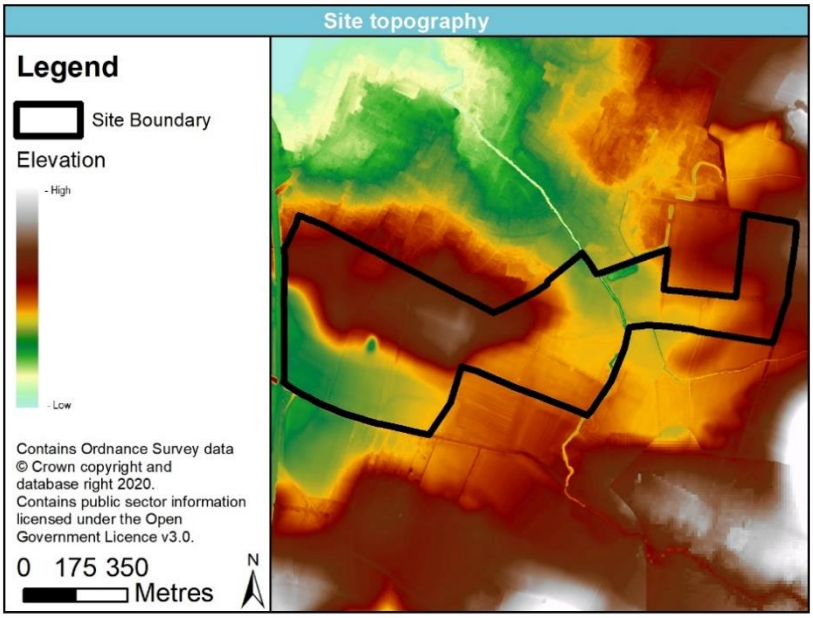
Charnwood Borough Council Strategic Flood Risk Assessment Level 2 Detailed Site Summary Tables

<table>
<tr><td rowspan="5">Site details</td><td>Site Code</td><td colspan="4">PSH69</td></tr>
<tr><td>Address</td><td colspan="4">Land south east of Syston</td></tr>
<tr><td>Area</td><td colspan="4">64.35 ha</td></tr>
<tr><td>Current land use</td><td colspan="4">Greenfield</td></tr>
<tr><td>Proposed land use</td><td colspan="4">Residential</td></tr>
<tr><td rowspan="4">Sources of flood risk</td><td>Topography</td><td colspan="4"> 

The site varies in topography with a high elevation area located to the north west corner of the site and the north east corners of the site. Two topographic depressions are located in the south west corner of the site and the central north part of the site.
• There are no existing buildings located within the site.
• The site generally has a slope of less than 5%.</td></tr>
<tr><td>Existing drainage features</td><td colspan="4">Barkby Brook runs along the south eastern border of the site, where it meets an unnamed ordinary watercourse as it tracks north. This then cuts through the site northwards and leaves the site at the north site boundary by St Hildas Close. This then flows into the River Wreake 2.5km north west of the site.</td></tr>
<tr><td rowspan="4">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><1%</td><td><1%</td><td>40%</td><td>60%</td></tr>
<tr><td colspan="4">Highest zone of risk (Risk of Flooding from Rivers and Sea)</td></tr>
<tr><td colspan="4">Medium</td></tr>
</table>

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 colspan="3">PSH69</td></tr>
<tr><td>Address</td><td colspan="3">Land south east of Syston</td></tr>
<tr><td>Area</td><td colspan="3">64.35 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="11"></td><td rowspan="2"></td><td colspan="3">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="3">Available data: The site is covered by the Environment Agency's Lower Wreake (2015) hydraulic model from the northern site boundary and 2D generalised modelling through the site and upstream (south).

Flood characteristics:
The Flood Map for Planning presents the site to be located within Flood Zone 3 as the watercourse flows through the site, with water remaining in bank through the site. Almost the entire southern half of the site is shown to be located within Flood Zone 2. This is a very wide area of floodplain where the Barkby Brook meets an unnamed drain at the site's southern boundary, and water spreads out to the west and ponds against the railway embankment along the western boundary.
The defended 100-year model extent from the Lower Wreake model has been used to assess the actual risk to the site. Model outputs show the site to be at negligible risk from fluvial flooding. However, the extent of this model starts at the site's northern boundary, so there is no depth, velocity or hazard data available. The deepest area of the site would be to the west adjacent to the railway line.
It is recommended that this model is extended further upstream to provide a better understanding of the fluvial risk associated with the site, which may see a reduction in the severity of Flood Zone 2 shown in the Flood Zone mapping.</td></tr>
<tr><td rowspan="9">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>1%</td><td>2%</td><td>10%</td></tr>
<tr><td colspan="3">Max depths (m)</td></tr>
<tr><td>0.9-1.2</td><td>0.9-1.2</td><td>0.9-1.2</td></tr>
<tr><td colspan="3">Max velocity (m/s)</td></tr>
<tr><td>>2</td><td>>2</td><td>>2</td></tr>
<tr><td colspan="3">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 %)</td></tr>
</table>

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

Site details	**Site Code**	**PSH69**
	Address	Land south east of Syston
	Area	64.35 ha
	Current land use	Greenfield
	Proposed land use	Residential
		Description of surface water flow paths: For the 30-year event, surface water accumulation occurs predominantly in small, localised patches across the site due to lower ground elevations along Barkby Lane and parallel to the railway line. Surface water accumulation is also observed along the Barkby Brook watercourse. An increase in 2% for the 100-year displays greater accumulation of surface water at the same locations for the 30-year event. There is over double the area predicted to be impacted by surface water for the 1,000-year event, where there is significant expansion and development of flow routes through the site. Most notably in the south-west corner by Barkby Lane and along the Barkby Brook watercourse where a significant flow route from Pembrook Avenue intersects with the northern boundary of the site. Overall, however, only 10% of the site is shown to be at risk. Depths are high in all events due to these topographic depressions where water ponds. 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.
	Groundwater	The Areas Susceptible to Groundwater Flooding dataset shows the site is located within a 1 km grid square where >=50% to <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 at the site should be used to confirm groundwater levels to support the design of SUDS features.
	Reservoir	The site is not shown to be at risk of reservoir flooding from the available online maps.
	Flood history	There are no records of historic flooding at this site from the Environment Agency. No recorded historical flood incidents occurred within 450m of the proposed development site. Leicestershire County Council may hold additional records which are not available at this time. These records detail historical flood incidents from all sources, whereas the Environment Agency dataset only records incidents of fluvial, tidal or coastal flooding. The Lead Local Flood Authority should be contacted to obtain further details.

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

Site details	**Site Code**	**PSH69**		
	Address	Land south east of Syston		
	Area	64.35 ha		
	Current land use	Greenfield		
	Proposed land use	Residential		
Flood risk management infrastructure	**Defences**	**Defence Type**	**Standard of Protection**	**Condition**
		High Ground	Unknown	Unknown
		High ground is located to the north of the site and follows the banks of the Barkby Brook. This includes 80m of the site boundary. It is unknown what the standard of protection or condition of the high ground is.		
	Residual risk	The Barkby Brook is culverted under Pembroke Avenue to the north of the site. If this structure were to become blocked during a flood event, it is possible that water could back up and increase flood risk on the site. This residual risk should be investigated in a site-specific FRA.		
Emergency planning	**Flood warning**	The site is partially within the Environment Agency's River Wreake in Leicestershire Flood Alert area (034WAF404). The site is not situated within an Environment Agency Flood Warning area.		
	Access and egress	Access and egress to the site can be gained in the north east corner of the site via Barkby Road for all fluvial and surface water events. Surface water and fluvial flood risk bisects the site and therefore consideration is needed regarding access to the western portion of the site, as to whether provision can be made from the housing estate to the north, so as not to cross flood waters. With detailed modelling, the Flood Zone 2 extent may reduce; this needs to be confirmed at detailed FRA stage.		

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

Site details	**Site Code**	**PSH69**
	Address	Land south east of Syston
	Area	64.35 ha
	Current land use	Greenfield
	Proposed land use	Residential
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. • There is no detailed fluvial modelling available at the site to indicate fluvial flood risk at the site due to climate change. The site is partially clipped by detailed model extents for the Lower Wreake model which covers fluvial risk downstream of the site. As part of a site-specific Flood Risk Assessment, latest EA climate change allowances will need to be considered in a detailed hydraulic model of the watercourse which runs through the site, to confirm the impact in the site. Using the 1,000-year as a proxy for climate change, an increase in flood risk is predicted to occur as a result of climate change. • Only the 100-year flood extent is available for the site to assess potential future Flood Zone 3b. The 100-year extent (Flood Zone 3) when compared to the 20-year (Flood Zone 3b) suggests that only a marginal area could become Flood Zone 3b in the future. Two areas to the north of the site where out of bank flow routes occur could become the functional floodplain the future. • Due to the number of dwellings proposed at the site, the H++ climate change uplift should be considered for the site as part of a site-specific Flood Risk Assessment. • 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. • 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	**Bedrock Geology**	The entire site's bedrock geology consists of mudstone, siltstone and sandstone.
	Superficial Geology	The site is underlain with River Terrace Deposits (undifferentiated) consisting of sand and gravel.

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

Site details	**Site Code**	**PSH69**
	Address	Land south east of Syston
	Area	64.35 ha
	Current land use	Greenfield
	Proposed land use	Residential
impact mitigation	**Soils**	The north of the site has slightly acid loamy and clayey soils with impeded drainage whilst the south has loamy and clayey floodplain soils with naturally high groundwater.
	Source Protection Zone	The site is not located within any Environment Agency designated Source Protection Zone.
	Historic Landfill Site	The site is not designated by the Environment Agency as previously being a landfill site.

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

Site details	**Site Code**	**PSH69**
	Address	Land south east of Syston
	Area	64.35 ha
	Current land use	Greenfield
	Proposed land use	Residential
	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.

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

Site details	**Site Code**	**PSH69**
	Address	Land south east of Syston
	Area	64.35 ha
	Current land use	Greenfield
	Proposed land use	Residential
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'. It is recommended that proposed development will be sequentially located within Flood Zone 1 areas of the site, which may need to be confirmed through a site-specific assessment. 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 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.

	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.
		• Other 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.
		• A more detailed hydraulic model (or extension upstream to the existing Lower Wreake model) may be required at Flood Risk Assessment stage, to confirm flood risk and flow paths, FZ3b and climate change extents from the Barkby Brook, using channel topographic survey.
		• Climate change modelling should be undertaken using the relevant allowances for the type of development and level of risk.
		• Where there is a reasonable likelihood of multiple sources of flood risk having significant impact in combination, it is recommended that consideration is given to assessing the combined risks of these.
		• 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, 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 design event may remove the need for resilience measures.
		• 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.
		• All development should adopt source control SuDS techniques to reduce the risk of frequent low impact flooding due to post development runoff.
		• SuDS should be designed to deliver multiple benefits including water quality, biodiversity, amenity, green infrastructure etc. Example features include swales, attenuation features, green roofs, rainwater capture and reuse and permeable paving.
		• Green infrastructure should be considered within the mitigation measures for surface water runoff from potential development and consider using Flood Zones 2 and 3 as public open space.
		• Efforts should be made to limit runoff to greenfield rates and discharge rates from the site should not increase downstream flood risk.
		• The Environment Agency has currently a project looking at the feasibility of multi-benefit interventions in the Barkby brook which runs through Syston. The Brook suffers from reduced water quality and biodiversity. Although the new development is not adjacent to the Brook, the development could increase flood risk and reduce water quality. The EA would like development to contribute to improvement in the quality of the river, biodiversity and reduce flood risk. High quality and high functioning SuDS schemes could benefit the river downstream.

Key messages		The flood risk element of the Exception Test is likely to be passed if: • Development is limited to the 60% of the site located within Flood Zone 1 and therefore should be steered towards the north-western and north-eastern side of the site. • It should be noted that the Flood Zones and surface water flood risk bisects the site and therefore consideration is needed regarding access from both sides to local roads.

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

Site details	**Site Code**	**PSH69**
	Address	Land south east of Syston
	Area	64.35 ha
	Current land use	Greenfield
	Proposed land use	Residential
		• Detailed hydraulic modelling will need to be conducted for the watercourse that intersects the site to assess the present and future fluvial risk to the site. • Areas in Flood Zone 2 are used for the least vulnerable parts of the development in accordance with Table 2 in the NPPF. No residential development is permitted in Flood Zone 3 and no development at all is permitted in Flood Zone 3b. • 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. Refer to the 'detailed guidance for developers' section (above) for further information on the measures that are appropriate for this site.

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 Flood Zone data is based on the Environment Agency's Lower Wreake and tributaries (2015) hydraulic model and the EA's Flood Map for Planning.
Climate change	Climate change was based on the Environment Agency's Lower Wreake and tributaries (2015) hydraulic model and Flood Zone 2 given the modelled extents are further downstream of the site.
Fluvial depth, velocity and hazard mapping	The 100-year modelled outputs used to assess depth, velocity and hazard are from the detailed Environment Agency Lower Wreake and tributaries (2015) hydraulic model. However, model coverage is further downstream of the site.
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.