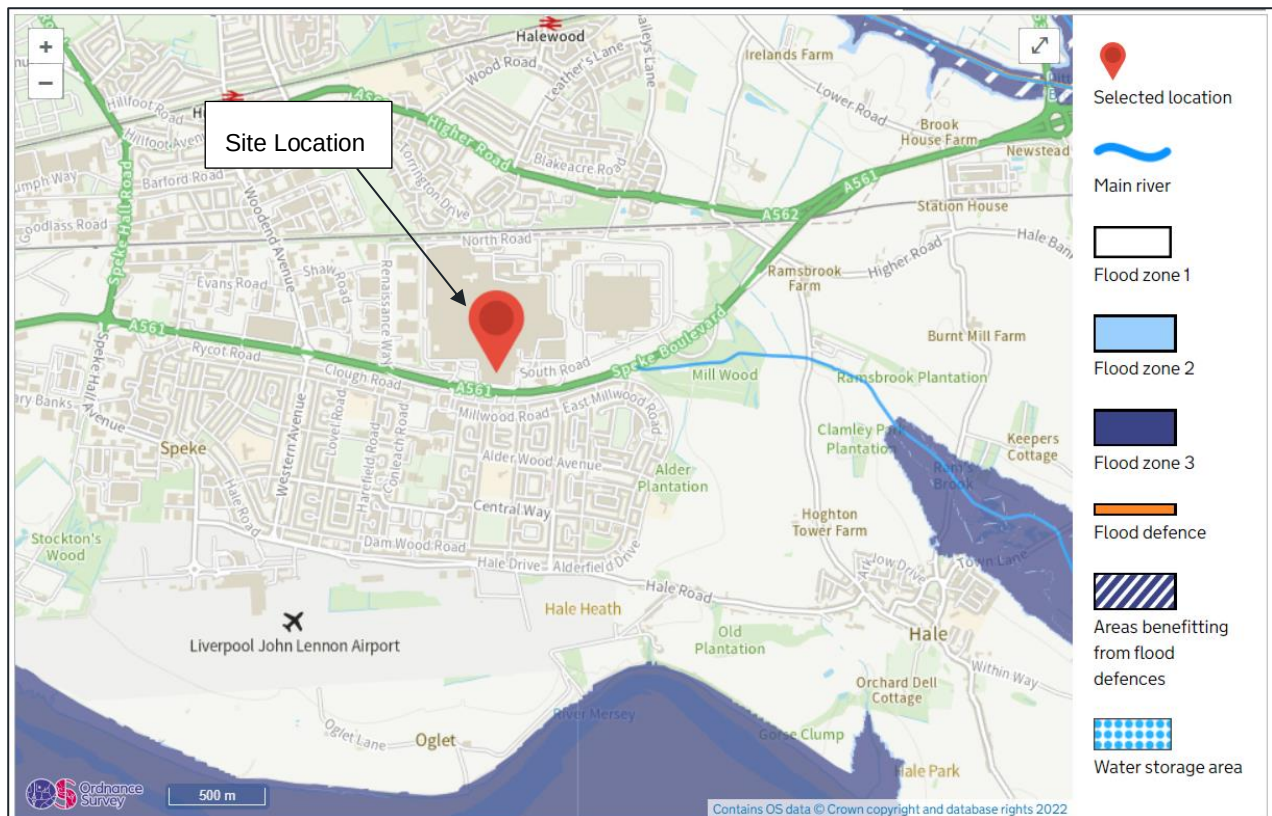
### 5.3 FLOOD RISK FROM RIVERS

- 5.3.1. The EA holds the most up to date information on fluvial flood risk for the Halewood area including the River Mersey. Therefore, the EA web-based information has been used as the basis for this FRA.

#### EA Flood Map for Planning

- 5.3.2. The EA flood map for planning (Figure 5-1) indicates that the site is within Flood Zone 1 (Low Probability).
- 5.3.3. Ram's Brook is located approximately 600m downstream from the eastern boundary of the site. The EA flood map does not show the site to be at risk of flooding from Ram's Brook.
- 5.3.4. Based on the above information, the fluvial flood risk from Ram's Brook is considered low.

**Figure 5-1 - EA Fluvial Flood Risk (Source - EA, 2022)**



### 5.4 FLOOD RISK FROM SURFACE WATER

#### SFRA Susceptibility to Surface Water Flooding Mapping

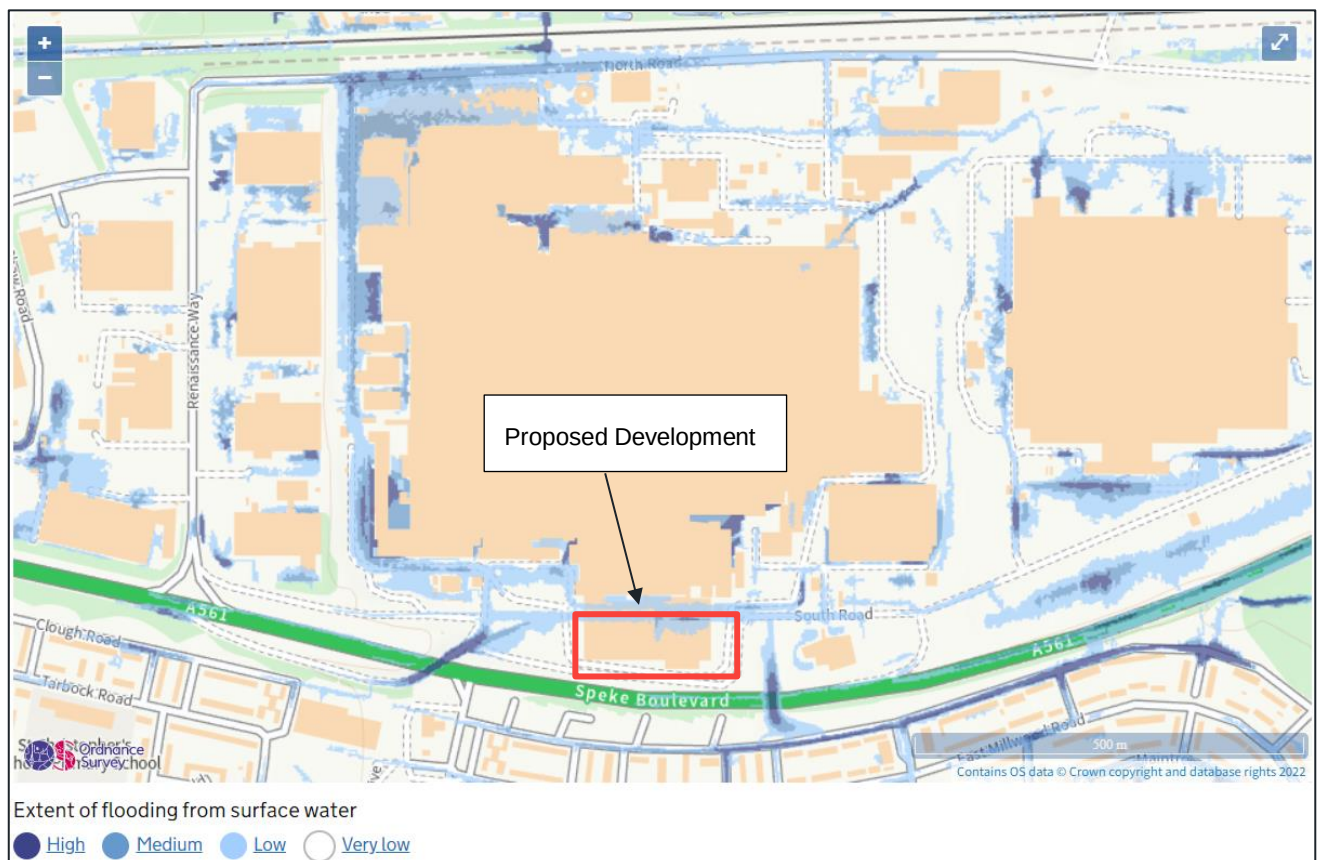
- 5.4.1. The SFRA includes first generation surface water flood mapping, which identifies locations which are more, immediately and less vulnerable to surface water flooding.

- 5.4.2. In the SFRA mapping, the site location is identified to be within an area that is at medium to low risk of surface water flooding. The areas affected are North Road, South Road, and the exterior of the Jaguar Land Rover Halewood Operations.

#### EA Surface Water Flood Risk Mapping

- 5.4.3. The freely available EA Risk of Flooding from Surface Water Maps were utilised to assess the risk of flooding from surface water at the site, this is provided in Figure 5-2.
- 5.4.4. Overall, based on the information available, the development site is identified as being between medium to low risk (chance of flooding between 0.1% and 3.3%) of surface water flooding.
- 5.4.5. In addition, there is a small risk of surface water runoff from North Road to the development site. However, there are surface water drainage systems in place to reduce this risk to the site.

**Figure 5-2 - EA Surface Water Flood Risk (Source - EA, 2022)**



## 5.5 SURFACE WATER RUNOFF RATES

- 5.5.1. To comply with the DEFRA Non-Statutory Technical Guidance for Sustainable Drainage Systems S3, the peak runoff rate for the 1 in 1 year (100% annual exceedance probability) and the 1 in 100 year (1% annual exceedance probability) rainfall events from the developed site must be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event; and the peak runoff rate must never exceed the rate of discharge from the development site prior to the development.

### Existing Scenario (Brownfield)

- 5.5.2. The site in its current state is considered developed (Brownfield). Post-development, there will be no increase in impermeable area on site and no corresponding increase in the rate of surface water runoff.
- 5.5.3. The runoff values from the site in the QBAR, 1 in 2, 1 in 30, 1 in 100 and 1 in 200-year rainfall events, calculated based on the IH124 method as summarised in Table 5-2.
- 5.5.4. Parameters used in the IH124 method were taken from HR Wallingford web service; point descriptors for the site location were selected and the IH124 method plot scale equations and methodology applied to the site.

**Table 5-2 – Pre-Development (Brownfield) Runoff**

| Rainfall Event (Return Periods, Years) | Runoff (l/s) using IH124 Method |
|----------------------------------------|---------------------------------|
| Qbar                                   | 10.5                            |
| 1 in 2                                 | 9.1                             |
| 1 in 30                                | 17.9                            |
| 1 in 100                               | 21.8                            |

### Climate Change

- 5.5.5. Climate Change within the UK over the next few decades is likely to result in changes to observed weather patterns, which will be subject to regional variations. This could include milder wetter winters and hotter drier summers. Short duration, high intensity rainfall and more periods of long duration rainfall are expected, in addition to rising sea levels. These factors may lead to an increased risk of flooding to planned developments and so the consequences of climate change need to be anticipated and mitigated.
- 5.5.6. The importance of climate change in regard to flooding and development is highlighted in the EA's 'Flood Risk Assessments: Climate Change Guidance'. The climate change recommended precautionary sensitivity ranges for rainfall are shown in Table 5-3 and Table 5-4. For FRA's, this guidance suggests the assessment of both the Central and Upper End allowances to understand the range of impacts.
- 5.5.7. Based on a 100-year design life, the 2061 – 2125 peak rainfall intensity increases for the 1% AEP of both 30% (Central) and 45% (Upper End) and 3.3% AEP of both 25% (Central) and 40% (Upper End) have been used in this assessment.

**Table 5-3 – 1% Annual Exceedance Peak Rainfall Intensity Allowance for the Lower Mersey Management Catchment. Flood Risk Assessments: Climate Change Allowance (Source – EA, 2022)**

| Applies to the Lower Mersey Management Catchment | Total potential change anticipated for the '2050s' (2022 to 2060) | Total potential change anticipated for the '2070s' (2061 to 2125) |
|--------------------------------------------------|-------------------------------------------------------------------|-------------------------------------------------------------------|
| Central                                          | 25%                                                               | 40%                                                               |
| Upper End                                        | 30%                                                               | 45%                                                               |

**Table 5-4 – 3.3% Annual Exceedance Peak Rainfall Intensity Allowance for the Lower Mersey Management Catchment. Flood Risk Assessments: Climate Change Allowance (Source- EA, 2022)**

| Applies to the Lower Mersey Management Catchment | Total potential change anticipated for the '2050s' (2022 to 2060) | Total potential change anticipated for the '2070s' (2061 to 2125) |
|--------------------------------------------------|-------------------------------------------------------------------|-------------------------------------------------------------------|
| Central                                          | 20%                                                               | 30%                                                               |
| Upper End                                        | 35%                                                               | 40%                                                               |

- 5.5.8. Surface water runoff accounting for climate change was assessed over the design life of the development. Accounting for this, the revised runoff values from the site are presented in Table 5-5.

**Table 5-5 – Existing Brownfield Runoff with Climate Change**

| Rainfall Event (Return Period, Years) | Existing Pre-development Runoff (l/s) | Proposed Post-development Runoff (l/s) |
|---------------------------------------|---------------------------------------|----------------------------------------|
| 1 in 100 + Climate Change (Central)   | 30.52                                 | 30.52                                  |
| 1 in 100 + Climate Change (Upper End) | 31.61                                 | 31.61                                  |

- 5.5.9. The impacts of climate change should be considered when designing the new drainage infrastructure. Surface water attenuation systems need to be designed so there is no flooding to properties on or off site for rainfall events up to the 1 in 100-year event (including an allowance for climate change).

#### Post-Development Scenario

- 5.5.10. Table 5-6 presents the existing and proposed brownfield runoff rates (based on the 1.91 hectare application site).

**Table 5-6 – Runoff Rates for the Proposed Development**

| Rainfall Event (Return Period, Years) | Existing Pre-development Runoff (l/s) | Proposed Post-development Runoff (l/s) |
|---------------------------------------|---------------------------------------|----------------------------------------|
| Qbar                                  | 10.5                                  | 10.5                                   |
| 1 in 2                                | 9.1                                   | 9.1                                    |
| 1 in 30                               | 17.9                                  | 17.9                                   |
| 1 in 100                              | 21.8                                  | 21.8                                   |
| 1 in 100 + Climate Change (Central)   | 30.52                                 | 30.52                                  |
| 1 in 100 + Climate Change (Upper End) | 31.61                                 | 31.61                                  |

- 5.5.11. Knowsley Council promote the use of SuDS to attenuate peak flows, produce water quality improvements and environmental enhancements where ground conditions are suitable. Any attenuation or infiltration features will be required to be designed in accordance with Knowsley Council requirements for SuDS.

- 5.5.12. Based on the information above, a detailed drainage strategy should be prepared for this site as the proposals progress; to ensure any increased flood risk, on or off site, from surface water runoff is mitigated.
- 5.5.13. At this stage is it proposed that surface water runoff from the site is adequately intercepted, attenuated, and discharged on site to the existing Surface water drainage system. This should be provided with the rate of discharge limited to the pre-existing development brownfield runoff rates.
- 5.5.14. The use of SuDS should be considered to provide betterment and reduce discharge rates below the pre-existing brownfield runoff rates.

## **5.6 FLOOD RISK FROM SEWERS**

- 5.6.1. The PFRA and SFRA mapping shows that there are no incidents of sewer flooding on record within the site and the surrounding industrial park. In addition, online searches did not uncover any additional historic sewer flooding events close to the site. Therefore, it is considered that the site is at low risk of flooding from a sewer.

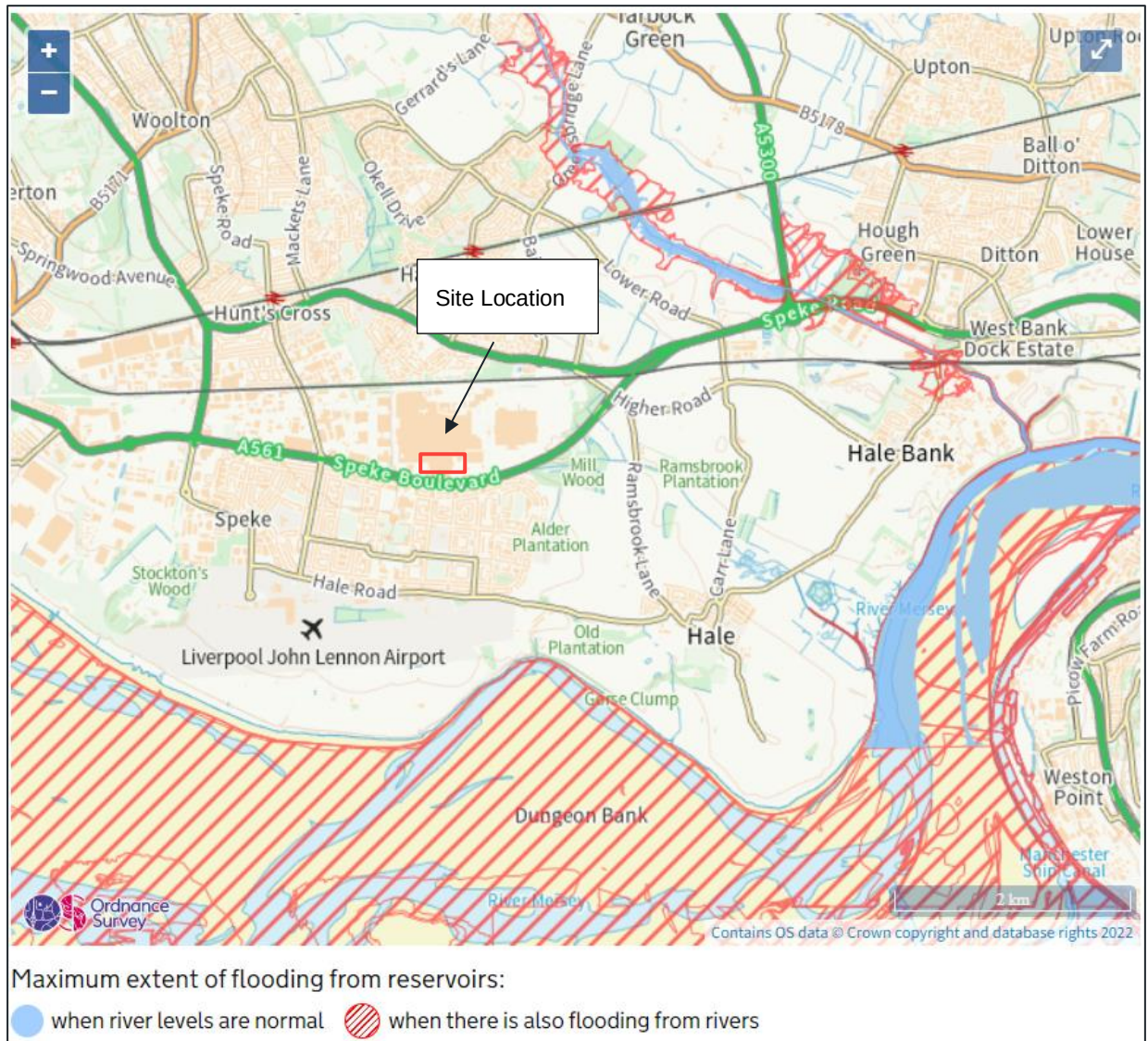
## **5.7 FLOOD RISK FROM GROUNDWATER**

- 5.7.1. The development site is located in an area at medium risk of flooding from emergence of groundwater (between 25% and 50%). Therefore, appropriate pollution treatment mitigations will be required for the proposed soakaway drainage system.
- 5.7.2. The site does not lie within an EA Groundwater Source Protection Zone as currently published on the DEFRA Magic Map web-based service.
- 5.7.3. On the basis of the above, it is considered to be at medium risk of groundwater flooding.

## **5.8 FLOOD RISK FROM RESERVOIRS**

- 5.8.1. The EA web-based mapping identifies the site is not within the vicinity of a reservoir (Figure 5-3).
- 5.8.2. Therefore, the risk of flooding from reservoirs is considered to be very low.

Figure 5-3 - EA Reservoir Flood Risk (Source - EA, 2022)



## 5.9 FLOOD RISK FROM CANALS

- 5.9.1. There are no canals located within the vicinity of the site or surrounding areas. Therefore, the risk of flooding from canals is considered to be very low.

## 6 FLOOD RISK MITIGATION

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- 6.1.1. Chapter 5 identified that the proposed development will not increase the impermeable area on site and therefore will not increase the risk of surface water flooding on or off site. To ensure that the current flood risk is not exacerbated elsewhere, appropriate measures should be taken.
- 6.1.2. It is recommended that SuDS are incorporated within the development. SuDS aim to reduce the risk of flooding on the site by imitating natural drainage and managing surface water runoff in a more sustainable way. In addition to reducing the risk of flooding, SuDS can also produce water quality improvements and environmental enhancements on site.
- 6.1.3. Provided that surface water from roof drainage and other paved/drained areas is intercepted, surface water runoff from the development can be suitably managed and this will not lead to possible flooding for the site or elsewhere. A range of SuDS components are outlined in the SuDS Manual (CIRIA C753, 2015).
- 6.1.4. At this stage of the proposed development, it is recommended that the following SuDS options be considered for the site.
- Attenuation Storage Tanks are used to store the required volume of surface water runoff beneath ground prior to discharge at a restricted rate.
- 6.1.5. The use of SuDS is dependant to some extent on the ground conditions, and it is recommended that before SuDS are incorporated into this development, a thorough assessment of their suitability is undertaken as the drainage design progresses; including site-based infiltration should infiltration options be considered.
- 6.1.6. For areas where vehicles are going to be regularly present, fuel interceptors may be required to reduce the risk of hydrocarbons entering the drainage system.
- 6.1.7. In addition to the use of SuDS, the external ground levels should always slope away from any building, especially entrances to avoid ponding of water against or within the structure.

## 7 CONCLUSIONS AND RECOMMENDATIONS

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- 7.1.1. Flood risk related to the proposed development has been assessed in accordance with the National Planning Policy Framework (NPPF) and the Planning Policy Guidance (PPG). Environment Agency (EA) and British Geological Survey (BGS) data; and the Knowsley Council Strategic Flood Risk Assessment Maps (SFRA, 2012); Knowsley Council Preliminary Flood Risk Assessment (2011); Knowsley Council Local Flood Risk Management Strategy Maps (LFRMS, 2017) have also been used to gather information for this study.
- 7.1.2. A review of the EA flood risk zones for rivers has shown that the site lies within Flood Zone 1 and is considered to be at low risk of flooding. In addition, the proposed development, classed as 'Less Vulnerable' under the NPPF, is appropriate in this location and does not require to undertake the Exception Test.
- 7.1.3. The Knowsley Council PFRA, SFRA and EA surface water flood risk maps indicate that the site is within medium to low risk of flooding from surface water.
- 7.1.4. There is no known historic sewer flooding associated with the site. Therefore, the flood risk to the site from sewers is considered to be low.
- 7.1.5. The site is underlain by slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils and is located within an area that is at 25%-50% of groundwater emergence. Therefore, the flood risk from groundwater to the site is considered medium.
- 7.1.6. There are no canals or reservoirs located within the vicinity or surrounding areas of the development site. Therefore, the flood risk from artificial sources is considered very low.
- 7.1.7. Based on the findings of this FRA, it is considered that there are no grounds for objection to the proposed development on the basis of flood risk, providing that the recommendations are followed.



Opus House  
Yale Business Village  
Wrexham Technology Park  
Wrexham  
1st Floor Station House  
Tithebarn Street  
Exchange Station  
Liverpool  
L2 2QP

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