



EASTLANDS CAR PARK

Flood Risk Assessment

Jaguar Land Rover Limited

JULY 2019



VERSION CONTROL

Version	Date	Author	Checker	Approver	Changes
031-UA008628-WEN-01	29/02/2016	EB	LD	LD	Issue for Client comment
031-UA008628-WEN-02	03/03/2016	EB	LD	LD	Final for Planning
10033196	05/07/2019	EB	IJ	IJ	Update for Planning Extension

This report dated 05 July 2019 has been prepared for Jaguar Land Rover Limited (the “Client”) in accordance with the terms and conditions of appointment dated 07 June 2019 (the “Appointment”) between the Client and **Arcadis (UK) Consulting Limited** (“Arcadis”) for the purposes specified in the Appointment. For avoidance of doubt, no other person(s) may use or rely upon this report or its contents, and Arcadis accepts no responsibility for any such use or reliance thereon by any other third party.

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1 Introduction

1.1 General

Arcadis Consulting (UK) Limited (“Arcadis”) has been instructed by Jaguar Land Rover Limited (“the Client”) to update the previous Flood Risk Assessment (FRA) prepared in March 2016 (Arcadis document reference: 031-UA008628-WEN-02) as it is understood that the Client intends to apply for an extension of the existing temporary planning permission, addressed in the previous FRA, for another three years.

This report revisits the findings of the previous FRA with respect to the provision of extended and temporary parking within the plant boundary in the area known as Eastlands.

1.2 Description of Development

In 2016, planning approval was granted for the creation of 1,589 temporary parking spaces on and around the existing Eastlands car park (shown in the images below). This was inclusive of the existing 304 spaces already on the site and was intended to free up other areas of the site for future development associated with increased market demands. The proposals included the replacement of the existing Eastlands car park and surrounding land within the fence-line with hard-standing marked with parking spaces. The surrounding areas were largely topsoil-stripped and cleared in the past. The proposals also included the redevelopment of an area of scrubland which would also need to be cleared and replaced with a temporary surfacing.

An indicative plan of the 2016 proposals is presented in Images 1-1 and 1-2 below, indicating two distinct car parking areas, in the north and south respectively (collectively termed “the application site” hereafter):

Image 1 Identification of proposed Eastlands car park within Jaguar Land Rover Halewood

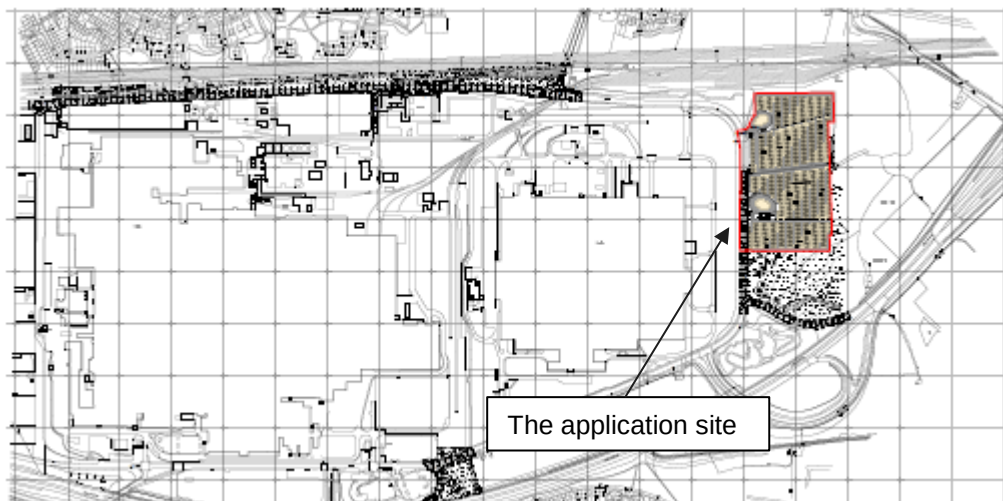
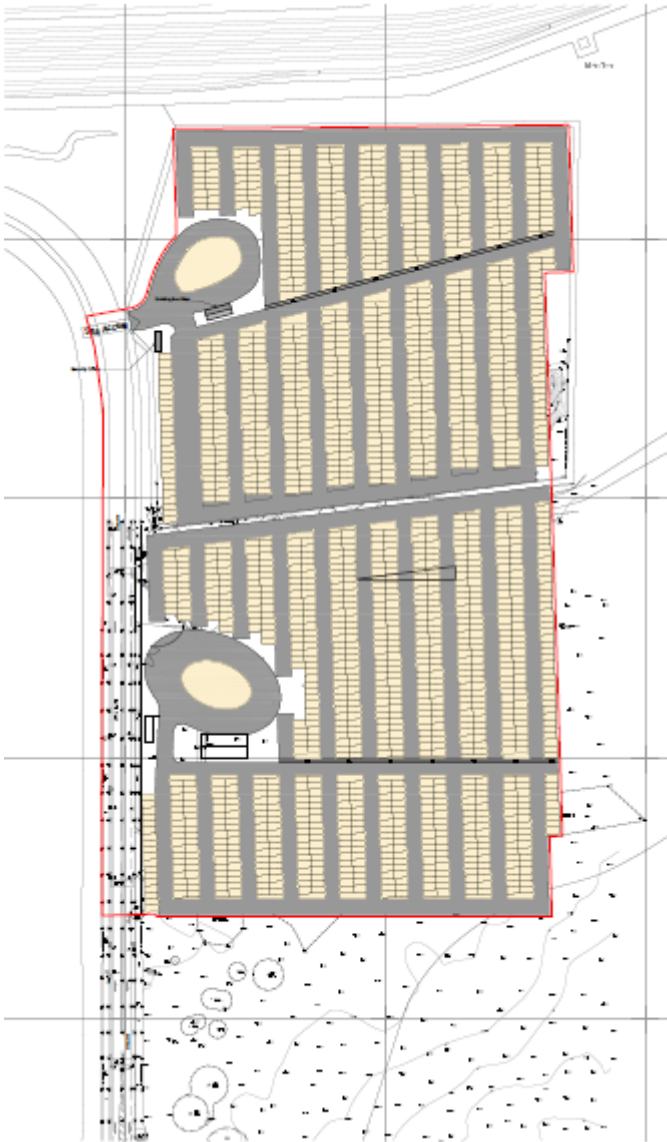


Image 2 Indicative layout of proposed Eastlands car park



It is understood that, following the original planning approval in 2016, the proposed were partially implemented, with the southern car park built out in its entirety, along with only the southern portion of the northern car park. The remainder of the northern car park, along the northern edge of the application site, has not yet been implemented.

1.3 Scope of Works

A single site assessment of Jaguar Land Rover Halewood has been carried out to inform future planning applications but this report focusses on the application site. The following tasks have been undertaken as part of this assessment, which is an update to the original FRA (031-UA008628-WEN-02):

1. Review existing data (e.g. Strategic Flood Risk Assessment, Preliminary Flood Risk Assessment, EA flood risk mapping)
2. Qualitative assessment of flood risk from all sources
3. Identify key flood risk constraints and management strategies
4. Update the FRA report to address any specific changes since the original planning approval and partial construction of the approved proposals.

1.4 Terminology

Flood risk is a product of both the likelihood and consequence of flooding. Throughout this report, flood events are defined according to their likelihood of occurrence. Floods are described according to an 'annual chance', meaning the chance of a particular flood occurring in any one year. This is directly linked to the probability of a flood. For example, a flood with an annual chance of 1 in 100 (a 1 in 100 chance of occurring in any one year), has an annual exceedance probability (AEP) of 1%.

2 Background

2.1 Site Location

The Jaguar Land Rover Plant is located in Halewood, Merseyside, as illustrated in Figure 2-1. Within the plant, the application site is located towards the eastern boundary, as previously shown in Image 1.

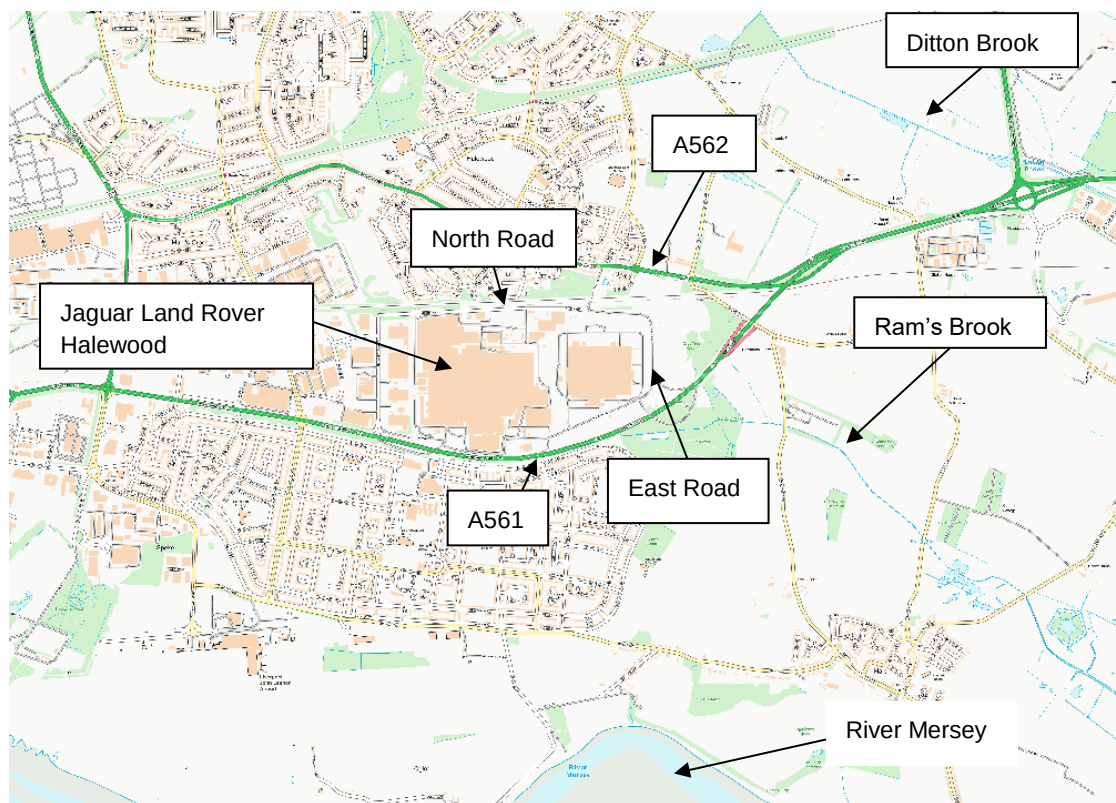


Figure 2-1: Location of Jaguar Land Rover Halewood (Contains OS data © Crown copyright and database right 2019)

2.2 Site Description

The site is bounded by East Road to the west and an access road to the south. Prior to development of the temporary car park under the 2016 planning approval, the site comprised trees, spoil mounds, wire mesh fencing, scrub, concrete, grass, gravel, overgrown areas and a waterlogged area to the east of the centre of the site.

2.3 Topographic Survey

A topographic survey was undertaken by MSurveys (Ref.3) in February 2016. Pre-development ground levels across the site varied from 20.41 metres Above Ordnance Datum (mAOD) to 24.02mAOD, with the highest elevation in the north, at the top of the spoil heaps. The topography survey is included in Appendix A.

2.4 Historical Flooding Information

The Preliminary Flood Risk Assessment (PFRA) prepared by Knowsley Council (Ref.4) was consulted to seek any evidence of historic flooding at the application site or wider plant. Figure 4-1 in the PFRA shows that surface water flooding has previously occurred in the residential areas to the north of the site but not occurred on site. In 2011, a storm with an estimated annual chance of 1% caused internal flooding of 12 residential properties and 3 non-residential properties across the borough, with no evidence to suggest that the application site or wider plant was affected. Data from 2008, provided by United Utilities to inform the

PFRA, records 12 surface water flooding incidents caused by lack of capacity in the sewer network, however none of these events occurred in Halewood and there is no evidence that the site or wider plant has been affected by flooding from sewers.

The Level 2 Strategic Flood Risk Assessment (SFRA; Ref.5) discusses flood risk from the Ditton Brook. Similarly, the Local Flood Risk Management Strategy (LFRMS) (Ref. 6) details the Environment Agency (EA) Flood Warning Areas for Knowsley in Appendix 2; Ditton Brook at Halewood is identified as a Flood Warning Area affecting 96 properties. However, as illustrated in Figure 2-1, this watercourse is approximately 1.9km (and is downslope) from the application site and hence there are no associated records of flooding associated with the application site or wider plant. The SFRA report states that groundwater flooding is considered a potential source of flooding in some locations in the borough.

During preparation of the previous FRA, Knowsley Council were contacted, in their role as lead Local Flood Authority (LLFA), regarding flood risk to the site from local sources. No response was received at the time.

3 National Planning Policy Framework

3.1 Overview

The NPPF, 2019 (Ref.1) and its accompanying Planning Practice Guidance, 2019 (Ref.7) sets out Government planning policy for England. The principle aim of the NPPF is to achieve sustainable development. This includes ensuring that flood risk is taken into account at all stages of the planning process, avoiding inappropriate development in areas at risk of flooding and directing development away from those areas where risks are highest. Where development is necessary in areas at risk of flooding, the NPPF aims to ensure that it is safe, without increasing flood risk elsewhere.

A site-specific FRA is required for proposals of 1 ha or greater in Flood Zone 1; all proposals for new development (including minor development and change of use) in Flood Zones 2 and 3, or in an area within Flood Zone 1 which has critical drainage problems (as notified to the local planning authority by the EA); and where proposed development or a change of use to a more vulnerable class may be subject to other sources of flooding. The FRA should identify and assess the risks of all forms of flooding to and from the development and demonstrate how these flood risks will be managed so that the development remains safe throughout its lifetime, taking climate change into account.

Early adoption of, and adherence to, the principles set out in the NPPF and its Technical Guidance, with respect to flood risk, can ensure that detailed designs and plans for developments take due account of the importance of flood risk and the need for appropriate mitigation, if required.

3.2 The Sequential and Exception Tests

The NPPF identifies four Flood Zone classifications, detailed in Table 3-1

Flood Zone	Annual Probability of Flooding (%)	Corresponding Annual Chance of Flooding (1 in x Years)
1. Low Probability	Fluvial and Tidal <0.1%	< 1 in 1,000
2. Medium Probability	Fluvial 0.1-1.0% Tidal 0.1-0.5%	Between 1 in 100 and 1 in 1,000 Between 1 in 200 and 1 in 1,000
3a. High Probability	Fluvial > 0.1% Tidal > 0.5%	> 1 in 100 > 1 in 200
3b. The Functional Floodplain	Fluvial and Tidal > 5.0% * Starting point for consideration. LPAs should identify Functional Floodplain, which should not be defined solely by rigid probability parameters	>1 in 20

Table 3-1: Flood Zones (Planning Practice Guidance – Flood risk and coastal change, Table 1)

The NPPF specifies that the suitability of all new development in relation to flood risk should be assessed by applying the Sequential Test. This test should be used to demonstrate that there are no reasonably available sites in areas with a lower probability of flooding that would be appropriate to the type of development proposed. The NPPF provides guidance on the suitability of each land use classification in relation to each of the Flood Zones as summarised in Table 3-2.

Flood Zone	Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	✓	Exception Test required	✓	✓
Zone 3a	Exception Test required	✓	✗	Exception Test required	✓
Zone 3b	Exception Test required	✓	✗	✗	✗

Key:

✓ Development is appropriate

✗ Development should not be permitted

Table 3-2: Flood Risk Vulnerability Classification (Planning Practice Guidance – Flood risk and coastal change, Table 3)

3.3 Knowsley Council Strategic Flood Risk Assessments

SFRAs are intended to guide development decisions and allow Local Planning Authorities (LPA) to apply the NPPF Sequential Test. A Level 1 SFRA (Ref.8) was completed by Atkins in 2009, it is a hybrid Level 1 assessment at Borough level for both Knowsley Council and Sefton Council. A Level 2 SFRA for Knowsley Council, was completed by Capita Symonds in 2012 (Ref.5). The specific objectives for an SFRA are as follows, taken from the Level 1 SFRA:

- Provide sufficient data and information to enable the LPA to apply the Sequential Test to land use allocations and, where necessary, the Exception Test.
- Enable the LPA to prepare appropriate policies for the management of flood risk within the Local Development Documents (LDDs)
- Inform the Sustainability Appraisal so that flood risk is taken into account when considering options and preparing strategic land use policies
- Identify the need for site specific FRAs in particular locations along with the level of detail required in these areas; and
- Enable LPAs to determine the acceptability of flood risk in relation to emergency planning capability.

3.4 Flood Zone Classification

The EA 'Flood Map for Planning (Rivers and Sea)' (Ref.2) shows that the application site is located in Flood Zone 1 (land assessed as having less than 1 in 1,000 annual probability of river or sea flooding (<0.1%)).

3.5 Application of the Sequential and Exception Tests

The development proposals are classified as 'less vulnerable' within the NPPF and the location, in Flood Zone 1, meets with the aims of the Sequential Test. **The application site is therefore appropriate for the proposed development on flood risk grounds, passing the Sequential Test. Application of the Exception Test is not required.**

3.6 Need for an FRA

NPPF states that development of less vulnerable land use is appropriate in Flood Zone 1. However, all applications for development proposals on sites of 1 hectare or above in Flood Zone 1 should be accompanied by an FRA. The remainder of this report provides a qualitative assessment of the flood risk to the application site from all potential sources.

4 Potential Sources of Flooding

4.1 Overview

In line with best practice, this section of the FRA considers flood risk from the range of possible sources listed in Table 4-1.

Source of Flooding	Description
1. Flooding from Rivers (Fluvial)	Floodwater originating from a nearby watercourse when the amount of water exceeds the channel capacity of that watercourse
2. Flooding from the Sea (Coastal)	High tides, storm surges and wave action, often acting in combination, flooding low-lying coastal land
3. Flooding from Groundwater	Flooding caused when groundwater levels rise above ground level following prolonged rainfall
4. Flooding from Land (Surface Water)	Flooding caused by intense rainfall exceeding the available infiltration and/or drainage capacity of the ground
5. Flooding from Sewers	Flooding originating from surface water, foul or combined drainage systems, typically caused by limited capacity or blockages
6. Flooding from Reservoirs, Canals and other Artificial Sources	Failure of infrastructure that retains or transmits water or controls its flow

Table 4-1: Sources of Flooding

4.2 Fluvial

The Flood Map for Planning (Rivers and Sea) shows that the application site is in Flood Zone 1 and is therefore at 'low probability', in planning terms, of fluvial flooding from rivers equivalent to an annual chance of flooding less than 1 in 1,000 (0.1%).

The Flood Map for Planning (Rivers and Sea) does not typically illustrate fluvial flood risk from ordinary watercourses and, as illustrated in Figure 2-1, the Ram's Brook is located in close proximity to the application site and ultimately receives drainage from the application site and surrounds. Flood risk from this source is minor given that the topography is such that any out of bank flows from the Brook would travel to the south east away from the application site, which is upslope of the watercourse.

The site is therefore considered to be at very low risk of fluvial flooding.

4.3 Coastal

The application site and wider plant are at a minimum distance from the coast/River Mersey estuary of approximately 1.5km. The topographic survey shows that ground levels across the applicaiton site vary from 20.41mAOD to 24.02mAOD such that it is sufficiently elevated so as not to be at elevated risk of coastal flooding.

The site is therefore considered to be at very low risk of coastal flooding.

4.4 Groundwater

Groundwater flooding occurs when water originating in aquifers reaches the surface, typically as a result of high groundwater levels caused by prolonged rainfall, obstructions to groundwater flow or rebound of previously depressed groundwater levels.

With reference to public data provided by the British Geological Survey (BGS) Geology of Britain Viewer (Ref.10) the bedrock geology underlying the development site consists of the Kinnerton Sandstone Formation – Sandstone. Superficial deposits of Till, Devensian – Diamicton (i.e. glacial till) are also recorded. The Kinnerton Sandstone formation is a fine to medium grained and pebble free sandstone, it has a high porosity and the ability to store groundwater (Ref.11).

The bedrock is classified by the EA as a Principal Aquifer, while the superficial deposits are classified as a Secondary (undifferentiated) Aquifer. Principal Aquifers provide a high level of water storage which could result in the potential for groundwater flooding, if not overlain by less permeable superficial deposits or land cover. Secondary (undifferentiated) Aquifers were previously designated both minor and non-aquifer, which do not provide for groundwater storage and therefore typically act to prevent upward movement of groundwater from the bedrock.

The 1:250,000 soil map of England and Wales (Ref.12), classify underlying soils as 'urban not classified' or 'Salop' (711M), which is described as reddish till, made up of fine loamy soils over clayey soils prone to slight seasonal waterlogging.

The PFRA provides indicative mapping that shows areas susceptible to groundwater flooding within the borough. The application site is not included within this area. However, a Groundsure report, dating to January 2016 (Ref.13), suggests that there is a potential for groundwater flooding and during the topographical survey an area of waterlogged ground was noted.

Given the typically cohesive and reasonably impermeable nature of the glacial till mapped across the application site and surrounds, it is possible that any water logging was caused by local retention of rainfall within low-lying areas, rather than groundwater rising to the surface.

Overall, it is considered that the site has a potential risk of localised groundwater flooding. However, the application site's proposed use as a car park limits the vulnerability of the development to shallow depths of flooding from groundwater. This is because the largely impermeable land cover would limit the potential for groundwater to rise to the ground surface, while at the same time installed drainage systems would act to provide a pathway for shallow surface flows to drain below ground.

4.5 Surface Water

Flooding from the land (often known as surface water flooding) occurs when extreme rainfall exceeds the infiltration or drainage capacity of the ground surface. This form of flooding can pose both a flood risk to a site, from surface water runoff from off-site area, and an increased flood risk to adjacent sites, where proposed development affects the existing rainfall runoff regime.

The EA Risk of Flooding from Surface Water map (Ref.2) shows that the majority of the application site has a very low risk of surface water flooding, equivalent to an annual chance less than 1 in 1,000 (0.1%). In the west and east of the site, some areas are shown to experience localised flooding in a low and medium likelihood surface water flood event, with an annual chance of 1 in 1,000 (0.1%) and 1 in 100 (1%) respectively. While areas at risk in a high likelihood surface water flood event, with an annual chance of 1 in 30 (3.3%) are restricted to small areas to the east and west of the application site.

The Knowsley and Sefton SFRA documents surface water flooding from council records, with the closest area to the development site experiencing surface water flooding issues being located to the north east, near Higher Road.

Overall, surface water flooding is not considered to pose an onerous risk to the application site, but the redevelopment of the site, since it results in an increase in impermeable land cover, has the potential to impact on existing runoff rates and volumes. A suitable surface water drainage system is therefore required to manage this source, as discussed further in Section 5.

4.6 Sewers

The Preliminary Flood Risk Assessment (Ref.4) shows a table of historic surface water flooding and combined sewers that have been identified to be hydraulically inadequate. Halewood as an area is not mentioned in the table and there is no evidence to suggest that the site has a history of being affected by sewer flooding.

This absence of flood history, along with previously undeveloped nature of the application site **means it is therefore considered to be at very low risk of sewer flooding.**

4.7 Reservoirs, Canals and other Artificial Sources

The EA Risk of Flooding from Reservoirs Map shows the maximum potential flood extent, in the event that all reservoirs with a capacity of over 25,000 cubic metres were to fail and release the water they hold. The map shows that the development site would not experience flooding in this scenario.

There are no canals in the vicinity of the site that could pose a risk to the site should they breach or overtop.

The application site therefore has a very low risk of flooding of reservoirs, canals and other artificial sources.

5 Approach to Surface Water Management

A Drainage Strategy was prepared, at the time of the original submission, to address local and national requirements with respect to the management of surface water post-development of the proposed car parking areas. The drainage strategy proposed that surface water runoff from the car parking areas would drain into gulleys with a distribution tank connected to the gully outlets. This would allow the water to permeate through a clean stone blanket under the parking areas, lined with an impermeable membrane to prevent leaching of contaminants if ground contamination was found to be present, or in the absence of ground contamination allowed to infiltrate to ground. The strategy assumed, on account of the reasonably impermeable nature of glacial till mapped as underlying the application site, that an outlet would be provided between the clean stone blanket and the existing private surface water sewer in the wider plant to the west of the application site. It was envisaged that this connection would have been restricted to greenfield runoff rates using a flow control device such as a Hydrobrake.

It is understood that, as part of construction of the proposed car parking areas following the original planning approval, an alternative strategy was instead adopted, taking account of conditions encountered on site alongside other constraints. The Client has provided an as-built drawing (attached as Appendix B) illustrating that drainage from the southern car park is now achieved via a network of French Drains installed in a linear manner between parking bays. These drains run from north to south and, instead of connecting to the existing sewer to the west, discharge via a longer length of French Drain to open ground south-east of the application site.

It is assumed that the installed French Drains consist of suitable aggregate infill containing a perforated pipe, such that attenuation volume is provided below-ground to accommodate extreme rainfall, while infiltration to ground is ultimately provided. On this basis, the impact of the proposed development on wider surface water runoff rates (e.g. sewers/watercourses) should be minimised. Quantitative review of the as-built surface water drainage system has not been undertaken by Arcadis to support this FRA and no information is available as to the drainage provision in the (partially built out) northern car park.

6 Summary

1. This FRA has been prepared to support an extension of the existing temporary planning permission for car parking on the land in the eastern part of the Jaguar Land Rover plant in Halewood, Knowsley.
2. The application site comprises the Eastland's car park, partially built-out following the original planning approval and formerly covered in grass, shrubs and trees.
3. The application site is located entirely within Flood Zone 1 on the Flood Map for Planning (Rivers and Sea), indicating a very low risk of flooding from rivers and sea.
4. The application site is also considered to be generally at low risk of flooding from coastal, surface water, sewers and artificial sources.
5. The application site is shown on some regional mapping to be at potential risk from localised groundwater flooding, but there is limited evidence for a widespread risk and the low vulnerability of the application site's use as a car park means this source of flooding is not considered to pose an onerous risk.
6. A Drainage Strategy was previously prepared to support the original planning approval. It is understood that an alternative strategy was ultimately employed upon build out of the car park, on account of ground conditions and other constraints encountered. An as-built drawing indicates that a network of French Drains has been used, routing runoff towards open ground in the south, and assume to provide both attenuation storage and infiltration potential below-ground. It is assumed that this does not result in increasing rates of runoff to local sewers (located to the west of the application site).

7 References

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APPENDIX A

Topography

APPENDIX B

As Built Drainage Plan

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