Solihull Metropolitan Borough Council Level 2 Strategic Flood Risk Assessment Flood Risk Assessment Detailed Site Summary Table

<table>
<tr><td rowspan="5">Site details</td><td>Site Code</td><td colspan="4">Site 9</td></tr>
<tr><td>Address</td><td colspan="4">South of Knowle</td></tr>
<tr><td>Area</td><td colspan="4">49 Hectares</td></tr>
<tr><td>Current Land Use</td><td colspan="4">Greenfield/Agricultural, Residential & Education</td></tr>
<tr><td>Proposed Land Use</td><td colspan="4">Residential</td></tr>
<tr><td rowspan="6">Sources of flood risk</td><td>Location of site within catchment</td><td colspan="4">The site is located within the north extent of the Cuttle Brook catchment and contains the upstream extent of the Cuttle Brook and two other unnamed tributaries of this watercourse. A small portion of the site on the northern boundary falls within the River Blythe catchment.</td></tr>
<tr><td>Existing drainage features</td><td colspan="4">The upstream extent of the Cuttle Brook flows in a easterly direction through the southern portion of the site, around 150m north of the southern boundary. This watercourse flows under Warwick Road (A4141), which runs along the site's eastern boundary and then under the Grand Union Canal. The Cuttle Brook's confluence with the River Blythe is approximately 2km east of the site.
There are two unnamed tributaries of the Cuttle Brook located on or near the site. The first unnamed watercourse is located just outside the eastern site boundary, adjacent to the road that provides access to Lansdowne Farm within the site boundary from Warwick Road. This tributary joins the Cuttle Brook approximately 700m downstream of the site.
The second unnamed tributary is located to the north of the second access road that bisects the site and links Station Road to the west and Warwick Road to the east. An extended portion of this watercourse is culverted under Warwick Road. After flowing under the Grand Union Canal to the east, this watercourse joins the Cuttle Brook approximately 1.4km downstream of the site.</td></tr>
<tr><td rowspan="5">Fluvial</td><td colspan="4">Proportion of Site at Risk</td></tr>
<tr><td>FZ3b</td><td>FZ3a</td><td>FZ2</td><td>FZ1</td></tr>
<tr><td>3.0%</td><td>3.1%</td><td>3.5%</td><td>96.5%</td></tr>
<tr><td colspan="4">Highest Zone of Risk (Risk of Flooding from Rivers and Sea)</td></tr>
<tr><td colspan="4">Majority of site - Very Low
Area around the Cuttle Brook and Unnamed Watercourses - Medium to High</td></tr>
<tr><td colspan="4">The % Flood Zones quoted show the % of the site at flood risk from that particular Flood Zone/event, including the percentage of the site at flood risk at a higher risk zone, e.g. FZ2 includes the FZ3 %. FZ1 is the remaining area outside FZ2 (FZ2 + FZ1 = 100%)</td></tr>
<tr><td colspan="4">Available Data:
As part of the Level 2 SFRA, 2D strategic modelling has been completed for the watercourses associated with this site using TUFLOW. Limitations of the strategic modelling are discussed in the SFRA Strategic Modelling Report and summarised in the Mapping Information section at the end of this table.
Flood Characteristics:
The strategic 2D modelling shows that there are two defined areas of fluvial flood risk. The first area is associated with the Cuttle Brook in the southern portion of the site and the second is associated with the two unnamed watercourses in the centre and north of the site.
Fluvial flooding associated with the Cuttle Brook is narrow in extent and closely follows the watercourse eastwards across towards Warwick Road.
Fluvial flooding associated with the two unnamed watercourses is wider in extent and is modelled to impact around 150m of Warwick Road. Because flooding is shown to occur where the two access roads enter the site from Warwick Road, this may impact on access and egress. In all events, flood depths here are largely less than 0.1m in depth with some isolated areas reaching 0.3m in depth. There is very little variation in flood extent and depth between the 20 year, 100 year and 1000 year modelled flood events.
The connectivity of the unnamed drain in the northern part of the proposed site is based on OS mapping and LIDAR. No connectively could be found linking it downstream channel. It is recommended that this is reviewed as part of a future detailed site-specific assessment.</td></tr>
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	Surface Water	**Proportion of site at risk (RoFfSW)**		
		30-year High Risk	**100-year Medium Risk**	**1,000-year Low Risk**
		1.1%	3.1%	11.6%
		Max depths (m)		
		0.3 – 0.9m	0.3 – 0.9m	0.3 – 0.9m
		Max velocity (m/s)		
		>0.25	>0.25	>0.25
		The % SW extents quoted show the % of the site at surface water risk from that particular event, including the percentage of the site at flood risk at a higher risk zone (e.g. 100-year includes the 30-year %).		
		Description of surface water flow paths: There is one surface water flow path associated with each of the three watercourses on or near the boundary of the site and hence the mapping is likely to be picking up their natural floodplains. The largest flow path is associated with the Cuttle Brook and extends across the southern portion of the site. Less extensive flow paths are associated with the two unnamed tributaries of the Cuttle Brook in the centre and north of the site. In the 30 year event, only a small portion of the site around the Cuttle Brook is affected by surface water flooding and the tributaries are unaffected. During this event, flood depths are generally less than 0.3m but deeper water could build up around the existing pond on the watercourse. A very small amount of surface water ponding is shown on Warwick Road adjacent to this watercourse. In the 100 year event, a narrow band of surface water flooding is seen along the entirety of the Cuttle Brook within the site boundary. In the centre of the site, there is a small area of surface water flooding associated with the watercourse to the east of the boundary. This affects Station Road, accessed from Warwick Road. Isolated areas of surface water ponding are associated with the northern unnamed watercourse. Small areas of flooding on Warwick Road are modelled in three locations, associated with each watercourse. In the 100 year event, flood depths are generally less than 0.3m. In the 1000 year event, flood extents around the Cuttle Brook are wider and extend from the western boundary to the eastern boundary. Flooding is also modelled in the existing housing estate to the west. In the centre of the site, surface water flood extents are greater over Station Road and Warwick Road. In the north, surface water flooding extends across the unnamed road and Warwick Road. Despite flood extents being greater, flood depths are still largely less than 0.3m, with isolated areas of deeper ponding along the Cuttle Brook.		
	Reservoir	The site is not shown to be at risk of reservoir flooding from the available online maps.		

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	Groundwater	The Environment Agency Areas Susceptible to Groundwater Flooding dataset, provided as 1km grid squares, shows the susceptibility of an area to groundwater flood emergence. The following comments can be made about groundwater flood risk: • The south-western portion of the site has a < 25% susceptibility to groundwater flood emergence from superficial deposits. • The south-eastern portion of the site has a >= 25% <50% susceptibility to groundwater flood emergence from superficial deposits. • The north-eastern portion of the site has a < 25% susceptibility to groundwater flood emergence from superficial deposits. • The north-western portion of the site has not been assessed as part of the Areas Susceptible to Groundwater Flooding dataset. This assessment does not negate the requirement that an appropriate assessment of the groundwater regime should be carried out at the site specific FRA stage.		
	Flood History	There are no records of historic flooding from the Environment Agency within the recorded flood outlines dataset or historic flooding dataset. The SMBC November 2012 dataset identifies that there was flooding on Warwick Road as a result of a blocked downstream grill where the Cuttle Brook flows under the road on the eastern site boundary. No flood incidents were recorded within the site boundary by Severn Trent Water. However, one incident was recorded in November 2014 in the Station Road area to the north of the site.		
Flood risk management infrastructure	**Defences**	**Defence Type**	**Standard of Protection**	**Condition**
		-	-	-
		This site is not protected by any formal flood defences.		
	Residual risk	There two culverts along the eastern site boundary where the Cuttle Brook and northern unnamed watercourse flow eastwards towards the River Blythe. If these structures were to become blocked, there is potential for increased surface water and fluvial flooding across the eastern portion of the site. The potential for blockage will need to be considered in any future site-specific assessment.		
Emergency planning	**Flood warning**	The site is not covered by an Environment Agency Flood Warning or Alert area.		
	Access and Egress	The site is bounded by Warwick Road (A4141) along the eastern boundary, Grove Road along the southern boundary and Station Road to the west. The site is bisected by an unnamed road providing access through the site from Station Road to Warwick Road. There is also a second small road, south of the bisecting road, providing access to Lansdowne Farm. In terms of fluvial flood risk, Warwick Road is shown to be affected by flooding in all events in the areas adjacent to the Cuttle Brook and two unnamed watercourses. There is very little variation between the flood extents for the 20 year, 100 year and 1000 year events. In all flood events, flood depths on Warwick Road and the two access roads are mainly less than 0.1m in depth with some isolated areas reaching 0.3m in depth. Access and egress to the site could be affected as a result of flooding on Warwick Road and the existing roads on the site however depths are not significant. In terms of surface water flood risk, surface water flooding associated with the Cuttle Brook and two unnamed tributaries, is modelled in all events. Station Road to the west and Grove Road to the south have small, isolated areas of surface water flooding during all events but flood risk is greatest on Warwick Road. The road which bisects the site from east to west is also likely to be impacted by surface water flooding.		

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		In the 30 year event, very minor flooding is modelled on the road adjacent to the Cuttle Brook and depths are less than 0.3m so access and egress is unlikely to be affected. In the 100 year event, three isolated areas of surface water flooding are seen of Warwick Road associated with the 3 watercourses. Again, and depths are less than 0.3m so access and egress is unlikely to be affected. In the 1000 year event, flood extents across Warwick road are greater but flood depths remain below 0.3m. It would be preferable to access the site from Station Road to the west, Grove Road in the south western corner or the northern end of Warwick Road, away from areas of surface water flooding and fluvial flow paths associated with the Cuttle Brook and its tributaries along Warwick Road. The depths, velocities, hazards, durations and speeds of onset of surface water and fluvial flooding along access/ egress routes should be investigated further in a site-specific assessment, to confirm whether access for emergency vehicles could still be obtained.
Climate Change	**Implications for the site**	• Increased storm intensity and frequency as a result of climate change may increase the extent, depth, velocity, hazard and frequency of fluvial flooding from the Cuttle Brook, unnamed watercourses and surface water flooding across the site. • As part of the Level 2 SFRA, 2D strategic modelling has been completed for the watercourses covering this site using TUFLOW, including allowances for climate change. For the 1 in 100 year event, the 2080s period was used, and all three allowance categories were modelled (20%, 30% & 50%). Within the site boundary, there is very little change in the 100 year flood extent when climate change allowances are applied suggesting that there is low sensitivity to climate change. • As part of a site-specific Flood Risk Assessment, latest EA climate change allowances will need to be considered in a detailed hydraulic model, to confirm the impact in the site. • Climate change also needs to be considered for surface water events; at the site-specific stage. The 100-year event with a 40% allowance for climate change should be considered as part of surface water drainage strategies, or surface water modelling. • The current day 1,000-year surface water extent provides an indication of the likely increase in extent of the more frequent events. It is likely that surface water flooding associated with the Cuttle Brook and two tributaries will impact a greater area of the site in the future. Flooding on Warwick Road is likely to be more extensive, but depths suggest that this is unlikely to affect access and egress. The impact of climate change on surface water flood risk will require a detailed FRA to assess the site layout and design. • Developers should consider SuDS strategies to help to manage the impacts of climate change from surface water in a detailed site-specific FRA.

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Requirements for drainage control and impact mitigation	**Broad scale assessment of possible SuDS**	Geology at the site consists of: • Bedrock: o Western Band: Branscombe Mudstone Formation – Mudstone o Central Band: Arden Sandstone Formation - Siltstone And Sandstone o Eastern Band: Sidmouth Mudstone Formation - Mudstone • Superficial: None Recorded Soils at the site consist of: • Northern Area: Loamy soils with naturally high groundwater • Southern Area: Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils The site is not located within an EA designated Source Protection Zone. The site is also not designated by the Environment Agency as previously being a landfill site. • Most source control techniques are likely to be suitable. Mapping suggests that permeable paving may have to use non-infiltrating systems given the possible risk from groundwater in the east of the site. Mapping also suggests that slopes may be unsuitable for selective source control techniques. • Infiltration likely to be suitable where mapping suggests a low risk of ground water flooding. Infiltration is less likely to be suitable in the east of the site where a medium risk of groundwater flooding is identified. Site investigations should be carried out to assess potential for drainage by infiltration. • This option is unlikely to be feasible as mapping suggests mean site slopes are > 5%. Feasibility of such options should be assessed as part of a site specific assessment. If this feature is feasible a liner maybe required to prevent the egress of groundwater. • This option is unlikely to be feasible as mapping suggests mean site slopes are > 5%. Feasibility of such options should be assessed as part of a site specific assessment. If this feature is feasible it should be located where the depth to the water table is >1m, additionally a liner maybe required to prevent the egress of groundwater. • All forms of conveyance are likely to be suitable. Where the slopes are >5% features should follow contours or utilise check dams to slow flows. A liner maybe required to prevent the egress of groundwater. • Site masterplans should be designed to ensure space is made for above ground SuDS features. • Developers should refer to Solihull Metropolitan Borough Council's **Guide to SuDS and Drainage in Solihull** document as well as the Level 1 SFRA, for information on suitable types of SuDS, the management train and opportunities and constraints in site master-planning.
NPPF and Planning Implications	**Exception Test Requirements**	The Local Authority have carried out the Sequential Test in line with national guidance. The Sequential Test will need to be passed before the Exception Test is applied. Residential development is classified as 'More Vulnerable'. It is anticipated that proposed development will be sequentially located within Flood Zone 1. The Exception test will need to be applied if: • More Vulnerable and Essential Infrastructure development is located in FZ3a and for Highly Vulnerable development located in FZ2. • Highly Vulnerable infrastructure is not be permitted within FZ3a and FZ3b. • More Vulnerable and Less Vulnerable Infrastructure should not be permitted within FZ3b.

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	Requirements and guidance for site-specific Flood Risk Assessment	**Flood Risk Assessment:** • At the planning application stage, a site-specific Flood Risk Assessment will be required if any development is located within Flood Zones 2 or 3 or it is greater than one hectare. • The site-specific FRA should be carried out in line with the National Planning Policy Framework; Flood Risk and Coastal Change Planning Practice Guidance; Solihull Council's Local Plan policies, and the LLFA's **Guide to SuDS and Drainage in Solihull**. • Consultation with the Local Authority, Local Lead Flood Authority and the Environment Agency should be undertaken at an early stage. • All sources of flooding, particularly the risk of fluvial, surface water and groundwater flooding, should be considered as part of a site-specific flood risk assessment. • A detailed hydraulic model will be required to confirm both fluvial and surface water flood risk and flow paths, FZ3b and climate change extents, using channel, asset and topographic survey. The residual risk from culvert blockage should be assessed and suitable mitigation proposed. • The development should be designed using a sequential approach. Development should be steered away from areas of fluvial flood risk and surface water flow routes, preserving these spaces as green infrastructure. Development must be in line with Table 3: flood risk vulnerability and flood zone compatibility of the NPPG. • Development in FZ3b should be avoided unless appropriate use can be demonstrated in line with NPPF. • Development in FZ3 may require floodplain compensation and this should be confirmed with the EA at FRA stage. **Guidance for site design and making development safe:** • The developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the development meets the objectives of the NPPF's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development. (Para 048 Flood Risk and Coastal Change PPG). • Safe access and egress will need to be demonstrated in the 1 in 100-year plus climate change fluvial and rainfall events, using the depth, velocity and hazard outputs. Raising of access routes must not impact on surface water flow routes. Consideration should be given to the siting of access points with respect to areas of surface water flood risk. • Resilience measures will be required if buildings are situated in the flood risk area. Raising Finished Floor Levels above the 100 year event with allowance for climate change may remove the need for resilience measures. • Culverting should be avoided where at all possible and limited to short lengths for essential infrastructure. The need to ensure both fluvial and surface water flows can pass through the site is essential. • Deculverting of any watercourse assets is also considered a priority. • The impact of culvert blockage needs to be fully assessed. Any new culverts proposed as part of access improvements will need to be designed to ensure they do not increase flood risk up or downstream and will require a Land Drainage Consent outside of the planning process from the LLFA. • If existing culverts are to be kept, a full CCTV condition survey is required to ensure the culvert will be sound for the lifetime of the proposed development. Improvements should be sought, such as trash screens compliant with the latest Environment Agency guidance and relining where this is an appropriate and sustainable option.

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		• For any culverts (old or new), the developer must set out who is adopting and maintaining those culverts throughout the lifetime of the development. The design of the development must consider the residual risk of blockage e.g. properties should not be placed in the area that could flood if a culvert blocks and the exceedance flows from such an event should be built into the site masterplan. • The risk from surface water flow routes should be quantified as part of a site-specific FRA, including a drainage strategy, to ensure that runoff from the development is not increased by development across any ephemeral surface water flow routes. A drainage strategy should help inform site layout and design to ensure there is no increase in runoff beyond current greenfield rates. • **Areas at risk from fluvial and surface water flooding should ideally be integrated into green infrastructure, which presents wider opportunities to improve biodiversity and amenity as well as climate change adaptation. An integrated flood risk management and sustainable drainage scheme for the site is advised.** This needs to be modelled to inform the design to ensure that surface water overland flows or fluvial flooding do not overwhelm sustainable drainage features. • New developments should adopt exemplar source control SuDS techniques to reduce the risk of frequent low impact flooding due to post-development runoff. Assessment for runoff should include allowance for climate change effects. • Betterment on the existing site runoff rate should be sought on the brownfield areas of the site to ensure that there is no increase in surface water flood risk elsewhere. Surface water runoff must be fully attenuated to the greenfield rate. • Developers should refer to **SMBC's Guide to SuDS and Drainage in Solihull** and the Level 1 SFRA for background information on SuDS.
Key Messages		The flood risk element of the Exception Test is likely to be passed if: • Development is limited to the 96.5% of the site located outside of the Environment Agency's Flood Zone 2 and 3. • Areas in Flood Zone 1 and then 2 are used for the least vulnerable parts of the development in accordance with Table 2 in the NPPF. • If flood mitigation measures are implemented then they are tested to ensure that they will not displace water elsewhere (for example, if land is raised to permit development on one area, compensatory flood storage will be required in another) • Space for green infrastructure should be considered in the areas of highest flood risk. • New developments should adopt exemplar source control SuDS techniques to reduce the risk of frequent low impact flooding due to post-development runoff. Assessment for runoff should include allowance for climate change effects. • Betterment on the existing site runoff rate should be sought to ensure that there is no increase in surface water flood risk elsewhere. Surface water runoff must be fully attenuated to the greenfield rate. • Safe access and egress routes must not be in the areas of high surface water risk or the 100-year fluvial design flood event (taking into account climate change). The site would be best accessed from Station Road to the west or Grove Road to the south, reducing access from Warwick Road where fluvial and surface water flood risk is greatest. Refer to the detailed 'guidance for developers' section for further information on the measures that are appropriate for this site.

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Mapping Information

The key datasets used to make planning recommendations regarding this site were the strategic 2D modelling outputs and the Risk of Flooding from Surface Water map. More details regarding data used for this assessment can be found below.

Flood Zones	Flood Zones 2 and 3 have been taken from strategic 2D modelling completed as part of the Level 2 SFRA. It is recommended that a more detailed hydraulic model is constructed at the site-specific Flood Risk Assessment stage, to confirm flood risk. The connectivity of the unnamed drain in the northern part of the proposed site is based on OS mapping and LIDAR. No connectively could be found linking it downstream channel. It is recommended that this is reviewed as part of a future detailed site-specific assessment.
Climate change	Climate change was modelled as part of Level 2 SFRA strategic 2D modelling. However, it is recommended that the latest EA's climate change allowances are modelled in a detailed hydraulic model as part of a site-specific Flood Risk Assessment.
Fluvial depth, velocity and hazard mapping	Fluvial depth, velocity and hazard mapping has been taken from the strategic 2D modelling completed as part of the Level 2 SFRA. This should be explored further at site-specific stage.
Surface Water	The Risk of Flooding from Surface Water has been used to define areas at risk from surface water flooding.
Surface water depth, velocity and hazard mapping	The surface water depth, velocity and hazard mapping for the 1 in 100-year event (considered to be medium risk) is taken Environment Agency's Risk of Flooding from Surface Water.