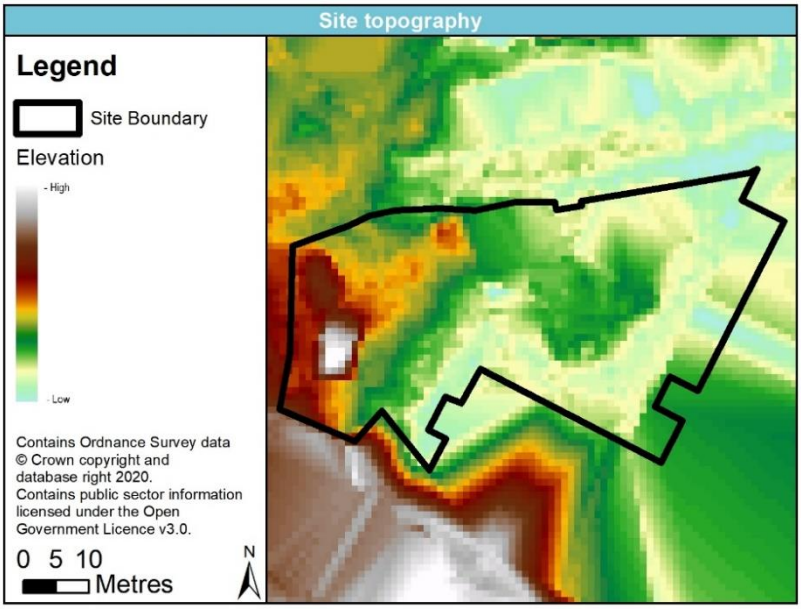
Charnwood Borough Council Strategic Flood Risk Assessment Level 2 Detailed Site Summary Tables

<table>
<tr><td rowspan="5">Site details</td><td>Site Code</td><td>PSH245</td></tr>
<tr><td>Address</td><td>Carillon Court Shopping Centre, Derby Square</td></tr>
<tr><td>Area</td><td>0.22 ha</td></tr>
<tr><td>Current land use</td><td>Greenfield</td></tr>
<tr><td>Proposed land use</td><td>Residential</td></tr>
<tr><td rowspan="4">Sources of flood risk</td><td>Topography</td><td> 

The site generally slopes from west to east.
There is a road located within the site boundary which provides a low depression in the topography to the east of the site.
The ground slope across the site generally has a gradient of less than 5%.</td></tr>
<tr><td>Existing drainage features</td><td>The Wood Brook watercourse is culverted directly under the site.</td></tr>
<tr><td rowspan="5">Fluvial</td><td>Proportion of site at risk
<table>
<tr><th>FZ3b</th><th>FZ3a</th><th>FZ2</th><th>FZ1</th></tr>
<tr><td>0%</td><td>59%</td><td>100%</td><td>0%</td></tr>
</table></td></tr>
<tr><td>Highest zone of risk (Risk of Flooding from Rivers and Sea)</td></tr>
<tr><td>Medium</td></tr>
<tr><td>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>
</table>

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<tr><td rowspan="5">Site details</td><td>Site Code</td><td colspan="3">PSH245</td></tr>
<tr><td>Address</td><td colspan="3">Carillon Court Shopping Centre, Derby Square</td></tr>
<tr><td>Area</td><td colspan="3">0.22 ha</td></tr>
<tr><td>Current land use</td><td colspan="3">Greenfield</td></tr>
<tr><td>Proposed land use</td><td colspan="3">Residential</td></tr>
<tr><td rowspan="4"></td><td></td><td colspan="3">Available data: The site is covered by the latest 2021 Environment Agency Wood Brook hydraulic model. The extent of the Flood Zones predicted by the flood model are different to the extent of the actual flood risk, as there are flood risk management features that change the risk.
It should be noted that these results are still draft format and that this same process (with additional EA quality assurance checks) will be undertaken by the EA and updated online Flood Zone mapping will be available later in 2021. Developers should contact the EA for latest information on the Wood Brook.
The current EA online Flood Map for Planning shows a different picture of flood risk, as this is based on older outdated modelling, which is due to be updated in 2021 using latest Wood Brook results. This dataset has therefore not been used in this assessment.
Flood characteristics:
This site is at high fluvial risk in the 100-year undefended Wood Brook (Flood Zone 3a) scenario, where the flow path forms a circle around the site's boundary, leaving a 'dry island' in the middle. The site is shown to be 100% covered by Flood Zone 2 and is situated in the middle of this overland flow path which flows south to north.
The defended 20-year (Flood Zone 3b) and defended 100-year extents do not affect the site; the water is still in-bank in these scenarios upstream and downstream, with the main culvert running underneath the site, showing the 'actual' flood risk when flood risk management features are in place.
As the defended 100-year extent does not affect the site, the maximum depth for the 100-year plus 30% (higher central) climate change event has been inspected, which covers the majority of the site. The deepest areas of the site are along the southern, eastern and north-eastern boundaries, with the highest depth of 0.41m in the far north-eastern corner. Depths reach 0.33m in the southern boundary. Velocity and hazard outputs were provided for the 100-year event, but as there is no risk to the site in this event, these should be interrogated in the climate change events at site-specific level. If velocities are also high in the areas of deepest water, this would result in a high hazard rating.</td></tr>
<tr><td rowspan="4">Surface Water</td><td colspan="3">Proportion of site at risk (RoFfSW)</td></tr>
<tr><td>30-year</td><td>100-year</td><td>1,000-year</td></tr>
<tr><td>54%</td><td>91%</td><td>100%</td></tr>
<tr><td colspan="3">Max depths (m)</td></tr>
</table>

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		0.6-0.9	0.6-0.9	>1.2
		Max velocity (m/s)		
		0.5-1	1-2	1-2
		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: The site is at risk of surface water flooding in all events due to it being in a highly urbanised area and an area of overland flow paths following the Wood Brook valley. The site is in the middle of a surface water flow path, though parts of the site are topographically lower, allowing ponding. The risk is significant, with over 50% at risk in the 30-year and 100% at risk in the 1,000-year event. In the 30-year and 100-year events, the site looks to form a topographic low area where water ponds, as immediately beyond the western, southern and eastern boundaries, there is no risk and therefore access is possible. Depths are fairly high in all events at 0.6-0.9m in the 30-year and 100-year events, as water ponds at the site, deepest in the south and east. Velocities are high in the 100-year and 1,000-year events as the flow path becomes more prominent. Loughborough sees a very large overland flow route from surface water in all events, along the course and topography of the Wood Brook, though the Wood Brook itself is largely in culvert through Loughborough. RoFfSW takes account of building footprints so the flood risk may be affected by existing buildings on the site. It also only considers flood risk where the hazard rating is greater than 0.575. The surface water mapping does not account for culverts, structures, channel hydraulics or sewer capacity, and therefore this is deemed to overestimate risk in the Wood Brook valley, and therefore the confidence in this dataset is reduced. It is recommended that developers investigate surface water risk in more detail at the planning application stage and may need to consider undertaking integrated modelling. Therefore, it is recommended that further assessment is undertaken at the site-specific FRA stage.		

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	Groundwater	The Areas Susceptible to Groundwater Flooding dataset shows the site is located within a 1 km grid square where >=50% <75% of the area is predicted to be at risk of groundwater flooding. The AStGWF data should be used only in combination with other information, for example local data or historical data. It should not be used as sole evidence for any specific flood risk management, land use planning or other decisions at any scale. However, the data can help to identify areas for assessment at a local scale where finer resolution datasets exist. Ground investigations may be required at the site.		
	Reservoir	The available online maps show that the maximum extent from reservoir flooding reaches across the entire proposed site. Reservoir risk is considered low, but this risk should be confirmed in a site-specific flood risk assessment.		
	Flood history	Between 2018-2020, there have been 87 LLFA reports of internal flooding; 32 of which were in Loughborough. There are no records of historic flooding at this site from the Environment Agency. No recorded historical flood incidents occurred within 550m of the proposed development site. Records from Leicestershire County Council detail historical flood incidents from all sources, whereas the Environment Agency dataset only records incidents of fluvial, tidal or coastal flooding. Loughborough is also one of the 40 highlighted priority settlements for the purpose of the Local Flood Risk Management Strategy, coming in the top 5 settlements at risk from surface water, with most properties at risk. The Lead Local Flood Authority should be contacted to obtain further details.		
Flood risk management infrastructure	**Defences**	**Defence Type**	**Standard of Protection**	**Condition**
		High ground	N/A	N/A
		This site is near high ground 15m north and 50m south of the site, following the banks of Wood Brook. The standard of protection and condition is unknown.		
	Residual risk	The Wood Brook is culverted directly under the site. If the entrance to the culvert were to become blocked or if a manhole were to become surcharged, further flooding may occur within the site. The site is therefore at a residual risk. This should be investigated further in a site-specific FRA.		

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Emergency planning	**Flood warning**	The site is situated within the Environment Agency's Leicester Wood Brook Flood Alert area (034WAF426) and the East Midlands Flood Warning area (034FWFWOLUFSOUTH).
	Access and egress	Access and egress would be in all cases, to the south east from the site. In the 30-year and 100-year surface water events, the site looks to form a topographic low area where water ponds, as immediately beyond the western, southern and eastern boundaries, there is no risk and therefore access is possible. The entire surrounding area is at risk in the 1,000-year event. Access to the north from the site should be avoided. Safe access and egress is possible in the 100-year fluvial event, but when climate change is included, the risk to the site becomes more significant. Safe access and egress needs to be considered at this site, given the coverage of surface water risk, including in climate change events. 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 using the latest Wood Brook model results, to confirm whether access for emergency vehicles could still be obtained in the climate change events.

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Climate Change	**Implications for the site**	• Increased storm intensities due to climate change may increase the extent, depth, velocity, hazard and frequency of both fluvial and surface water flooding. • Detailed modelled outputs from the latest 2021 Wood Brook modelling have been used to assess the impact of climate change on fluvial risk. The 100-year 20%, 30% and 50% defended uplifts show a significant increase in flood risk in comparison to the 100-year defended event, as the defended 100-year extent does not affect the site. The extents are slightly larger than the 100-year undefended extent, but do not reach that of the 1,000-year defended flood event. They do however cover the majority of the site and beyond the boundary, so implications of this for flood mitigation and access need to be considered. • Climate change also needs to be considered for surface water events; at the site-specific stage, the 100-year +40% event is 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. This would require a detailed FRA to assess the site layout and design, and account for integrated modelling given the national surface water does not represent hydraulic structures. • Developers should consider SuDS strategies to reduce the impacts of climate change from surface water in a detailed site-specific FRA.
Requirements for drainage control and impact mitigation	**Bedrock Geology**	The entire site's bedrock geology consists of the mudstone, siltstone and sandstone.
	Superficial Geology	The site is underlain with Alluvium deposits, consisting of clay, silt and sand.
	Soils	Loamy soils with naturally high groundwater
	Source Protection Zone	The site is not located within any Environment Agency designated Source Protection Zone.

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	Historic Landfill Site	The site is not designated by the Environment Agency as previously being a landfill site.
	Broad scale assessment of possible SuDS	Implementation of SuDS at the site could provide opportunities to deliver multiple benefits including volume control, water quality, amenity and biodiversity. This could provide wider sustainability benefits to the site and surrounding area. Proposals to use SuDS techniques should be discussed with relevant stakeholders (LPA, LLFA and EA) at an early stage to understand possible constraints. Development at this site should not increase flood risk either on or off site. The design of the surface water management proposals should take into account the impacts of future climate change over the projected lifetime of the development. Proposed SuDS should be discussed with relevant stakeholders (LPA, LLFA and EA) at an early stage to understand possible opportunities and constraints. The following techniques are considered suitable for the 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. • Infiltration may be suitable. Mapping suggests a medium risk of groundwater flooding and underlying soils may be permeable. Further site investigation should be carried out to assess potential for drainage by infiltration. If infiltration is suitable it should be avoided in areas where the depth to the water table is <1m. • Mapping suggests that the site slopes are suitable for all forms of detention. A liner maybe required due to the site potential groundwater flooding. • All filtration techniques are likely to be suitable. 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.

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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 satisfied based on fluvial and other sources of flood risk before the Exception Test is applied. Residential development is classified as 'More Vulnerable'. The site is wholly covered by Flood Zone 2 according to the EA's latest Wood Brook Flood Zones and surrounded by undefended 100-year (FZ3a) risk around the boundary, so there is nowhere to sequentially steer development to which is not at flood risk at all. The Exception test will need to be applied if the site is residential and in Flood Zone 3. However, the Exception Test is based on 'defended'/ 'actual' flood risk, and when using the defended 100-year extents, this shows no risk to the site; only the climate change extents and above affect the site, though these flood extents match more closely with the Flood Zones. • More Vulnerable and Essential Infrastructure development is located in FZ3a and for Highly Vulnerable development located in FZ2. • Highly Vulnerable infrastructure should not be permitted within FZ3a and FZ3b. • More Vulnerable and Less Vulnerable Infrastructure should not be permitted within FZ3b. Development will not be permitted for the following scenario: • Highly vulnerable development within FZ3a. • Highly vulnerable, More vulnerable and / or Less vulnerable development within FZ3b. Consideration should be given to the surface water risk within Charnwood Borough, particularly within Loughborough with regards to the Exception Test. For example, a site may pass the test based on fluvial flood risk alone, but greater risk comes from surface water at the four Loughborough sites. However, the national surface water mapping does not account for culverts, structures, channel hydraulics or sewer capacity, and therefore this is deemed to overestimate risk in the Wood Brook valley, and therefore the confidence in this dataset is reduced. It is recommended that developers investigate surface water risk in more detail at the planning application stage and may need to consider undertaking integrated modelling.

	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 for this site as development is located within Flood Zone 3b and may be subject to other sources of flooding and the development may introduce a more vulnerable use. It will also be required where development sites:
		  ○ are 1 hectare or more in size;
		  ○ contain land which has been identified by the Environment Agency as having critical drainage problems; or
		  ○ contain land identified in the strategic flood risk assessment as being at increased flood risk in future.
		• All sources of flooding must be considered as part of any site-specific Flood Risk Assessment, including surface water and groundwater.
		• Consideration should be given to the potential effects of climate change, particularly with respect to surface water. Proposals should consider the opportunity to include measures that provide for a reduction in the predicted surface water flood risk at existing development.
		• Flood risk needs to be considered for the lifetime of the development, accounting for climate change.
		• Latest modelled outputs from the Wood Brook Environment Agency study show the site is located in the Flood Zones, but not the 100-year defended/ actual risk. Risk to the site is more significant in the climate change events and is wholly covered by Flood Zone 2.
		• Consideration should be given to the surface water risk within Charnwood Borough, particularly within Loughborough with regards to the Exception Test. For example, a site may pass the test based on fluvial flood risk alone, but greater risk comes from surface water at the four Loughborough sites. However, the national surface water mapping does not account for culverts, structures, channel hydraulics or sewer capacity, and therefore this is deemed to overestimate risk in the Wood Brook valley, and therefore the confidence in this dataset is reduced. It is recommended that developers investigate surface water risk in more detail at the planning application stage and may need to consider undertaking integrated modelling.
		• The site extents include a Main River (in culvert), where an easement of 8m is required from either side of the bank. In this site, this is in the middle of the site, requiring 16-20m easement area, which will have implications for development. Developers will be required to apply for a permit and ensure the activity being carried out over this easement would not increase flood risk.
		• Any FRA should be carried out in line with the National Planning Policy Framework, Flood Risk and Coastal Change Planning Practice Guidance, Charnwood Council's Local Plan policies and the LLFA's SuDS guidance.
		• Consultation with the Local Authority, Local Lead Flood Authority and the Environment Agency should be undertaken at an early stage.
		• 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. Development must be in line with Table 3: flood risk vulnerability and flood zone compatibility of the NPPG.

		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 design event or existing ground levels may be needed. With the flood risk from surface water being a flow path, residential development may need to be placed on higher levels, allowing the ground floor to flood, e.g. through a void or siting car parking on ground levels. The flow path should not be obstructed so as to displace the risk elsewhere. Design should account for surface water with an element of climate change.
		• 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 placing 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 the current greenfield rates.
		• On site attenuation schemes would need to be tested against the watercourse to ensure flows are not exacerbated downstream within the catchment.
		• New or re-development 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.
		• New development must seek opportunities to reduce overall level of flood risk at the site, for example by:
		  ○ Reducing volume and rate of runoff
		  ○ Relocating development to zones with lower flood risk
		  ○ Creating space for flooding.
		• Efforts should be made to limit runoff to greenfield rates and discharge rates from the site should not increase downstream flood risk.
		• The opportunity should be taken to store additional water on development sites in the Wood Brook to alleviate flooding in the wider area, in addition to long term storage requirements. Opportunities to complement and enhance the existing NFM scheme within the catchment should also be investigated. Such schemes may also improve the surface water risk in the catchment, by slowing the fluvial flows in the system allowing the surface water drainage to outfall to the channel.
		• Developers should enter into conversations with the Borough Council/ EA at pre-application stage to understand

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		the latest position with regards to the Environment Agency led Wood Brook scheme. Betterment may be required: ○ In the form of additional storage for surface water runoff from development sites on site, ○ In the form of 'in kind' works, such as additional floodplain storage on site, and/ or ○ In the form of a contribution towards wider community flood alleviation works within the catchment.
Key messages		• The modelled defended 100-year shows the site to be developable, with no risk shown to the site; however, the climate change extents fully surround the site boundary and Flood Zone 2 fully covers the site, so consideration is needed for flood risk mitigation and safe access for the lifetime of the development. • Surface water is a high risk to the site, though access to/ from the site looks possible in the 30-year and 100-year events as the site contains the surface water topographically. The site is part of a flow path, so this needs to be maintained and not obstructed in future development design. • Site-specific assessments should investigate surface water risk in more detail using integrated modelling to fully understand the interaction between fluvial and surface water risk and hydraulic structures. • The site extents include a Main River (in culvert), where an easement of 8m is required from either side of the bank. In this site, this is in the middle of the site, requiring 16-20m easement area. Developers will be required to apply for a permit and ensure the activity being carried out over this easement would not increase flood risk. • If flood mitigation measures and flood resilient design are implemented, then they are tested to ensure that they will not displace water elsewhere. Refer to the 'detailed guidance for developers' section (above) 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 was the Environment Agency's Risk of Flooding from Surface Water mapping. More details regarding data used for this assessment can be found below.

Flood Zones	The EA Flood Map for Planning does not currently represent the latest Environment Agency's 2021 Wood Brook modelling, which was in progress at the time of the SFRA, and hence the current EA Flood Zones 3a and 2 largely overestimate flood risk along this watercourse, with them being based on the Lower Soar modelling. Due to the significant difference between the EA's current Flood Map for Planning in this area and new Wood Brook model results, the new model results have been used to derive the Flood Zones for the purpose of the L2 SFRA at the four Loughborough sites. The draft defended and undefended 100-year extents have been merged to form a composite Flood Zone 3a extent, and the defended and undefended 1,000-year flood extents have been merged with the Historic Flood Map to form a composite Flood Zone 2 extent. Flood Zone 3b has been derived from the 20-year defended modelled flood extent. It should be noted that these results are still draft format and that this same process (with additional EA quality assurance checks) will be undertaken by the EA and updated online Flood Zone mapping will be available later in 2021. Developers should contact the EA for latest information on the Wood Brook.
Climate change	Climate change was based on the latest Environment Agency 2021 Wood Brook model and the 1,000-year surface water flood extent. It should be noted that these results are still draft format and that this same process (with additional EA quality assurance checks) will be undertaken by the EA. Developers should contact the EA for latest information on the Wood Brook.

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Fluvial depth, velocity and hazard mapping		The 100-year defended modelled outputs were used to assess depth, velocity and hazard are from the detailed 2021 Wood Brook hydraulic model. These do not affect the site, but the other modelled event outputs were not provided at the time of the study. It should be noted that these results are still draft format and that this same process (with additional EA quality assurance checks) will be undertaken by the EA. Developers should contact the EA for latest information on the Wood Brook.
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 30-year (high risk), 1 in 100-year (medium risk) and 1 in 1,000-year (low risk) events is taken from the Environment Agency's Risk of Flooding from Surface Water mapping.