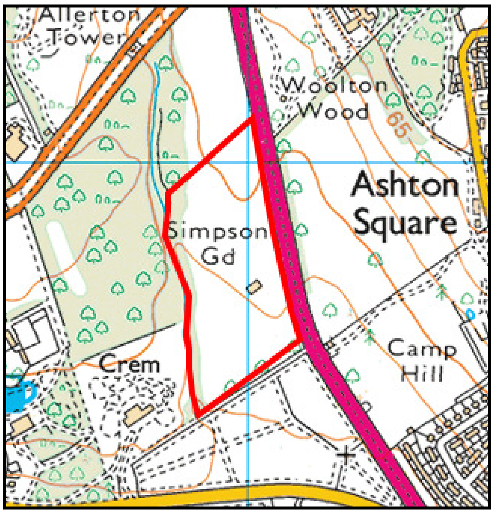
Simpson Ground

FA Parklife Project

Flood Risk Assessment



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Contents

1 Introduction

1.1 Scope

Mouchel Consulting have been commissioned by Kier Business Services to undertake a Flood Risk Assessment (FRA) for the proposed development of the Simpson Ground, Hillfoot Road, Woolton, Liverpool, L25 7UN as part of the Football Association (FA) Parklife Project.

This FRA (Level 1)[1] has been carried out in accordance with the requirements of the National Planning Policy Framework (NPPF)[2], the Planning Practice Guidance[3] (PPG) and with information available on the Environment Agency (EA) web site.

The NPPF sets out the framework for planning decisions made by local, regional and national government and the EA. The NPPF advises that FRAs are required for all developments in Flood Zones 2[4], 3a[5] and 3b[6] and for all development sites in Flood Zone 1 that are 1 hectare or greater. The proposed development site is in Flood Zone 1 and covers an area of approximately 7.76 hectares; therefore, a FRA is required.

The aim of this assessment is to establish the flood risks associated with the proposed development.

The tasks to be undertaken for this FRA are summarised as follows:

- Assess current flood risk from all sources (rivers (fluvial), sea (tidal), surface water, sewers, groundwater and all artificial sources) using existing online EA data and information from previous studies,
- Establish whether the existing and proposed development is likely to be affected by current or future flooding,
- Assess the potential impacts of the proposed development on flood risk elsewhere,

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[1] *FRA Level 1 is a screening study to identify whether there are any flooding or surface water management issues related to a development site that may warrant further consideration. This is based on available information including the SFRA. The screening study will ascertain whether a FRA Level 2 or 3 is required (http://www.ciria.org/downloads.htm).*

[2] *'National Planning Policy Framework', Department for Communities and Local Government (2012)*

[3] *http://planningguidance.planningportal.gov.uk/*

[4] *Flood Zone 2 (medium probability) comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% - 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% - 0.1%) in any year.*

[5] *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.*

[6] *Flood Zone 3b (functional floodplain) comprises land where water has to flow or be stored in times of flood.*

- Determine any necessary mitigation measures required to manage flooding issues post development in a sustainable way, and
- Set out the FRA conclusions and recommendations.

1.2 Information Provided

The following information was provided by the Client for use in this study:

- Existing site location plan (Appendix A).
- Topographic survey data for the existing site, November 2015 (Appendix B).
- Proposed site layout plan (Appendix C).
- Existing United Utilities (UU) asset location plans (Appendix D).

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

- Mersey Estuary Catchment Flood Management Plan (CFMP)[7].
- Liverpool Surface Water Management Plan (SWMP)[8].
- Liverpool City Council (LCC) Strategic Flood Risk Assessment (SFRA) and its update[9].
- LCC Preliminary Flood Risk Assessment (PFRA)[10].
- EA web based mapping[11].

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[7] *Mersey Estuary CFMP Summary Document, Environment Agency, December 2009*

[8] *Liverpool SWMP, Mouchel on behalf of Liverpool City Council, December 2011*

[9] *Liverpool City Council SFRA, 2008 and its Update, Draft submitted by Mouchel following Liverpool SWMP, April 2012*

[10] *Liverpool City Council PFRA, June 2011*

[11] *http://maps.environment-agency.gov.uk/wiyby/wiybyController?ep=maptopics&lang=_e*

2 Existing Site

The existing site (grid reference 341979, 385806) covers approximately 7.76 hectares and is currently grassed playing field and one existing building, which is assumed to includes changing facilities. There are no formal car parking or hard standing areas at the site. The site boundary is shown in Figure 1 and in Appendix A.

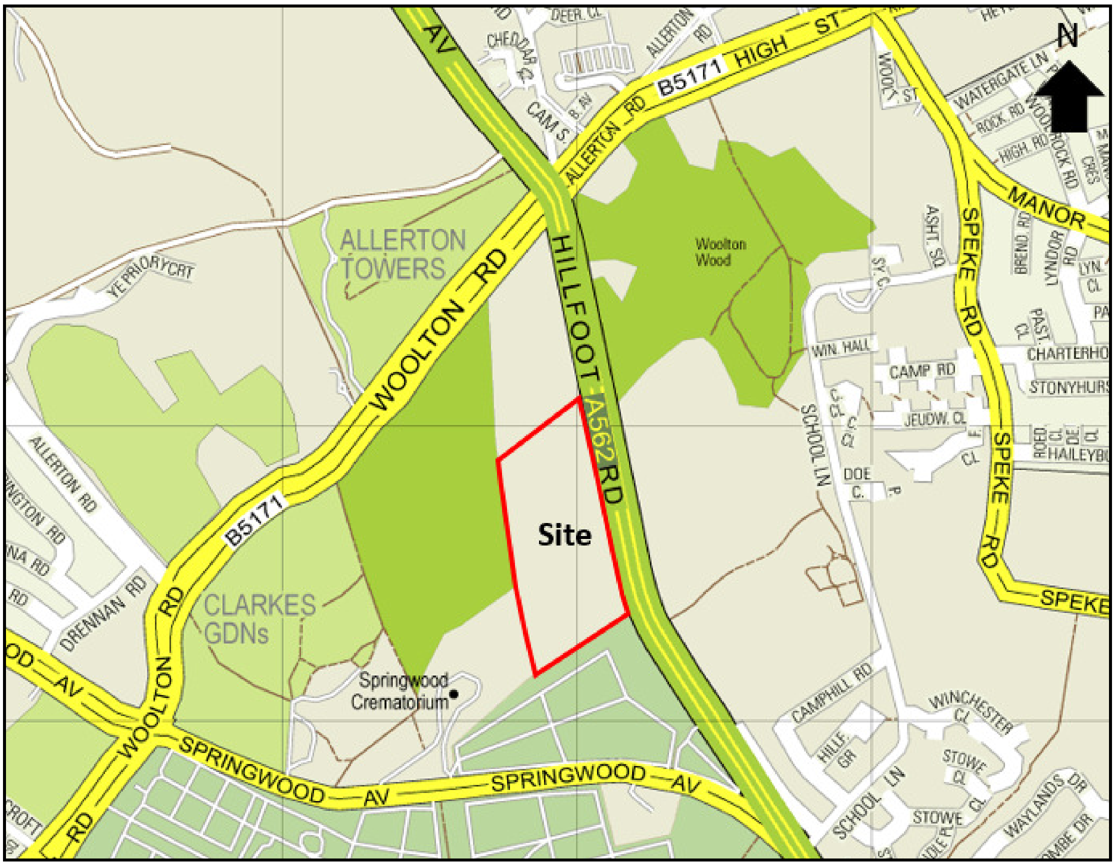

Figure 1 – Existing site boundary in red

The site is bordered by further grassed public open space to the north, Hillfoot Road (A562) to the east, and the Springwood Cemetery and Crematorium to the south and south west and wooded land to the north west.

The nearest watercourse to the site is an unnamed ‘ordinary’ watercourse that runs from north to south along the western site boundary. The nearest EA ‘main river’ to the site is Ditton Brook which is located approximately 2km to the north east of the site. The tidal River Mersey is approximately 2.9km to the south west of the site. Refer to Figure 2.

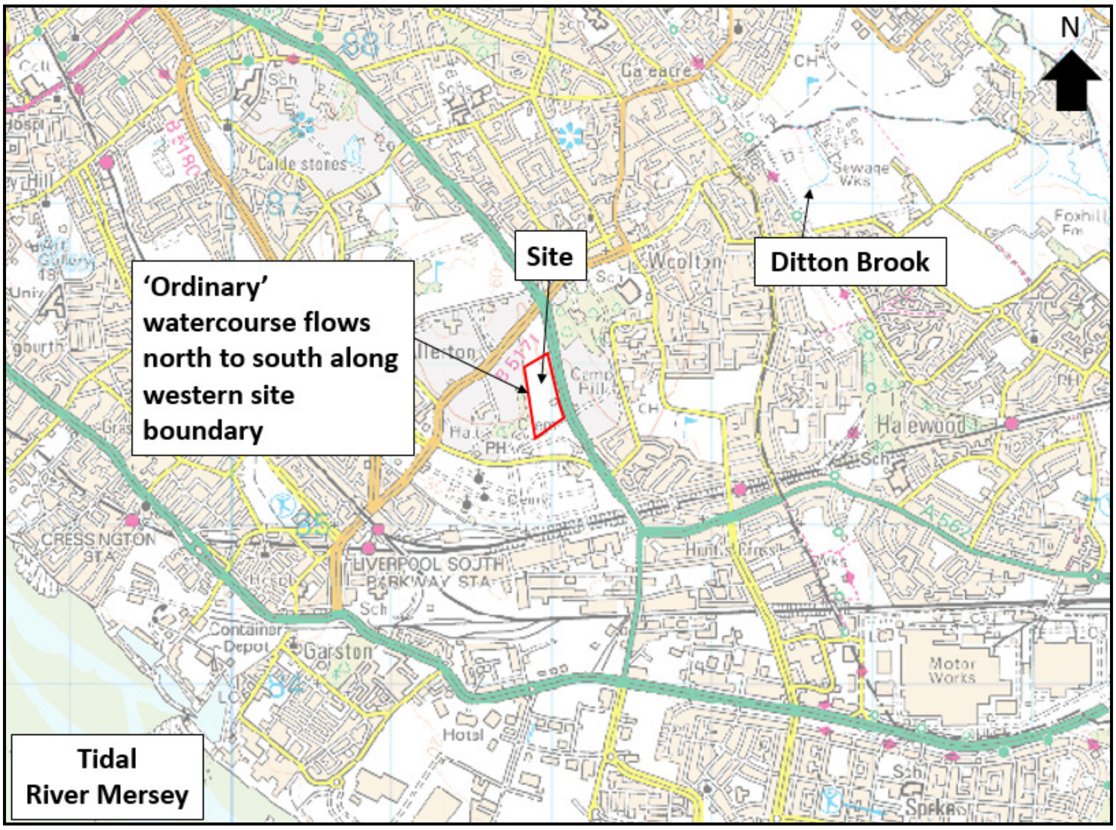

Figure 2 – Watercourse location

The site has a general slope from north east to south west. The highest point is approximately 50mAOD at the north eastern corner. The lowest point is approximately 40.5mAOD at the south western corner. The existing topographic survey was undertaken by Survey Operations in November 2015 on behalf of Kier Business Services and can be found in Appendix B Drawing Number 15J264/001.

The UU asset location information for the area of the site provided in Figure 3a and 3b (and in full in Appendix D) shows that there is a public combined sewer (red network) along the western site boundary flowing from north to south and surface water (blue network) sewers to the south west corner of the site and associated with Hillfoot Road. The combined sewer carries both surface water and foul water flows. From the existing drainage network shown in Drawing Number 15J264/001 it is understood that the surface water and foul water drainage from the existing site is served by the combined sewer along the western site boundary.

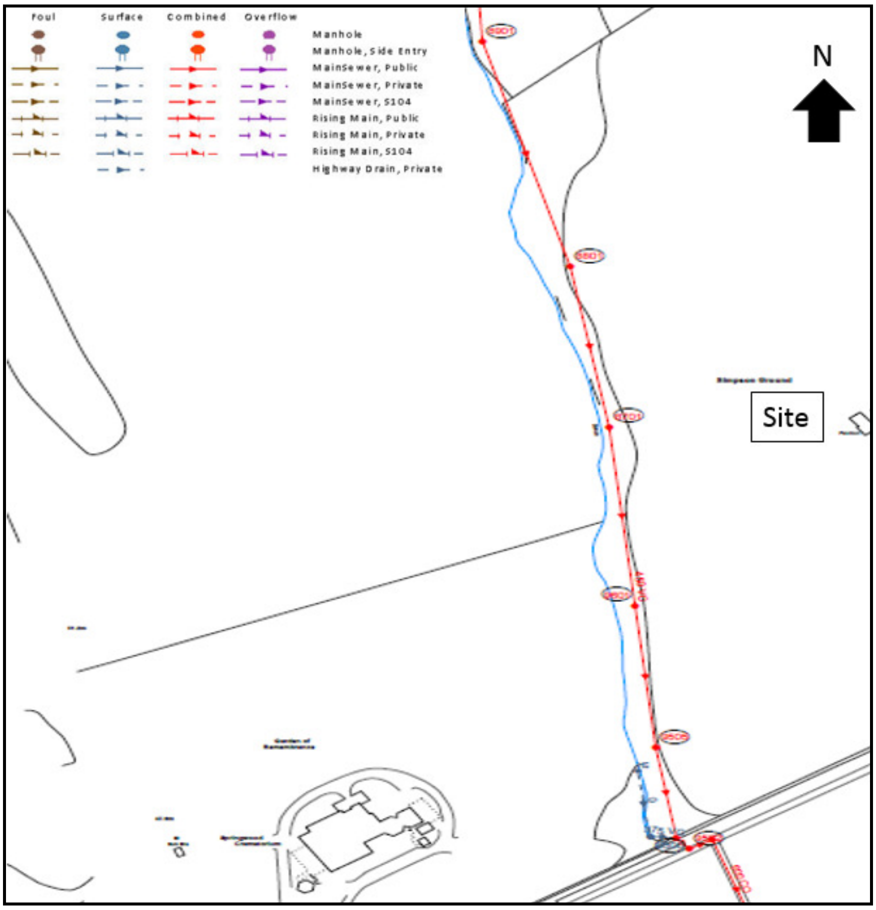

Figure 3a – Sewer locations

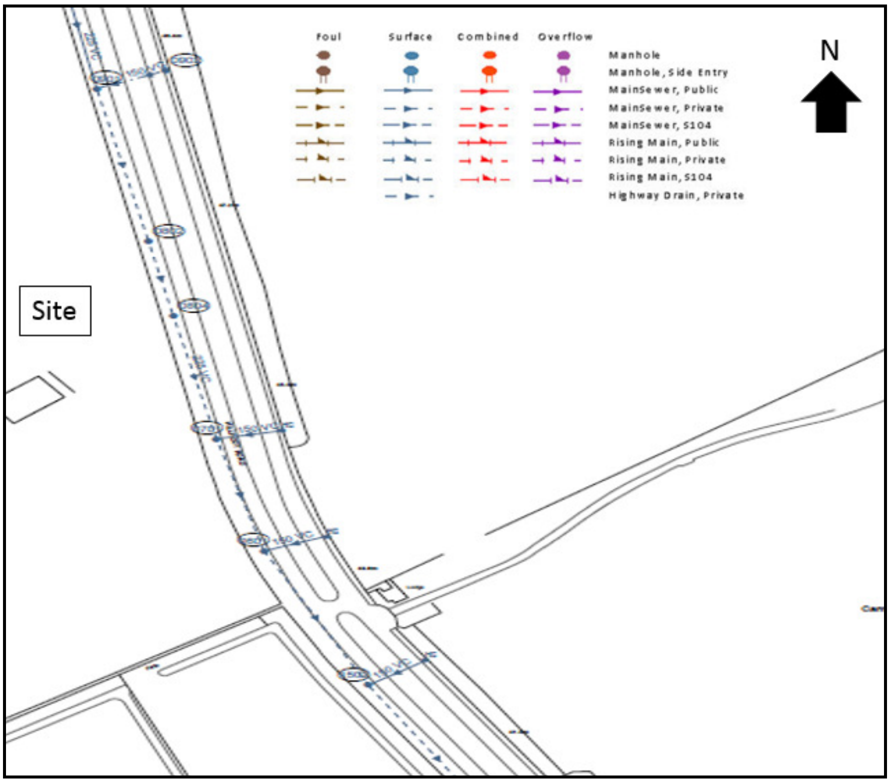

Figure 4b – Sewer locations

3 Proposed Development

The proposed development comprises of a new pavilion building that includes changing facilities, six playing pitches and a car parking area. The old pavilion building is to be demolished and replaced by the new pavilion.

The proposed site layout is shown in Figure 5 and Appendix C.

Figure 5 – Proposed site layout

4 National Planning Policy Framework

4.1 Flood Zone Definition

Table 1 shows the various flood zones as defined in the NPPF PPG. These Flood Zones refer to the probability of the river and sea flooding, ignoring the presence of any flood defences. As set out in Section 6, the site is located in Flood Zone 1.

Flood Zone 1	This zone comprises 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 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 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 land where water has to flow or be stored in times of flood. The identification of functional floodplain should take 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

Table 1 – Flood zone definitions

4.2 Flood Risk Vulnerability

In the NPPF PPG, developments are classified according to their 'Flood Risk Vulnerability' as presented in the extract from the NPPF PPG in Table 2. The Site development proposals are classified as 'Water-compatible development' under the NPPF PPG as it includes buildings to be used for "*Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms*".

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[3].
- Installations requiring hazardous substances consent[4]. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage 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")[5].

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[6].
- Sites used for holiday or short-let caravans and camping, *subject to a specific warning and evacuation plan.*[7]

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 (except landfill and hazardous waste facilities). • Minerals working and processing (except for sand and gravel working). • Water treatment works which do *not* need to remain operational during times of flood. • Sewage treatment works (if adequate measures to control pollution and manage sewage during flooding events are in place).
Water-compatible development • 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 (excluding sleeping accommodation). • 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, *subject to a specific warning and evacuation plan*.

Table 2 – Flood risk vulnerability (extract from the NPPF PPG)

4.3 Appropriate Development

The appropriate uses and FRA requirements for land in each flood zone is described in NPPF PPG.

From the flood risk analysis, the proposed development site classified as 'Water-compatible development' under "*outdoor sports and recreation and essential facilities such as changing rooms*" 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 6) shows that the proposed development is appropriate in this location and that the Exception Test is not required to be undertaken for this development proposal.

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	✓	×	×	×

Key: ✓ Development is appropriate.
× Development should not be permitted.

Figure 6 - Flood risk vulnerability and flood zone 'compatibility' (extract from the NPPF PPG)

5 Previous Studies and Historic Flood Risk

5.1 Previous Studies

5.1.1 Mersey Estuary CFMP Summary

The Mersey Estuary CFMP Summary completed in 2009 by the EA provides an overview of flood risk in the River Mersey catchments and sets out a plan for sustainable flood risk management over the next 50 – 100 years. The CFMP describes how future changes in flood risk to the catchment will be driven by climate change and urbanisation within the catchment.

The Mersey Estuary CFMP policy (Option 4) for the Maritime Mersey sub-area is 'Areas of low, moderate or high flood risk where we are already managing the flood risk effectively but where we may need to take further actions to keep pace with climate change. This policy will tend to be applied where the risks are currently deemed to be appropriately-managed, but where the risk of flooding is expected to significantly rise in the future. In this case we would need to do more in the future to contain what would otherwise be increasing risk. Taking further action to reduce risk will require further appraisal to assess whether there are socially and environmentally sustainable, technically viable and economically justified options'.

The key messages from the CFMP for the sub-area 8 – Maritime Mersey for which the Simpson Ground site lies within are:

- Tourism is important within this unit, especially along the waterfront. Maintaining a low risk of flooding to these sites will ensure that this is maintained.
- Tidal flooding issues are being addressed by the Liverpool Bay Shoreline Management Plan.
- This area is heavily urbanised and so there may be little opportunity for environmental enhancement through the creation or enhancement of Biodiversity Action Plan habitats.
- Future development should avoid flood risk areas.
- Rising groundwater levels will need to be monitored in the future and appropriate actions (resilience, dewatering) should be implemented according to the risk and consequences (to be identified).
- There are opportunities for UU and the EA to work in partnership to identify areas at risk of flooding from complex sources.
- Sustainable Drainage Systems (SuDS) should be encouraged as a means of reducing overall flood risk and controlling pollution from urban run-off.

The essential actions to achieve the policy aim are listed below:

- Engage with key stakeholders to develop maintenance plan for existing flood defence assets within this sub-area to take account of future changes being driven by sea level rise, climate change and regeneration within Liverpool. Review tidal flood forecasting and flood warning procedures within this sub-area to take account of future changes.

- We are currently undertaking a groundwater resource investigation in the North Merseyside and Lower Mersey Basin. We will review outcomes of this study and look to enhance existing groundwater monitoring network targeting areas susceptible to groundwater emergence.

- Identify and map the watercourses in Liverpool using a combination of desk top studies and site investigation to improve understanding and to help prioritise flood management issues.

- Look to encourage the use of flood resilience and flood-proofing to existing properties in Liverpool by providing information and advice.

- To develop a System Asset Management Plan for the Birket system in order to identify opportunities to mitigate for future increase in flood risk.

- Seek to ensure that, where development must take place in flood risk areas, measures such as, raising floors to an appropriate level and flood resilience is incorporated into buildings. It must also be demonstrated that safe access and evacuation can be provided during flooding.

- Encourage the use of appropriately designed SuDS to control run-off.

- Work with UU to look at operation and maintenance of the Great Culvert Pumping Stations, to address current flood risk and future increases in flood risk.

5.1.2 Liverpool SWMP Summary

The "Flood Maps for Surface Water" were second generation surface water flood maps produced by the EA in 2010 to show areas where surface water would be expected to flow or pond. It used a 1 in 30 year and 1 in 200 year annual probably rainfall and two bands of flood depth: shallow and deep.

An image of the 1 in 200 year return period map is provided in Figure 7 for the Simpson Ground site. The light blue shading represents shallow flooding and a few small and localised areas of shallow surface water flooding (0.05 – 0.1m deep) are indicated within the site boundary.

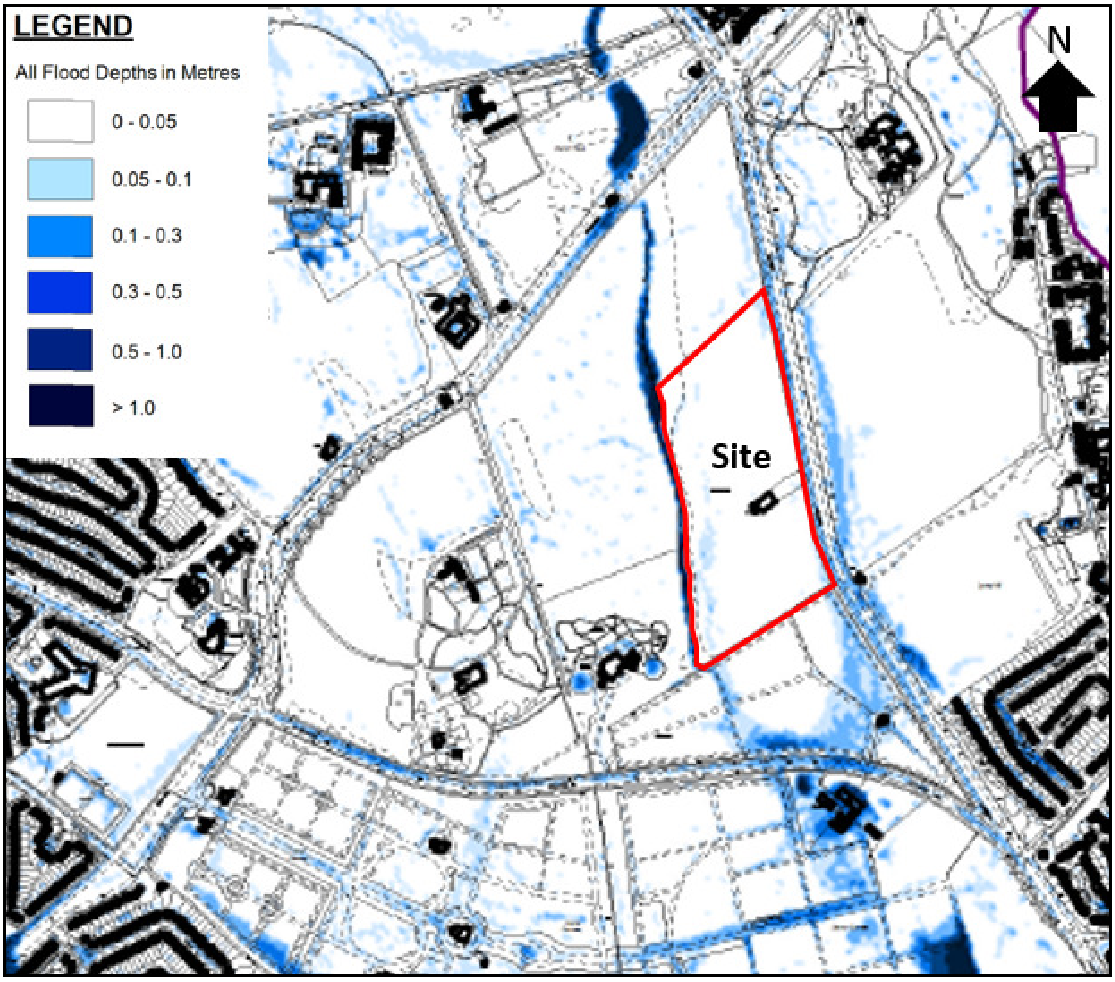

Figure 7 – SWMP Flood map for surface water at the site

5.1.3 *Liverpool SFRA Summary*

The SFRA and its update fulfils the following criteria:

- Provide strategic guidance for Local Planning Authority (LPA) planners and developers on all sources of flooding within the Liverpool, based upon the latest available information and considering the potential effects of climate change,
- Contribute to the Council's Sustainability Appraisal so that flood risk is taken into account within Local Development Documents,
- Identify the need and the level of detail required for site specific FRAs and provide sufficient information to enable the LPA to apply the Sequential Test and the Exception Test,
- Provide sufficient information to enable LPAs to identify specific locations where further and more detailed flood risk data and assessment work is required, and
- Inform the emergency planning process.

The Flood and Water Management Act (FWMA) 2010 brought the recommendations of the 2007 Pitt Report into legislation, giving Local Authorities a co-ordinating role for flood risk management. The SFRA update sets out roles and responsibilities and states that as a Lead Local Flood Authority (LLFA), LCC is now responsible for coordinating flood risk management across Liverpool.

The SFRA update summarises the findings from previous studies such as the Mersey Estuary CFMP, Liverpool SWMP and the Liverpool PFRA.

Using the data sets available, an analysis was undertaken using MapInfo software to determine the area of Liverpool susceptible to flooding from each source and classification. Table 3 shows the results of this analysis.

Source	Classification	Area of Liverpool affected	Percentage of Liverpool area
Flood Map	Tidal	0.23 km²	0.2%
	Fluvial • Flood Zone 1 • Flood Zone 2 • Flood Zone 3	 109.43 km² 3.52 km² 1.05 km²	 96% 3.1% 0.9%
Surface Water	Pluvial • <0.1m depth of flooding • 0.1m to 0.3m depth of flooding • 0.3m to 0.5m depth of flooding • >0.5m depth of flooding	 101.25 km² 8.96 km² 2.10 km² 1.69 km²	 88.8% 7.9% 1.8% 1.5%
Areas Susceptible to Ground Water Flooding	Area susceptible to groundwater flood emergence	28.52 km²	25%
Reservoir Flood Map	Area at risk of flooding from a "credible worst case" breach scenario.	2.97 km²	2.6%

Table 3 – Flood risk data analysis results for Liverpool

As part of this FRA, the Simpson Ground site has been checked for all the datasets shown in Table 3.

5.1.4 Liverpool PFRA Summary

The PFRA was produced in June 2011 in order for LCC to comply with the Flood Risk Regulations (2009) and the FWMA (2010). The scope of the PFRA included flooding from surface water, ordinary watercourses, groundwater, and canals. The methodology for producing the PFRA was been based on EA PFRA Final Guidance document and Defra's guidance on selecting and reviewing Flood Risk Areas.

The aims of the PFRA were to provide an assessment of local flood risk across the study area, including past floods and potential consequences of future floods. The following is a list of objectives for Liverpool's PFRA:

- To support local flood risk management strategy,
- To identify Flood Risk Areas,
- To collate information on past floods and potential future flood risk,
- To determine significant local flood risk,

- To provide a reference point for local flood risk management and inform strategies, and
- To establish partnership arrangements in assessment of flood risk.

Information on flood risk from surface water and groundwater in the PFRA has been reviewed and utilised in this FRA.

5.2 Historic Flooding

Historic flooding in the wider area of the site mainly attributed to the tidal River Mersey, located to the south west of the site, or the Ditton Brook 'main river', located to the north east of the site. A map of Historical Flooding Areas taken from Liverpool SFRA (2008) shows there has been no recorded limited flooding of the 'ordinary' watercourse along the western site boundary. This is indicated in Figure 8.

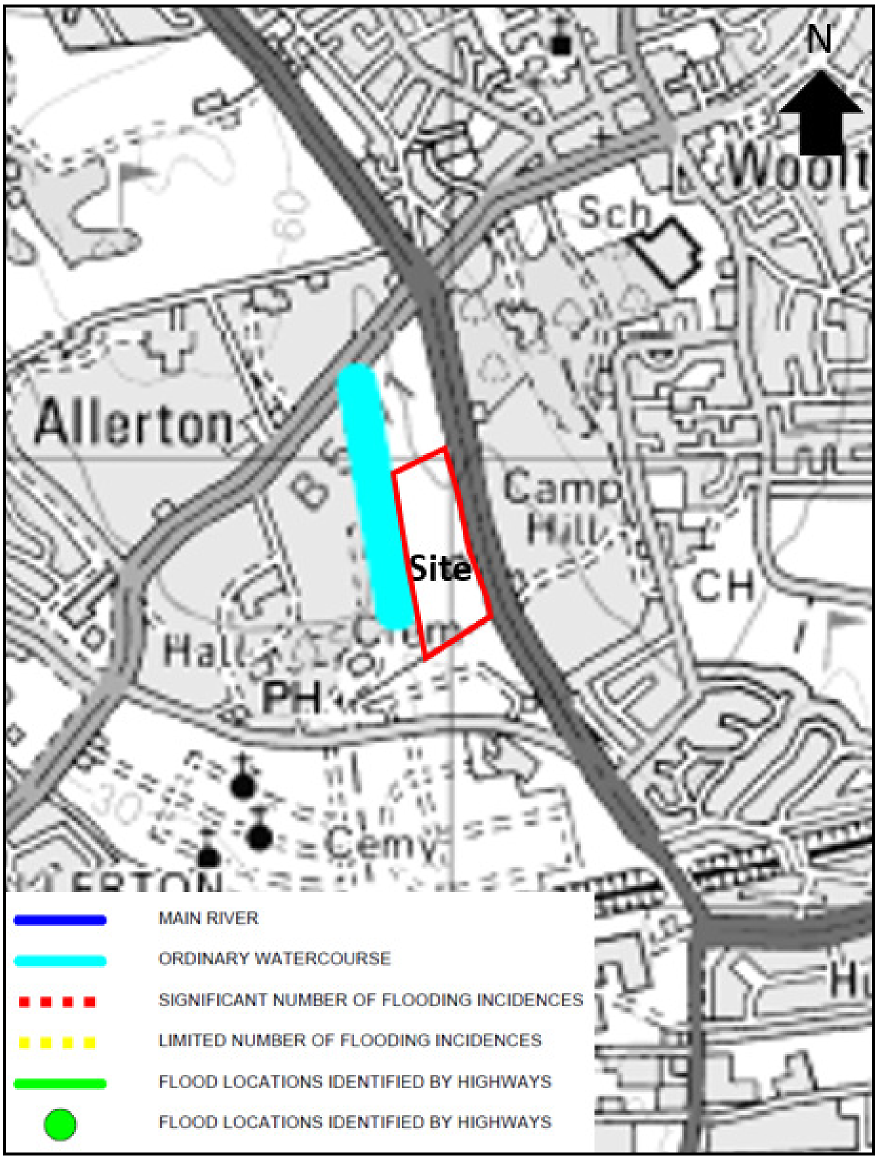

Figure 8 – Extract of Historical Flooding Areas from Liverpool SFRA (2008)

A map of Historical Sewer Flooding taken from Liverpool SFRA (2008) shows there has been no internal or external sewer flooding recorded by UU at the Simpson Ground site. A low number (1 - 2) of cases was reported nearby in the postcode area to the south west shown by the hatched light yellow area in Figure 9.

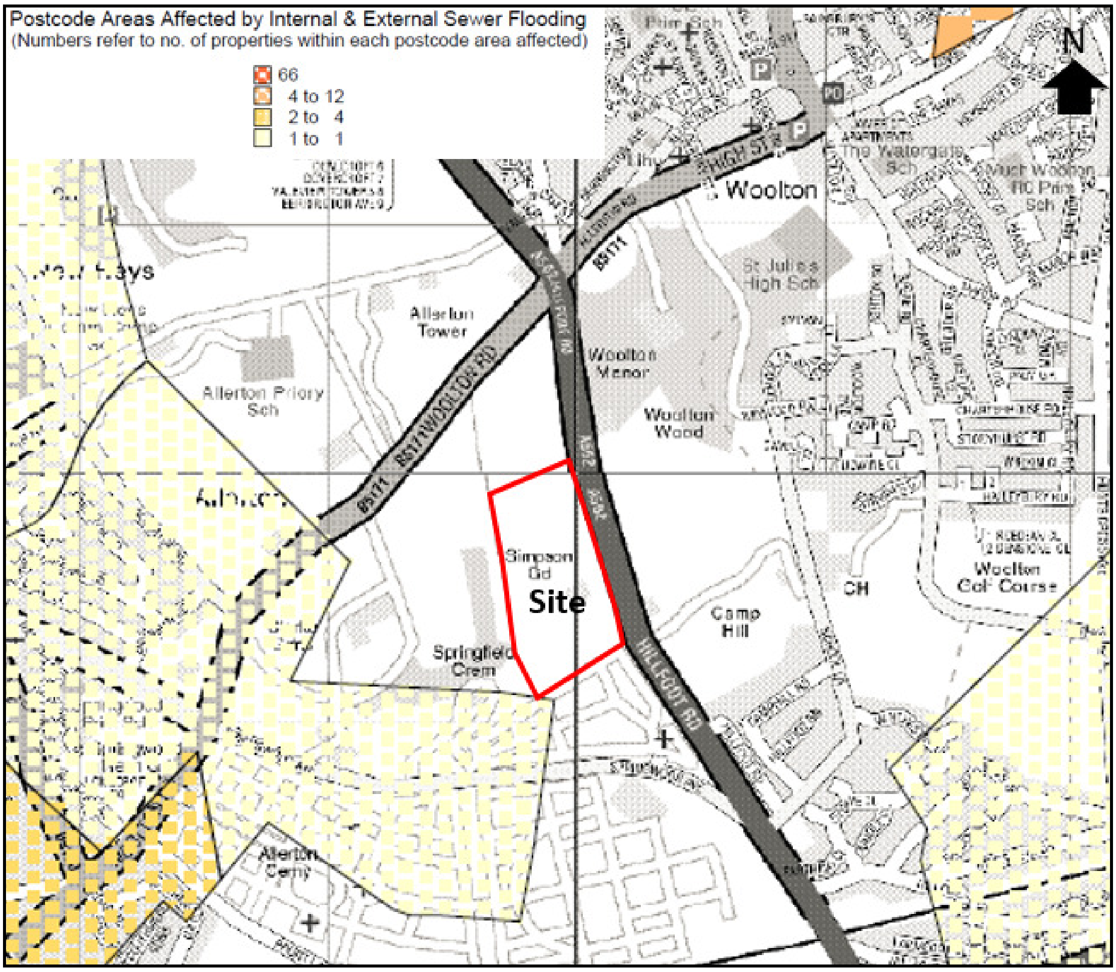

Figure 9 – Extract of Historical Sewer Flooding (from Liverpool SFRA (2008))

6 Flood Risk Assessment

6.1 Flood Risk from Rivers and the Sea

The EA takes the lead responsibility for planning flood and coastal erosion risk management functions in relation to flooding from the sea and main rivers. The EA flood map outline indicates areas at risk of river flooding for the 1 in 100 year and 1 in 1000 year return period events. As such the EA holds the most up to date information on fluvial and tidal flood risk at this site and therefore the EA web based mapping has been used as the basis for this FRA. The EA flood map is shown in Figure 10.

The map indicates areas which are at risk of river and sea flooding. The dark blue shading represents areas that could be flooded from rivers by a flood that has 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. These areas are classified as Flood Zone 3 (high probability).

The light blue area shows the additional extents of an extreme flood from rivers or the sea. These areas are assessed as having between a 1 in 100 and 1 in 100 annual probability of river flooding (1% - 0.1%), or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% - 0.1%) in any year. These areas are classified as Flood Zone 2 (medium probability) within NPPF. These maps show the extent of the natural floodplain if there were no flood defences.

Unshaded areas are where flooding from rivers and the sea is very unlikely. There is less than a 0.1 per cent (1 in 1000) chance of flooding occurring each year. These areas are classified as Flood Zone 1 (low probability) within NPPF.

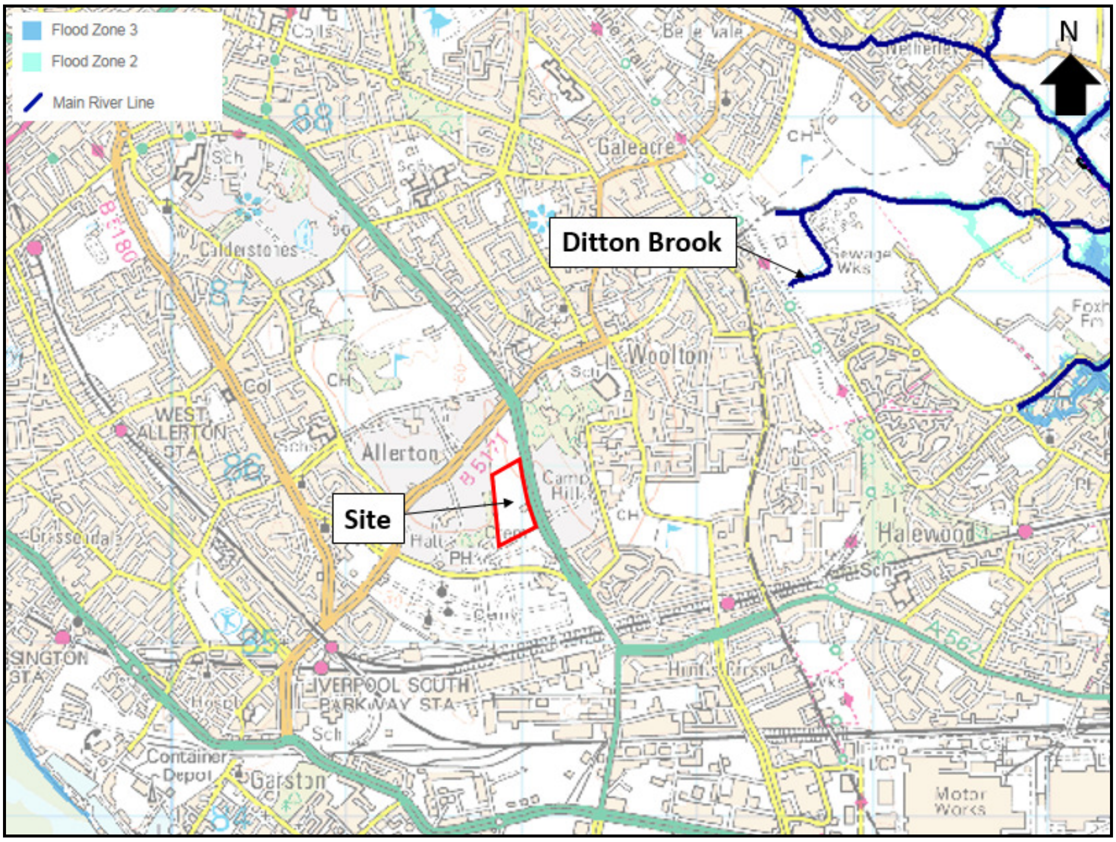

Figure 10 – Extract from the EA Flood Map (© EA copyright and / or database rights 2015)

The EA flood map shows that the site is located within Flood Zone 1 (low probability).

The site is not within an EA Flood Warning Area, as shown by the purple shaded area in Figure 11.

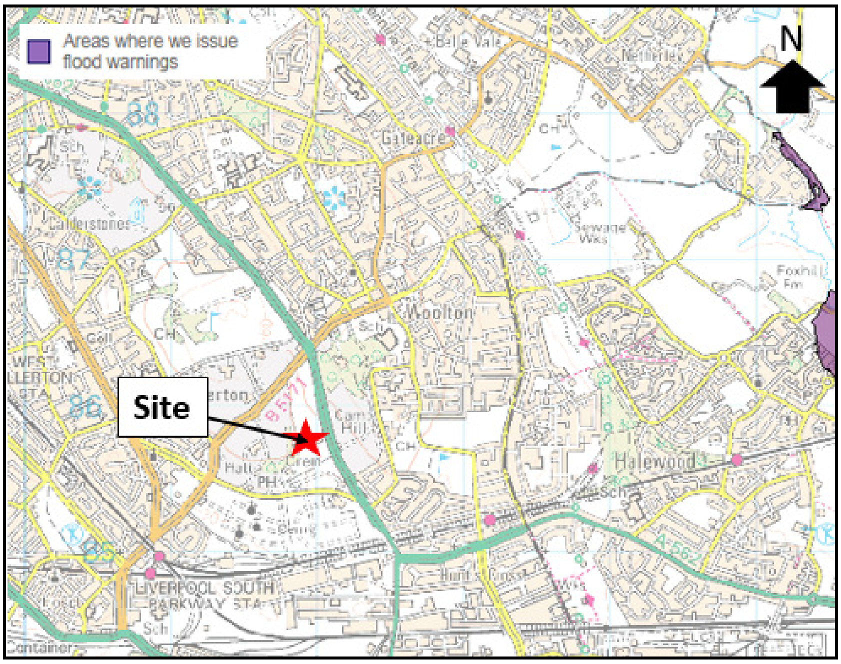

Figure 11 – Extract from the EA Flood Warning Map (© EA copyright and / or database rights 2015)

Under the terms of the Water Resources Act 1991, and the Land Drainage Byelaws, the prior written consent of the EA is required for any proposed works or structures in, under, over or within 8 metres of the top of the bank of a watercourse designated as a 'main river'. As the site is not located within close proximity of any EA 'main river' there is no need for written consent from the EA.

6.2 Surface Water Runoff from Land

6.2.1 Surface Water Flood Risk Mapping

The EA web based risk of flooding from surface water mapping is provided in Figure 11. The site is identified as being at very low risk (each year this area has a chance of flooding of less than 1 in 1000 (0.1%)) of surface water flooding. The watercourse along the western boundary is identified by the blue shading along this boundary.

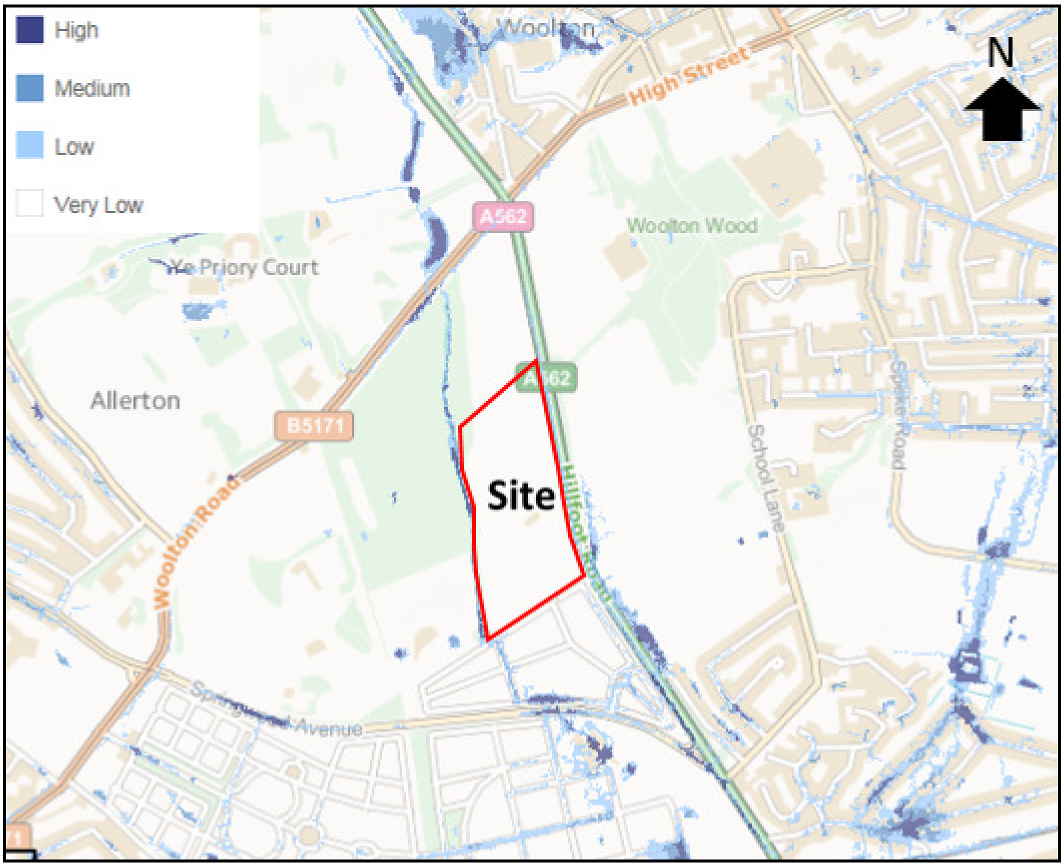

Figure 12 – EA risk of flooding from surface water map

The Simpson Ground site was not identified as being a low, medium or high risk area for flood risk. The overall flood risk from surface water runoff from land is assessed as being very low.

6.2.2 Surface Water Runoff Rates

NPPF requires that the potential to increase flood risk elsewhere through the addition of hard surfaces and the effect of the new development on surface water runoff, is incorporated in the FRA. An increase in hard surfaces could increase the surface water runoff from the site to the adjoining drainage network if no mitigation measures are included.

The EA advises that the proposed development should provide a significant betterment in terms of surface water runoff rates compared to the existing site, and where possible, should discharge at the original pre-development (greenfield) rate.

Pre-developed Scenario (greenfield)

This scenario assumes that the site is a greenfield site with no impermeable areas identified. The pre-developed runoff values from the site in a 30 and 100 year rainfall events calculated based on the IH124 method are summarised in Table 4. FEH catchment descriptors used for the IH124 method were taken from the FEH CD ROM v3 for the catchment[12].

Rainfall event (return period in years)	Pre-development (greenfield) runoff from the site (m^3/s)
30	0.072
100	0.088

Table 4 – Pre-development (greenfield) runoff

Climate Change

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 lead to an increased risk of flooding to planned developments and so the consequences of climate change need to be anticipated and mitigated for.

The importance of climate change in regard to flooding and development is highlighted in the EA guidance under the NPPF PPG. The climate change recommended precautionary sensitivity ranges are shown in Table 5. The design life of the development is assumed to be in the order of 50 - 70 years the 2055-2085 peak rainfall intensity and peak river flow increase has been used (i.e. 20%) as appropriate in the calculations.

Parameter	1990 to 2025	2025 to 2055	2055 to 2085	2085 to 2115
Peak rainfall intensity	*+5%*	*+10%*	*+20%*	*+30%*
Peak river flow	*+10%*	*+20%*		
Offshore wind speed	*+5%*		*+10%*	
Extreme wave height	*+5%*		*+10%*	

Table 5 – Climate change recommended precautionary sensitivity ranges (from EA Guidance)

[12] The parameters used for the IH124 calculation include: SPRHOST = 24.9%, SAAR = 840mm, Soil Type 4 assumed for whole site based on W.R.A.P map.

Surface water runoff accounting for climate change was assessed to ensure that an increased risk of flooding and the consequences of climate change are anticipated and mitigated. Accounting for this, the revised pre-development runoff values from the development site are presented in Table 6.

Rainfall event	Pre-development (greenfield) runoff from the site with climate change allowance (m^3/s)
100 year + climate change	0.105

Table 6 – Pre-development (greenfield) runoff with climate change allowance

The impacts of climate change need to be taken into account when designing the new drainage infrastructure. Surface water attenuation systems need to be designed so there is no flooding to buildings on or off site for rainfall events up to 1 in 100 year return period (including an allowance for climate change).

Post-development Scenario

The proposed development comprises of a new pavilion building including changing facilities, six playing pitches and car parking area. The impermeable surfaces (building roofs and hard landscape) include the pavilion roof, car parking and hardstanding bounding the playing pitches. The remaining permeable area (soft landscape) includes grassed areas surrounding the pavilion, car parking, and playing pitches.

The breakdown of the existing and proposed surface areas is presented in Table 7.

Area	Existing area (m^2)	Proposed area (m^2)
Impermeable areas	690	7,663
Permeable area	76,944	69,971
Total	77,634	77,634

Table 7 – Existing and proposed areas

The proposed development includes buildings and hard standing area with the amount of impermeable area on site increasing post-development. These changes will result in an increase in impermeable surfacing and a reduction in permeable surfacing, increasing surface water runoff at the site.

The area of impermeable surfacing will increase by 6,973m^2 on site following the development. The impacts of the additional surface water contribution from the increased impermeable area will need to be mitigated by attenuating the additional discharge from the site. This will ensure that there is no increase in flood risk to areas surrounding the site.

Table 8 provides a comparison of the greenfield surface water runoff rates (based on the 7.76 hectares pre-development site using the IH124 method), with the post-development runoff rates. The runoff rates for the post developed site have been derived using the modified rational method[13] and the proposed surface areas presented in Table 7.

Rainfall event (return period in years)	Pre-development (greenfield) runoff from the site (m^3/s)	Total post development runoff for both impermeable and permeable areas (m^3/s)	Additional runoff from the site due to proposed development (m^3/s) *
30	0.072	0.112	0.04
100	0.088	0.145	0.057
100 and climate change allowance	0.105	0.174	0.069

* based on a critical storm duration of 2 hours

Table 8 – Runoff rates greenfield and post proposed development

The results show that the maximum increase of the surface water runoff for the 1 in 100 years flood event with climate change allowance based on a critical storm duration of 2 hours is 0.174m^3/s. The values for the 30 and 100 year return period events are provided for information only.

The runoff of the 100 year event including climate change allowance is to be attenuated on site, with discharge to be limited to the greenfield runoff rate.

The EA promotes the use of SuDS to attenuate peak flows, produce water quality improvements and environmental enhancements where ground conditions are suitable. It is proposed that the new development may connect to either the watercourse along the western site boundary or to the existing UU surface water network along Hillfoot Road, following onsite management through one or more SuDS techniques. SuDS and their use on this site are discussed further in Section 7.

The maximum required volume, based on a critical storm duration of 2 hours, to be attenuated with the SuDS is 365m^3 for the 100 year event including climate change allowance.

The watercourse to the western boundary is not EA 'main river' therefore it is under the responsibility of LCC as the LLFA. Consultation with the LLFA would be needed for agreement and would be likely to be based on limiting to greenfield runoff rates and adhering to any water quality requirements.

Consultation with UU is currently being undertaken as part of the drainage strategy for the detailed design stage to discuss any proposed changes to the drainage network and any potential discharge limitations. The drainage strategy is currently being prepared to support the planning application in addition to this FRA.

[13] With reference to Preliminary Management of Rainfall Runoff for Developments. Ref. Technical Report W5-074/A/TR1 Preliminary Rainfall Runoff Management for Developments (2005) Rev D.

6.3 Flood Risk from Sewers

6.3.1 Surface Water Sewers

There is one existing surface water sewer in close proximity to the site along Hillfoot Road. Any surcharged flows from this sewer are likely to progress from north to south following the gradient of Hillfoot Road, however, some flows may enter the site at locations where the site boundary levels are less than those of the road surface. The flood risk from this sewer is assessed as being low to medium.

6.3.2 Foul Water Sewers

There are no foul water sewers in close proximity to or the surrounding area of the site. As such flood risk from foul water sewers is nil. Foul water flows are managed within the combined water sewer network discussed in Section 6.3.3.

6.3.3 Combined Water Sewers

There is an existing combined sewer (carrying both surface water and foul water flows) to the western boundary of the site. Any surcharge in flows are unlikely to enter the site due to ground levels falling away from the site to the south west. As such it is unlikely that this sewer would be a significant source of flood risk to the site. The flood risk from this sewer is assessed as being low.

It is assumed that the development foul flows will connect to the existing combined sewer to the west of the site, subject to prior agreement with UU.

An estimate for the foul sewage discharge requirements for a “Local community sports club” is 40 litres per person per day[14]. An initial estimate of the number of users of the Simpson Ground facilities per day is 410[15], therefore the total estimated foul sewage volume is 16,400 litres per day (16.40m^3 per day).

Consultation with UU is currently being undertaken as part of the drainage strategy for the detailed design stage to discuss any proposed changes to the drainage network and any potential capacity issues.

6.4 Flood Risk from Groundwater

6.4.1 Geology and Groundwater

Based on British Geological Survey mapping the bedrock geology of the site is Chester Pebble Beds Formation - Sandstone, Pebbly (gravelly). Sedimentary Bedrock formed approximately 246 to 251 million years ago in the Triassic Period. Local environment previously dominated by rivers.

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[14] *British Water Code of Practice - Sizing criteria, Treatment Capacity for Sewage Treatment Systems (2009)*

[15] *Estimation of user numbers based on 60% of sports facility users Mon-Fri, 50% of sports facility users Sat-Sun and 25% of spectators/social area users contributing to foul flows.*

Based on British Geological Survey mapping the superficial deposit geology of the site comprises Devensian Till, Diamicton. Superficial Deposits formed up to 2 million years ago in the Quaternary Period. Local environment previously dominated by ice age conditions.

The Simpson Ground site is in an area designated as Principal Aquifer (bedrock) and Secondary Undifferentiated Aquifer (superficial deposits). Principal Aquifer classification is defined as layers of rock or drift deposits that have high intergranular and / or fracture permeability, meaning they usually provide a high level of water storage. They may support water supply and / or river base flow on a strategic scale. The potential effects of the development on water quality and the protection of water resources should be considered. Secondary Undifferentiated Aquifer classification is defined as areas where it has not been possible to attribute category Secondary A or Secondary B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.

The proposed site does not lie within an EA Groundwater Source Protection Zone as currently published on the EA website.

The Areas Susceptible to Groundwater Flooding Map included in the Liverpool PFRA and SWMP shows the proportion of each 1km grid square where geological and hydrogeological conditions indicate that groundwater might emerge. The Simpson Ground site is within a 1km square where no part of that square is identified as being susceptible to groundwater emergence.

As such flood risk from groundwater is assessed as very low.

6.5 Flood Risk from Artificial Sources

6.5.1 Flood Risk from Reservoirs

The EA web based mapping includes maximum extent of flooding from reservoirs. The Simpson Ground site is not located within this maximum extent areas. As such the site is not considered to be at flood risk from reservoirs.

6.5.2 Flood Risk from other Artificial Sources

The Simpson Ground site is not located near to any other artificial sources of flood risk such as canals or pumped drainage / wetland areas. As such the site is not considered to be at flood risk from other artificial sources of flood risk.

7 Flood Risk Mitigation

7.1 Flood Risk from Surface Water Mitigation

The proposed development will increase the impermeable areas and in turn the surface water runoff from the site. In order to mitigate this, it is recommended that SuDS are included in this 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 produce water quality improvements and environmental enhancements on site.

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. Table 9 sets out the range of SuDS techniques outlined in the SuDS Manual (CIRIA C753, 2015).

Component type	Description
Rainwater harvesting systems	Rainwater is collected from the roof of a building or from other paved surfaces in an over-ground or underground tank for use on site. Depending on its intended use, the system may include treatment elements. The system should include specific storage provision if it is to be used to manage runoff to a design standard.
Green roofs	A planted soil layer is constructed on the roof of a building to create a living surface. Water is stored in the soil layer and absorbed by vegetation. Blue roofs store water at roof level, without the use of vegetation.
Infiltration systems	These systems collect and store runoff allowing it to infiltrate into the ground. Overlying vegetation and underlying unsaturated soils can offer protection to groundwater from pollution risks.
Proprietary treatment systems	These subsurface and surface structures are designed to provide treatment of water through the removal of contaminants.
Filter strips	Runoff from an impermeable area is allowed to flow across a grassed or otherwise densely planted area to promote sedimentation and filtration.
Filter drains	Runoff is temporarily stored below the surface in a shallow trench filled with stone/gravel, providing attenuation, conveyance and treatment (via filtration).
Swales	A vegetated channel is used to convey and treat runoff (via filtration). These can be "wet", where water is designed to remain permanently at the base of the swale, or "dry" where water is only present in the channel after rainfall events. It can be lined, or unlined to allow infiltration.
Bioretention systems	A shallow landscaped depression allows runoff to pond temporarily on the surface, before filtering through vegetation and underlying soils prior to collection or infiltration. In its simplest form it is often referred to as a rain garden. Engineered soils (gravel and sand layers) and enhanced vegetation can be used to improve treatment performance.
Trees	Trees can be planted within a range of infiltration SuDS components to improve their performance, as root growth and decomposition increase soil infiltration capacity. Alternatively they can be used as standalone features within soil-filled tree pits, tree planters or structural soils, collecting and storing runoff and providing treatment (via filtration and phytoremediation).
Pervious pavements	Runoff is allowed to soak through structural paving. This can be paving blocks with gaps between solid blocks, or porous paving where water filters through the block itself. Water can be stored in the sub-base and potentially allowed to infiltrate into the ground.
Attenuation storage tanks	Large, below-ground voided spaces can be used to temporarily store runoff before infiltration, controlled release or use. The storage structure is often constructed using geocellular or other modular storage systems, concrete tanks or oversized pipes.
Detention basins	During a rainfall event, runoff drains to a landscaped depression with an outlet that restricts flows, so that the basin fills and provides attenuation. Generally, basins are dry, except during and immediately following the rainfall event. If vegetated, runoff will be treated as it is conveyed and filtered across the base of the basin.
Ponds and wetlands	Features with a permanent pool of water can be used to provide both attenuation and treatment of runoff, where outflows are controlled and water levels are allowed to increase following rainfall. They can support emergent and submerged vegetation along their shoreline and in shallow, marshy zones, which enhances treatment processes and biodiversity.

Table 9 – SuDS Techniques (from the SuDS Manual (CIRIA 2015))

At this stage of the development proposals it is recommended that the following SuDS options that are likely to be most suitable for the proposed development site are considered as the proposals progress:

- **Green roof** and **rainwater reuse**. Green roofs can reduce peak flow and improve water quality. They can also improve building insulation. Rainwater harvesting could also be considered.
- A **detention basin** could be incorporated into the development. This would enable surface water from high rainfall events to be stored on site, reducing the peak flows into the drainage system, and allowing water to discharge naturally over time.
- **Filter strips** and **swales** could be incorporated into the development. They provide temporary storage for storm water, reduce peak flows and filter pollutants.
- **Pervious pavements** for car parks and other paved areas. A pervious surface will allow surface water to infiltrate into the subsoil or be stored, either above ground or underground, for release into the ground at a later time.

The use of SuDS is dependent 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 it will affect the detailed design.

For the car parking area, pollution control elements would be required to reduce the risk of hydrocarbons entering the drainage system or polluting groundwater.

8 Conclusions and Recommendations

8.1 Conclusions

The flood risk to the proposed Simpson Ground site has been assessed in accordance with the National Planning Policy Framework (NPPF), the Planning Practice Guidance (PPG) and with Liverpool City Council (LCC) and Environment Agency (EA) data. The Liverpool Strategic Flood Risk Assessment and its recent update, the River Mersey Catchment Flood Management Plan, the Liverpool Surface Water Management Plan and the Liverpool Preliminary Flood Risk Assessment have been used to gather information for this study. It is recommended that further consultations are undertaken with the EA, United Utilities (UU) and LCC as the scheme develops.

A review of the EA flood risk maps show that the site lies within Flood Zone 1, in an area at low risk of river and sea flooding. The proposed development is classed as 'water-compatible development' under NPPF, as such the development is appropriate for this site. Flood risk from rivers or the sea does not pose an issue for the site.

In 2011 Mouchel undertook on behalf of LCC a detailed hydraulic modelling for the city using 'FloodFlow' as part of Liverpool's Surface Water Management Plan. The results for the 1 in 200 year rainfall return period for the site show that a few small and localised areas of shallow surface water flooding (0.05 – 0.1m deep) are indicated within the site boundary. The EA risk of flooding from surface water mapping identifies the site as being at very low risk of surface water flooding. As such the overall flood risk to the site from surface water runoff from land is assessed as being very low.

There is a limited network of both surface water and combined water sewers located to the east and west of the site respectively. There is no foul sewer network in the area of the site. The flood risk to the site from surcharge flows from these sewers is considered to be low to medium from the surface water sewer and low from the combined sewer.

The Simpson Ground site is in an area designated as a bedrock Principal Aquifer and superficial deposits Secondary Undifferentiated Aquifer. The site does not however lie within a Groundwater Source Protection Zone and the 'Areas Susceptible to Groundwater Flooding Map' shows that the site is within a 1km square where no part of that square is identified as being susceptible to groundwater emergence. As such groundwater flood risk to the site is assessed as being very low.

The site is not at risk of flooding from artificial sources such as reservoirs, canals and pumped drainage / wetland areas.

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 the recommendations below are followed.

8.2 Recommendations

The area of impermeable surfacing will increase by 6,973m² on site following the development. The developer will need to attenuate any additional flows resulting from this within the site boundary, and ensure that post development runoff does not exceed the current 100 year including climate change greenfield runoff rate.

An allowance for climate change should be included in the design of the proposed surface water drainage system and it is recommended that the Sustainable Drainage Systems (SuDS) options outlined in Section 7 of this FRA are considered for attenuating surface water on site. The maximum required volume, based on a critical storm duration of 2 hours, to be attenuated with the SuDS is 365m^3 for the 100 year event including climate change allowance.

The SuDS for surface water runoff could discharge to the unnamed watercourse to the west of the site, consultation with the LCC as Lead Local Flood Authority would be needed for agreement on limiting to greenfield runoff rates and any water quality requirements. As an alternative the site could discharge to the existing UU surface water sewer associated with Hillfoot Road. Consultation with UU is currently being undertaken to discuss any proposed changes to the surface water drainage network and any potential discharge limitations and requirements

The total initial estimated foul sewage volume for 410 people is 16,400 litres per day (16.40m^3 per day). Consultation with UU is currently being undertaken as part of the foul water drainage strategy for the detailed design stage to discuss any proposed changes to the foul sewer network and any potential capacity issues.

9 Appendices

Appendix A	Existing Site Plan
Appendix B	Topographic Survey
Appendix C	Proposed Site Layout
Appendix D	United Utilities Asset Location Plans

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APPENDIX A

Existing Site Plan

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APPENDIX B

Topographic Survey

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APPENDIX C

Proposed Site Layout

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APPENDIX D

United Utilities Asset Location Plans

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We have used our reasonable endeavours to provide information that is correct and accurate and have discussed above the reasonable conclusions that can be reached on the basis of the information available.