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Site code	G1
Site name	South of Hardwicke

Site details	OS Grid reference	SO 79768 12585																	
	Area	67.85Ha																	
	Current land use	Agricultural																	
	Proposed site use	Residential																	
	Flood risk vulnerability	More vulnerable																	
Sources of flood risk	Existing watercourses	<p>The Shorn Brook passes through the central and western land parcels of the site. The majority of the Shorn Brook is classified as an ordinary watercourse, however the lower reach, at the boundary of the western land parcel, is designated as a Main River.</p> <p>The Gloucester and Sharpness Canal is adjacent to the boundary of the western land parcel.</p> <p>Two ponds lie within Herbert's Plantation, located at the centre of the largest land parcel. This site is located approximately 350m north of the Lower Severn IDB boundary.</p>																	
	Flood history	<p>The site is not located within an Environment Agency recorded flood outline, which reflects the classification of the Shorn Brook as an ordinary watercourse at this location.</p> <p>The following flood incidents recorded by Gloucestershire County Council are located adjacent to the site:</p> <ul style="list-style-type: none"> 11/05/2012 - Pound Lane (GL2 4RJ) – source of flooding unknown Date unknown - Green Lane (GL2 4QA) – fluvial flooding causing internal flooding. 16/07/2016 - B4006 Bristol Road (GL2 4RA) – source of flooding unknown 																	
	Fluvial	<table border="1"> <thead> <tr> <th colspan="5">Proportion of site at risk in Flood Zones</th> </tr> <tr> <th>Proportion of the site at risk (%)</th> <th>Flood Zone 3b 5% AEP (1 in 20)</th> <th>Flood Zone 3a 1% AEP (1 in 100)</th> <th>Flood Zone 2 0.1% AEP (1 in 1,000)</th> <th>Flood Zone 1</th> </tr> </thead> <tbody> <tr> <td></td> <td>N/A</td> <td>7%</td> <td>1%</td> <td>92%</td> </tr> </tbody> </table> <p>Available modelled data: The site is not covered by a detailed hydraulic model, with the Flood Zones generated from generalised national scale mapping. Therefore, there are no detailed results available for the site. In the absence of detailed modelling information, the Flood Zones have been used to assess risks to the site during the 1 in 100 and 1 in 1,000 fluvial flood events. However, the Flood Zones do not extend beyond Sticky Lane, the access track bordering the eastern land parcel. Therefore, the potential extent of the Flood Zones and effect on the allocation proposals should be evaluated to enable the application of the sequential approach. The Risk of Flooding from Surface Water dataset has been used to assess fluvial flood risk in areas of the Shorn Brook outside the Flood Zones.</p>				Proportion of site at risk in Flood Zones					Proportion of the site at risk (%)	Flood Zone 3b 5% AEP (1 in 20)	Flood Zone 3a 1% AEP (1 in 100)	Flood Zone 2 0.1% AEP (1 in 1,000)	Flood Zone 1		N/A	7%	1%
Proportion of site at risk in Flood Zones																			
Proportion of the site at risk (%)	Flood Zone 3b 5% AEP (1 in 20)	Flood Zone 3a 1% AEP (1 in 100)	Flood Zone 2 0.1% AEP (1 in 1,000)	Flood Zone 1															
	N/A	7%	1%	92%															

Site code	G1
Site name	South of Hardwicke

		<p>Flood characteristics: The upper portion of the central land parcel is predicted to be affected during a 1 in 100 flood event, where the Shorn Brook passes through the site, with the extent of flooding extending northwards during a 1 in 1,000 event. Church Lane, which separates the central and western parcels, is predicted to flood during a 1 in 100 event. However, the lower reach of the Shorn Brook, which borders the western land parcel, has not been assessed by flood modelling and so the potential presence of a Flood Zone has not been determined. The RoFSW dataset has been used to assess fluvial flood risk in this location.</p>		
Surface Water	Proportion of site at risk (RoFSW)			
	3.3% AEP (1 in 30)	1% AEP (1 in 100)	0.1% AEP (1 in 1,000)	
	2%	13%	15%	
	<p>Description of surface water flow paths: The site is at moderate risk of surface water flooding, with dispersed areas of ponding predicted to occur in low points across the site.</p> <p>With the exception of an area of ponding against Green Lane during a 1 in 30 rainfall event, the eastern land parcel is identified as at low risk of surface water flooding. The central land parcel is at higher risk of surface water flooding, with areas of ponding predicted to occur during a 1 in 30 rainfall event in the centre of the site alongside Shorn Brook, as well as in the north and south against Green Lane and Pound Lane, respectively.</p> <p>Surface water flood risk in the western land parcel is concentrated against the embankment of the Stroudwater and Sharpness Canal, where ponding forms during a 1 in 30 rainfall event, and extends to a continuous line during the 1 in 1,000 rainfall event. At the southern edge of the western land parcel, the RoFSW dataset provides a proxy for fluvial flood risk in the lower reaches of the Shorn Brook. The mapping indicates that flooding is predicted to remain close to the channel in events up to and including the 1 in 1,000-year rainfall event.</p>			
	<p style="text-align: center;">Areas Susceptible to Groundwater Flooding Map class (risk of groundwater emergence)</p>			
Groundwater	ASTGWF - Category 2 ≥25% <50%	ASTGWF - Category 3 ≥50% <75%	ASTGWF - Category 4 ≥75%	
	0%	0%	0%	
	The site is identified as at low risk of groundwater flooding.			
Reservoir	The site is not identified as at risk from reservoir flooding.			
Canal	The Gloucester and Sharpness Canal is located adjacent to the western land parcel. The canal appears to be embanked in this location, and therefore the site is identified as at potential risk of flooding from the canal. The residual risk to the site, in the event of breach or overtopping of the canal, should be assessed within a site-specific Flood Risk Assessment.			

Site code	G1
Site name	South of Hardwicke

	Defences	Defence Type	Standard of Protection	Condition								
		There are no flood defences within the site.										
Flood risk management infrastructure	Residual risk	Culvert / structure blockage?	The Shorn Brook is culverted beneath Church Lane and adjacent to the Gloucester and Sharpness Canal, which may pose a risk of flooding to the central land parcel, in the event of blockage. This residual risk should be assessed in further detail within a site-specific FRA.									
		Impounded water body failure?	The site is not at risk of reservoir breach.									
		Defence breach / overtopping?	<p style="text-align: center;">Breach Zone</p> The site is not identified as benefitting from flood defence. However, the residual risk of flooding to the site in the event of breach or overtopping of the Gloucester and Sharpness Canal should be assessed in further detail within a site-specific FRA.									
Emergency planning	Flood warning	The site is not covered by an Environment Agency Flood Warning or Flood Alert Area.										
	Access and egress	The site may be accessed from five roads: B4008 Bristol Road, Green Lane, Church Lane, Pound Lane and Sticky Lane. Sticky Lane and Church Lane are identified as at risk of flooding from the Shorn Brook during the 1 in 100 and 1 in 1,000 fluvial flood events, as well as being at risk of flooding during a 1 in 30 rainfall event. Therefore, access via these roads is likely to be restricted during times of flood. Green Lane and Pound Lane are at low risk of fluvial flooding. However they are at risk of surface water flooding during a 1 in 30 rainfall event and greater return periods, with extensive flooding predicted to affect Pound Lane. The B4008 Bristol Road is at low risk of fluvial and surface water flooding.										
Climate Change	Climate change allowances for '2080s'	<table border="1"> <thead> <tr> <th>River Basin District</th> <th>Central</th> <th>Higher Central</th> <th>Upper End</th> </tr> </thead> <tbody> <tr> <td>Severn</td> <td>25%</td> <td>35%</td> <td>70%</td> </tr> </tbody> </table>	River Basin District	Central	Higher Central	Upper End	Severn	25%	35%	70%		
	River Basin District	Central	Higher Central	Upper End								
Severn	25%	35%	70%									
Implications for the site	The site is likely to be impacted by climate change. The extent of the 1 in 100 + climate change flood event is greater than that of the 1 in 100 within the site, which indicates that climate change is likely to increase the risk of fluvial flooding to the site. It should be noted that, due to the absence of detailed model results, the climate change extents here are represented using the 1 in 1,000 extent and therefore may be conservative in the area of land that is indicated to be affected.											

Site code	G1
Site name	South of Hardwicke

Requirement for drainage control and impact mitigation	Bedrock Geology	The site is underlain by the Lias Group Mudstone, Siltstone, Limestone and Sandstone.		
	Superficial Geology	There are no superficial geology deposits recorded at the site.		
	Soils	The site is overlain by lime-rich loamy and clayey soils with impeded drainage.		
	SuDS	<ul style="list-style-type: none"> As a large, relatively undeveloped site, opportunities should be taken to incorporate above ground SuDS features, which provide multiple benefits. Severn Trent Water has flagged parts of the site as being at high risk for surface water drainage, as there are no surface water sewers in the vicinity of the site, and connection distances into the nearest watercourses may be large. If infiltration techniques are not feasible on the site, early consultation with Severn Trent Water and Gloucestershire County Council (as LLFA) is recommended, to secure a suitable surface water discharge destination. As one of several sites within a large area of growth, it is recommended that an overarching drainage strategy is developed across the nearby sites (PS30, PS31, PS32, PS43), in consultation with Severn Trent Water and Gloucestershire County Council (as LLFA). A high-level assessment of SuDS suitability carried out as part of the Level 1 SFRA suggests that the site is best suited to conveyance features, such as swales and rills, or detention features, such as ponds and wetlands. Attenuation features must be located outside areas of fluvial flood risk. The site geology is impermeable in nature, therefore there is likely to be limited potential for discharge of surface water by infiltration. However, the potential for infiltration should be investigated within site-specific infiltration testing. 		
	Groundwater Source Protection Zone	The site is not within a groundwater Source Protection Zone.		
	Historic Landfill Site	There are no historical landfill sites within the proposed boundary.		
	Opportunities for flood risk betterment	Development should seek to strictly limit the rate and volumes of surface water leaving the site, to help to reduce and delay the timing of flows entering the Shorn Brook. Opportunities should be taken to daylight culverts on the Shorn Brook wherever possible.		
		Water Framework Directive Catchment	Sensitivity to cumulative impacts	Implications

Site code	G1
Site name	South of Hardwicke

	Cumulative impacts of development	Epney Rhyne – source to confluence with River Severn Estuary	High	FRA should include consideration of effects on potential sensitive receptors off-site and if necessary, include additional mitigation, so there are no adverse cumulative effects
Recommendations for Local Plan policy	Sequential Test and Exception Test requirements			
	<p>The Sequential Test must be satisfied. Only once the Sequential Test is satisfied should the Exception Test be applied. It is anticipated that proposed development will be sequentially located within Flood Zone 1. For this site, the Exception Test must be satisfied:</p> <ul style="list-style-type: none"> • If More Vulnerable and Essential Infrastructure is located in FZ3a or FZ3a plus climate change. • If Highly Vulnerable development is located in FZ2. <p>If Essential Infrastructure is located in Flood Zone 3b then it must be demonstrated that the exception test is satisfied. Development will not be permitted in the following scenarios:</p> <ul style="list-style-type: none"> • Highly Vulnerable development within FZ3a or FZ3a plus climate change and FZ3b. <p>More Vulnerable and Less Vulnerable development within FZ3b.</p>			
	Recommendations for requirements of site-specific Flood Risk Assessment, including guidance for developers			
<p>Flood risk assessment:</p> <ul style="list-style-type: none"> • Consultation with the Local Authority and the Environment Agency should be undertaken at an early stage. • A site-specific flood risk assessment will be required because the site is within Flood Zone 2 and 3 and at risk from sources of flooding other than rivers and the sea. Government guidance on flood risk assessments must be followed (https://www.gov.uk/guidance/floodrisk-assessment-for-planning-applications). • The impact of the development on flood risk from all sources both on and off-site must be considered and modelled where appropriate. It is recommended that a detailed hydraulic model of the Shorn Brook is carried out for the site to accurately understand the fluvial flood risk to the site, and the impact of climate change, in greater detail. The Environment Agency and LLFA should be consulted to obtain the latest hydraulic modelling information for the site at the time of preparing a flood risk assessment. • Blockage modelling should be conducted to assess the residual risk associated with blockage of the culvert within the site. • The residual risk of flooding to the site in the event of breach or overtopping of the Gloucester and Sharpness Canal should be assessed in further detail within a site-specific FRA. • Climate change should be assessed using recommended climate change allowances at the time of the assessment (https://www.gov.uk/guidance/flood-risk-assessmentsclimate-change-allowances) for the type of development and level of risk. The current allowances were published in February 2016 but may be subject to change in the future. • The site is located within a catchment identified as highly sensitive to the cumulative impact of development. The effects which development of the site may have on flood risk within the catchment will need to be considered within a site-specific flood risk assessment. • Appropriate storage of surface water runoff will need to be provided, and assessments should identify opportunities to provide off-site betterment, to help offset the cumulative impact of development. For example, this may include contribution to the delivery of schemes within the catchment, such as flood alleviation schemes, Natural Flood Management, SuDS retrofit or river restoration. 				

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	<p>Guidance for site design and making development safe:</p> <ul style="list-style-type: none">• A site-specific surface water drainage strategy will be required.• Development must seek opportunities to reduce overall level of flood risk at the site and should seek to reduce the levels of flood risk downstream.• Consultation with Gloucestershire County Council as Lead Local Flood Authority (LLFA) and the Stroud District Council Drainage Engineer on surface water drainage of the site and potential SuDS features should be undertaken at an early stage.• Development must seek opportunities to reduce overall level of flood risk both on and off-site, for example by reducing volume and rate of runoff and creating space for flooding.• 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.• The site layout and drainage design must ensure that surface water flows resulting from rainfall in excess of a 1 in 100 event are managed via exceedance routes that minimise the risks to people and property.• Safe access and egress should be demonstrated in the 1 in 100 plus climate change fluvial and rainfall events. 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.• Opportunities should be taken to de-culvert, or 'daylight' existing culverts within the site.
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Site code	G2
Site name	Land at Whaddon

Site details	OS Grid reference	SO 82863 13037				
	Area	173.1 ha				
	Current land use	Greenfield				
	Proposed site use	Residential				
	Flood risk vulnerability	More vulnerable				
Sources of flood risk	Existing watercourses	The Main River Daniel's Brook flows in a north-westerly direction through the site before becoming culverted below the railway embankment along the western boundary. In the south of the site, another ordinary watercourse forms a tributary to the brook. The Whaddon Brook, an ordinary watercourse which becomes a main River downstream at Lower Tuffley, forms the northern boundary of the site.				
	Flood history	There are no historical flood events associated with the site.				
	Fluvial	Proportion of site at risk in Flood Zones				
		Proportion of the site at risk (%)	Flood Zone 3b 4% AEP (1 in 25)	Flood Zone 3a 1% AEP (1 in 100)	Flood Zone 2 0.1% AEP (1 in 1,000)	Flood Zone 1
			N/A	5%	2%	93%
	<p>Available modelled data: The site is covered by the Environment Agency 2009 Daniel's Brook ESTRY-TUFLOW hydraulic model, although the model is 1D-only in this location, with the 2D domain starting downstream of the railway line adjacent to the site. As a result, the Flood Zones for Daniel's Brook are based on generalised modelling, and therefore detailed model results are not available. The Whaddon Brook 2009 ESTRY-TUFLOW model covers the northern boundary of the site. Additional detailed modelling of watercourses within the site is due to be undertaken, as part of a planning application for the site.</p> <p>Flood characteristics: The central portion of the site is located within Flood Zone 3a, 3b and Flood Zone 2 and is at risk of flooding from the Daniel's Brook during the 1 in 100 and 1 in 1,000 events. During a 1 in 1,000 event, the extent of flooding in the north west of the site increases, as floodwaters are predicted to pond against the railway embankment.</p> <p>A very small portion of the northern site boundary is at risk of flooding from the Whaddon Brook during a 1 in 100 event. The extent of flooding increases to impact the north of the site during a 1 in 1,000 event. The centre of the site contains a "dry island", where floodwaters bypass an area of higher ground during a 1 in 100-year and 1 in 1,000-year event.</p>					
Surface Water	Proportion of site at risk (RoFSW)					
	1 in 30	1 in 100		1 in 1,000		
	5%	13%		15%		

Site code	G2
Site name	Land at Whaddon

		Description of surface water flow paths: The surface water flood risk across the site is largely associated with the fluvial flood extents of Daniel's Brook and its tributary watercourses. However, a number of additional surface water flow paths are predicted to form in the south, north and east of the site during a 1 in 1,000 rainfall event, and drain into the nearest watercourse. In addition, some isolated ponding is predicted to occur on natural low points within the site.							
	Groundwater	Areas Susceptible to Groundwater Flooding Map class (risk of groundwater emergence)							
		ASTGWF - Category 2 >=25% <50%	ASTGWF - Category 3 >=50% <75%	ASTGWF - Category 4 >=75%					
		0%	0%	0%					
		The site is at low risk of groundwater flooding, with a less than 25% risk of occurring within the surrounding 1km ² grid cell during a 1 in 100 groundwater flood event.							
	Reservoir	The site is not at risk of reservoir breach.							
	Canal	There are no canals within the site boundary.							
Flood risk management infrastructure	Defences	Defence Type	Standard of Protection	Condition					
		There are no flood defences within the site.							
	Residual risk	Culvert / structure blockage?	Consideration should be given to potential residual risk posed by blockage on the railway culvert at the west of the site within a site-specific FRA.						
		Impounded water body failure?	The site is not at risk of flooding in the event of reservoir breach.						
	Defence breach / overtopping?	<table border="1"> <tr> <td colspan="2">Breach Zone</td> </tr> <tr> <td colspan="2">There are no defences within the site.</td> </tr> </table>				Breach Zone		There are no defences within the site.	
Breach Zone									
There are no defences within the site.									
Emergency planning	Flood warning	The site is covered by the Environment Agency Rivers in North Gloucestershire Flood Alert Area							
	Access and egress	<p>The site is likely to be accessed via Stroud Road (A4173) which is along the eastern boundary of the site. This route is intersected by surface water flow paths from the east during the 1 in 30 event. At higher return periods, highway flooding occurs in some parts along the road. However, the road is at low fluvial flood risk and remains within Flood Zone 1.</p> <p>The centre of the site contains a "dry island", where floodwaters bypass an area of higher ground during a 1 in 100-year and 1 in 1,000-year event. It is unlikely that development will be appropriate on this area of land unless appropriate provisions are made with respect to safe access and egress.</p>							
Climate Change	Climate change allowances for '2080s'	River Basin District	Central	Higher Central	Upper End				
		Severn	25%	35%	70%				

Site code	G2
Site name	Land at Whaddon

Implications for the site	<p>The site is likely to be impacted by climate change. The extent of the 1 in 100 + climate change flood event is greater than that of the 1 in 100 within the site, which indicates that climate change is likely to increase the risk of fluvial flooding to the site.</p> <p>In the north of the site, the 1 in 100 + 70% climate change extent increases beyond the extent of Flood Zone 3a (1 in 100), but to meet Flood Zone 2 (1 in 1,000).</p> <p>It should be noted that the climate change extents for Daniel's Brook are represented using the 1 in 1,000 flood extent, as there is no detailed model coverage for this section of the watercourse, and therefore are likely to be conservative in their extents.</p> <p>In-channel peak water level results for the Daniel's Brook model were also assessed in the centre of the site (DB-03150.1) for the H++ climate change scenario (see table below). The H++ (90%) climate change allowance saw a significant increase in the baseline 1 in 100 event water levels, which exceeded the 1 in 1,000 event water levels.</p>		
	Scenario	Peak Water Level at site (DB-03150.1) (mAOD)	Difference in water level with 1 in 100 baseline (mA)
	1 in 100 – baseline	24.49	N/A
	1 in 100 + 90% CC (H++)	25.05	+ 0.56

Site code	G2
Site name	Land at Whaddon

Requirement for drainage control and impact mitigation	Bedrock Geology	The site is underlain by Blue Lias Formation and Charmouth Mudstone Formation (undifferentiated).		
	Superficial Geology	The bedrock geology is overlain by Cheltenham sand and gravel deposits in the south east of the site.		
	Soils	The site has a range of soil types. In the centre there is an area of freely draining lime-rich soils, whereas the north and south of the site are covered by areas of lime-rich loamy and clayey soils with impeded drainage.		
	SuDS	<ul style="list-style-type: none"> As a large, undeveloped site, opportunities should be taken to incorporate above ground SuDS features, which provide multiple benefits, such as biodiversity, recreation and water resource education, through integration with areas of greenspace. All development should adopt source control SuDS techniques. Conveyance features should be designed above ground and following natural flow paths where possible. A high-level assessment of SuDS suitability carried out as part of the Level 1 SFRA suggests that the site is best suited to conveyance features, such as swales and rills, or detention features, such as ponds and wetlands. Attenuation features must be located outside areas of fluvial flood risk. The site geology is impermeable in nature; therefore infiltration techniques are unlikely to be suitable. However, the presence of more permeable superficial deposits may allow shallow infiltration techniques. To better understand the infiltration potential at the site, site-specific infiltration testing will be required. 		
	Groundwater Source Protection Zone	The site is not included within a Source Protection Zone.		
	Historic Landfill Site	There are no historical landfill sites within the proposed boundary.		
	Opportunities for flood risk betterment	The majority of the proposed site is currently in a greenfield state and therefore post-development greenfield rates and volumes should be restricted to the existing rate. The site provides opportunities for the temporary storage of floodwaters, to reduce peak flows and downstream flood risk Daniel's Brook. The proposals should take account of any land that would potentially be needed to provide affordable mitigation of flood risk in the lower reaches of the catchment in particular with respect to climate change.		
	Cumulative impacts of development	Water Framework Directive Catchment	Sensitivity to cumulative impacts	Implications
Daniel's Brook – Source to Gloucester and Sharpness Canal		Medium	The effects which development of the site may have on flood risk within the catchment will need to be considered within a site-specific flood risk assessment.	
Coastal Catchment 2 (not part of a WFD river catchment)	Medium			

Site code	G2
Site name	Land at Whaddon

Recommendations for Local Plan policy	Sequential Test and Exception Test requirements
	<p>The Sequential Test must be satisfied. Only once the Sequential Test is satisfied should the Exception Test be applied. It is anticipated that proposed development will be sequentially located within Flood Zone 1. For this site, the Exception Test must be satisfied:</p> <ul style="list-style-type: none"> • If More Vulnerable and Essential Infrastructure is located in FZ3a or FZ3a plus climate change. • If Highly Vulnerable development is located in FZ2. <p>If Essential Infrastructure is located in Flood Zone 3b then it must be demonstrated that the exception test is satisfied. Development will not be permitted in the following scenarios:</p> <ul style="list-style-type: none"> • Highly Vulnerable development within FZ3a or FZ3a plus climate change and FZ3b. • More Vulnerable and Less Vulnerable development within FZ3b.
	Recommendations for requirements of site-specific Flood Risk Assessment, including guidance for developers
	<p>Flood risk assessment:</p> <ul style="list-style-type: none"> • Consultation with the LLFA should be undertaken at an early stage • A site-specific flood risk assessment will be required because the site is within Flood Zone 2 and 3 and at risk from sources of flooding other than rivers and the sea. Government guidance on flood risk assessments must be followed (https://www.gov.uk/guidance/flood-risk-assessment-for-planning-applications). • The impact of the development on flood risk from all sources, including surface water and groundwater, both on and off-site must be considered and modelled where appropriate. • Blockage modelling should be conducted to assess the residual risk associated with blockage of the culvert within the site. • Climate change should be assessed using recommended climate change allowances at the time of the assessment (https://www.gov.uk/guidance/flood-risk-assessmentsclimate-change-allowances) for the type of development and level of risk. The current allowances were published in February 2016 but may be subject to change in the future. • The site is located within a catchment identified as moderately sensitive to the cumulative impact of development. The effects which development of the site may have on flood risk within the catchment will need to be considered within a site-specific flood risk assessment. <p>Guidance for site design and making development safe:</p> <ul style="list-style-type: none"> • Development must seek opportunities to reduce overall level of flood risk at the site and should seek to reduce the levels of flood risk downstream. • Consultation with Gloucestershire County Council as Lead Local Flood Authority (LLFA) and the Stroud District Council Drainage Engineer on surface water drainage of the site and potential SuDS features should be undertaken at an early stage. • Development must seek opportunities to reduce overall level of flood risk both on and off-site, for example by reducing volume and rate of runoff and creating space for flooding. • 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. This includes the “dry island” in the centre of the site, unless it is appropriate to implement measures so safe access and egress can be achieved for this area of the site. • The site layout and drainage design must ensure that surface water flows resulting from rainfall in excess of a 1 in 100 event are managed via exceedance routes that minimise the risks to people and property. • Safe access and egress should be demonstrated in the 1 in 100 plus climate change fluvial and rainfall events. 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.

Site code	PS01
Site name	Brimscombe Mill

Site details	OS Grid reference	OS 86692 02439				
	Area	1.72 ha				
	Current land use	Industrial / Commercial				
	Proposed site use	Mixed				
	NPPF Flood risk vulnerability	More vulnerable				
Sources of flood risk	Existing watercourses	The River Frome (Main River) flows in a north-westerly direction through the centre of the site. A large historic mill pond is located in the north west corner of the site, and is fed by the River Frome. The Thames and Severn Canal flows along the southern boundary of the site.				
	Flood history	<p>There are no historic outlines of fluvial flooding recorded at the site. A cluster of flood incidents are recorded beyond the eastern corner of the site. However, it should be noted that these are postcode-scale incidents, which have been plotted at the centre of the postcode area, and therefore the location affected may differ.</p> <p>The following flood incidents are recorded for postcode GL5 2QN:</p> <ul style="list-style-type: none"> • 01/01/2002 – reported sewer flooding caused internal flooding • 01/01/2003 - reported sewer flooding caused internal flooding • 22/07/2006 - reported sewer flooding caused internal flooding • 22/09/2007 - reported sewer flooding caused internal flooding 				
	Fluvial	Proportion of site at risk in Flood Zones				
		Proportion of the site at risk (%)	Flood Zone 3b 4% AEP (1 in 25)	Flood Zone 3a 1% AEP (1 in 100)	Flood Zone 2 0.1% AEP (1 in 1,000)	Flood Zone 1
			54%	14%	9%	23%
Range of depths (m)		0.01 - 2.7	0.02 - 2.9	0.02 - 3.0	N/A	
Maximum hazard	3.1 (Danger for all)	3.8 (Danger for all)	4.3 (Danger for all)	N/A		
	<p>Available modelled data:</p> <p>The site is covered by the Environment Agency River Frome 1D-2D ESTRY-TUFLOW detailed hydraulic model, which was prepared in 2008 and covers the River Frome, as well as the Thames and Severn Canal. The model was further developed as part of the Stroud Valleys modelling study in 2015. The site does not benefit from flood defence, and therefore the undefended scenario is assessed here. Detailed 2D results for the 2008 River Frome model were not supplied with the model, and therefore the depth and hazard values above were extracted from outputs of the 2015 Stroud Valleys modelling study. It is understood that site-specific modelling of the site has also been prepared to support regeneration works.</p>					

Site code	PS01
Site name	Brimscombe Mill

		<p>Flood characteristics:</p> <p>The site is at high risk of fluvial flooding, with the centre of the site being located in the 4% AEP (1 in 25) fluvial extent, the functional floodplain. A larger area of the south east and centre of the site is predicted to be affected during the 1% AEP (1 in 100) and 0.1% AEP (1 in 1,000) flood events. The highest flood depths are predicted to occur in the south eastern portion of the site, immediately downstream of Brimscombe Port. Flooding flows south westwards across the site, towards the canal, although flood depths remain shallower.</p> <p>The north of the site, alongside the A419, and the southern border remain at low risk (Flood Zone 1). The north west corner of the site, surrounding the mill pond, is identified at high fluvial flood risk.</p> <p>It should be noted that the highest values, for both depth and hazard, are associated with the mill pond in the north west corner of the site.</p>		
	Surface Water	Proportion of site at risk (RoFSW)		
		3.3% AEP (1 in 30)	1% AEP (1 in 100)	0.1% AEP (1 in 1,000)
		49%	58%	70%
		<p>Description of surface water flow paths:</p> <p>A large area of the site is at high surface water flood risk, with flooding expected to occur to the centre of the site during a 3.3% AEP (1 in 30) rainfall event. The area at risk extends in the centre and south east of the site during the 1% AEP (1 in 100) and 0.1% AEP (1 in 1,000) rainfall events. The surface water risk is located within the same area as fluvial risk from the River Frome, although surface water flooding may occur independently.</p> <p>It should be noted that the existing surface water flood maps are influenced by the outline of existing buildings across the site, and so the flood outlines are likely to change with development of the site.</p>		
	Groundwater	Areas Susceptible to Groundwater Flooding Map class (risk of groundwater emergence)		
		ASTGWF - Category 2 >=25% <50%	ASTGWF - Category 3 >=50% <75%	ASTGWF - Category 4 >=75%
		0%	0%	0%
		The site is at low risk of groundwater flooding during a 1 in 100 flood event.		
	Reservoir	The site is not at risk of reservoir flooding.		
	Canal	The Thames and Severn Canal flows along the southern boundary of the site. The canal is represented within the River Frome model, and does not show flooding in the location of the site. There are also no recorded incidents of flooding from the canal. However, there is a residual risk of flood risk to the site, in the event of overtopping of the canal, which should be assessed in greater detail within a site-specific Flood Risk Assessment.		

Site code	PS01
Site name	Brimscombe Mill

	Defences	Defence Type	Standard of Protection	Condition	
		There are no flood defences present within the site boundary or within the vicinity of the site.			
Flood risk management infrastructure	Residual risk	Culvert / structure blockage?	The River Frome is culverted for a short section in the centre of the site. A blockage to this culvert poses a residual risk to the south eastern portion of the site. To fully understand this risk, further blockage modelling will be required within a site-specific FRA.		
		Impounded water body failure?	The site is not identified as being at risk of reservoir failure. However, consideration should be given to the mill pond in the north west corner of the site, which outfalls into the River Frome. Blockage of this outfall could cause the pond to overtop, and impact the lower-lying central and southern areas of the site. However, the residual risk of flooding from the pond should be assessed as part of a site-specific FRA.		
		Defence breach / overtopping?	Breach Zone There are no flood defences located in the vicinity of the site.		
	Emergency planning	Flood warning	The site is located within the following Environment Agency Flood Warning and Flood Alert Areas: <ul style="list-style-type: none"> Flood Alert Area: Rivers Frome and Cam Flood Warning Area: River Frome at Brimscombe and Thrupp 		
Emergency planning	Access and egress	The site is likely to be accessed from London Road (A419) at the northern boundary of the site, Brimscombe Hill to the east, or the access track to the west. London Road (A419) is at risk of surface water flooding during a 1 in 30 and greater rainfall events, travelling eastbound. However, to the north of the site, the road is at low risk of flooding from all sources. The western access track is at risk of fluvial flooding during a 1 in 25 event (Flood Zone 3b), whereas Brimscombe Hill is at risk during a 1 in 100 fluvial flood event (Flood Zone 3a).			
Climate Change	Climate change allowances for '2080s'	River Basin District	Central	Higher Central	Upper End
	Implications for the site	Severn	25%	35%	70%
Climate Change	Implications for the site	Modelling shows that the extents of Flood Zone 3a + 35% CC and + 70% CC extend beyond that of Flood Zone 3a, particularly in the centre and south of the site, where Flood Zone 3a + 70% CC exceeds beyond Flood Zone 2. Therefore, climate change is predicted to impact the proposed site.			

Site code	PS01
Site name	Brimscombe Mill

Requirement for drainage control and impact mitigation	Bedrock Geology	Lias Group, Inferior Oolite Group And Great Oolite Group (undifferentiated) - Limestone, Argillaceous Rocks And Subordinate Sandstone, Interbedded.		
	Superficial Geology	Alluvium – clay, silt, sand and gravel.		
	Soils	Lime-rich loamy and clayey soils with impeded drainage		
	SuDS	<ul style="list-style-type: none"> As a previously developed site, development should seek to reduce the coverage of impermeable surfaces, to limit the rates and volumes of surface water runoff generate on the site. Opportunities should be taken to incorporate above ground, natural SuDS features, which provide multiple benefits (including biodiversity, amenity and water quality improvements). The geology suggests that infiltration may be an option across the site, particularly in areas of superficial geology. However, the clay-based soils may impede drainage, and therefore site-specific infiltration testing is advised. Detention and conveyance features will be appropriate on the site. However, attenuation features must be located outside areas of fluvial flood risk. 		
	Groundwater Source Protection Zone	The site is not located within a Groundwater Source Protection Zone.		
	Historic Landfill Site	There are no historic landfill sites within the site boundary.		
	Opportunities for flood risk betterment	The site, and particularly the existing mill pond, provides opportunities to store flows from the River Frome during times of flood, to reduce peak flow and delay the time at which it reaches communities downstream. Opportunities to open, or 'daylight', the section of culverted watercourse in the centre of the site should be investigated, to reduce the risk of a blockage affecting the site.		
	Cumulative impacts of development	Water Framework Directive Catchment	Sensitivity to cumulative impacts	Implications
Frome - source to Ebley Mill		Medium	The effects which development of the site may have on flood risk within the catchment will need to be considered within a site-specific flood risk assessment.	
Sequential Test and Exception Test requirements				

Site code	PS01
Site name	Brimscombe Mill

Recommendations for Local Plan policy	<p>The Sequential Test must be satisfied. If the Sequential Test has been passed, then Table 3 of the NPPG gives details of appropriate flood risk vulnerability for each Flood Zone. For this site, if More Vulnerable (residential) development is proposed within Flood Zone 3, or Highly Vulnerable development is proposed within Flood Zone 2, the Exception Test must be satisfied.</p> <p>A large proportion of the site is at high fluvial flood risk (>50% in Flood Zone 3) and flood depths are deep, with a high flood hazard to people. Therefore, if the development passes the Exception Test and More Vulnerable development is placed within Flood Zone 3, robust flood risk mitigation (including floodplain compensation and raised floor levels) and resilience measures (such as flood resilient construction) must be implemented.</p> <p>It is noted that planned canal regeneration works at Brimscombe Port will include provision of additional storage for water within the reinstated canal, as well as ground raising in areas of the site, which are proposed to manage and reduce existing flood risk to the site from the River Frome and mitigate potential effects.</p>
	<p>Recommendations for requirements of site-specific Flood Risk Assessment, including guidance for developers</p>
	<p>Flood risk assessment:</p> <ul style="list-style-type: none"> • A site-specific flood risk assessment will be required because the site is partially within Flood Zones 2 and 3. Government guidance on flood risk assessments must be followed (https://www.gov.uk/guidance/flood-risk-assessment-for-planning-applications). • All sources of flooding, particularly the risk of surface water, should be considered as part of a site-specific flood risk assessment. • The site is located within a catchment identified as moderately sensitive to the cumulative impact of development. The effects which development of the site may have on flood risk within the catchment will need to be considered within a site-specific flood risk assessment. • Climate change should be assessed using recommended climate change allowances at the time of the assessment (https://www.gov.uk/guidance/flood-risk-assessmentsclimate-change-allowances) for the type of development and level of risk. The current allowances were published in February 2016 but may be subject to change in the future. • Blockage modelling should be conducted to assess the residual risk associated with blockage of the culvert within the site. • The residual risk of flooding to the site, in the event of overtopping of the Thames and Severn Canal, should be assessed in further detail. • Appropriate storage of surface water runoff will need to be provided, and assessments should identify opportunities to provide off-site betterment, to help offset the cumulative impact of development. For example, this may include contribution to the delivery of schemes within the catchment, such as flood alleviation schemes, Natural Flood Management, SuDS retrofit or river restoration. <p>Guidance for site design and making development safe:</p> <ul style="list-style-type: none"> • Development must seek opportunities to reduce overall level of flood risk at the site and should seek to reduce the levels of flood risk downstream. • Consultation with Gloucestershire County Council as Lead Local Flood Authority (LLFA) and the Stroud District Council Drainage Engineer on surface water drainage of the site and potential SuDS features should be undertaken at an early stage. • Development must seek opportunities to reduce overall level of flood risk both on and off-site, for example by reducing volume and rate of runoff and creating space for flooding. • 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.

Site code	PS01
Site name	Brimscombe Mill

	<ul style="list-style-type: none">• The site layout and drainage design must ensure that surface water flows resulting from rainfall in excess of a 1 in 100-year event are managed via exceedance routes that minimise the risks to people and property.• Safe access and egress should be demonstrated in the 1 in 100-year plus climate change fluvial and rainfall events. 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.
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Site code	PS02
Site name	Brimscombe Port

Site details	OS Grid reference	SO 87016 02262				
	Area	3.86 ha				
	Current land use	Industrial / Commercial				
	Proposed site use	Residential				
	Flood risk vulnerability	More vulnerable				
Sources of flood risk	Existing watercourses	The Thames and Severn Canal flows through the site in a north westerly direction. Plans are underway to restore the canal at Brimscombe Port. The River Frome also flows along the southern boundary of the site, before passing through the north western portion of the site, where it is culverted.				
	Flood history	<p>There are no historic outlines of fluvial flooding recorded at the site.</p> <p>A cluster of flood incidents is recorded beyond the south western corner of the site. However, it should be noted that these are postcode-scale incidents, which have been plotted at the centre of the postcode area, and therefore the location affected may differ.</p> <p>The following flood incidents are recorded for postcode GL5 2QN:</p> <ul style="list-style-type: none"> • 01/01/2002 – reported sewer flooding caused internal flooding • 01/01/2003 - reported sewer flooding caused internal flooding • 22/07/2006 - reported sewer flooding caused internal flooding • 22/09/2007 - reported sewer flooding caused internal flooding 				
	Fluvial	Proportion of site at risk in Flood Zones				
		Proportion of the site at risk (%)	Flood Zone 3b 4% AEP (1 in 25)	Flood Zone 3a 1% AEP (1 in 100)	Flood Zone 2 0.1% AEP (1 in 1,000)	Flood Zone 1
			90%	5%	2%	23%
Range of depths (m)		0.07 - 1.9	0.08 – 2.0	0.1 – 2.4	N/A	
Maximum hazard	1.9 (Danger for most)	2.6 (Danger for all)	3.1 (Danger for all)	N/A		
<p>Available modelled data:</p> <p>The site is covered by the Environment Agency River Frome 1D-2D ESTRY-TUFLOW detailed hydraulic model, which was prepared in 2008 and covers the River Frome, as well as the Thames and Severn Canal. The model was further developed as part of the Stroud Valleys modelling study in 2015. The site does not benefit from flood defence, and therefore the undefended scenario is assessed here. Detailed 2D results for the 2008 River Frome model were not supplied with the model, and therefore the depth and hazard values above were extracted from outputs of the 2015 Stroud Valleys modelling study. It is understood that site-specific modelling of the site has also been prepared to support regeneration works.</p>						

Site code		PS02		
Site name		Brimscombe Port		
		<p>Flood characteristics: The site is at a high risk of fluvial flooding, with the majority of the site located in Flood Zone 3b, the functional floodplain, which is predicted to flood during a 1 in 25 event. The extent of flooding increases to cover the north west and south east of the site during a 1 in 100 and 1 in 1,000 event. Peak flood depths are highest in the west of the site, particularly to the south of the River Frome, where they exceed 1m in depth during the 1% AEP event. Flood hazard is significant across the majority of the site during a 1 in 100 event, and increases to extreme in the north west and south east of the site during a 1 in 1,000 event.</p>		
	Surface Water	Proportion of site at risk (RoFSW)		
		3.3% AEP (1 in 30)	1% AEP (1 in 100)	0.1% AEP (1 in 1,000)
		46%	58%	99%
		<p>Description of surface water flow paths: Surface water flood risk across the site is high, with widespread flooding predicted to occur to the centre and west of the site during a 3.3% AEP (1 in 30) event. During a 1% AEP (1 in 100) and 0.1% AEP (1 in 1,000) event, the flood risk extends to cover the majority of the site, excluding the northern border. However, the areas at surface water flood risk are located within Flood Zones 3a and 3b, and therefore should not be considered in addition to fluvial risk. It should be noted that the existing surface water flood maps are influenced by the outline of existing buildings across the site, and so the flood outlines are likely to change with development.</p>		
	Groundwater	Areas Susceptible to Groundwater Flooding Map class (risk of groundwater emergence)		
		ASTGWF - Category 2 ≥25% <50%	ASTGWF - Category 3 ≥50% <75%	ASTGWF - Category 4 ≥75%
0%		0%	0%	
	The site is at low risk of groundwater flooding.			
Reservoir	The site is not at risk of reservoir flooding.			
Canal	The Thames and Severn Canal flows through the site. The canal is represented within the River Frome model, and does not show flooding in the location of the site. There are also no recorded incidents of flooding from the canal. However, there is a residual risk of flooding to the site, in the event of overtopping of the canal, which should be assessed in greater detail within a site-specific Flood Risk Assessment..			

Site code		PS02			
Site name		Brimscombe Port			
Flood risk management infrastructure	Defences	Defence Type	Standard of Protection	Condition	
		There are no flood defences within the site boundary or within close proximity.			
	Residual risk	Culvert / structure blockage?	The River Frome is culverted in the west of the site, beneath a commercial building. Blockage of the pipe would pose a risk to the centre and east of the site. To fully understand the residual risk associated with the culvert, blockage runs should be conducted within a site-specific FRA.		
		Impounded water body failure?	There is no residual risk from impounded waterbodies.		
		Defence breach / overtopping?	Breach Zone There are no defences within the site.		
Emergency planning	Flood warning	The site is located within the following Environment Agency Flood Warning and Flood Alert Areas: <ul style="list-style-type: none"> Flood Alert Area: Rivers Frome and Cam Flood Warning Area: River Frome at Brimscombe and Thrupp 			
	Access and egress	The site is likely to be accessed from London Road (A419) at the northern boundary of the site, or Port Lane/Brimscombe Hill to the south. The section of London Road (A419) immediately north of the site is at risk of surface water flooding in a 3.3% AEP (1 in 30) and greater rainfall events. Port Lane and Brimscombe Hill are located within Flood Zone 3a, and therefore at risk of fluvial flooding during a 1% AEP (1 in 100) event.			
Climate Change	Climate change allowances for '2080s'	River Basin District	Central	Higher Central	Upper End
		Severn	25%	35%	70%
	Implications for the site	Modelling (of 2008 River Frome model) shows that the extent of the Flood Zone 3a + 70% climate change uplift extends beyond that of Flood Zone 3a (1 in 100 event), but does not exceed Flood Zone 2 (1 in 1,000 event). Therefore, climate change is predicted to have a moderate impact on the extent of flood risk to the site.			

Site code		PS02		
Site name		Brimscombe Port		
Requirement for drainage control and impact mitigation	Bedrock Geology	Lias Group, Inferior Oolite Group And Great Oolite Group (undifferentiated) - Limestone, Argillaceous Rocks And Subordinate Sandstone, Interbedded.		
	Superficial Geology	Alluvium – clay, silt, sand and gravel.		
	Soils	Lime-rich loamy and clayey soils with impeded drainage		
	SuDS	<ul style="list-style-type: none"> As a previously developed site, development should seek to reduce the coverage of impermeable surfaces, to limit the rates and volumes of surface water runoff generated on the site. Opportunities should be taken to incorporate above ground SuDS features, which provide multiple benefits (including biodiversity, amenity and water quality improvements). The geology suggests that infiltration may be an option across the site, particularly in areas of superficial geology. However, the soils suggest impeded drainage, and so site-specific infiltration testing is advised. Detention and conveyance features will be appropriate on the site. However, attenuation features must be located outside areas of fluvial flood risk. 		
	Groundwater Source Protection Zone	The site is not located within a Groundwater Source Protection Zone.		
	Historic Landfill Site	There are no historic landfill sites within the site boundary.		
	Opportunities for flood risk betterment	The site provides opportunities for storing water from the River Frome and the Thames and Severn Canal during times of flood, to reduce the flow and delay the timing in which it reaches communities downstream. Proposals to reinstate the canal and create a new online basin are likely to increase the capacity for conveying flow within the canal.		
	Cumulative impacts of development	Water Framework Directive Catchment	Sensitivity to cumulative impacts	Implications
Frome - source to Ebley Mill		Medium	The effects which development of the site may have on flood risk within the catchment will need to be considered within a site-specific flood risk assessment.	
Sequential Test and Exception Test requirements				

Site code	PS02
Site name	Brimscombe Port
Recommendations for Local Plan policy	<p>The Sequential Test must be satisfied. If the Sequential Test has been passed, then Table 3 of the NPPG gives details of appropriate flood risk vulnerability for each Flood Zone. For this site, if More Vulnerable (residential) development is proposed within Flood Zone 3, or Highly Vulnerable development is proposed within Flood Zone 2, the Exception Test must be satisfied.</p> <p>A large proportion of the site is at high fluvial flood risk (>50% in Flood Zone 3) and flood depths are deep, with a high flood hazard to people. Therefore, if the development passes the Exception Test and More Vulnerable development is placed within Flood Zone 3, appropriate flood risk mitigation (including floodplain compensation and raised floor levels) and resilience measures (such as flood resilient construction) must be implemented.</p> <p>It is noted that planned canal regeneration works at Brimscombe Port will include provision of additional storage for water within the reinstated canal, as well as ground raising in areas of the site, which are proposed to manage and reduce existing flood risk to the site from the River Frome and mitigate potential effects.</p>
	<p>Recommendations for requirements of site-specific Flood Risk Assessment, including guidance for developers</p>
	<p>Flood Risk Assessment:</p> <ul style="list-style-type: none"> • A site-specific flood risk assessment will be required because the site is partially within Flood Zones 2 and 3. Government guidance on flood risk assessments must be followed (https://www.gov.uk/guidance/flood-risk-assessment-for-planning-applications). • All sources of flooding, particularly the risk of surface water, should be considered as part of a site-specific flood risk assessment. • Climate change should be assessed using recommended climate change allowances at the time of the assessment (https://www.gov.uk/guidance/flood-risk-assessmentsclimate-change-allowances) for the type of development and level of risk. The current allowances were published in February 2016 but may be subject to change in the future. • Blockage modelling should be conducted to assess the residual risk associated with blockage of the culvert within the site. • The residual risk of flooding to the site, in the event of overtopping of the Thames and Severn Canal, should be assessed in further detail. • The site is located within a catchment identified as moderately sensitive to the cumulative impact of development. The effects which development of the site may have on flood risk within the catchment will need to be considered within a site-specific flood risk assessment. • Appropriate storage of surface water runoff will need to be provided, and assessments should identify opportunities to provide off-site betterment, to help offset the cumulative impact of development. For example, this may include contribution to the delivery of schemes within the catchment, such as flood alleviation schemes, Natural Flood Management, SuDS retrofit or river restoration. <p>Guidance for site design and making development safe:</p> <ul style="list-style-type: none"> • Development must seek opportunities to reduce overall level of flood risk at the site and should seek to reduce the levels of flood risk downstream. • Consultation with Gloucestershire County Council as Lead Local Flood Authority (LLFA) and the Stroud District Council Drainage Engineer on surface water drainage of the site and potential SuDS features should be undertaken at an early stage. • Development must seek opportunities to reduce overall level of flood risk both on and off-site, for example by reducing volume and rate of runoff and creating space for flooding. • 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. • The site layout and drainage design must ensure that surface water flows resulting from rainfall in excess of a 1 in 100-year event are managed via exceedance routes that minimise the risks to people and property.



Site code	PS02
Site name	Brimscombe Port
	<ul style="list-style-type: none">• Safe access and egress should be demonstrated in the 1 in 100-year plus climate change fluvial and rainfall events. 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.

Site code	PS09
Site name	Rooksmoor Mill, North Woodchester

Site details	OS Grid reference	SO 84168 03124				
	Area	1.0				
	Current land use	Commercial				
	Proposed site use	Residential				
	Flood risk vulnerability	More vulnerable				
Sources of flood risk	Existing watercourses	The Nailsworth Stream (Main River) flows in a northerly direction through the southern portion of the site, before flowing along the western border of the site. A small ordinary watercourse flows into the site from the east, forming a tributary to Nailsworth Stream.				
	Flood history	The EA Recorded Flood Outline dataset identifies that the south of the site was affected by flooding in July 1968, as a result of channel exceedance on Nailsworth Stream.				
	Fluvial	Proportion of site at risk in Flood Zones				
		Proportion of the site at risk (%)	Flood Zone 3b 5% AEP (1 in 20)	Flood Zone 3a 1% AEP (1 in 100)	Flood Zone 2 0.1% AEP (1 in 1,000)	Flood Zone 1
			9%	0%	66%	25%
		Range of depths (m)	-	-	0.02 - 1.47	N/A
		Maximum hazard	-	-	1.4 Significant – Danger to most	N/A
	Available modelled data:	The site is covered by the Environment Agency Nailsworth Stream FM-TUFLOW detailed hydraulic model, prepared in 2019. The site does not benefit from flood defence, and therefore the undefended scenario is assessed here.				
	Flood characteristics:	During a 5% AEP (1 in 20) and 1% AEP (1 in 100) events, flooding is confined to the channel in the site. Flooding is first predicted to occur to the north east of the site during a 0.5% AEP (1 in 200) event. During a 0.1% AEP (1 in 1,000) event, flooding is predicted to extend beyond the channel to cover the majority of the site. The north eastern and south western corners of the site remain within Flood Zone 1 (i.e. very low risk of flooding).				
		The ordinary watercourse at the east of the site also requires consideration, and further hydraulic modelling may be required to understand the flood risk associated with this watercourse. The Risk of Flooding from Surface Water dataset has been used to assess fluvial flood risk in areas outside the Flood Zones.				
Surface Water	Proportion of site at risk (RoFSW)					
	3.3% AEP (1 in 30)	1% AEP (1 in 100)	0.1% AEP (1 in 1,000)			
	12%	28%	76%			

Site code		PS09		
Site name		Rooksmoor Mill, North Woodchester		
		<p>Description of surface water flow paths: The surface water flood risk within the site is largely associated with the low-lying fluvial floodplain. During the 3.3% AEP and 1% AEP rainfall events, the extent of surface flooding is largely confined within the Nailsworth Stream channel, with the exception of a small area of flooding in the centre of the site during the 1% AEP rainfall event. The flood extent during the 0.1% AEP (1 in 1000) rainfall event extends to cover the floodplain of the Nailsworth Stream. Where the surface water flood risk coincides with the floodplain, it should not be considered as an additional source of flood risk. Surface water flow paths beyond the east of the site suggest that the ordinary watercourse tributary may follow Rooksmoor Hill before joining the Nailsworth Stream. However, more detailed hydraulic modelling should be performed to confirm this route.</p>		
	Groundwater	Areas Susceptible to Groundwater Flooding Map class (risk of groundwater emergence)		
		ASTGWF - Category 2 >=25% <50%	ASTGWF - Category 3 >=50% <75%	ASTGWF - Category 4 >=75%
		0%	0%	0%
	The site is at low risk of groundwater emergence during a flood event.			
Reservoir	The majority of the site is at risk of flooding, in the rare event of breach from the following reservoirs (in order of flood extent at the site): <ul style="list-style-type: none"> • Middle Pond, Woodchester • Kennel Pond, Woodchester • Parkmill Pond, Woodchester • Gatcombe Water 			
Canal	There are no canals within the site boundary, or within close proximity.			

Site code		PS09			
Site name		Rooksmoor Mill, North Woodchester			
Flood risk management infrastructure	Defences	Defence Type	Standard of Protection	Condition	
		There are no defences within the site boundary, or within close proximity.			
	Residual risk	Culvert / structure blockage?	Nailsworth Stream is culverted within the centre of the site. There is a residual risk of flooding to southern areas of the site, in the event of blockage to the culvert. Further modelling would be required to understand the impact of this blockage to the site within a site-specific FRA.		
		Impounded water body failure?	A large majority of the site is at risk of flooding, in the rare event of a reservoir breach at Middle Pond, Kennel Pond, Parkmill Pond or Gatcombe Water.		
		Defence breach / overtopping?	Breach Zone		
	There are no defences which pose a residual risk to the site, in the event of breach or overtopping.				
Emergency planning	Flood warning	The site is located within the Environment Agency Rivers Frome and Cam Flood Alert Area. It is not located within any Flood Warning Areas.			
	Access and egress	The site is likely to be accessed via the A46 Bath Road, at the eastern boundary of the site. The road is likely to be affected by fluvial flooding from Nailsworth Stream during a 0.1% AEP (1 in 1000) event. The section of road adjacent to the site is also at risk of surface water flooding during a 3.3% AEP (1 in 30) and greater rainfall events. Therefore access to the site may be restricted during heavy rainfall, and times of fluvial flooding.			
Climate Change	Climate change allowances for '2080s'	River Basin District	Central	Higher Central	Upper End
		Severn	25%	35%	70%
	Implications for the site	Modelling shows that the extents of Flood Zone 3a + 35% CC and + 70% CC extend beyond that of Flood Zone 3a, particularly in the centre and north of the site. However, Flood Zone 3a + 70% CC does not extend beyond Flood Zone 2 (1 in 1,000 event).			

Site code		PS09		
Site name		Rooksmoor Mill, North Woodchester		
Requirement for drainage control and impact mitigation	Bedrock Geology	Marlstone Rock Formation - Limestone, Ferruginous.		
	Superficial Geology	No superficial deposits are recorded at the site.		
	Soils	Slightly acidic loamy and clayey soils with impeded drainage.		
	SuDS	<ul style="list-style-type: none"> As a previously developed site, development should seek to reduce the coverage of impermeable surfaces, to limit the rates and volumes of surface water runoff generated on the site. Opportunities should be taken to incorporate above ground SuDS features, which provide multiple benefits. The geology suggests that infiltration techniques may be feasible across the site. However, the clayey soils may impede drainage, and therefore site-specific infiltration testing is advised. Detention and conveyance features will be appropriate on the site. However, attenuation features must be located outside areas of fluvial flood risk. 		
	Groundwater Source Protection Zone	The site is not within a Groundwater Source Protection Zone.		
	Historic Landfill Site	There are no historic landfill sites within the site or in close proximity.		
	Opportunities for flood risk betterment	<p>The site provides opportunities for storing surface water generated within the steep Nailsworth Stream, to reduce the flow and delay the timing in which it reaches downstream communities in Dudbridge.</p> <p>Opportunities to open, or 'daylight', the section of culverted watercourse in the centre of the site should be investigated, to reduce the risk of a blockage affecting the site.</p>		
	Cumulative impacts of development	Water Framework Directive Catchment	Sensitivity to cumulative impacts	Implications
Nailsworth Stream - source to conf R Frome		Medium	The effects which development of the site may have on flood risk within the catchment will need to be considered within a site-specific flood risk assessment.	
Sequential Test and Exception Test requirements				

Site code	PS09
Site name	Rooksmoor Mill, North Woodchester
Recommendations for Local Plan policy	<p>The Sequential Test must be satisfied. If the Sequential Test has been passed, then Table 3 of the NPPG gives details of appropriate flood risk vulnerability for each Flood Zone. For this site, if More Vulnerable (residential) development is proposed within FZ3a or FZ3a plus climate change, or Highly Vulnerable development is proposed within Flood Zone 2, the Exception Test must be satisfied.</p> <p>A large proportion of the site is at fluvial flood risk (>50% in FZ3a plus climate change) and flood depths are deep, with a high flood hazard to people.</p> <p>If no alternative sites at lower flood risk can be allocated according to the Sequential Test, a sequential approach must be taken to designing the site, avoiding placing More Vulnerable development in areas of highest risk within the site, using them instead for appropriate uses such as Water Compatible uses (e.g. green infrastructure, flood storage) or Less Vulnerable (e.g. commercial development).</p> <p>If the development passes the Exception Test and More Vulnerable development is placed within Flood Zone 3a plus climate change, appropriate flood risk mitigation (including floodplain compensation and raised floor levels) and resilience measures (such as flood resilient construction) must be implemented.</p>
	Recommendations for requirements of site-specific Flood Risk Assessment, including guidance for developers
	<p>Flood risk assessment:</p> <ul style="list-style-type: none"> • A site-specific flood risk assessment will be required because the site is partially within Flood Zones 2 and 3. Government guidance on flood risk assessments must be followed (https://www.gov.uk/guidance/flood-risk-assessment-for-planning-applications). • All sources of flooding, particularly the risk of surface water and reservoir flooding, should be considered as part of a site-specific flood risk assessment. • Blockage modelling should be conducted to assess the residual risk associated with blockage of the culvert within the site. • The site is located within a catchment identified as moderately sensitive to the cumulative impact of development. The effects which development of the site may have on flood risk within the catchment will need to be considered within a site-specific flood risk assessment. <p>Guidance for site design and making development safe:</p> <ul style="list-style-type: none"> • A site-specific surface water drainage strategy will be required. • Development must seek opportunities to reduce overall level of flood risk at the site and should seek to reduce the levels of flood risk downstream. • Consultation with Gloucestershire County Council as Lead Local Flood Authority (LLFA) and the Stroud District Council Drainage Engineer on surface water drainage of the site and potential SuDS features should be undertaken at an early stage. • Development must seek opportunities to reduce overall level of flood risk both on and off-site, for example by reducing volume and rate of runoff and creating space for flooding. • 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. • The site layout and drainage design must ensure that surface water flows resulting from rainfall in excess of a 1 in 100-year event are managed via exceedance routes that minimise the risks to people and property. • Safe access and egress should be demonstrated in the 1 in 100-year plus climate change fluvial and rainfall events. 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.

Site code	PS11
Site name	Merrywalks Arches, Merrywalks

Site details	OS Grid reference	SO 84868 05207				
	Area	0.2 ha				
	Current land use	Residential				
	Proposed site use	Residential/ town centre				
	Flood risk vulnerability	More vulnerable				
Sources of flood risk	Existing watercourses	The site is located 15m south east of the Slad Brook (Main River), which flows in a southerly direction. The watercourse is culverted in this location, as it passes below the railway.				
	Flood history	There are no recorded flood events recorded within the site. However, the recorded flood extent from the July 2007 flood event on the River Frome is located 30m south of the site.				
	Fluvial	Proportion of site at risk in Flood Zones				
		Proportion of the site at risk (%)	Flood Zone 3b 5% AEP (1 in 20)	Flood Zone 3a 1% AEP (1 in 100)	Flood Zone 2 0.1% AEP (1 in 1,000)	Flood Zone 1
			N/A (10%)	10%	15%	85%
	<p>Available modelled data: The Flood Zones in this location are generated from national broadscale modelling, rather than a detailed hydraulic model. No 5% AEP (1 in 20) results were available for the Slad Brook, and therefore the results for 1% AEP (Flood Zone 3a) have been used as a proxy for Flood Zone 3b.</p> <p>Flood characteristics: The northwestern boundary and western corner of the site, adjacent to the A46 Merrywalks, are at risk of fluvial flooding during a 1% AEP (1 in 100) event. A marginal increase in flood extent is predicted to occur during the 0.1% AEP (1 in 1,000) event. The remaining areas of the site are at very low risk of fluvial flooding (Flood Zone 1).</p>					
Surface Water	Proportion of site at risk (RoFSW)					
	3.3% AEP (1 in 30)	1% AEP (1 in 100)	0.1% AEP (1 in 1,000)			
	6%	7%	14%			
<p>Description of surface water flow paths: The south west corner of the site is predicted to be at risk of surface water flooding during a 3.3% AEP (1 in 30) rainfall event. Surface water is predicted to flow off Merrywalks and pond in the lower-lying ground against the railway embankment. The extent of flooding is predicted to increase during the 1% AEP (1 in 100) and 0.1% AEP (1 in 1,000) rainfall events It should be noted that the surface water flood maps are influenced by the existing building on the site, and therefore the flood outlines are likely to change with development.</p>						
Groundwater	Areas Susceptible to Groundwater Flooding Map class (risk of groundwater emergence)					

Site code	PS11
Site name	Merrywalks Arches, Merrywalks

		ASTGWF - Category 2 >=25% <50%	ASTGWF - Category 3 >=50% <75%	ASTGWF - Category 4 >=75%	
			0%	100%	0%
			The site is at moderate to high susceptibility to flooding from groundwater.		
	Reservoir	The site is not recorded to be at risk from reservoir flooding.			
	Canal	There are no canals within the site boundary.			
Flood risk management infrastructure	Defences	Defence Type	Standard of Protection	Condition	
		There are no defences within the site.			
	Residual risk	Culvert / structure blockage?	There are no culverts within the site.		
		Impounded water body failure?	The site is not at risk of flooding, in the event of a reservoir breach.		
Defence breach / overtopping?		<p style="text-align: center;">Breach Zone</p> There are no defences within the site boundary.			
Emergency planning	Flood warning	The site is located within the following Environment Agency Flood Alert and Flood Warning Areas: <ul style="list-style-type: none"> • River Frome and Cam Flood Alert Area • River Frome at Stroud and Ryeford Flood Warning Area 			
	Access and egress	Access is likely to be via the A46 Merrywalks, at the western boundary of the site. Merrywalks is at high surface water flood risk, with flooding predicted to occur during the 3.3% AEP (1 in 30) and greater rainfall events. The road is also at risk of fluvial flooding during a 1% AEP (1 in 100) event. Therefore, access to the site may be restricted during intense rainfall events, and at times of fluvial flooding.			
Climate Change	Climate change allowances for '2080s'	River Basin District	Central	Higher Central	Upper End
		Severn	25%	35%	75%
	Implications for the site	Due to the lack of a detailed hydraulic modelling in this location, Flood Zone 2 has been used as a proxy for the Flood Zone 3a + 35% and 70% climate change extents. This indicates that climate change will result in an increase in flood risk during the 1% AEP flood event (Flood Zone 3a), although it may give a conservative account of risk.			

Site code	PS11
Site name	Merrywalks Arches, Merrywalks

Requirement for drainage control and impact mitigation	Bedrock Geology	The site is underlain by the Lias group of mudstone, siltstone, limestone and sandstone.		
	Superficial Geology	The site is overlain by undifferentiated river terrace deposits.		
	Soils	Slightly acid loamy and clayey soils with impeded drainage		
	SuDS	<ul style="list-style-type: none"> As a previously developed site, development should seek to reduce the coverage of impermeable surfaces, to limit the rates and volumes of surface water runoff generate on the site. Opportunities should be taken to incorporate above ground, natural SuDS features, which provide multiple benefits (including biodiversity, amenity and water quality improvements). Due to the high risk of groundwater flooding, discharge of the site via infiltration may not be suitable. However, shallower infiltration techniques may be feasible. This should be investigated within site-specific infiltration testing. Detention and conveyance features will be appropriate on the site. However, attenuation features must be located outside areas of fluvial flood risk. 		
	Groundwater Source Protection Zone	The site is not located within a designated Groundwater Source Protection Zone.		
	Historic Landfill Site	There are no historic landfill sites located within the site boundary. Farhill historic landfill site is located approximately 300m west of the site boundary.		
	Opportunities for flood risk betterment	Opportunities for using source control SuDS to manage runoff rates and volumes, contributing to the reduction of flood peaks downstream and existing surface water flow paths leaving the site.		
Cumulative Impact of development		Water Framework Directive Catchment	Sensitivity to cumulative Impacts	Implications
		Slad Brook source to confluence Stroudwater canal	Moderate	The effects which development of the site may have on flood risk within the catchment will need to be considered within a site-specific flood risk assessment.
Sequential Test and Exception Test requirements				

Site code	PS11
Site name	Merrywalks Arches, Merrywalks

Recommendations for Local Plan policy	<p>The Sequential Test must be satisfied. Only once the Sequential Test is satisfied should the Exception Test be applied. It is anticipated that proposed development will be sequentially located within Flood Zone 1. For this site, the Exception Test must be satisfied:</p> <ul style="list-style-type: none"> • If More Vulnerable and Essential Infrastructure is located in FZ3a or FZ3a plus climate change. • If Highly Vulnerable development is located in FZ2. <p>If Essential Infrastructure is located in Flood Zone 3b then it must be demonstrated that the exception test is satisfied. Development will not be permitted in the following scenarios:</p> <ul style="list-style-type: none"> • Highly Vulnerable development within FZ3a or FZ3a plus climate change and FZ3b. • More Vulnerable and Less Vulnerable development within FZ3b.
	<p>Recommendations for requirements of site-specific Flood Risk Assessment, including guidance for developers</p> <p>Flood risk assessment:</p> <ul style="list-style-type: none"> • At the planning application stage, a site-specific flood risk assessment and surface water drainage strategy will be required. • Consultation with the Local Authority and the Environment Agency should be undertaken at an early stage. • A site-specific flood risk assessment will be required because the site is within Flood Zone 2 and 3 and at risk from sources of flooding other than rivers and the sea. Government guidance on flood risk assessments must be followed (https://www.gov.uk/guidance/floodrisk-assessment-for-planning-applications). • Other sources of flooding should also be considered as part of a site-specific flood risk assessment, including surface water and groundwater. • Detailed modelling will be required to confirm more precisely the Flood Zone and climate change extents for the site (see 'Available modelled data'). The Environment Agency and LLFA should be consulted to obtain the latest hydraulic modelling information for the site at the time of preparing a flood risk assessment. <p>Guidance for site design and making development safe:</p> <ul style="list-style-type: none"> • Development must seek opportunities to reduce overall level of flood risk at the site and should seek to reduce the levels of flood risk downstream. • Consultation with Gloucestershire County Council as Lead Local Flood Authority (LLFA) and the Stroud District Council Drainage Engineer on surface water drainage of the site and potential SuDS features should be undertaken at an early stage. • Development must seek opportunities to reduce overall level of flood risk both on and off-site, for example by reducing volume and rate of runoff and creating space for flooding. • 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. • The site layout and drainage design must ensure that surface water flows resulting from rainfall in excess of a 1 in 100-year event are managed via exceedance routes that minimise the risks to people and property. • Safe access and egress should be demonstrated in the 1 in 100-year plus climate change fluvial and rainfall events. 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.

Site code	PS13
Site name	Central River, Canal Corridor

Site details	OS Grid reference	SO 84124 04959			
	Area	10.84 ha			
	Current land use	Brownfield site			
	Proposed site use	Tourism/employment			
	Flood risk vulnerability	Less vulnerable			
Sources of flood risk	Existing watercourses	The River Frome flows to the south of the site, and the Stroudwater Canal forms the northern boundary. Painswick Stream, a Main River, also forms a confluence with the Stroudwater Canal at the northern site boundary. Two lakes are located within the centre of the site.			
	Flood history	<p>There are no historic outlines of fluvial flooding recorded at the site. An incident of overtopping on the Stroudwater Canal was recorded in the north of the site on 20th July 2007 and led to the flooding of one garage as well as nearby Cainscross Road. One incident of highway flooding was recorded at Frome Hall Lane, at the southern boundary of the site on 4th July 2007, with exceedance of the surface water sewer or drainage system suspected to be the cause.</p> <p>A cluster of flood incidents are recorded beyond the eastern corner of the site, at the junction between A46 Bath Rad and A419 Dr Newton's Way. However, it should be noted that these are postcode-scale incidents, and which have been plotted at the centre of the postcode area, and therefore the location affected may differ. The recorded incidents are as follows:</p> <ul style="list-style-type: none"> • 14/12/2000 – reported sewer flooding causing internal flooding • 13/02/2001 – reported sewer flooding causing curtilage flooding • 24/06/2007 – reported sewer flooding causing internal, external and highway flooding • 03/11/2011 - reported sewer flooding causing highway flooding • 02/08/2018 – reported fluvial flooding 			
	Fluvial	Proportion of site at risk in Flood Zones			
		Proportion of the site at risk (%)	Flood Zone 3b 5% AEP (1 in 20)	Flood Zone 3a 1% AEP (1 in 100)	Flood Zone 2 0.1% AEP (1 in 1,000)
		30%	13%	11%	46%
	Range of depths (m)	0.05 - 0.5	0.01 - 0.69	0.01 - 0.99	N/A
	Maximum hazard	1.2 – Moderate (Dangerous for some)	1.4 – Significant (Dangerous for most)	1.9 - Significant (Dangerous for most)	N/A

Site code	PS13
Site name	Central River, Canal Corridor

	<p>Available modelled data: The site is covered by the Environment Agency River Frome 2D detailed hydraulic model, prepared in 2008. The model was further developed as part of the Stroud Valleys modelling study in 2015. The site does not benefit from flood defence, and therefore the undefended scenario is assessed here. Detailed 2D results for the 2008 River Frome model were not supplied with the model, and therefore the depth and hazard values above were extracted from outputs of the 2015 Stroud Valleys modelling study.</p> <p>Flood characteristics: The site is at high risk of fluvial flooding, with the centre of the site located within the 1 in 20 fluvial extent, the functional floodplain. The centre and east of the site are also predicted to be affected during a 1 in 100 and 1 in 1,000 flood event, whereas the western portion of the site remains at very low risk (i.e. within Flood Zone 1). Peak flood depths in the centre and east of the site are predicted to reach between 0.1 – 0.3m in depth during a 1 in 100 event, with the highest depths predicted to form at the northern site boundary, adjacent to the Stroudwater Canal. Flood hazard ranges from very low to significant during a 1 in 100 event, with the greatest hazard to people predicted in the south of the site, adjacent to the River Frome.</p>		
Surface Water	Proportion of site at risk (RoFSW)		
	1 in 30	1 in 100	1 in 1,000
	2%	11%	42%
	<p>Description of surface water flow paths: The site is at moderate risk of surface water flooding. The central and north eastern areas of the site, between the Stroudwater Canal and River Frome, are at highest risk of flooding, with large areas of ponding predicted to accumulate around the existing buildings during the 1 in 100r and 1 in 1,000 rainfall events.</p>		
Groundwater	Areas Susceptible to Groundwater Flooding Map class (risk of groundwater emergence)		
	ASTGWF - Category 2 >=25% <50%	ASTGWF - Category 3 >=50% <75%	ASTGWF - Category 4 >=75%
	26%	29%	0%
	<p>The site is at moderate groundwater flood risk, being partially located within 1km² grid squares with a greater than 25% but less than 75% risk of groundwater emergence during a 1 in 100 event.</p>		
Reservoir	<p>The south western boundary of the site is at risk of reservoir flooding. However, the area of coverage by Reservoir Inundation Mapping is very small.</p>		
Canal	<p>The Stroudwater Canal forms the northern boundary of the site. The canal is represented within the River Frome model, and the model is considered to represent flood risk to the site from the canal. The residual risk of flood risk to the site, in the event of overtopping of the canal, which should be assessed in greater detail within a site-specific Flood Risk Assessment..</p>		

Site code	PS13
Site name	Central River, Canal Corridor

	Defences	Defence Type	Standard of Protection	Condition	
		There are no flood defences within, or within the vicinity of the site.			
Flood risk management infrastructure	Residual risk	Culvert / structure blockage?	There are no culverts within the site boundary. However, the River Frome appears to be bridged or culverted to the east of the site, where it passes beneath A46 Bath Road.		
		Impounded water body failure?	A small proportion of the south western boundary of the site is at risk of reservoir flooding, in the event of a breach.		
		Defence breach / overtopping?	<p style="text-align: center;">Breach Zone</p> There is a residual risk of flooding due to overtopping of the Stroudwater Canal, which is modelled as part of the undefended flood extent from the River Frome (as represented by the Flood Zones). However, there are no reported incidents of canal breach or overtopping in this location.		
Emergency planning	Flood warning	The site is covered by the following Environment Agency Flood Warning and Flood Alert Areas: <ul style="list-style-type: none"> • River Frome at Stroud and Ryeford Flood Warning Area • Rivers Frome and Cam Flood Alert Area 			
	Access and egress	The site is likely to be accessed from A46 Bath Road. However, alternative access routes are available on Chestnut Lane and Lodgemoor Lane, to the north. The area of Bath Road at the eastern corner of the site, and the end of Lodgemoor Lane, are identified as at risk of flooding during a 1 in 100 and 1 in 1,000 event on the River Frome. The risk of surface water flooding to all three roads is relatively low, with areas of ponding predicted to occur during a 1 in 1,000 rainfall event only.			
Climate Change	Climate change allowances for '2080s'	River Basin District	Central	Higher Central	Upper End
		Severn	25%	35%	70%
	Implications for the site	Modelling (of 2008 River Frome model) shows that the extent of Flood Zone 3a + 70% climate change allowance is expected to extend beyond that of Flood Zone 3a and Flood Zone 2, in the south and east of the site.			

Site code	PS13
Site name	Central River, Canal Corridor

Requirement for drainage control and impact mitigation	Bedrock Geology	The underlying geology is Lias Group Mudstone, Siltstone, Limestone and Sandstone.		
	Superficial Geology	Landslip deposits are located over the majority of the north and west of the site, with river terrace deposits present across the east and south.		
	Soils	The majority of the site is underlain by slowly permeable and slightly acid, base-rich loamy and clayey soils, which are seasonally wet. The east of the site is covered by slightly acid loamy and clayey soils with impeded drainage		
	SuDS	<ul style="list-style-type: none"> As a previously developed site, development should seek to reduce the coverage of impermeable surfaces, to limit the rates and volumes of surface water runoff generated on the site. Severn Trent Water has identified a large pumped Combined Sewer Overflow (CSO) within the site, at which pollution incidents have previously been reported. The asset may be adversely impacted by any increase in flow, and therefore surface water drainage should follow the discharge hierarchy and drain into surface waters (e.g. Painswick Stream or Stroudwater Canal), rather than the combined sewer network. Opportunities should be taken to incorporate above ground SuDS features, which provide multiple benefits. A desk-based review of the site geology suggests that infiltration techniques may not be suitable at the site. However, the potential for infiltration should be investigated within site-specific infiltration testing. Detention and conveyance features will be appropriate on the site. However, attenuation features must be located outside areas of fluvial flood risk. 		
	Groundwater Source Protection Zone	The site is not located within a designated Source Protection Zone.		
	Historic Landfill Site	There are no historic landfill sites within the development site boundary. However, Farhill Landfill site is located approximately 30m to the north of the site. Cainscross landfill is located approximately 400m to the north west of the site.		
	Opportunities for flood risk betterment	The site provides opportunities for storing flood water from the River Frome, to reduce the flow and delay the timing in which it reaches communities downstream.		
	Cumulative impacts of development	Water Framework Directive Catchment	Sensitivity to cumulative impacts	Implications
		River Frome – Source to Ebley Mill	Medium	The effects which development of the site may have on flood risk within the catchment will need to be considered within a site-specific flood risk assessment.
Sequential Test and Exception Test requirements				

Site code	PS13
Site name	Central River, Canal Corridor

Recommendations for Local Plan policy	<p>The Sequential Test must be satisfied. If the Sequential Test has been passed, then Table 3 of the NPPG gives details of appropriate flood risk vulnerability for each Flood Zone. For this site, if More Vulnerable (residential) development is proposed within FZ3a, or Highly Vulnerable development is proposed within FZ2, the Exception Test must be satisfied.</p> <p>A large proportion of the site is at fluvial flood risk (>50% in FZ3) and flood depths are moderately deep, with a high flood hazard to people.</p> <p>If no alternative sites at lower flood risk can be allocated according to the Sequential Test, a sequential approach must be taken to designing the site, avoiding placing More Vulnerable development in areas of highest risk within the site, using them instead for appropriate uses such as Water Compatible uses (e.g. green infrastructure, flood storage) or Less Vulnerable (e.g. commercial development).</p> <p>If the development passes the Exception Test and More Vulnerable development is placed within FZ3, appropriate flood risk mitigation (including floodplain compensation and raised floor levels) and resilience measures (such as flood resilient construction) must be implemented.</p>
	<p>Recommendations for requirements of site-specific Flood Risk Assessment, including guidance for developers</p>
	<p>Flood risk assessment:</p> <ul style="list-style-type: none"> A site-specific flood risk assessment will be required because the site is partially within Flood Zones 2 and 3. Government guidance on flood risk assessments must be followed (https://www.gov.uk/guidance/flood-risk-assessment-for-planning-applications). All sources of flooding, particularly the risk of surface water and groundwater flooding, should be considered as part of a site-specific flood risk assessment. The site is located within a catchment identified as moderately sensitive to the cumulative impact of development. The effects which development of the site may have on flood risk within the catchment will need to be considered within a site-specific flood risk assessment. <p>Guidance for site design and making development safe:</p> <ul style="list-style-type: none"> A site-specific surface water drainage strategy will be required. Development must seek opportunities to reduce overall level of flood risk at the site and should seek to reduce the levels of flood risk downstream. Consultation with Gloucestershire County Council as Lead Local Flood Authority (LLFA) and the Stroud District Council Drainage Engineer on surface water drainage of the site and potential SuDS features should be undertaken at an early stage. Development must seek opportunities to reduce overall level of flood risk both on and off-site, for example by reducing volume and rate of runoff and creating space for flooding. 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. The site layout and drainage design must ensure that surface water flows resulting from rainfall in excess of a 1 in 100 event are managed via exceedance routes that minimise the risks to people and property. Safe access and egress should be demonstrated in the 1 in 100 plus climate change fluvial and rainfall events. 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.

Site code	PS14
Site name	Stanley Mills, Kings Stanley

Site details	OS Grid reference	SO 81184 04305																						
	Area	1.78ha																						
	Current land use	Industrial																						
	Proposed site use	Residential																						
	Flood risk vulnerability	More vulnerable																						
Sources of flood risk	Existing watercourses	<p>The site is formed of two parcels, a smaller eastern and a larger western parcel, separated by Brockley Road.</p> <p>The River Frome (Main River) flows in a south westerly direction along the southern boundary of both land parcels. The River Frome splits into two channels at Brockley Road, and a further watercourse flows in a north-westerly direction through the centre of the western land parcel.</p>																						
	Flood history	<p>Both parts of the sites are partially included within the Environment Agency Recorded Flood Outlines. The majority of the eastern land parcel was flooded in July 1968, whereas a small area at the western border of the western site was flooded during the July 2007 event. Both of these flood events occurred as a result of the River Frome channel being exceeded.</p> <p>To the north of the site, two additional flood incidents have been recorded in October 2000:</p> <ul style="list-style-type: none"> October 2000 - residential flooding incident. Postcode area GL10 2LG. The source of flooding is unknown. 09/10/2000 – reported sewer flooding caused external flooding in postcode area GL5 2BA. <p>It should be noted that these are postcode-scale incidents, which have been plotted at the centre of the postcode area, and therefore the location affected may differ.</p>																						
	Fluvial	<table border="1"> <thead> <tr> <th colspan="5">Proportion of site at risk in Flood Zones</th> </tr> <tr> <th>Proportion of the site at risk (%)</th> <th>Flood Zone 3b 4% AEP (1 in 25)</th> <th>Flood Zone 3a 1% AEP (1 in 100)</th> <th>Flood Zone 2 0.1% AEP (1 in 1,000)</th> <th>Flood Zone 1</th> </tr> </thead> <tbody> <tr> <td></td> <td>4%</td> <td>0%</td> <td>16%</td> <td>80%</td> </tr> <tr> <td>Maximum Water Level (mAOD)</td> <td>23.67 – 27.89</td> <td>23.83 – 27.62</td> <td>24.02 – 27.66</td> <td>N/A</td> </tr> </tbody> </table> <p>Available modelled data:</p> <p>The site is covered by the Environment Agency River Frome 1D-2D ESTRY-TUFLOW detailed hydraulic model, which was prepared in 2008 and covers the River Frome, as well as the Thames and Severn Canal. This section of the model was not developed as part of the Stroud Valleys modelling study in 2015. The site does not benefit from flood defence, and therefore the undefended scenario is assessed here. Detailed 2D results for the 2008 River Frome model were not supplied with the model, however maximum water levels within the site have been extracted.</p>				Proportion of site at risk in Flood Zones					Proportion of the site at risk (%)	Flood Zone 3b 4% AEP (1 in 25)	Flood Zone 3a 1% AEP (1 in 100)	Flood Zone 2 0.1% AEP (1 in 1,000)	Flood Zone 1		4%	0%	16%	80%	Maximum Water Level (mAOD)	23.67 – 27.89	23.83 – 27.62	24.02 – 27.66
Proportion of site at risk in Flood Zones																								
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	4%	0%	16%	80%																				
Maximum Water Level (mAOD)	23.67 – 27.89	23.83 – 27.62	24.02 – 27.66	N/A																				

Site code	PS14
Site name	Stanley Mills, Kings Stanley

		<p>Flood characteristics:</p> <p>The majority of the eastern land parcel is located within Flood Zone 2, and is therefore predicted to flood during a 1 in 1,000 fluvial event. Within the western land parcel, the western border and the western corner of the site are located within Flood Zone 3b, and are predicted to flood during a 4% AEP (1 in 25) event. Areas of the site predicted to flood are located adjacent to the channel of the River Frome.</p> <p>It should be noted that the Environment Agency Flood Zone 2 extent is greater than the area predicted to flood within the 0.1% AEP (1 in 1,000) modelled results for the River Frome. This is a result of the inclusion of recorded flood outlines within the Environment Agency Flood Zone 2. For example, the eastern parcel of land is predicted to be predominantly at risk of flooding, but this is as a result of the July 1968 flood event.</p>						
	Surface Water	<p style="text-align: center;">Proportion of site at risk (RoFSW)</p> <table border="1"> <thead> <tr> <th>30-year</th> <th>100-year</th> <th>1,000-year</th> </tr> </thead> <tbody> <tr> <td>6%</td> <td>11%</td> <td>19%</td> </tr> </tbody> </table>	30-year	100-year	1,000-year	6%	11%	19%
30-year		100-year	1,000-year					
6%		11%	19%					
	<p>Description of surface water flow paths:</p> <p>The western land parcel is at moderate to high risk of surface water flooding. Areas of high risk, where surface water flooding is predicted to occur during a 1 in 30 (3.3% AEP) rainfall event, are located at the southern and western borders of the site, which coincides with the floodplain of the River Frome. In these locations, surface water risk should not be considered in addition to fluvial flood risk.</p> <p>Within this land parcel, there is a further area of surface water flooding predicted in the east of the site. This runoff forms on Brockley Road and flows westwards, forming ponding around the existing buildings on the site during a 3.3% AEP (1 in 30) rainfall event. The flooding extends to cover the centre of the site during the 1% AEP (1 in 100) and 0.1% AEP (1 in 1,000) rainfall events.</p> <p>In the eastern parcel of land, a small area along the northern border is predicted to flood during a 3.3% AEP (1 in 30) rainfall event. This flooding is associated with the adjacent mill pond.</p>							
	Groundwater	<p style="text-align: center;">Areas Susceptible to Groundwater Flooding Map class (risk of groundwater emergence)</p> <table border="1"> <thead> <tr> <th>ASTGWF - Category 2 >=25% <50%</th> <th>ASTGWF - Category 3 >=50% <75%</th> <th>ASTGWF - Category 4 >=75%</th> </tr> </thead> <tbody> <tr> <td>0%</td> <td>100%</td> <td>0%</td> </tr> </tbody> </table>	ASTGWF - Category 2 >=25% <50%	ASTGWF - Category 3 >=50% <75%	ASTGWF - Category 4 >=75%	0%	100%	0%
ASTGWF - Category 2 >=25% <50%		ASTGWF - Category 3 >=50% <75%	ASTGWF - Category 4 >=75%					
0%	100%	0%						
		<p>The entirety of the site is located within a 1km² grid square with a 50 - 75% likelihood of groundwater emergence during a 1 in 100-year event, and is therefore identified as at moderate-to-high risk.</p>						
	Reservoir	<p>There is a residual risk of flooding to the western and southern borders of the western land parcel, as well as the eastern and southern borders of the eastern land parcel. This flooding is associated with the unlikely event that a breach occurred on one of the following reservoirs:</p> <ul style="list-style-type: none"> • Mill Pond, Woodchester • Parkmill Pond, Woodchester • Gatcombe Water • Kennel Pond, Woodchester 						
	Canal	<p>There are no canals within the site boundary. The Stroudwater canal is located approximately 400m north of the south, and therefore the risk of flooding from canals is considered to be low.</p>						

Site code	PS14
Site name	Stanley Mills, Kings Stanley

	Defences	Defence Type	Standard of Protection	Condition	
		There are no flood defences within the site boundary or within close proximity.			
Flood risk management infrastructure	Residual risk	Culvert / structure blockage?	The River Frome is culverted for a section within the centre of the western land parcel. The RoFSW mapping has been used as a proxy for a blockage scenario, as the culvert is not represented within the RoFSW modelling. The mapping indicates that, due to the higher topography at the south eastern corner of the site, downstream of the culvert entrance, blockage would have a limited impact on flood risk to the site. However, blockage scenario testing would be required within a site-specific FRA to fully understand the risk that culvert blockage poses to the site.		
		Impounded water body failure?	There is a residual risk of flooding to the western and southern borders of the western land parcel, as well as the eastern and southern borders of the eastern land parcel. This flooding is associated with the unlikely event that a breach occurred on one of the following reservoirs: <ul style="list-style-type: none"> • Mill Pond, Woodchester • Parkmill Pond, Woodchester • Gatcombe Water • Kennel Pond, Woodchester 		
	Defence breach / overtopping?	Breach Zone			
			There are no defences within the site.		
Emergency planning	Flood warning	Both land parcels are included within the Environment Agency Rivers Frome and Cam Flood Alert Area.			
	Access and egress	Access for both parcels of land is likely to be via Brockley Road, which is located between the two land parcels. This route is shown to be affected by fluvial flooding in the 4% AEP (1 in 25) and greater fluvial flood events, to the south of western land parcel. However, this flood risk is associated with the channel below the road bridge. North of the site, the road is affected by fluvial flooding during the 0.1% AEP (1 in 1,000) event. Brockley Road is also at high risk of surface water flooding, with flow paths predicted to form outside the two land parcels during the 3.3% AEP (1 in 30) and greater rainfall events. Therefore, access to the two land parcels is likely to be affected by fluvial and surface water flooding.			
Climate Change	Climate change allowances for '2080s'	River Basin District	Central	Higher Central	Upper End
	Implications for the site	Severn	25%	35%	70%
		Modelling shows that the extents of Flood Zone 3a + 35% CC and + 70% CC extend beyond that of Flood Zone 3a, but do not extend beyond Flood Zone 2. Therefore, climate change is not predicted to significantly impact the proposed site.			

Site code	PS14
Site name	Stanley Mills, Kings Stanley

Requirement for drainage control and impact mitigation	Bedrock Geology	Blue Lias formation and Charmouth mudstone formation (undifferentiated)		
	Superficial Geology	Alluvium – clay, silt, sand and gravel		
	Soils	Loamy and clayey floodplain soils with naturally high groundwater		
	SuDS	<ul style="list-style-type: none"> As a previously developed site, development should seek to reduce the coverage of impermeable surfaces, to limit the rates and volumes of surface water runoff generate on the site. Severn Trent Water has identified a Combined Sewer Overflow (CSO) adjacent to the site, at which a pollution incident has previously been reported. The asset may be adversely impacted by any increase in flow, and therefore surface water drainage should follow the discharge hierarchy and drain into surface waters (e.g. Painswick Stream or Stroudwater Canal), rather than the combined sewer network. Opportunities should be taken to incorporate above ground SuDS features, which provide multiple benefits. A desk-based review of the site geology and risk of groundwater emergence suggests that infiltration techniques may not be suitable at the site. However, the potential for infiltration should be investigated within site-specific infiltration testing. Detention and conveyance features will be appropriate on the site. However, attenuation features must be located outside areas of fluvial flood risk. 		
	Groundwater Source Protection Zone	The site is not within a Groundwater Source Protection Zone.		
	Historic Landfill Site	There are no historic landfill sites within the site boundary. However, the Brockley Road landfill site is adjacent to the south western corner of the left parcel of land.		
	Opportunities for flood risk betterment	The site, and particularly the existing mill pond, provides opportunities to store flows from the River Frome during times of flood, to reduce peak flow and delay the time at which it reaches communities downstream. Opportunities to open, or 'daylight', the section of culverted watercourse in the centre of the site should be investigated, to reduce the risk of a blockage affecting the site.		
Cumulative impacts of development	Water Framework Directive Catchment	Sensitivity to cumulative impacts	Implications	
	Frome - source to Ebley Mill	Medium	The effects which development of the site may have on flood risk within the catchment will need to be considered within a site-specific flood risk assessment.	
Sequential Test and Exception Test requirements				

Site code	PS14
Site name	Stanley Mills, Kings Stanley

Recommendations for Local Plan policy	<p>The Sequential Test must be satisfied. Only once the Sequential Test is satisfied should the Exception Test be applied. It is anticipated that proposed development will be sequentially located within Flood Zone 1. For this site, the Exception Test must be passed:</p> <ul style="list-style-type: none"> • If More Vulnerable and Essential Infrastructure is located in FZ3a or FZ3a plus climate change. • If Highly Vulnerable development is located in FZ2. <p>If Essential Infrastructure is located in Flood Zone 3b then it must be demonstrated that the exception test is passed. Development will not be permitted in the following scenarios:</p> <ul style="list-style-type: none"> • Highly Vulnerable development within FZ3a or FZ3a plus climate change and FZ3b. • More Vulnerable and Less Vulnerable development within FZ3b.
	<p>Recommendations for requirements of site-specific Flood Risk Assessment, including guidance for developers</p> <p>Flood risk assessment:</p> <ul style="list-style-type: none"> • Consultation with the Local Authority and the Environment Agency should be undertaken at an early stage. • A site-specific flood risk assessment will be required because the site is within Flood Zone 2 and 3 and at risk from sources of flooding other than rivers and the sea. Government guidance on flood risk assessments must be followed (https://www.gov.uk/guidance/floodrisk-assessment-for-planning-applications). • The impact of the development on flood risk from all sources both on and off-site must be considered and modelled where appropriate. It is recommended that a detailed hydraulic model is carried out for the site to accurately understand risk to the site. • A detailed assessment of the risk and location of high groundwater levels and groundwater emergence should be undertaken, including groundwater monitoring during the winter months. • Climate change should be assessed using recommended climate change allowances at the time of the assessment (https://www.gov.uk/guidance/flood-risk-assessmentsclimate-change-allowances) for the type of development and level of risk. The current allowances were published in February 2016 but may be subject to change in the future. • Blockage modelling should be conducted to assess the residual risk associated with blockage of the culvert within the site. • The site is located within a catchment identified as moderately sensitive to the cumulative impact of development. The effects which development of the site may have on flood risk within the catchment will need to be considered within a site-specific flood risk assessment. <p>Guidance for site design and making development safe:</p> <ul style="list-style-type: none"> • A site-specific surface water drainage strategy will be required. • Development must seek opportunities to reduce overall level of flood risk at the site and should seek to reduce the levels of flood risk downstream. • Consultation with Gloucestershire County Council as Lead Local Flood Authority (LLFA) and the Stroud District Council Drainage Engineer on surface water drainage of the site and potential SuDS features should be undertaken at an early stage. • Development must seek opportunities to reduce overall level of flood risk both on and off-site, for example by reducing volume and rate of runoff and creating space for flooding. • 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. • The site layout and drainage design must ensure that surface water flows resulting from rainfall in excess of a 1 in 100-year event are managed via exceedance routes that minimise the risks to people and property. • Safe access and egress should be demonstrated in the 1 in 100-year plus climate change fluvial and rainfall events. 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.

Site code	PS19a
Site name	Stonehouse Northwest

Site details	OS Grid reference	SO 80096 07026				
	Area	37.59 ha				
	Current land use	Greenfield				
	Proposed site use	Residential / open space / employment				
	Flood risk vulnerability	More vulnerable				
Sources of flood risk	Existing watercourses	An unnamed ordinary watercourse, which forms a tributary of the River Frome, flows in a south westerly direction and along the southern boundary of the site.				
	Flood history	<p>There are no historic flood events recorded within the site boundary. However, several sewer flooding incidents are recorded 575m downstream of the site, in Nastend.</p> <p>It should be noted that these are postcode-scale incidents, which have been plotted at the centre of the postcode area, and therefore the location affected may differ.</p> <p>The following flood incidents are recorded for postcode GL10 3SX:</p> <ul style="list-style-type: none"> 18/03/2018 - reported sewer flooding caused external flooding 21/03/2016 – reported sewer flooding caused internal and external flooding 22/03/2016 - reported sewer flooding caused flooding (unknown whether internal or external) 				
	Fluvial	Proportion of site at risk in Flood Zones				
		Proportion of the site at risk (%)	Flood Zone 3b 5% AEP (1 in 20)	Flood Zone 3a 1% AEP (1 in 100)	Flood Zone 2 0.1% AEP (1 in 1,000)	Flood Zone 1
Surface Water	Proportion of site at risk (RoFSW)					
	3.3% AEP (1 in 30)	1% AEP (1 in 100)		0.1% AEP (1 in 1,000)		

Site code	PS19a
Site name	Stonehouse Northwest

		1%	1%	6%
		Description of surface water flow paths: Three large surface water flow paths form at the northern, southern and south western boundaries of the site. The south west flow path forms during a 3.3% AEP (1 in 30) rainfall event, and the southern flow path forms during a 1% AEP (1 in 100) event. Both flow paths drain southwards into a tributary of the River Frome. The northern boundary of the site is at risk of surface water flooding during a 3.3% AEP (1 in 30) rainfall event, and greater return periods. Runoff flows north-eastwards, towards Pidgemore Farm, before entering a tributary watercourse of Epney Ryne.		
		Areas Susceptible to Groundwater Flooding Map class (risk of groundwater emergence)		
	Groundwater	ASTGWF - Category 2 ≥25% <50%	ASTGWF - Category 3 ≥50% <75%	ASTGWF - Category 4 ≥75%
		41%	0%	0%
		The site has a low to moderate likelihood of groundwater emergence.		
	Reservoir	The site is not at risk of flooding in the event of a reservoir breach.		
	Canal	There are no canals within the site boundary.		

Site code	PS19a
Site name	Stonehouse Northwest

	Defences	Defence Type	Standard of Protection	Condition		
		There are no defences located within the site.				
Flood risk management infrastructure	Residual risk	Culvert / structure blockage?	There are no culverts located within the site boundary. The ordinary watercourse to the east of the site is culverted beneath the railway line. RoFSW mapping (which does not represent the culvert, and therefore acts as a proxy for a blockage scenario) indicates that blockage of this culvert will cause ponding at the upstream face of the railway embankment, but will not impact the site. However, the impact of this blockage on the residual risk to the site should be assessed in detail within a site-specific Flood Risk Assessment.			
		Impounded water body failure?	The site is not at risk of flooding in the event of a reservoir breach.			
		Defence breach / overtopping?	Breach Zone			
			N/A			
Emergency planning	Flood warning	The site is not covered by any Environment Agency Flood Warning or Flood Alert Areas.				
	Access and egress	The site is likely to be accessed by the track in the centre of the site, which currently provides access from the existing dwelling of Stagholt Farm, on to the B4008 Gloucester Road. The current access route is predicted to experience localised areas of surface water flooding during a 3.3% AEP (1 in 30) and greater rainfall events.				
Climate Change	Climate change allowances for '2080s'	River Basin District	Central	Higher Central	Upper End	
		Severn	25%	35%	70%	
	Implications for the site	Due to the lack of a detailed hydraulic modelling in this location, Flood Zone 2 has been used as a proxy for the Flood Zone 3a + 35% and 70% climate change extents. This indicates that climate change will result in an increase in flood risk during the 1% AEP flood event (Flood Zone 3a), although it may give a conservative account of risk.				

Site code	PS19a
Site name	Stonehouse Northwest

Requirement for drainage control and impact mitigation	Bedrock Geology	The site is underlain by the Lias group mudstone, siltstone, limestone and sandstone.		
	Superficial Geology	The site is not overlain with superficial geological deposits.		
	Soils	Lime-rich loamy and clayey soils with impeded drainage.		
	SuDS	<ul style="list-style-type: none"> As a large undeveloped site, opportunities should be taken to incorporate above ground, natural SuDS features, which provide multiple benefits (including biodiversity, amenity and water quality improvements). The impermeable underlying geology suggests that discharge of the site via infiltration is unlikely to be feasible. However, this should be confirmed within a site-specific drainage strategy. Detention and conveyance features will be appropriate on the site. However, attenuation features must be located outside areas of fluvial flood risk. 		
	Groundwater Source Protection Zone	The site is not located within a designated Groundwater Source Protection Zone.		
	Historic Landfill Site	There are no historical landfill sites within the proposed site boundary, or in close proximity to the site.		
	Opportunities for flood risk betterment	Opportunities for using source control SuDS to manage runoff rates and volumes, contributing to the reduction of existing surface water flow paths leaving the site, as well as flood peaks downstream on the River Frome and Epney Rhyne.		
	Cumulative impacts of development	Water Framework Directive Catchment	Sensitivity to cumulative impacts	Implications
Frome- Ebley Mill to confluence with the River Severn		High	FRA should include consideration of effects on potential sensitive receptors off-site and if necessary, include additional mitigation, so there are no adverse cumulative effects	
Epney Rhyne – source to confluence with the River Severn Estuary		High		
Sequential Test and Exception Test requirements				

Site code	PS19a
Site name	Stonehouse Northwest

Recommendations for Local Plan policy	<p>The Sequential Test must be satisfied. Only once the Sequential Test is satisfied should the Exception Test be applied. It is anticipated that proposed development will be sequentially located within Flood Zone 1. For this site, the Exception Test must be satisfied:</p> <ul style="list-style-type: none"> • If More Vulnerable and Essential Infrastructure is located in FZ3a or FZ3a plus climate change. • If Highly Vulnerable development is located in FZ2. <p>If Essential Infrastructure is located in Flood Zone 3b then it must be demonstrated that the exception test is satisfied. Development will not be permitted in the following scenarios:</p> <ul style="list-style-type: none"> • Highly Vulnerable development within FZ3a or FZ3a plus climate change and FZ3b. <p>More Vulnerable and Less Vulnerable development within FZ3b.</p>
	<p>Recommendations for requirements of site-specific Flood Risk Assessment, including guidance for developers</p> <p>Flood risk assessment:</p> <ul style="list-style-type: none"> • At the planning application stage, a site-specific flood risk assessment and surface water drainage strategy will be required. • Consultation with the Local Authority and the Environment Agency should be undertaken at an early stage. • A site-specific flood risk assessment will be required because the site is within Flood Zone 2 and 3 and at risk from sources of flooding other than rivers and the sea. Government guidance on flood risk assessments must be followed (https://www.gov.uk/guidance/floodrisk-assessment-for-planning-applications). • Other sources of flooding should also be considered as part of a site-specific flood risk assessment, including surface water and groundwater. • Modelling should be conducted to assess the residual risk associated with potential blockage of the culvert to the east of the site. • The site is located within a catchment identified as highly sensitive to the cumulative impact of development. The effects which development of the site may have on flood risk within the catchment will need to be considered within a site-specific flood risk assessment. • Appropriate storage of surface water runoff will need to be provided, and assessments should identify opportunities to provide off-site betterment, to help offset the cumulative impact of development. For example, this may include contribution to the delivery of schemes within the catchment, such as flood alleviation schemes, Natural Flood Management, SuDS retrofit or river restoration. <p>Guidance for site design and making development safe:</p> <ul style="list-style-type: none"> • Development must seek opportunities to reduce overall level of flood risk at the site and should seek to reduce the levels of flood risk downstream. • Consultation with Gloucestershire County Council as Lead Local Flood Authority (LLFA) and the Stroud District Council Drainage Engineer on surface water drainage of the site and potential SuDS features should be undertaken at an early stage. • Development must seek opportunities to reduce overall level of flood risk both on and off-site, for example by reducing volume and rate of runoff and creating space for flooding. • 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. • The site layout and drainage design must ensure that surface water flows resulting from rainfall in excess of a 1 in 100-year event are managed via exceedance routes that minimise the risks to people and property. • Safe access and egress should be demonstrated in the 1 in 100-year plus climate change fluvial and rainfall events. 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.

Site code	PS20
Site name	M5 Junction 13

Site details	OS Grid reference	SO 78534 06603				
	Area	23 ha				
	Current land use	Greenfield				
	Proposed site use	Sports stadium/employment/community/open source				
	Flood risk vulnerability	Less vulnerable				
Sources of flood risk	Existing watercourses	<p>The site is formed of two land parcels separated by the A419. There are no watercourses located within the site boundary of the north parcel. However, an ordinary watercourse tributary of the River Frome forms a section of the northern boundary of the parcel.</p> <p>The River Frome forms the south western boundary of the south parcel. In addition, the Stroudwater Canal and a further tributary of the Frome flow in a north westerly direction through the centre of the parcel. The site is located within the Lower Severn IDB.</p>				
	Flood history	<p>There are no recorded flood events recorded within the north land parcel. The Environment Agency Recorded Flood Outline identifies that the southwestern portion of the south parcel was affected by flooding in July 2007, when the channel capacity of the undefended River Frome was exceeded.</p> <p>Upstream of the site, an incident of overtopping on the Stroudwater Canal was recorded on 19th July 2007 by the Canal and Rivers Trust. The cause of flooding was recorded to be blockage due to high magnitude canal flows and bypasses due to weed growth, causing water to back up and flood the A419.</p>				
	Fluvial	Proportion of site at risk in Flood Zones				
		Proportion of the site at risk (%)	Flood Zone 3b 4% AEP (1 in 25)	Flood Zone 3a 1% AEP (1 in 100)	Flood Zone 2 0.1% AEP (1 in 1,000)	Flood Zone 1
	12%	7%	2%	79%		
	<p>Available modelled data: The site is covered by the Environment Agency River Frome 1D-2D detailed hydraulic model, prepared in 2008. The site does not currently benefit from flood defence, and therefore the undefended scenario is assessed here.</p> <p>As part of the proposed development of this site, works will be carried out to the Stroudwater Canal in this location, which will lead to greater interaction between the canal and the River Frome via a new weir. The impact of these works on the flood risk to the site has been modelled as part of the proposed development. This assessment uses the existing Flood Zones, which are the best available information at this point in time. Detailed 2D results for the 2008 River Frome model were not supplied with the model, however maximum water levels for the site have been extracted.</p>					

Site code	PS20
Site name	M5 Junction 13

		<p>Flood characteristics: The north parcel is at very low risk of fluvial flooding (i.e. within Flood Zone 1). The south western portion of the south parcel is predicted to be at risk of flooding from the River Frome during a 1 in 25, 1 in 100 and 1 in 1,000 flood event. Peak flood levels are greatest at the south western corner of the site, where they reach 13.59m AOD in the 1 in 100 and 13.71m AOD in the 1 in 1,000 event. At the north western corner of the land parcel, maximum flood levels are predicted to range between 12.93m AOD (1 in 100) and 13.06m AOD (1 in 1,000).</p>		
	Surface Water	Proportion of site at risk (RoFSW)		
		1 in 30	1 in 100	1 in 1,000
		7%	13%	42%
	Groundwater	<p>Description of surface water flow paths: In the north parcel, surface water flood risk is concentrated in the southern, and north western corners of the site, where ponding occurs against the higher ground of the A419 and M5, during a 1 in 30 rainfall event, and greater return periods. The northern boundary of the parcel is also identified to be at risk of surface water flooding during a 1 in 30 rainfall event. However, the extent of risk appears to represent the floodplain of the unnamed River Frome tributary and therefore may be fluvial in nature.</p> <p>In the south parcel, the greatest surface water flood risk is concentrated at the north western corner, in a low point where the Stroudwater Canal and a tributary of the River Frome pass below the M5. Flooding is predicted to occur here in a 1 in 30 rainfall event. During the 1 in 100 and 1 in 1,000 rainfall events, the extent of flood risk extends southwards, covering the western portion of the land parcel.</p>		
		Areas Susceptible to Groundwater Flooding Map class (risk of groundwater emergence)		
	Reservoir	ASTGWF - Category 2 >=25% <50%	ASTGWF - Category 3 >=50% <75%	ASTGWF - Category 4 >=75%
		0%	0%	45%
	Canal	<p>The majority of the south parcel and north western corner of the north parcel are located within a 1km² grid square with a 75% or greater risk of groundwater emergence during a 1 in 100 event, and is therefore identified as at high risk. Elsewhere, the risk of groundwater flooding is low, with a <25% risk of groundwater emergence.</p> <p>The north western portion and western boundary of the south parcel are identified as at risk of reservoir flooding.</p> <p>The Stroudwater Canal flows through the south parcel. The residual risk of flooding to the site, in the event of overtopping of the canal, should be assessed in greater detail within a site-specific Flood Risk Assessment.</p>		

Site code	PS20
Site name	M5 Junction 13

		Defence Type	Standard of Protection	Condition	
		Flood risk management infrastructure	Defences	There are no defences located within the site. The nearest defence is an earth embankment, built to 'agricultural standards' and located on the opposite bank of the River Frome to the south parcel. However the site is not identified as benefitting from this defence.	
Residual risk	Culvert / structure blockage?		There are no culverts located within the site boundary. The River Frome and its unnamed tributary at the north parcel are culverted beneath the M5. The RoFSW extent at the site provides a proxy of the residual flood risk to the site, in the event of blockage to these culverts.		
	Impounded water body failure?		The north western portion and western boundary of the south parcel are identified as at risk of reservoir flooding, in the event of a breach.		
	Defence breach / overtopping?		<p style="text-align: center;">Breach Zone</p> The site may be at residual risk of flooding from canal overtopping or breach.		
Emergency planning	Flood warning	The site is located within the following Environment Agency Flood Alert and Flood Warning Areas: <ul style="list-style-type: none"> • River Frome at Fromebridge and Eastington Flood Warning Area • Rivers Frome and Cam Flood Alert Area 			
	Access and egress	Access is likely to be either via the A419, which runs inbetween the two subsection areas of the site, or via the M5. The A419 is at very low risk of both fluvial and surface water flooding. The M5 at the south parcel is predicted to be at risk of fluvial flooding during a 1 in 100 and 1 in 1,000 flood event, where the River Frome passes beneath it. The sections of the M5 adjacent to both the north and south parcel is at risk of surface water flooding during a 1 in 30 rainfall and greater return periods.			
Climate Change	Climate change allowances for '2080s'	<p style="text-align: center;">River Basin District</p> Severn	<p style="text-align: center;">Central</p> 25%	<p style="text-align: center;">Higher Central</p> 35%	<p style="text-align: center;">Upper End</p> 70%
	Implications for the site	Modelling shows that the extent of the Flood Zone 3a + 70% climate change uplift extends marginally beyond that of Flood Zone 3a (1 in 100 event) in the west of the site, but does not exceed Flood Zone 2 (1 in 1,000 event).			

Site code	PS20
Site name	M5 Junction 13

Requirement for drainage control and impact mitigation	Bedrock Geology	The underlying geology is Lias Group mudstone, siltstone, limestone and sandstone.		
	Superficial Geology	Superficial alluvium and river terrace deposits are located over a large area of the site, with the exception of the eastern portion of the north parcel.		
	Soils	The north parcel and the eastern portion of the south parcel are underlain by lime-rich loamy and clayey soils with impeded drainage. The southern and western areas of the south parcel are underlain by loamy and clayey floodplain soils with naturally high groundwater.		
	SuDS	<ul style="list-style-type: none"> As a large undeveloped site, opportunities should be taken to incorporate above ground SuDS features, which provide multiple benefits. Severn Trent Water has flagged the site as being at high risk for surface water drainage, as there are no surface water sewers in the vicinity of the site, and no watercourses nearby. Surface water should be managed on site, through the use of SuDS. If infiltration techniques are not feasible on the site, early consultation with Severn Trent Water and Gloucestershire County Council (as LLFA) is recommended, to secure a suitable surface water discharge destination. Due to the high groundwater levels, and risk of groundwater flooding, infiltration techniques are unlikely to be suitable. However, the potential for infiltration should be investigated within site-specific infiltration testing. Detention and conveyance features will be appropriate on the site. However, attenuation features must be located outside areas of fluvial flood risk. Below-ground SuDS features in areas of high groundwater on the site may need to be lined, to prevent the ingress of groundwater and loss of attenuation storage. 		
	Groundwater Source Protection Zone	The site is not located within a designated Source Protection Zone.		
	Historic Landfill Site	There are no historic landfill sites recorded within the site boundary.		
	Opportunities for flood risk betterment	The site provides opportunities for storing flood water from the River Frome, to reduce the flow and delay the timing in which it reaches downstream. This may provide benefit during periods of high tide or high river level on the River Severn, when the River Frome becomes tide-locked and flows on the river back up.		
		Water Framework Directive Catchment	Sensitivity to cumulative impacts	Implications

Site code	PS20
Site name	M5 Junction 13

	Cumulative impacts of development	River Frome – Ebley Mill to Severn	High	FRA should include consideration of effects on potential sensitive receptors off-site and if necessary, include additional mitigation, so there are no adverse cumulative effects
Recommendations for Local Plan policy	Sequential Test and Exception Test requirements			
	<p>The Sequential Test must be satisfied. Only once the Sequential Test is satisfied should the Exception Test be applied. It is expected that proposed development will be sequentially located within Flood Zone 1. For this site, the Exception Test must be satisfied:</p> <ul style="list-style-type: none"> • If More Vulnerable and Essential Infrastructure is located in FZ3a or FZ3a plus climate change. • If Highly Vulnerable development is located in FZ2. <p>If Essential Infrastructure is located in Flood Zone 3b then it must be demonstrated that the exception test is satisfied. Development will not be permitted in the following scenarios:</p> <ul style="list-style-type: none"> • Highly Vulnerable development within FZ3a or FZ3a plus climate change and FZ3b. • More Vulnerable and Less Vulnerable development within FZ3b. 			
	Recommendations for requirements of site-specific Flood Risk Assessment, including guidance for developers			
<p>Flood risk assessment:</p> <ul style="list-style-type: none"> • A site-specific flood risk assessment will be required because the site is partially within Flood Zones 2 and 3. Government guidance on flood risk assessments must be followed (https://www.gov.uk/guidance/flood-risk-assessment-for-planning-applications). • All sources of flooding, particularly the risk of surface water and groundwater flooding, should be considered as part of a site-specific flood risk assessment. • The site is located within a catchment identified as highly sensitive to the cumulative impact of development. The effects which development of the site may have on flood risk within the catchment will need to be considered within a site-specific flood risk assessment. • Appropriate storage of surface water runoff will need to be provided, and assessments should identify opportunities to provide off-site betterment, to help offset the cumulative impact of development. For example, this may include contribution to the delivery of schemes within the catchment, such as flood alleviation schemes, Natural Flood Management, SuDS retrofit or river restoration. <p>Guidance for site design and making development safe:</p> <ul style="list-style-type: none"> • A site-specific surface water drainage strategy will be required. • Development must seek opportunities to reduce overall level of flood risk at the site and should seek to reduce the levels of flood risk downstream. • Consultation with Gloucestershire County Council as Lead Local Flood Authority (LLFA), the Lower Severn IDB and the Stroud District Council Drainage Engineer on surface water drainage of the site and potential SuDS features should be undertaken at an early stage. • Development must seek opportunities to reduce overall level of flood risk both on and off-site, for example by reducing volume and rate of runoff and creating space for flooding. 				

Site code	PS20
Site name	M5 Junction 13

	<ul style="list-style-type: none">• 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.• The site layout and drainage design must ensure that surface water flows resulting from rainfall in excess of a 1 in 100 event are managed via exceedance routes that minimise the risks to people and property.• Safe access and egress should be demonstrated in the 1 in 100 plus climate change fluvial and rainfall events. 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.
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Site code	PS25
Site name	East of River Cam

Site details	OS Grid reference	SO 75131 00558				
	Area	7.07 ha				
	Current land use	Agricultural land				
	Proposed site use	Residential				
	Flood risk vulnerability	More vulnerable				
Sources of flood risk	Existing watercourses	There are no watercourses within the site, however the River Cam flows along the western boundary.				
	Flood history	<p>There are no recorded flood incidents within the proposed boundary of the site. The flood extent from July 1968 (which occurred as a result of channel exceedance) is within 10m of the site.</p> <p>In addition, the following sewer flooding events were recorded upstream and downstream of the site:</p> <ul style="list-style-type: none"> 22/05/2006, 30/09/2006, 26/06/2007 – external flooding of public open space (GL11 5LQ) 24/09/1999, 02/02/2004, 03/08/2007 – external flooding of the highway (GL11 5NR – plotted at Station Road) 				
	Fluvial	Proportion of site at risk in Flood Zones				
		Proportion of the site at risk (%)	Flood Zone 3b 4% AEP (1 in 25)	Flood Zone 3a 1% AEP (1 in 100)	Flood Zone 2 0.1% AEP (1 in 1,000)	Flood Zone 1
			2%	1%	2%	95%
Available modelled data: The site is covered by the Environment Agency River Cam and Wickster's Brook 1D hydraulic model, which was completed in 2007. The site does not benefit from flood defence, and therefore the undefended scenario is assessed here. Flood characteristics: The south western border of the site is located within the functional floodplain of the River Cam, defined here as the 1 in 25 flood event, as well as 1 in 100 and 1 in 1,000 flood events. Modelled peak flood levels on the River Cam range from 35.44mAOD (1 in 100) to 36.03mAOD (1 in 1,000) at the northwest corner of the site, to between 35.56mAOD (1 in 100) and 36.18mAOD (1 in 1,000) at the southwest corner.						
Surface Water	Proportion of site at risk (RoFSW)					
	1 in 30	1 in 100	1 in 1,000			
	2%	3%	7%			

Site code	PS25
Site name	East of River Cam

		Description of surface water flow paths: The south western border of the site is predicted to experience surface water flooding during the 1 in 30 and greater flood events. However, this is associated with the low-lying floodplain of the River Cam and therefore should not be considered in addition to fluvial risk. Two small surface water flow paths cross the centre and northern edge of the site in a westerly direction during the 1 in 1,000 event, before entering the River Cam.				
	Groundwater	Areas Susceptible to Groundwater Flooding Map class (risk of groundwater emergence)				
		ASTGWF - Category 2 >=25% <50%	ASTGWF - Category 3 >=50% <75%	ASTGWF - Category 4 >=75%		
		0%	0%	0%		
	The site is at low risk of groundwater emergence during a 1 in 100 event.					
Reservoir	The site is not at risk of reservoir flooding.					
Canal	There are no canals within the site boundary.					
Flood risk management infrastructure	Defences	Defence Type	Standard of Protection	Condition		
		There are no flood defences within the site.				
	Residual risk	Culvert / structure blockage?	There are no culverts or structures within or adjacent to the site which pose a blockage risk. Middle Mills culvert is located 30m north east of the site, and Station Road culvert is located 95m to the south. However, due to the surrounding topography, blockage of these structures is not considered to pose a risk of flooding to the site. This should be assessed and confirmed within a site-specific Flood Risk Assessment.			
		Impounded water body failure?	The site is not at risk of reservoir flooding, in the event of a breach event.			
		Defence breach / overtopping?	Breach Zone There are no defences within the			
Emergency planning	Flood warning	The site is not included with an Environment Agency Flood Alert Area or Flood Warning Area.				
	Access and egress	Access to the proposed site is likely to be from the south or the west of the site. If access is taken from the south, a connecting road would be required from Upthorpe road, which is at risk of surface water flooding during the 1 in 100 and 1 in 1,000 rainfall events. Alternatively, access from the west could be via Rowley. Access from this side of the site would require a new access bridge over the River Cam, which would be at high risk of fluvial flooding.				
Climate Change	Climate change allowances for '2080s'	River Basin District	Central	Higher Central	Upper End	
		Severn	25%	35%	70%	

Site code	PS25
Site name	East of River Cam

	Implications for the site	As the Cam and Wickster's Brook is 1D-only, Flood Zone 2 has been used as a proxy for the Flood Zone 3a + 35% and 70% climate change extents. This indicates that climate change will result in an increase in flood risk during the 1% AEP flood event (Flood Zone 3a), although it may give a conservative account of risk.
Requirement for drainage control and impact mitigation	Bedrock Geology	The site is underlain by Blue Lias Formation and Charmouth Mudstone Formation (undifferentiated)
	Superficial Geology	None recorded on the site.
	Soils	Soils on the site are slowly permeable, slightly acid, but base-rich loamy and clayey soils, which are seasonally wet.
	SuDS	<ul style="list-style-type: none"> As a large undeveloped site, opportunities should be taken to incorporate above ground SuDS features, which provide multiple benefits. Severn Trent Water has identified a Combined Sewer Overflow (CSO) crossing the River Cam, at which several pollution incidents have previously been reported. Spill of the CSO may increase in frequency as a result of this development, and therefore surface water drainage should follow the discharge hierarchy and avoid connection into the combined sewer network. A high-level assessment of SuDS suitability carried out as part of the Level 1 SFRA suggests that the site is best suited to conveyance features, such as swales and rills, or detention features, such as ponds and wetlands. Attenuation features must be located outside areas of fluvial flood risk. The site geology is impermeable in nature and therefore there is likely to be limited potential for discharge of surface water by infiltration. However, the potential for infiltration should be investigated within site-specific infiltration testing.
	Groundwater Source Protection Zone	<ul style="list-style-type: none"> The site is not within a groundwater Source Protection Zone.
	Historic Landfill Site	<ul style="list-style-type: none"> There are no historic landfill sites within the proposed boundary.

Site code	PS25
Site name	East of River Cam

Requirement for drainage control and impact mitigation	Opportunities for flood risk betterment	The proposed site is in greenfield state, and so runoff volumes should be limited to the current value. Discharge to the River Cam should be limited as far as possible to ensure flood risk downstream is not impacted.		
	Cumulative impacts of development	Water Framework Directive Catchment	Sensitivity to cumulative impacts	Implications
		The Cam – Source to confluence with Gloucester and Sharpness Canal	High	FRA should include consideration of effects on potential sensitive receptors off-site and if necessary, include additional mitigation, so there are no adverse cumulative effects

Recommendations for Local Plan policy	Sequential Test and Exception Test requirements			
	<p>The Sequential Test must be satisfied. Only once the Sequential Test is satisfied should the Exception Test be applied. It is anticipated that proposed development will be sequentially located within Flood Zone 1. For this site, the Exception Test must be satisfied:</p> <ul style="list-style-type: none"> • If More Vulnerable and Essential Infrastructure is located in FZ3a or FZ3a plus climate change. • If Highly Vulnerable development is located in FZ2. <p>If Essential Infrastructure is located in Flood Zone 3b then it must be demonstrated that the exception test is satisfied. Development will not be permitted in the following scenarios:</p> <ul style="list-style-type: none"> • Highly Vulnerable development within FZ3a or FZ3a plus climate change and FZ3b. • More Vulnerable and Less Vulnerable development within FZ3b. 			
	Recommendations for requirements of site-specific Flood Risk Assessment, including guidance for developers			
	<p>Flood risk assessment:</p> <ul style="list-style-type: none"> • At the planning application stage, a site-specific flood risk assessment and surface water drainage strategy will be required. • Consultation with the Local Authority and the Environment Agency should be undertaken at an early stage. • A site-specific flood risk assessment will be required because the site is within Flood Zone 2 and 3 and at risk from sources of flooding other than rivers and the sea. Government guidance on flood risk assessments must be followed (https://www.gov.uk/guidance/floodrisk-assessment-for-planning-applications). • Other sources of flooding should also be considered as part of a site-specific flood risk assessment, including surface water and groundwater. • The site is located within a catchment identified as highly sensitive to the cumulative impact of development. The effects which development of the site may have on flood risk within the catchment will need to be considered within a site-specific flood risk assessment. • Appropriate storage of surface water runoff will need to be provided, and assessments should identify opportunities to provide off-site betterment, to help offset the cumulative impact of development. For example, this may include contribution to the delivery of schemes within the catchment, such as flood alleviation schemes, Natural Flood Management, SuDS retrofit or river restoration. <p>Guidance for site design and making development safe:</p> <ul style="list-style-type: none"> • A site-specific surface water drainage strategy will be required. • Development must seek opportunities to reduce overall level of flood risk at the site and should seek to reduce the levels of flood risk downstream. 			

Site code	PS25
Site name	East of River Cam

	<ul style="list-style-type: none"> • Consultation with Gloucestershire County Council as Lead Local Flood Authority (LLFA) and the Stroud District Council Drainage Engineer on surface water drainage of the site and potential SuDS features should be undertaken at an early stage. • Development must seek opportunities to reduce overall level of flood risk both on and off-site, for example by reducing volume and rate of runoff and creating space for flooding. • 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. • The site layout and drainage design must ensure that surface water flows resulting from rainfall in excess of a 1 in 100 event are managed via exceedance routes that minimise the risks to people and property. • Safe access and egress should be demonstrated in the 1 in 100 plus climate change fluvial and rainfall events. 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.
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Site code		PS30				
Site name		Hunts Grove Extension				
Site details	OS Grid reference	SO 80507 11791				
	Area	34.89				
	Current land use	Greenfield				
	Proposed site use	Residential / Community / Open Space				
	Flood risk vulnerability	More vulnerable				
Sources of flood risk	Existing watercourses	There are no existing watercourses within the site boundary. An ordinary watercourse, Beaurepair Brook, which forms a tributary of the Epney Rhyne watercourse, is located at the southern boundary of the site. The Shorn Brook is located approximately 200m north of the site.				
	Flood history	There are no recorded flood incidents located within the site, or within the vicinity of the site.				
	Fluvial	Proportion of site at risk in Flood Zones				
		Proportion of site at risk (%)	Flood Zone 3b 4% AEP (1 in 25)	Flood Zone 3a 1% AEP (1 in 100)	Flood Zone 2 0.1% AEP (1 in 1,000)	Flood Zone 1
			N/A (3%)	3%	6%	91%
		Available modelled data: The Flood Zones in this location are generated from national broadscale modelling, rather than a detailed hydraulic model. No 5% AEP (1 in 20) results were available for the Beaurepair Brook, and therefore the results for 1% AEP (Flood Zone 3a) have been used as a proxy for Flood Zone 3b. Flood characteristics: The south of the site is affected by flooding from the Beaurepair Brook during a 1% AEP (1 in 100) fluvial flood event. Flooding is predicted to pond against an area of high ground beyond the south west corner of the site, and during a 0.1% AEP (1 in 1,000) event, flooding extends northwards, to cover the western border of the site, as well as a greater area of the south east corner of the site. The remaining areas of the site are predicted to be at very low risk of fluvial flooding.				
	Surface Water	Proportion of site at risk (RoFSW)				
		3.3% AEP (1 in 30)	1% AEP (1 in 100)		0.1% AEP (1 in 1,000)	
		0%	2%		31%	
		Description of surface water flow paths: The site is at low risk of flooding from surface water. Isolated areas at the western and south western higher corners of the site are at higher surface water risk, with flooding predicted to occur during a 3.3% AEP (1 in 30) and 1% AEP (1 in 100) rainfall event. In a 0.1% AEP (1 in 1,000) rainfall event, surface water flooding is predicted to extend considerably, to cover the southern and western borders of the site. It should be noted that this area of surface water ponding is associated with the low-lying floodplain of the Beaurepair Brook, and therefore there is likely to be overlap between fluvial and surface water flood risk.				
Groundwater	Areas Susceptible to Groundwater Flooding Map class (risk of groundwater emergence)					

Site code		PS30			
Site name		Hunts Grove Extension			
		ASTGWF - Category 2 >=25% <50%	ASTGWF - Category 3 >=50% <75%	ASTGWF - Category 4 >=75%	
		0%	0%	%	
	The site has a low likelihood of groundwater emergence.				
	Reservoir	The site is not at risk of flooding, in the event of a reservoir breach.			
Canal	There are no canals within the site boundary or in close proximity.				
Flood risk management infrastructure	Defences	Defence Type	Standard of Protection	Condition	
	There are no flood defences within the site.				
	Residual risk	Culvert / structure blockage?	There are no culverts or structures within the site. The Beaurepair Brook appears to be culverted beneath A4008 Bath Road, at the west of the site. However, the Flood Zone and RoFSW mapping both do not represent the culvert beneath this road. Therefore, it is possible the mapping represents a fully 'blocked' scenario on the site. However, the impact of blockage to the structure should be assessed in detail within a site-specific FRA.		
		Impounded water body failure?	The site is not at risk of reservoir flooding, in the event of a breach event.		
		Defence breach / overtopping?	Breach Zone There are no defences within the site boundary.		
Emergency planning	Flood warning	The site is not included within an Environment Agency Flood Alert Area or Warning Area.			
	Access and egress	<p>The site is likely to be accessed either via Haresfield Lane, at the northern boundary of the site, or A4008 Bath Road at the western boundary.</p> <p>The road is at low risk of surface water flooding, with localised ponding predicted to occur between Colethrop Farm and the M5, during a 0.1% AEP (1 in 1,000) rainfall event. Surface water flood risk on the road increases towards the M5, with flooding predicted to occur during a 3.3% AEP (1 in 30) rainfall event, which may restrict access to the south.</p> <p>On A4008 Bath Road, surface water flooding is relatively low. Predicted flooding is concentrated around the roundabout connecting the A38 and the B4008, with isolated ponding occurring during a 3.3% (1 in 30) rainfall event, and becoming more extensive during a 0.1% AEP (1 in 1,000) rainfall event.</p> <p>The M5 is also likely to be a key transport link for travelling to the site. The site is at high risk of surface water flooding, particularly of the south west of the site.</p>			
Climate Change	Climate change allowances for '2080s'	River Basin District	Central	Higher Central	Upper End
		Severn	25%	35%	75%
	Implications for the site	Due to the lack of a detailed hydraulic modelling in this location, Flood Zone 2 has been used as a proxy for the Flood Zone 3a + 35% and 70% climate change extents. This indicates that climate change will result in an increase in flood risk during the 1% AEP flood event (Flood Zone 3a), although it may give a conservative account of risk.			

Site code		PS30		
Site name		Hunts Grove Extension		
Requirement for drainage control and impact mitigation	Bedrock Geology	The site is underlain with the Lias group, consisting of mudstone, siltstone, limestone and sandstone.		
	Superficial Geology	The site is not overlain with superficial geological deposits.		
	Soils	Freely draining lime-rich loamy soils		
	SuDS	<ul style="list-style-type: none"> As a large undeveloped site, opportunities should be taken to incorporate above ground, natural SuDS features, which provide multiple benefits (including biodiversity, amenity and water quality improvements). Severn Trent Water has flagged parts of the site as being at high risk for surface water drainage, as there are no surface water sewers in the vicinity of the site, and connection distances into the nearest watercourses may be large. If infiltration techniques are not feasible on the site, early consultation with Severn Trent Water and Gloucestershire County Council (as LLFA) is recommended, to secure a suitable surface water discharge destination. As one of several sites within a large area of growth, it is recommended that an overarching drainage strategy is developed across the nearby sites (PS31, PS32, G1, PS43), in consultation with Severn Trent Water and Gloucestershire County Council (as LLFA). The impermeable underlying geology suggests that discharge of the site via infiltration is unlikely to be feasible. However, this should be confirmed within a site-specific drainage strategy. Detention and conveyance features will be appropriate on the site. However, attenuation features must be located outside areas of fluvial flood risk. 		
	Groundwater Source Protection Zone	The site is not located within a Groundwater Source Protection Zone.		
	Historic Landfill Site	There are no historic landfill sites within the site boundary. Naas Lane Historic landfill is located approximately 1km to the north east of the site.		
	Opportunities for flood risk betterment	The large site provides opportunities for the temporary storage of fluvial and surface water during times of flood. Opportunities for using source control SuDS to manage runoff rates and volumes, contributing to the reduction of existing surface water flow paths leaving the site, and flood peaks downstream on Epney Rhyne.		
Cumulative Impacts of development	Water Framework Directive Catchment	Sensitivity to cumulative impacts	Implications	
	Epney Rhyne – source to conference River Severn Estuary	High	FRA should include consideration of effects on potential sensitive receptors off-site and if necessary, include additional mitigation, so there are no adverse cumulative effects	

Site code	PS30
Site name	Hunts Grove Extension
Recommendations for Local Plan policy	<p>Sequential Test and Exception Test requirements</p> <p>The Sequential Test must be satisfied. Only once the Sequential Test is satisfied should the Exception Test be applied. It is anticipated that proposed development will be sequentially located within Flood Zone 1. For this site, the Exception Test must be satisfied:</p> <ul style="list-style-type: none"> • If More Vulnerable and Essential Infrastructure is located in FZ3a or FZ3a plus climate change. • If Highly Vulnerable development is located in FZ2. <p>If Essential Infrastructure is located in Flood Zone 3b then it must be demonstrated that the exception test is satisfied. Development will not be permitted in the following scenarios:</p> <ul style="list-style-type: none"> • Highly Vulnerable development within FZ3a or FZ3a plus climate change and FZ3b. • More Vulnerable and Less Vulnerable development within FZ3b.
	<p>Recommendations for requirements of site-specific Flood Risk Assessment, including guidance for developers</p> <p>Flood risk assessment:</p> <ul style="list-style-type: none"> • At the planning application stage, a site-specific flood risk assessment and surface water drainage strategy will be required. • A site-specific flood risk assessment will be required because the site is within Flood Zone 2 and 3 and at risk from sources of flooding other than rivers and the sea. Government guidance on flood risk assessments must be followed (https://www.gov.uk/guidance/floodrisk-assessment-for-planning-applications). • Other sources of flooding should also be considered as part of a site-specific flood risk assessment, including surface water and groundwater. • Blockage modelling should be conducted to assess the residual risk associated with blockage of the culvert within the site. • Climate change should be assessed using recommended climate change allowances at the time of the assessment (https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances) for the type of development and level of risk. The current allowances were published in February 2016 but may be subject to change in the future. • The site is located within a catchment identified as highly sensitive to the cumulative impact of development. The effects which development of the site may have on flood risk within the catchment will need to be considered within a site-specific flood risk assessment. • Appropriate storage of surface water runoff will need to be provided, and assessments should identify opportunities to provide off-site betterment, to help offset the cumulative impact of development. For example, this may include contribution to the delivery of schemes within the catchment, such as flood alleviation schemes, Natural Flood Management, SuDS retrofit or river restoration. <p>Guidance for site design and making development safe:</p> <ul style="list-style-type: none"> • Development must seek opportunities to reduce overall level of flood risk at the site and should seek to reduce the levels of flood risk downstream. • Consultation with Gloucestershire County Council as Lead Local Flood Authority (LLFA) and the Stroud District Council Drainage Engineer on surface water drainage of the site and potential SuDS features should be undertaken at an early stage. • Development must seek opportunities to reduce overall level of flood risk both on and off-site, for example by reducing volume and rate of runoff and creating space for flooding. • 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. • The site layout and drainage design must ensure that surface water flows resulting from rainfall in excess of a 1 in 100-year event are managed via exceedance routes that minimise the risks to people and property. • Safe access and egress should be demonstrated in the 1 in 100-year plus climate change fluvial and rainfall events. 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.

Site code	PS30
Site name	Hunts Grove Extension
Site code	PS33
Site name	Northwest of Berkeley

Site details	OS Grid reference	SO 68233 00017			
	Area	6.51 ha			
	Current land use	Greenfield			
	Proposed site use	Residential			
	Flood risk vulnerability	More vulnerable			
Sources of flood risk	Existing watercourses	An unnamed ordinary watercourse, which forms a tributary of the Little Avon, flows in a southerly direction along the western boundary of the site. The site is located within the Lower Severn IDB.			
	Flood history	<p>Flooding occurred along the western boundary of the site, in November 2000, as a result of channel capacity exceedance.</p> <p>Downstream of the site at Berkeley, several sewer flooding incidents occur:</p> <ul style="list-style-type: none"> 07/07/2008, 05/09/2008, 24/09/2012, 21/11/2012 - Lynch Road, Berkeley – external flooding to property garden from exceedance of foul/combined sewer network. 28/10/2013 - James Orchard, Berkeley - external flooding to road and footpath from exceedance of foul/combined sewer network. 			
	Fluvial	Proportion of site at risk in Flood Zones			
		Proportion of the site at risk (%)	Flood Zone 3b 5% AEP (1 in 20)	Flood Zone 3a 1% AEP (1 in 100)	Flood Zone 2 0.1% AEP (1 in 1,000)
			N/A (30%)	30%	8%
	Available modelled data:	Records indicate that 2D broadscale hydraulic modelling has been carried out for the watercourse along the western boundary of the site, which has been included in the Flood Zones. However there are no detailed modelling results for the site. With the absence of a 1 in 20 or 1 in 25 modelled flood extent for the watercourse, the 1 in 100 flood extent has been used to represent the functional floodplain. The site benefits from flood defence, however the available broadscale modelling represents the undefended scenario.			
	Flood characteristics:	The western portion of the site is identified as at risk of fluvial flooding during a 1 in 100 flood event, with flooding extending further into the centre of the site during a 1 in 1,000 event.			
Surface Water	Proportion of site at risk (RoFSW)				
	3.3% AEP (1 in 30)	1% AEP (1 in 100)	0.1% AEP (1 in 1,000)		
	3%	5%	10%		

Site code		PS30			
Site name		Hunts Grove Extension			
		Description of surface water flow paths: The site is at very low risk of surface water flooding overall. However, a small area at the north west corner the site is identified at high risk of surface water flooding during a 1 in 30 rainfall event and greater return periods. South-western corner of the site is also at lower risk of surface water flooding, during the 1 in 1,000 rainfall event.			
	Groundwater	Areas Susceptible to Groundwater Flooding Map class (risk of groundwater emergence)			
		ASTGWF - Category 2 >=25% <50%	ASTGWF - Category 3 >=50% <75%	ASTGWF - Category 4 >=75%	
		55%	0%	0%	
	The southern area of the site is at low to moderate groundwater flood risk, where the chance of groundwater emergence is between 25-50% within a given 1km ² grid square, during a 1 in 100 event.				
Reservoir	The site is not at risk of flooding from reservoirs.				
Canal	There are no canals within the site boundary.				
Flood risk management infrastructure	Defences	Defence Type	Standard of Protection	Condition	
		There are no defences within the site, although the site is identified as benefitting from the defence provided by flood embankments downstream on the Berkeley Pill.			
	Residual risk	Culvert / structure blockage?	There are no culverts or structures located within the site boundary.		
		Impounded water body failure?	The site is not at risk of reservoir flooding.		
Defence breach / overtopping?	Breach Zone The site is not at risk of defence breach or overtopping.				
Emergency planning	Flood warning	The site is located within the following Environment Agency Flood Warning and Flood Alert Areas: <ul style="list-style-type: none"> Flood Warning Area: Severn Estuary from Sharpness to Oldbury-on-Severn Flood Alert Area: Severn Estuary at Oldbury-on-Severn, Northwick and Avonmouth 			
	Access and egress	The site is likely to be accessed via the B4066 along the northern boundary of the site. The road is at risk of fluvial flooding during a 1 in 100 flood event, where the unnamed Little Avon tributary is culverted below the road due to its raised elevation. The route is not identified as at risk of surface water flooding.			
Climate Change	Climate change allowances for '2080s'	River Basin District	Central	Higher Central	Upper End
		South West	30%	40%	85%
	Implications for the site	The site is likely to be impacted by climate change. The extent of the 1 in 100 + climate change flood event is greater than that of the 1 in 100 within the site, which indicates that climate change is likely to increase the risk of fluvial flooding to the site. It should be noted that, due to the lack of a detailed hydraulic model in this location, Flood Zone 2 has been used as a proxy for the Flood Zone 3a + 35% and 70% climate change extents, and therefore it may give a conservative account of risk.			

Site code		PS30		
Site name		Hunts Grove Extension		
Requirement for drainage control and impact mitigation Cumulative impacts of development	Bedrock Geology	The site is underlain by Raglan Mudstone Formation, a series of interbedded Siltstone and Mudstone.		
	Superficial Geology	None recorded.		
	Soils	Soils on the site are slightly acid loamy and clayey soils with impeded drainage.		
	SuDS	<ul style="list-style-type: none"> As a large undeveloped site, opportunities should be taken to incorporate above ground SuDS features, which provide multiple benefits. A high-level assessment of SuDS suitability carried out as part of the Level 1 SFRA suggests that the site is best suited to conveyance features, such as swales and rills, or detention features, such as ponds and wetlands. Attenuation features must be located outside areas of fluvial flood risk. The site geology is impermeable in nature and there is moderate risk of groundwater flooding, therefore there is likely to be limited potential for discharge of surface water by infiltration. However, the potential for infiltration should be investigated within site-specific infiltration testing. 		
	Groundwater Source Protection Zone	The site is not within a groundwater Source Protection Zone.		
	Historic Landfill Site	There are no historical landfill sites within the proposed boundary.		
	Opportunities for flood risk betterment	Development should seek to strictly limit the rate and volumes of surface water leaving the site, to help alleviate sewer flooding issues at downstream Berkeley. Temporary storage of flood waters on the site would help to reduce and delay the timing of flows entering the Little Avon.		
	Cumulative impacts of development	Water Framework Directive Catchment	Sensitivity to cumulative impacts	Implications
Little Avon – confluence with Tortworth Brook to mouth		Medium	The effects which development of the site may have on flood risk within the catchment will need to be considered within a site-specific flood risk assessment.	
Sequential Test and Exception Test requirements				

Site code	PS30
Site name	Hunts Grove Extension
Recommendations for Local Plan policy	<p>The Sequential Test must be satisfied. Only once the Sequential Test is satisfied should the Exception Test be applied. It is anticipated that proposed development will be sequentially located within Flood Zone 1. For this site, the Exception Test must be satisfied:</p> <ul style="list-style-type: none"> • If More Vulnerable and Essential Infrastructure is located in FZ3a or FZ3a plus climate change. • If Highly Vulnerable development is located in FZ2. <p>If Essential Infrastructure is located in Flood Zone 3b then it must be demonstrated that the exception test is satisfied. Development will not be permitted in the following scenarios:</p> <ul style="list-style-type: none"> • Highly Vulnerable development within FZ3a or FZ3a plus climate change and FZ3b. • More Vulnerable and Less Vulnerable development within FZ3b.
	<p>Recommendations for requirements of site-specific Flood Risk Assessment, including guidance for developers</p> <p>Flood risk assessment:</p> <ul style="list-style-type: none"> • Consultation with the Local Authority, the Lower Severn IDB and the Environment Agency should be undertaken at an early stage. • A site-specific flood risk assessment will be required because the site is within Flood Zone 2 and 3 and at risk from sources of flooding other than rivers and the sea. Government guidance on flood risk assessments must be followed (https://www.gov.uk/guidance/floodrisk-assessment-for-planning-applications). • The impact of the development on flood risk from all sources both on and off-site must be considered and modelled where appropriate. It is recommended that a detailed hydraulic model is carried out for the site to accurately understand flood risk, and the impacts of climate change, to the site. The Environment Agency and LLFA should be consulted to obtain the latest hydraulic modelling information for the site at the time of the flood risk assessment. • A detailed assessment of the risk and location of high groundwater levels and groundwater emergence should be undertaken, including groundwater monitoring during the winter months. • Climate change should be assessed using recommended climate change allowances at the time of the assessment (https://www.gov.uk/guidance/flood-risk-assessmentsclimate-change-allowances) for the type of development and level of risk. The current allowances were published in February 2016 but may be subject to change in the future. • The site is located within a catchment identified as moderately sensitive to the cumulative impact of development. The effects which development of the site may have on flood risk within the catchment will need to be considered within a site-specific flood risk assessment. <p>Guidance for site design and making development safe:</p> <ul style="list-style-type: none"> • A site-specific surface water drainage strategy will be required. • Development must seek opportunities to reduce overall level of flood risk at the site and should seek to reduce the levels of flood risk downstream. • Consultation with Gloucestershire County Council as Lead Local Flood Authority (LLFA), the Lower Severn IDB and the Stroud District Council Drainage Engineer on surface water drainage of the site and potential SuDS features should be undertaken at an early stage. • Development must seek opportunities to reduce overall level of flood risk both on and off-site, for example by reducing volume and rate of runoff and creating space for flooding. • 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. • The site layout and drainage design must ensure that surface water flows resulting from rainfall in excess of a 1 in 100 event are managed via exceedance routes that minimise the risks to people and property. • Safe access and egress should be demonstrated in the 1 in 100 plus climate change fluvial and rainfall events. Raising of access routes must not impact on surface water flow routes.

Site code	PS30
Site name	Hunts Grove Extension
	Consideration should be given to the siting of access points with respect to areas of surface water flood risk.

Site code	PS34
Site name	Sharpness Docks

Site details	OS Grid reference	SO 67206 02559				
	Area	96.23 ha				
	Current land use	Docks and associate infrastructure				
	Proposed site use	Mixed development				
	Flood risk vulnerability	More vulnerable				
Sources of flood risk	Existing watercourses	The tidal River Severn forms the western and northern boundaries of the site. The Gloucester and Sharpness Canal crosses the site in a south-easterly direction from the north-eastern corner, before it joins the River Severn estuary. An unnamed ordinary watercourse also joins the canal from the eastern boundary of the site.				
	Flood history	Flooding of the northern and eastern boundaries of the site is recorded to have occurred in July 1968 from the tidal River Severn.				
	Fluvial / Tidal	Proportion of site at risk in Flood Zones				
		Fluvial/Tidal - Proportion of the site at risk (%)	Flood Zone 3a 1% AEP (1 in 100)	0.2% AEP (1 in 200)	Flood Zone 2 0.1% AEP (1 in 1,000)	Flood Zone 1
			6%	7%	3%	90%
		<p>Available modelled data: The site is covered by the Environment Agency 2007 Tidal River Severn hydraulic model. Detailed modelling is available for the River Severn; however, due to the tidal influence at Sharpness, a number of scenarios are available, combining river-dominant with a low tide, and tidal-dominant with a low river event. Therefore, Flood Zone 3b was unavailable for this site. Flood Zone 3a can be used as an indication of Flood Zone 3b in the absence of modelled data.</p> <p>Flood characteristics: The northern boundary and western corner of the site, which border the River Severn are identified as at risk of integrated fluvial and tidal flooding during a 1 in 100, 1 in 200 and 1 in 1,000 tidal flood event on the River Severn. The flood extent at the western edge of the site increases to meet the Gloucester and Sharpness Canal during the 1 in 1,000 event.</p>				
Surface Water	Proportion of site at risk (RoFSW)					
	1 in 30	1 in 100	1 in 1,000			
	2%	3%	9%			
	<p>Description of surface water flow paths: Overall, the site is at low risk of surface water flooding. It should be noted that the mapping identifies some areas within the Gloucester and Sharpness Canal as being at risk, and so the percentages shown above are likely to overestimate the surface water risk to the site. Discounting these areas, areas along the eastern boundary and at the west of the site are identified as at risk of flooding during the 1 in 30 event and greater return periods. However, these are isolated areas of ponding that appear to accumulate in low-lying areas of the local topography.</p>					

Site code	PS34
Site name	Sharpness Docks

	Groundwater	Areas Susceptible to Groundwater Flooding Map class (risk of groundwater emergence)		
		ASTGWF - Category 2 >=25% <50%	ASTGWF - Category 3 >=50% <75%	ASTGWF - Category 4 >=75%
		57%	0%	0%
		The site is at low to moderate risk of groundwater flooding, with a 25-50% chance of groundwater emergence within a given 1km ² grid square, during a 1 in 100 event.		
Reservoir	The site is not at risk of reservoir flooding.			
Canal	The Gloucester and Sharpness Canal flows through the site. There are no recorded incidents of breach or overtopping of the canal in this location. However, the residual risk of flooding to the site from the canal should be assessed within a site-specific Flood Risk Assessment. .			

Site code	PS34
Site name	Sharpness Docks

Flood risk management infrastructure	Defences	Defence Type	Standard of Protection	Condition	
		High ground: - Old tidal basin entrance - Old lock entrance - Dock houses defence - North part of old tidal basin - Sharpness Dock entrance - High ground around Sharpness Docks - Old rail crossing to old lock	Unknown	Fair (3)	
The northern and western boundaries of the site, bordering the River Severn, are formed of high ground, due to their use former lock and tidal basin entrances, and also former rail crossings. The standard of protection is unknown, however a very small area in the south west of the site, at the confluence between the canal and River Severn is identified as benefitting from the defence of the Sharpness Dock entrance.					
Residual risk	Culvert / structure blockage?	There is no risk to the site from of culvert or structure blockage.			
	Impounded water body failure?	The site is not at risk of reservoir breach.			
	Defence breach / overtopping?	Breach Zone There is a residual risk of flooding to the site should the high ground at the site boundary be overtopped. This should be investigated within a site-specific Flood Risk Assessment.			
Emergency planning	Flood warning	An area along the northern and western boundary of the site is within EA flood warning and alert areas. <ul style="list-style-type: none"> Flood Alert Area: Severn Estuary at Oldbury-on-Severn, Northwick and Avonmouth Flood Warning Areas: Severn Estuary from Sharpness to Oldbury-on-Severn and Sharpness and Lydney Harbour on the Severn Estuary 			
	Access and egress	The site is likely to be accessed from Oldminster Road along the eastern boundary of the site. A small section of this route is affected by surface water flooding during a 1 in 1,000 rainfall event. Otherwise, the risk along this access route is low.			
Climate Change	Climate change allowances for '2080s'	River Basin District Severn	Central 25%	Higher Central 35%	Upper End 70%
	Implications for the site	The site is likely to be impacted by climate change. The extent of the 1 in 100 + climate change flood event is greater than that of the 1 in 100 event within the site, which indicates that climate change is likely to increase the risk of fluvial and tidal flooding to the site.			

Site code	PS34
Site name	Sharpness Docks

Requirement for drainage control and impact mitigation	Bedrock Geology	The site is underlain by Raglan Mudstone Formation interbedded Siltstone and Mudstone		
	Superficial Geology	The site is overlain by deposits of the Holt Heath Sand and Gravel member		
	Soils	Soils on the site are slightly acid loamy and clayey, with impeded drainage		
	SuDS	<ul style="list-style-type: none"> As a large previously developed site, opportunities should be taken to reduce the coverage of impermeable surfaces on the site, and to incorporate above ground SuDS features, which provide multiple benefits. A high-level assessment of SuDS suitability carried out as part of the Level 1 SFRA suggests that the site is best suited to conveyance features, such as swales and rills, or detention features, such as ponds and wetlands. Attenuation features must be located outside areas of fluvial flood risk. The site geology is impermeable in nature and there is moderate risk of groundwater flooding, therefore there is likely to be limited potential for discharge of surface water by infiltration. However, the potential for infiltration should be investigated within site-specific infiltration testing. Drainage proposals to the Severn should be designed to take account of the consequences of tidal effects (such as tide locking of systems and how these will change as a consequence of predicted sea level rise over the lifetime of development). 		
	Groundwater Source Protection Zone	The site is not within a groundwater Source Protection Zone.		
	Historic Landfill Site	There are no historic landfill sites within the site.		
	Opportunities for flood risk betterment	Opportunities to implement systems that can accommodate climate change effects and provide betterment to existing drainage systems and channels.		
	Cumulative impacts of development	Water Framework Directive Catchment	Sensitivity to cumulative impacts	Implications
	Coastal Catchment 1 (not part of a WFD river catchment)	High	FRA should include consideration of effects on potential sensitive receptors off-site and if necessary, include additional mitigation, so there are no adverse cumulative effects	
Sequential Test and Exception Test requirements				

Site code	PS34
Site name	Sharpness Docks

Recommendations for Local Plan policy	<p>The Sequential Test must be satisfied. Only once the Sequential Test is satisfied should the Exception Test be applied. It is anticipated that proposed development will be sequentially located within Flood Zone 1. For this site, the Exception Test must be satisfied:</p> <ul style="list-style-type: none"> • If More Vulnerable and Essential Infrastructure is located in FZ3a or FZ3a plus climate change. • If Highly Vulnerable development is located in FZ2. <p>If Essential Infrastructure is located in Flood Zone 3b then it must be demonstrated that the exception test is satisfied. Development will not be permitted in the following scenarios:</p> <ul style="list-style-type: none"> • Highly Vulnerable development within FZ3a or FZ3a plus climate change and FZ3b. • More Vulnerable and Less Vulnerable development within FZ3b.
	<p>Recommendations for requirements of site-specific Flood Risk Assessment, including guidance for developers</p> <p>Flood risk assessment:</p> <ul style="list-style-type: none"> • At the planning application stage, a site-specific flood risk assessment and surface water drainage strategy will be required. • Consultation with the Local Authority and the Environment Agency should be undertaken at an early stage. • A site-specific flood risk assessment will be required because the site is within Flood Zone 2 and 3 and at risk from sources of flooding other than rivers and the sea. Government guidance on flood risk assessments must be followed (https://www.gov.uk/guidance/floodrisk-assessment-for-planning-applications). • Other sources of flooding should also be considered as part of a site-specific flood risk assessment, including surface water, tidal and groundwater. • The residual risk of flooding to the site in the event of overtopping of the high ground bordering the site and overtopping of the Thames and Severn Canal should be assessed in further detail. • The site is located within a catchment identified as highly sensitive to the cumulative impact of development. The effects which development of the site may have on flood risk within the catchment will need to be considered within a site-specific flood risk assessment. • Appropriate storage of surface water runoff will need to be provided, and assessments should identify opportunities to provide off-site betterment, to help offset the cumulative impact of development. For example, this may include contribution to the delivery of schemes within the catchment, such as flood alleviation schemes, Natural Flood Management, SuDS retrofit or river restoration. <p>Guidance for site design and making development safe:</p> <ul style="list-style-type: none"> • A site-specific surface water drainage strategy will be required. • Development must seek opportunities to reduce overall level of flood risk at the site and should seek to reduce the levels of flood risk on adjacent land. • Consultation with Gloucestershire County Council as Lead Local Flood Authority (LLFA) and the Stroud District Council Drainage Engineer on surface water drainage of the site and potential SuDS features should be undertaken at an early stage. • Development must seek opportunities to reduce overall level of flood risk both on and off-site, for example by reducing volume and rate of runoff and creating space for flooding. • 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. • The site layout and drainage design must ensure that surface water flows resulting from rainfall in excess of a 1 in 100 event are managed via exceedance routes that minimise the risks to people and property. • Safe access and egress should be demonstrated in the 1 in 100 plus climate change fluvial and rainfall events. 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.

Site code	PS36
Site name	New settlement at Sharpness

Site details	OS Grid reference	SO 67293 00626				
	Area	190.01 ha				
	Current land use	Agricultural land				
	Proposed site use	Residential				
	Flood risk vulnerability	More vulnerable				
Sources of flood risk	Existing watercourses	The site is formed of two land parcels, located either side of B4066 and the railway line. The River Severn forms the western boundary of the larger, southern land parcel, and the Main River Little Avon forms the southern boundary. Three ordinary watercourses cross the north, west and south of the parcel, and either drain westwards directly into the River Severn or south westwards into the Little Avon. In the smaller northern parcel of land, an ordinary watercourse tributary of the River Severn flows east to west across the site. The site is located within the Lower Severn IDB.				
	Flood history	The south west of the southern land parcel is recorded as having flooded in November 2012 as a result of fluvial flooding from the Little Avon. The site is not recorded as having flooded from the River Severn directly.				
	Fluvial / Tidal	Fluvial / Tidal (River Severn)				
		Proportion of the site at risk (%)	Flood Zone 3a 1% AEP (1 in 100)	0.2% AEP (1 in 200)	Flood Zone 2 0.1% AEP (1 in 1,000)	Flood Zone 1
			35%	36%	5%	60%
		Fluvial (Little Avon)				
		Proportion of the site at risk (%)	5% AEP	1% AEP	0.1% AEP	Flood Zone 1
			11%	11%	5%	73%
		Range of depths (m)	0.01 - 0.39	0.02 – 0.63	0.05 - 1.78	N/A
		Maximum hazard	1.5 – Significant (Danger to most)	2.0 – Significant (Danger to most)	2.2 – Extreme (Danger to all)	N/A
Available modelled data: The site is covered by the Environment Agency FM-TUFLOW 2016 model of the Little Avon as well as the 2007 1D Tidal River Severn hydraulic models. Detailed modelling is available for the River Severn; however, due to the tidal influence at Sharpness, a number of scenarios are available, combining river-dominant with a low tide, and tidal-dominant with a low river event. Therefore, Flood Zone 3b was unavailable for this site. Flood Zone 3a can be used as an indication of Flood Zone 3b in the absence of modelled data. There are some watercourses that potentially affect the sites that have not been included in the modelling and so further detail is required to understand the extent of Flood Zones and actual flood risk.						

Site code	PS36
Site name	New settlement at Sharpness

		<p>Flood characteristics: This section describes the undefended flood risk to the site. The northern, western and south-western areas of the site are at combined fluvial and tidal flood risk from the River Severn during the 1 in 100, 1 in 200 and 1 in 1,000 flood event.</p> <p>The south western portion of the site is also at risk of fluvial flooding from the Little Avon during a 1 in 5 flood event and greater return periods. Flooding initially occurs around the branched watercourse network at the south of the site, and then extends north westwards during a 1 in 50 event, ponding against the raised defences here, in the defended scenario.</p>		
	Surface Water	Proportion of site at risk (RoFSW)		
		1 in 30	1 in 100	1 in 1,000
		1%	2%	7%
		<p>Description of surface water flow paths: Surface water flood risk within the site is relatively low, with surface water mapping identifying the floodplains of small ordinary watercourses.</p> <p>Excluding these areas, low-lying land adjacent to the River Severn is identified as at risk of surface water flooding during the 1 in 1,000 rainfall event. Small surface water flow paths in both land parcels are predicted to form during the 1 in 1,000 event and flow into the adjacent ordinary watercourses.</p>		
	Groundwater	Areas Susceptible to Groundwater Flooding Map class (risk of groundwater emergence)		
		ASTGWF - Category 2 ≥25% <50%	ASTGWF - Category 3 ≥50% <75%	ASTGWF - Category 4 ≥75%
		10%	0%	0%
		The site is at low to moderate risk of groundwater flooding, with a 25-50% chance of groundwater emergence within a given 1km ² grid square, during a 1 in 100 event.		
	Reservoir	The site is not at risk of reservoir flooding.		
	Canal	There are no canals within the site.		

Site code	PS36
Site name	New settlement at Sharpness

		Defence Type	Standard of Protection	Condition	
		Defences	Coastal embankment	1 in 100	3 – Fair
Flood risk management infrastructure	Residual risk	Along the western boundary of the larger site there is an embankment that protects against fluvial/tidal flood risk from the River Severn, which entirely defends the southern land parcel against flooding from the 1 in 100 flood event on the River Severn. The limit of defence does not extend to the northern land parcel. The south west of the site remains at risk of flooding from the Little Avon.			
		Culvert / structure blockage?	In the smaller parcel of land, the watercourse is culverted below Saniger Lane. The residual flood risk associated with blockage at this location should be considered within a site-specific FRA.		
		Impounded water body failure?	The site is not at risk of flooding due to reservoir breach.		
		Defence breach / overtopping?	<p style="text-align: center;">Breach Zone</p> The west of the site benefits from coastal defence. Therefore, consideration should be given to the possibility of this defence being overtopped, and the risk that this would pose to the southern land parcel. The residual risk to the site must be assessed in detail within a site-specific Food Risk Assessment.		
Emergency planning	Flood warning	The western areas of the larger site are included within both Flood Alert and Flood Warning areas. <ul style="list-style-type: none"> Flood Alert Area: Severn Estuary at Oldbury-on-Severn, Northwick and Avonmouth Flood Warning Area: Severn Estuary from Sharpness to Oldbury-on-Severn 			
	Access and egress	Both of the parcels of land are likely to be accessed via the B4066 which passes between the two. At the northern edge of the larger site, the road is affected by the 1 in 100 fluvial flood event. The site is not at risk of surface water flooding.			
Climate Change	Climate change allowances for '2080s'	River Basin District	Central	Higher Central	Upper End
		Severn	25%	35%	70%
		South West	30%	40%	85%

Site code	PS36
Site name	New settlement at Sharpness

	Implications for the site	<p>The site is likely to be impacted by climate change. The extent of the 1 in 100 + climate change flood event for the upper end (+70% and +80% fluvial / to 2125 tidal) is greater than that of the 1 in 100 event within the site, which indicates that climate change is likely to increase the risk of fluvial and tidal flooding to the site. In-channel peak water level results for the Tidal Severn model were also assessed in the centre of the site (Node 56) for the upper end (+70%) and H++ climate change scenarios (see table below). Both climate change allowances saw a significant increase in the 1 in 200 tidal flood levels, with the greatest increase seen in the H++ (90%) climate change allowance.</p>		
		Scenario	Peak Water Level at site (Node 56) (mAOD)	Difference in water level with 1 in 200 baseline (mA)
		1 in 200 – baseline	9.67	N/A
		1 in 200 + 70% CC	11.37	+ 1.70
		1 in 200 + 90% CC (H++)	11.63	+ 1.96

Site code	PS36
Site name	New settlement at Sharpness

Requirement for drainage control and impact mitigation	Bedrock Geology	Raglan Mudstone Formation – Siltstone and Mudstone		
	Superficial Geology	Tidal flat deposits (clay, silt and sand) and Cheltenham sand and gravel along the western border of the larger site.		
	Soils	Along the western border of the larger site there are areas of loamy and clayey soils of coastal flats with naturally high groundwater. The remaining area of the site is slightly acid loamy and clayey soils with impeded drainage.		
	SuDS	<ul style="list-style-type: none"> As a large undeveloped site, opportunities should be taken to incorporate above ground SuDS features, which provide multiple benefits. A high-level assessment of SuDS suitability carried out as part of the Level 1 SFRA suggests that the site is best suited to conveyance features, such as swales and rills, or detention features, such as ponds and wetlands. Attenuation features must be located outside areas of fluvial flood risk. The site geology is impermeable in nature and there is moderate risk of groundwater flooding, however there are areas of superficial deposits which may provide opportunity for shallow infiltration. To better understand the infiltration potential at the site, site-specific infiltration testing will be required. Drainage proposals to the Severn should be designed to take account of the consequences of tidal effects (such as tide locking of systems and how these will change as a consequence of predicted sea level rise over the lifetime of development). 		
	Groundwater Source Protection Zone	The site is not within a groundwater Source Protection Zone.		
	Historic Landfill Site	There are no historic landfill sites within the proposed boundary.		
	Opportunities for flood risk betterment	The site provides opportunities to provide storage of surface water and limit the rate and volume of water discharged from the site into the River Severn. This is likely to provide benefit during periods of high tide or high river level on the River Severn, when tributary watercourses and the Little Avon become tide-locked and back up. Opportunities should be taken to contribute to improvements of the existing flood embankment at the western site boundary, which is currently 'fair' in condition.		
	Cumulative impacts of development	Water Framework Directive Catchment	Sensitivity to cumulative impacts	Implications
Coastal Catchment 1 (not part of a WFD river catchment)		High	FRA should include consideration of effects on potential sensitive receptors off-site and if necessary, include additional mitigation, so there are no adverse cumulative effects	
Coastal Catchment 2 (not part of a WFD river catchment)		Medium	The effects which development of the site may have on flood risk within the catchment will need to be considered	

Site code	PS36
Site name	New settlement at Sharpness

		Little Avon – confluence with Tortworth Brook to mouth	Medium	within a site-specific flood risk assessment.
Recommendations for Local Plan policy	Sequential Test and Exception Test requirements			
	<p>The Sequential Test must be satisfied. Only once the Sequential Test is satisfied should the Exception Test be applied. It is anticipated that proposed development will be sequentially located within Flood Zone 1. For this site, the Exception Test must be satisfied:</p> <ul style="list-style-type: none"> • If More Vulnerable and Essential Infrastructure is located in FZ3a or FZ3a plus climate change. • If Highly Vulnerable development is located in FZ2. <p>If Essential Infrastructure is located in Flood Zone 3b then it must be demonstrated that the exception test is satisfied. Development will not be permitted in the following scenarios:</p> <ul style="list-style-type: none"> • Highly Vulnerable development within FZ3a or FZ3a plus climate change and FZ3b. • More Vulnerable and Less Vulnerable development within FZ3b. 			
	Recommendations for requirements of site-specific Flood Risk Assessment, including guidance for developers			
<p>Flood risk assessment:</p> <ul style="list-style-type: none"> • At the planning application stage, a site-specific flood risk assessment and surface water drainage strategy will be required. • Consultation with the Local Authority and the Environment Agency should be undertaken at an early stage. • A site-specific flood risk assessment will be required because the site is within Flood Zone 2 and 3 and at risk from sources of flooding other than rivers and the sea. Government guidance on flood risk assessments must be followed (https://www.gov.uk/guidance/flood-risk-assessment-for-planning-applications). • Other sources of flooding should also be considered as part of a site-specific flood risk assessment, including surface water, tidal and groundwater. • Blockage modelling should be conducted to assess the residual risk associated with blockage of the culvert within the site. • The residual risk of flooding to the site in the event of overtopping of the embankment bordering the site should be assessed in further detail. • Climate change should be assessed using recommended climate change allowances at the time of the assessment (https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances) for the type of development and level of risk. The current allowances were published in February 2016 but may be subject to change in the future. • Subject to consultation with the Environment Agency and Lead Local Flood Authority, it is recommended that detailed hydraulic modelling of the unmodelled ordinary watercourse within the northern land parcel is carried out as part of a flood risk assessment. • The site is located within a catchment identified as highly sensitive to the cumulative impact of development. The effects which development of the site may have on flood risk within the catchment will need to be considered within a site-specific flood risk assessment. • Appropriate storage of surface water runoff will need to be provided, and assessments should identify opportunities to provide off-site betterment, to help offset the cumulative impact of development. For example, this may include contribution to the delivery of schemes within the catchment, such as flood alleviation schemes, Natural Flood Management, SuDS retrofit or river restoration. <p>Guidance for site design and making development safe:</p> <ul style="list-style-type: none"> • The site benefits from the presence of existing defences. As a consequence of climate change effects the standard of protection afforded by these defences will be reduced. A commitment must be made so appropriate provisions for flood risk management measures are secured for the lifetime of the development. • A site-specific surface water drainage strategy will be required. 				

Site code	PS36
Site name	New settlement at Sharpness

	<ul style="list-style-type: none"> • Development must seek opportunities to reduce overall level of flood risk at the site and should seek to reduce the levels of flood risk downstream. • Consultation with Gloucestershire County Council as Lead Local Flood Authority (LLFA) and the Stroud District Council Drainage Engineer on surface water drainage of the site and potential SuDS features should be undertaken at an early stage. • Development must seek opportunities to reduce overall level of flood risk both on and off-site, for example by reducing volume and rate of runoff and creating space for flooding. • 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. • The site layout and drainage design must ensure that surface water flows resulting from rainfall in excess of a 1 in 100 event are managed via exceedance routes that minimise the risks to people and property. • Safe access and egress should be demonstrated in the 1 in 100 plus climate change fluvial and rainfall events. 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.
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Site code	PS37
Site name	New settlement at Wisloe

Site details	OS Grid reference	SO 74692 02678				
	Area	83.97 ha				
	Current land use	Agricultural land and buildings				
	Proposed site use	Residential				
	Flood risk vulnerability	More vulnerable				
Sources of flood risk	Existing watercourses	The site is formed of two parcels of land, separated by the A4135 Draycott. In the eastern parcel of land, an ordinary watercourse tributary of the River Cam flows in a northerly direction to join the River Cam. In the western parcel of land, the Lighen Brook, an ordinary watercourse, flows in a north easterly direction through the centre of the site, and is culverted below Bristol Road at the western boundary of the site.				
	Flood history	<p>There are no recorded flood incidents at the site. However, the following sewer flooding incidents are recorded in the vicinity of the site:</p> <ul style="list-style-type: none"> 22/11/2016, 08/02/2016 – Flooding to open space and property curtilage (GL11 5DH) 12/01/2008, 17/03/2008, 03/11/2012, 21/12/2012, January 2013 (various), October 2013 (various), December 2013 (various) January – February 2014 (various), 27/12/2017 – flooding to curtilage (GL2 7AT, GL2 7AH). 23/06/2007 – flooding to highway (GL2 7AL) 				
	Fluvial	Proportion of site at risk in Flood Zones				
		Proportion of the site at risk (%)	Flood Zone 3b 5% AEP (1 in 20)	Flood Zone 3a 1% AEP (1 in 100)	Flood Zone 2 0.1% AEP (1 in 1,000)	Flood Zone 1
			N/A	0%	1%	99%
Surface Water	<p>Available modelled data: The site is included within the Environment Agency 2007 River Cam and Wickster's Brook 1D detailed hydraulic model. There are two watercourses that cross the land which are not represented within this model. The potential extent of the Flood Zones and effect on the allocation proposals should be evaluated to enable the application of the sequential approach. The RoFSW dataset has been used to assess fluvial flood risk for these watercourses.</p> <p>Flood characteristics: The north-western area of the most eastern parcel of land is identified as at risk during a 1 in 1,000 flood event on the River Cam. The smaller, ordinary watercourses are not covered by detailed hydraulic models. Peak flood levels modelled on the River Cam at the north eastern corner of the eastern land parcel reach 16.0mAOD during a 1 in 100 event, and 16.17mAOD during a 1 in 1,000 event.</p>					
	Proportion of site at risk (RoFSW)					
	1 in 30	1 in 100	1 in 1,000			
	0%	1%	3%			

Site code	PS37
Site name	New settlement at Wisloe

		Description of surface water flow paths: The risk of surface water flood risk across the site is low. Surface water flow paths are predicted to form on both land parcels during a 1 in 30 rainfall event and greater return periods. However, the mapping highlights that these follow the lower topography of the ordinary watercourses within the sites. Using the RoFSW data as a proxy for the fluvial flood risk from these watercourses, in the eastern land parcel the ordinary watercourse is at risk of flooding during the 1 in 100 and 1 in 1,000 events. In the western land parcel, flooding is predicted to occur in the south of the parcel during a 1 in 30 and greater events. An area of surface water ponding is also predicted to form on the northern corner of the western land parcel, in a low point adjacent to Bristol Road.			
	Groundwater	Areas Susceptible to Groundwater Flooding Map class (risk of groundwater emergence)			
		ASTGWF - Category 2 >=25% <50%	ASTGWF - Category 3 >=50% <75%	ASTGWF - Category 4 >=75%	
		10%	1%	89%	
	Reservoir	The site is at high risk of groundwater flooding, with a greater than 75% chance of groundwater emergence within a given 1km ² grid square, during a 1 in 100 event.			
Canal	The north eastern corner of the eastern land parcel is at risk of flooding during a reservoir breach.				
Flood risk management infrastructure	Defences	Defence Type	Standard of Protection	Condition	
		There are no flood defences within the site boundary, or within the vicinity of the site.			
	Residual risk	Culvert / structure blockage?	On the western land parcel, the ordinary watercourse which crosses the site is culverted beneath the M5, beyond the south east of the site, and beneath Bristol Road, at the north eastern boundary of the site. Blockage of the culvert beneath Bristol Road is likely to increase flood risk to the site, and should be assessed within a site-specific FRA.		
		Impounded water body failure?	The north eastern corner of the eastern land parcel is at risk of flooding during a reservoir breach.		
		Defence breach / overtopping?	Breach Zone There are no flood defences within the site boundary.		
Emergency planning	Flood warning	The eastern parcel of land is included within the Environment Agency Flood Alert Area for the River Frome and Cam.			
	Access and egress	The site is likely to be accessed from the A38 Bristol Road, which runs along the western boundary. Near the most western parcel of land, there is ponding on the road which occurs during the 1 in 30 event and greater return periods. North of the eastern site, the road is at risk of flooding during a 1 in 100 and 1 in 1,000 event on the River Cam.			
Change	Climate change allowances for '2080s'	River Basin District	Central	Higher Central	Upper End
		Severn	25%	35%	70%

Site code	PS37
Site name	New settlement at Wisloe

	Implications for the site	<p>As the Cam and Wickster's Brook is 1D-only, Flood Zone 2 has been used as a proxy for the Flood Zone 3a + 35% and 70% climate change extents. This indicates that climate change will result in an increase in flood risk during the 1% AEP flood event (Flood Zone 3a), although it may give a conservative account of risk.</p> <p>In-channel peak water level results for the Cam and Wickster's Brook model were also assessed at the site (CAM2702) for the 1 in 100 +70% and H++ climate change scenarios (see table below). The +70% climate change allowance saw a significant increase in the baseline 1 in 100 event water levels, although it did not reach the 1 in 1,000 event. The H++ scenario exceeded the 1 in 1,000 event water levels.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Scenario</th> <th style="text-align: left;">Peak Water Level at site (CAM2702) (mAOD)</th> <th style="text-align: left;">Difference in water level with 1 in 100 baseline (mA)</th> </tr> </thead> <tbody> <tr> <td>1 in 100 – baseline</td> <td>14.76</td> <td>N/A</td> </tr> <tr> <td>1 in 1000 – baseline</td> <td>15.14</td> <td>+ 0.38</td> </tr> <tr> <td>1 in 100 + 70% CC</td> <td>15.10</td> <td>+ 0.34</td> </tr> <tr> <td>1 in 100 + 90% CC (H++)</td> <td>15.17</td> <td>+ 0.41</td> </tr> </tbody> </table>	Scenario	Peak Water Level at site (CAM2702) (mAOD)	Difference in water level with 1 in 100 baseline (mA)	1 in 100 – baseline	14.76	N/A	1 in 1000 – baseline	15.14	+ 0.38	1 in 100 + 70% CC	15.10	+ 0.34	1 in 100 + 90% CC (H++)	15.17	+ 0.41
Scenario	Peak Water Level at site (CAM2702) (mAOD)	Difference in water level with 1 in 100 baseline (mA)															
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1 in 100 + 70% CC	15.10	+ 0.34															
1 in 100 + 90% CC (H++)	15.17	+ 0.41															

Site code	PS37
Site name	New settlement at Wisloe

Requirement for drainage control and impact mitigation	Bedrock Geology	The site is underlain by Blue Lias Formation and Charmouth Mudstone Formation (undifferentiated)		
	Superficial Geology	Cheltenham Sand and Gravel deposits overlie the bedrock geology on the site.		
	Soils	Soils on the site are freely draining, lime-rich and loamy.		
	SuDS	<ul style="list-style-type: none"> As a large undeveloped site, opportunities should be taken to incorporate above ground SuDS features, which provide multiple benefits. Severn Trent Water has identified that there are no surface water sewers in the vicinity of the site, and parts of the site may not be able to drain into the River Cam. Surface water should be managed on site, through the use of SuDS. If infiltration techniques or discharge to watercourse are not feasible on the site, early consultation with Severn Trent Water and Gloucestershire County Council (as LLFA) is recommended, to secure a suitable surface water discharge destination. A high-level assessment of SuDS suitability carried out as part of the Level 1 SFRA suggests that the site is best suited to conveyance features, such as swales and rills, or detention features, such as ponds and wetlands. Attenuation features must be located outside areas of fluvial flood risk. The site geology is impermeable in nature and there is a high risk of groundwater flooding, therefore infiltration techniques are unlikely to be suitable. However, to better understand the infiltration potential at the site, site-specific infiltration testing will be required. Below ground attenuation features may require an impermeable liner, to ensure storage capacity is not lost and there is no contamination to underlying groundwater. 		
	Groundwater Source Protection Zone	The site is not within a groundwater Source Protection Zone.		
	Historic Landfill Site	There are no historic landfill sites within the proposed boundary.		
	Opportunities for flood risk betterment	The majority of the proposed site is currently in a greenfield state and therefore post-development greenfield rates and volumes should be restricted to the existing rate. The site provides opportunities for the temporary storage of floodwaters, to reduce peak flows and downstream flood risk on the River Cam.		
	Cumulative impacts of development	Water Framework Directive Catchment	Sensitivity to cumulative impacts	Implications
The Cam – source to confluence with Gloucester and Sharpness Canal		High	FRA should include consideration of effects on potential sensitive receptors off-site and if necessary, include additional mitigation, so there are no adverse cumulative effects	
Sequential Test and Exception Test requirements				

Site code	PS37
Site name	New settlement at Wisloe

Recommendations for Local Plan policy	<p>The Sequential Test must be satisfied. Only once the Sequential Test is satisfied should the Exception Test be applied. It is anticipated that proposed development will be sequentially located within Flood Zone 1. For this site, the Exception Test must be satisfied:</p> <ul style="list-style-type: none"> • If More Vulnerable and Essential Infrastructure is located in FZ3a or FZ3a plus climate change. • If Highly Vulnerable development is located in FZ2. <p>If Essential Infrastructure is located in Flood Zone 3b then it must be demonstrated that the exception test is satisfied. Development will not be permitted in the following scenarios:</p> <ul style="list-style-type: none"> • Highly Vulnerable development within FZ3a or FZ3a plus climate change and FZ3b. • More Vulnerable and Less Vulnerable development within FZ3b.
	<p>Recommendations for requirements of site-specific Flood Risk Assessment, including guidance for developers</p> <p>Flood risk assessment:</p> <ul style="list-style-type: none"> • Consultation with the Local Authority and the Environment Agency should be undertaken at an early stage. • A site-specific flood risk assessment will be required because the site is within Flood Zone 2 and 3 and at risk from sources of flooding other than rivers and the sea. Government guidance on flood risk assessments must be followed (https://www.gov.uk/guidance/flood-risk-assessment-for-planning-applications). • All sources of flooding, particularly the risk of groundwater flooding, should be considered as part of a site-specific flood risk assessment. • A detailed assessment of the risk and location of high groundwater levels and groundwater emergence should be undertaken, including groundwater monitoring during the winter months, where required. • Blockage modelling should be conducted to assess the residual risk associated with blockage of the culvert within the site. • Climate change should be assessed using recommended climate change allowances at the time of the assessment (https://www.gov.uk/guidance/flood-risk-assessmentsclimate-change-allowances) for the type of development and level of risk. The current allowances were published in February 2016 but may be subject to change in the future. • Subject to consultation with the Environment Agency and Lead Local Flood Authority, it is recommended that detailed hydraulic modelling of the unmodelled ordinary watercourses within the western and eastern land parcels are carried out as part of a flood risk assessment. The Environment Agency and LLFA should be consulted to obtain the latest hydraulic modelling information for the site at the time of the flood risk assessment. • The site is located within a catchment identified as highly sensitive to the cumulative impact of development. The effects which development of the site may have on flood risk within the catchment will need to be considered within a site-specific flood risk assessment. Appropriate storage of surface water runoff will need to be provided, and assessments should identify opportunities to provide off-site betterment, to help offset the cumulative impact of development. For example, this may include contribution to the delivery of schemes within the catchment, such as flood alleviation schemes, Natural Flood Management, SuDS retrofit or river restoration. <p>Guidance for site design and making development safe:</p> <ul style="list-style-type: none"> • Development must seek opportunities to reduce overall level of flood risk both on and off-site, for example by reducing volume and rate of runoff and creating space for flooding. • The development should be designed using a sequential approach. Development should be steered away from surface water flow routes and areas where groundwater risk is highest, preserving these areas as green infrastructure. • Safe access and egress should be demonstrated in the 1 in 100 plus 40% climate change rainfall event. Raising of access routes must not impact on flow routes. Consideration should be given to the siting of access points with respect to surface water flood risk areas. • The design must ensure that surface water flows resulting from rainfall in excess of a 1 in 100 event are managed via exceedance routes that minimise the risks to people and property.

Site code	PS37
Site name	New settlement at Wisloe

	<ul style="list-style-type: none">• Mitigation for seasonal high groundwater levels must be considered (for example by raising finished floor levels to an appropriate height above ground level).• Flow routes would need to be preserved if carrying out land-raising within the surface water risk area.• The design of SuDS schemes must take into account the seasonally high groundwater table and low permeability. Infiltration techniques may be ineffective, and may pose a pollution risk. SuDS may need to be shallow and take up larger areas. Above ground conveyance and attenuation can be used but care must be taken that groundwater does not enter the SuDS feature and reduce the storage capacity and structural integrity of the design.• Detailed site investigations will be required including infiltration testing and groundwater monitoring during the winter months (November through to March).
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Site code	PS43
Site name	Javelin Park, Gloucester

Site details	OS Grid reference	SO 79911 10649				
	Area	26.98 ha				
	Current land use	Greenfield				
	Proposed site use	Employment				
	Flood risk vulnerability	Less vulnerable				
Sources of flood risk	Existing watercourses	An ordinary watercourse, a tributary of the Beaurepair Brook, flows north westwards along the boundary of the site, and appears to pass through the north of the site, and below the M5 motorway, within a culvert. However, there are no records of any culverts in the location of the site, within the EA asset dataset.				
	Flood history	<p>There are no historic outlines of fluvial flooding recorded at the site. The following flood incidents have been recorded in postcode area GL10 3DP:</p> <ul style="list-style-type: none"> Date of flooding not recorded - internal residential flooding from unknown sources. Date of flooding not recorded - internal residential flooding from fluvial sources. 				
	Fluvial	Proportion of site at risk in Flood Zones				
		Proportion of site at risk (%)	Flood Zone 3b 5% AEP (1 in 20)	Flood Zone 3a 1% AEP (1 in 100)	Flood Zone 2 0.1% AEP (1 in 1,000)	Flood Zone 1
			N/A (0%)	0%	2%	98%
<p>Available modelled data: The Flood Zones in this location are generated from national broadscale modelling, rather than a detailed hydraulic model. No 5% AEP (1 in 20) results were available for the Beaurepair Brook, and therefore the results for 1% AEP (Flood Zone 3a) have been used as a proxy for Flood Zone 3b. Within this assessment, RoFSW mapping has been used as a proxy for fluvial flood risk from this watercourse</p> <p>Flood characteristics: The north eastern border of the site is located within Flood Zone 2, and is at risk of flooding during the 0.1% AEP (1 in 1,000) event from the Beaurepair Brook. The north west corner of the site is located within Flood Zone 3a (0.2%), and is at risk of flooding during a 1% AEP (1 in 100) event. The remaining areas of the site are at negligible risk of fluvial flooding. However, it should be noted that the risk of flooding from the ordinary watercourse believed to flow below the site is not represented within Flood Zone modelling.</p>						
Surface Water	Proportion of site at risk (RoFSW)					
	30-year	100-year	1,000-year			
	17%	20%	28%			

Site code	PS43
Site name	Javelin Park, Gloucester

		Description of surface water flow paths: The site is at high surface water flood risk, with runoff predicted to pond against the M5 motorway. A large area of the site, extending from the north to the south-west, is at risk of flooding during a 3.3% AEP (1 in 30) rainfall event. A further area of ponding is predicted to form against the M5 embankment along the western boundary in the south west corner of the site during a 3.3% AEP (1 in 30) and greater rainfall event. A surface water flow path is expected to develop across the south east of the site during a 1% AEP (1 in 100) and 0.1% AEP (1 in 1,000) rainfall event. The RoFSW also appears to represent the fluvial flood risk associated with the ordinary watercourse which borders the site. The mapping indicates that flooding from the watercourse the watercourse during a 1% (1 in 100) and 0.1% AEP (1 in 1,000) event, which contributes to the surface water flood risk associated with the flow path at the south east of the site.		
	Groundwater	Areas Susceptible to Groundwater Flooding Map class (risk of groundwater emergence)		
		ASTGWF - Category 2 ≥25% <50%	ASTGWF - Category 3 ≥50% <75%	ASTGWF - Category 4 ≥75%
		0%	0%	0%
	The site has a low likelihood of groundwater emergence.			
Reservoir	The site is not at risk of flooding, in the unlikely event of a reservoir breach.			
Canal	The site is not within close proximity to a canal.			

Site code	PS43
Site name	Javelin Park, Gloucester

	Defences	Defence Type	Standard of Protection	Condition	
		There are no flood defences within the site.			
Flood risk management infrastructure	Residual risk	Culvert / structure blockage?	There are no mapped culverts or structures within the site boundary, although a tributary of the Bearepair Brook appears to pass through the north of the site, and below the M5 motorway, within a culvert. Using the RoFSW a proxy, as it does not represent the culvert below the M5, a blockage to the culvert is predicted to cause flooding to the northern portion of the site. However, fluvial flood risk to this, as well as the residual risk to the site in the event of a blockage, should be assessed within a site-specific flood risk assessment.		
		Impounded water body failure?	The site is not at risk of reservoir flooding, in the event of a breach event.		
		Defence breach / overtopping?	Breach Zone		
			There are no defences within the site boundary.		
Emergency planning	Flood warning	The site is not covered by an Environment Agency Flood Warning or Flood Alert Area.			
	Access and egress	Access to the site is likely to be via the B4008 Gloucester Road, at the eastern border of the site. The road is predicted to experience surface water flooding during the 3.3% AEP (1 in 30) and greater rainfall events, particularly where the south east corner of the site borders the B4008. The M5, at the western site boundary, may also provide an access route to the site. The M5 is at high risk of fluvial flooding during a 1% AEP (1 in 100) flood event, as well as at surface water flood risk during a 3.3% AEP (1 in 30) rainfall event.			
Climate Change	Climate change allowances for '2080s'	River Basin District	Central	Higher Central	Upper End
		Severn	25%	35%	70%
	Implications for the site	Due to the lack of a detailed hydraulic modelling in this location, Flood Zone 2 has been used as a proxy for the Flood Zone 3a + 35% and 70% climate change extents. This indicates that climate change will result in an increase in flood risk during the 1% AEP flood event (Flood Zone 3a), although it may give a conservative account of risk.			

Site code	PS43
Site name	Javelin Park, Gloucester

Requirement for drainage control and impact mitigation	Bedrock Geology	The site is underlain by the LIAS group, and consist of Mudstone, Siltstone, Limestone and Sandstone.		
	Superficial Geology	The site is not covered by superficial deposits.		
	Soils	Lime-rich loamy and clayey soils with impeded drainage.		
	SuDS	<ul style="list-style-type: none"> As a large undeveloped site, opportunities should be taken to incorporate above ground, natural SuDS features, which provide multiple benefits (including biodiversity, amenity and water quality improvements). As one of several sites within a large area of growth, it is recommended that an overarching drainage strategy is developed across the nearby sites (PS31, PS32, G1, PS43), in consultation with Severn Trent Water and Gloucestershire County Council (as LLFA). Severn Trent Water has flagged parts of the site as being at high risk for surface water drainage, as there are no surface water sewers in the vicinity of the site, and connection distances into the nearest watercourses may be large. If infiltration techniques are not feasible on the site, early consultation with Severn Trent Water and Gloucestershire County Council (as LLFA) is recommended, to secure a suitable surface water discharge destination. As one of several sites within a large area of growth, it is recommended that an overarching drainage strategy is developed across the nearby sites (PS30, PS31, PS32, G1), in consultation with Severn Trent Water and Gloucestershire County Council (as LLFA). The impermeable underlying geology suggests that discharge of the site via infiltration is unlikely to be feasible. However, this should be confirmed within a site-specific drainage strategy. Detention and conveyance features will be appropriate on the site. However, attenuation features must be located outside areas of fluvial flood risk. 		
	Groundwater Source Protection Zone	The site is not located within a Groundwater Source Protection Zone.		
	Historic Landfill Site	There are no historic landfill sites within the site boundary.		
	Opportunities for flood risk betterment	The greenfield site provides opportunities for the temporary storage of fluvial and surface water during times of flood. Opportunities for using source control SuDS to manage runoff rates and volumes, contributing to the reduction of existing surface water flow paths leaving the site, and flood peaks downstream on Epney Rhyne.		
		Water Framework Directive Catchment	Sensitivity to cumulative impacts	Implications

Site code	PS43
Site name	Javelin Park, Gloucester

	Cumulative impacts of development	Epney Rhyme – source to conference River Severn Estuary	High	FRA should include consideration of effects on potential sensitive receptors off-site and if necessary, include additional mitigation, so there are no adverse cumulative effects
Recommendations for Local Plan policy	Sequential Test and Exception Test requirements			
	<p>The Sequential Test must be satisfied. Only once the Sequential Test is satisfied should the Exception Test be applied. It is anticipated that proposed development will be sequentially located within Flood Zone 1. For this site, the Exception Test must be satisfied:</p> <ul style="list-style-type: none"> • If More Vulnerable and Essential Infrastructure is located in FZ3a or FZ3a plus climate change. • If Highly Vulnerable development is located in FZ2. <p>If Essential Infrastructure is located in Flood Zone 3b then it must be demonstrated that the exception test is satisfied. Development will not be permitted in the following scenarios:</p> <ul style="list-style-type: none"> • Highly Vulnerable development within FZ3a or FZ3a plus climate change and FZ3b. • More Vulnerable and Less Vulnerable development within FZ3b. 			
	Recommendations for requirements of site-specific Flood Risk Assessment, including guidance for developers			
	<p>Flood risk assessment:</p> <ul style="list-style-type: none"> • At the planning application stage, a site-specific flood risk assessment and surface water drainage strategy will be required. • A site-specific flood risk assessment will be required because the site is within Flood Zone 2 and 3 and at risk from sources of flooding other than rivers and the sea. Government guidance on flood risk assessments must be followed (https://www.gov.uk/guidance/floodrisk-assessment-for-planning-applications). • Other sources of flooding should also be considered as part of a site-specific flood risk assessment, including surface water and groundwater. • Blockage modelling should be conducted to assess the residual risk associated with blockage of the culvert within the site. • Climate change should be assessed using recommended climate change allowances at the time of the assessment (https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances) for the type of development and level of risk. The current allowances were published in February 2016 but may be subject to change in the future. • The site is located within a catchment identified as highly sensitive to the cumulative impact of development. The effects which development of the site may have on flood risk within the catchment will need to be considered within a site-specific flood risk assessment. • Appropriate storage of surface water runoff will need to be provided, and assessments should identify opportunities to provide off-site betterment, to help offset the cumulative impact of development. For example, this may include contribution to the delivery of schemes within the catchment, such as flood alleviation schemes, Natural Flood Management, SuDS retrofit or river restoration. <p>Guidance for site design and making development safe:</p> <ul style="list-style-type: none"> • Development must seek opportunities to reduce overall level of flood risk at the site and should seek to reduce the levels of flood risk downstream. • Consultation with Gloucestershire County Council as Lead Local Flood Authority (LLFA) and the Stroud District Council Drainage Engineer on surface water drainage of the site and potential SuDS features should be undertaken at an early stage. • Development must seek opportunities to reduce overall level of flood risk both on and off-site, for example by reducing volume and rate of runoff and creating space for flooding. 			

Site code	PS43
Site name	Javelin Park, Gloucester

	<ul style="list-style-type: none">• 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.• The site layout and drainage design must ensure that surface water flows resulting from rainfall in excess of a 1 in 100-year event are managed via exceedance routes that minimise the risks to people and property.• Safe access and egress should be demonstrated in the 1 in 100-year plus climate change fluvial and rainfall events. 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.
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Site code	PS47
Site name	Land west of Renishaw New Mills

Site details	OS Grid reference	ST 73537 92666				
	Area	16.18 ha				
	Current land use	Agricultural land and existing property				
	Proposed site use	Employment				
	Flood risk vulnerability	Less vulnerable				
Sources of flood risk	Existing watercourses	The Marlees Brook, a Main River and tributary of the Little Avon River, flows along the northern site boundary, from east to west. A large pond is located approximately 500m to the north west of the site.				
	Flood history	There are no historic flood extents or incidents recorded within the site boundary. An incident of groundwater flooding was recorded on 01/11/2014 to the south west of the site, and appears to have affected the B4058. However, there are few details on the property affected.				
	Fluvial	Proportion of site at risk in Flood Zones				
		Proportion of the site at risk (%)	Flood Zone 3b 5% AEP (1 in 20)	Flood Zone 3a 1% AEP (1 in 100)	Flood Zone 2 0.1% AEP (1 in 1,000)	Flood Zone 1
			1%	0%	3%	96%
		Range of depths (m)	0.01 - 1.0	0.01 - 0.84	0.02 - 0.96	N/A
		Maximum hazard	0.5 - 1.5	0.5 - 1.6	0.5 - 2.1	NA
		<p>Available modelled data: The Environment Agency detailed 1D-2D FM-TUFLOW hydraulic model of the Little Avon, which was completed in 2016, covers the site.</p> <p>Flood characteristics: The northern boundary of the site is at risk of flooding during a 1 in 20 event on the Marlees Brook, and the risk of flooding during a 1 in 100 event covers a very similar flood extent. The risk of flooding during a 1 in 1,000 event extends to the north east corner of the site, covering a larger area.</p>				
	Surface Water	Proportion of site at risk (RoFSW)				
		1 in 30	1 in 100	1 in 1,000		
1%		2%	4%			
	<p>Description of surface water flow paths: Surface water flood risk to the site is relatively low. The northern and south eastern site perimeters are at risk of flooding during the 1 in 30 rainfall event and greater return periods. In addition, ponding is predicted to occur around the existing buildings at the centre of the site, near Lower Barns Farm. In addition, a surface water flow path is predicted to form in the east of the site during the 1 in 100 and 1 in 1,000 rainfall events, and flows eastwards into the Marlees Brook.</p>					
Groundwater	Areas Susceptible to Groundwater Flooding Map class (risk of groundwater emergence)					
	ASTGWF - Category 2 >=25% <50%	ASTGWF - Category 3 >=50% <75%	ASTGWF - Category 4 >=75%			

Site code	PS47
Site name	Land west of Renishaw New Mills

		0%	0%	0%	
		The site is at relatively low risk of groundwater flooding, with a less than 25% risk of occurring within the surrounding 1km ² grid cell during a 1 in 100 groundwater flood event.			
	Reservoir	The site is not identified as at reservoir flood risk.			
	Canal	The site is not identified as at risk of flooding from canals.			
Flood risk management infrastructure	Defences	Defence Type	Standard of Protection	Condition	
		There are no flood defences located within the site boundary or within the vicinity of the site.			
	Residual risk	Culvert / structure blockage?	There are no culverted watercourses within the site boundary. However, the Maerlees Brook is culverted or bridged below the two access tracks which are located to the east and west of the site. A blockage to the culvert beneath the western access track may pose a residual flood risk to the north western corner of the site.		
		Impounded water body failure?	The site is not identified at risk of flooding in the event of reservoir failure. However, a large pond is located approximately 500m to the north west of the site. In the event of overtopping of this lake, flood waters would travel south eastwards into the Marlees Brook which could impact flooding at the site.		
	Defence breach / overtopping?	<p style="text-align: center;">Breach Zone</p> There are no flood defences located in the vicinity of the site.			
Emergency planning	Flood warning	The site is located within the Environment Agency Little Avon Catchment and the Vale of Berkeley Flood Alert Area.			
	Access and egress	Access to the site is likely to be via the B4058 road, located to the south of the site. The B058 is very at low fluvial flood risk (within Flood Zone 1). The majority of the road is also at very low risk of surface water flooding, with the exception of the roundabout at the south eastern corner of the site, which is at risk of flooding during a 1 in 30 rainfall event and greater return periods. The two existing access roads located on the east and west site boundary, which could also be used for access. The northern end of these access roads is at risk of flooding during the 1 in 20, 1 in 100 and 1 in 1,000 flood events. The eastern access road is also at risk of surface water flooding during a 1 in 30 event and greater return periods, particularly at the junction of B4058.			
Climate Change	Climate change allowances for '2080s'	River Basin District	Central	Higher Central	Upper End
		South West	30%	40%	85%
	Implications for the site	Climate change is expected to increase the extent of the 1 in 100 flood event at the site, with the plus 80% climate change scenario expected to remain within the extent of 1 in 1,000 flood extent.			

Site code	PS47
Site name	Land west of Renishaw New Mills

Requirement for drainage control and impact mitigation	Bedrock Geology	The majority of the site is underlain by Langport Member and Wilmcote Limestone Member, a series of interbedded Limestone and Mudstone. The eastern portion of the site is underlain by Blue Lias Formation and Charmouth Mudstone Formation. A band of Westbury Formation and Cotham Member Mudstone is located at the western boundary of the site.		
	Superficial Geology	A band of alluvial silt, clay, sand and gravel is located at the northern boundary of the site, and corresponds with the floodplain of Marlees Brook.		
	Soils	The soils within the site are slowly permeable, slightly acid but base-rich loamy and clayey soils which are seasonally wet.		
	SuDS	<ul style="list-style-type: none"> As a large, relatively undeveloped site, opportunities should be taken to incorporate above ground SuDS features, which provide multiple benefits, such as biodiversity, recreation and water resource education, through integration with areas of greenspace. All development should adopt source control SuDS techniques. Conveyance features should be designed above ground and following natural flow paths where possible. Due to the mixed geologies on the site, with variable permeability, the potential for infiltration should be investigated within site-specific infiltration testing. Detention and conveyance features will be appropriate on the site. However, attenuation features must be located outside areas of fluvial flood risk. 		
	Groundwater Source Protection Zone	The site is not located within a designated Source Protection Zone.		
	Historic Landfill Site	There are no historic landfill sites within the site boundary.		
	Opportunities for flood risk betterment	The site provides opportunities for storing flood water from the Marlees Brook, to reduce peak flows and delay the time in which they reach the Little Avon. This can help to manage the risk of flooding from the Little Avon to downstream settlements, such as Berkeley.		
	Cumulative impacts of development	Water Framework Directive Catchment	Sensitivity to cumulative impacts	Implications
Ozleworth Brook – source to confluence with Little Avon		Medium	The effects which development of the site may have on flood risk within the catchment will need to be considered within a site-specific flood risk assessment.	
Sequential Test and Exception Test requirements				

Site code	PS47
Site name	Land west of Renishaw New Mills

Recommendations for Local Plan policy	<p>The Sequential Test must be satisfied. Only once the Sequential Test is satisfied should the Exception Test be applied. It is anticipated that proposed development will be sequentially located within Flood Zone 1. For this site, the Exception Test must be satisfied:</p> <ul style="list-style-type: none"> • If More Vulnerable and Essential Infrastructure is located in FZ3a or FZ3a plus climate change. • If Highly Vulnerable development is located in FZ2. <p>If Essential Infrastructure is located in Flood Zone 3b then it must be demonstrated that the exception test is satisfied. Development will not be permitted in the following scenarios:</p> <ul style="list-style-type: none"> • Highly Vulnerable development within FZ3a or FZ3a plus climate change and FZ3b. • More Vulnerable and Less Vulnerable development within FZ3b.
	<p>Recommendations for requirements of site-specific Flood Risk Assessment, including guidance for developers</p>
	<p>Flood risk assessment:</p> <ul style="list-style-type: none"> • At the planning application stage, a site-specific flood risk assessment and surface water drainage strategy will be required. • Consultation with the Local Authority and the Environment Agency should be undertaken at an early stage. • A site-specific flood risk assessment will be required because the site is within Flood Zone 2 and 3 and at risk from sources of flooding other than rivers and the sea. Government guidance on flood risk assessments must be followed (https://www.gov.uk/guidance/floodrisk-assessment-for-planning-applications). • Other sources of flooding should also be considered as part of a site-specific flood risk assessment, including surface water and groundwater. • The site is located within a catchment identified as moderately sensitive to the cumulative impact of development. The effects which development of the site may have on flood risk within the catchment will need to be considered within a site-specific flood risk assessment. <p>Guidance for site design and making development safe:</p> <ul style="list-style-type: none"> • Development must seek opportunities to reduce overall level of flood risk at the site and should seek to reduce the levels of flood risk downstream. • Consultation with Gloucestershire County Council as Lead Local Flood Authority (LLFA) and the Stroud District Council Drainage Engineer on surface water drainage of the site and potential SuDS features should be undertaken at an early stage. • Development must seek opportunities to reduce overall level of flood risk both on and off-site, for example by reducing volume and rate of runoff and creating space for flooding. • 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. • The site layout and drainage design must ensure that surface water flows resulting from rainfall in excess of a 1 in 100 event are managed via exceedance routes that minimise the risks to people and property. • Safe access and egress should be demonstrated in the 1 in 100 plus climate change fluvial and rainfall events. 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.

Site code	WHI007 / WHI011
Site name	Land north of Grove End Farm, Whitminster

Site details	OS Grid reference	SO 78134 08067														
	Area	107.9 Ha														
	Current land use	Agricultural														
	Proposed site use	Mixed use – residential and commercial/employment														
	Flood risk vulnerability	More vulnerable (residential) – Less vulnerable (commercial/employment)														
Sources of flood risk	Existing watercourses	<p>The site is formed of two land parcels, a northern and southern parcel, which are located either side of Grove Lane.</p> <p>The Main River Frome flows in a north westerly direction, approximately 240m south of the site. An unnamed ordinary watercourse, which forms a tributary of the Moreton Valence Rhyne, flows in a north westerly direction through the northern land parcel, and forms the north eastern boundary of the site. This watercourse has a further small tributary that intersects the north east corner of the northern parcel of the site.</p> <p>The Stroudwater Canal is located approximately 105m south of the site. The canal in this location is currently undergoing restoration to allow navigation, which includes a new lock and roundabout crossing at A38, at the south west corner of the site. A new boat mooring basin and car park are also due to be built beyond the southern boundary of the site. There is also a small tributary of the River Frome that intersects the southern corner of the southern site parcel.</p>														
	Flood history	<p>The EA Recorded Flood Outlines dataset shows that the south west corner of the southern land parcel was affected by flooding during the July 1968 flood event. The extent of the July 2007 flood event reached the south western boundary of the southern land parcel.</p> <p>The Flood Risk Assessment (FRA) for the Stroudwater Canal development (Katherine Colby Hydrologists Limited, 2018) identifies that the M5 Stroudwater depot, located adjacent to the A419 beyond the south east corner of the site, has previously flooded from surface water flow paths.</p> <p>A cluster of flood incidents are recorded beyond the western boundary of the site. However, it should be noted that these are postcode-scale incidents, which have been plotted at the centre of the postcode area, and therefore the actual location affected may differ.</p> <p>The following flood incidents are recorded:</p> <ul style="list-style-type: none"> 02/01/2014, 27/01/2016: GL2 7LU – reported sewer flooding caused internal and external flooding. 21/11/2016, 10/03/2018, 31/03/2018, 02/04/2018: GL2 7LU – reported sewer flooding caused external flooding. 06/11/1999, 13/12/1999: GL2 7NT - reported sewer flooding caused highway flooding. 02/02/2002: GL2 7PB – reported sewer flooding caused external flooding. 														
	Fluvial	<table border="1"> <thead> <tr> <th colspan="4">Proportion of site at risk in Flood Zones</th> </tr> <tr> <th>Proportion of the site at risk (%)</th> <th>Flood Zone 3b 4% AEP (1 in 25)</th> <th>Flood Zone 3a 1% AEP (1 in 100)</th> <th>Flood Zone 2 0.1% AEP (1 in 1,000)</th> </tr> </thead> <tbody> <tr> <td></td> <td>0%</td> <td>0%</td> <td>1%</td> </tr> </tbody> </table>				Proportion of site at risk in Flood Zones				Proportion of the site at risk (%)	Flood Zone 3b 4% AEP (1 in 25)	Flood Zone 3a 1% AEP (1 in 100)	Flood Zone 2 0.1% AEP (1 in 1,000)		0%	0%
Proportion of site at risk in Flood Zones																
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Site code	WHI007 / WHI011
Site name	Land north of Grove End Farm, Whitminster

		<p>Available modelled data: The southern site parcel is covered by the Environment Agency River Frome 1D-2D ESTRY-TUFLOW detailed hydraulic model, which was prepared in 2008. The site does not benefit from flood defence, and therefore the undefended scenario is assessed here.</p> <p>Within the vicinity of the site, Flood Zone 2 is based on the recorded extents of the July 1968 and July 2007 flood events, rather than the 0.1% AEP modelled flood extent.</p> <p>The risk of flooding from the ordinary watercourse tributary of the Moreton Valence Rhyne and the River Frome tributary in the southern land parcel is not covered by a detailed hydraulic model. For the purpose of the SFRA assessment, the RoFSW mapping has been used as a proxy for fluvial flood risk from these watercourses. This assessment suggests that there is likely to be a margin of floodplain adjacent to the watercourses and this should be defined in higher resolution when more detailed site proposals are prepared.</p> <p>A 1D-2D model (ESTRY-TUFLOW) has been developed to support restoration of the Stroudwater Canal (Katherine Colby Hydrologists, 2018). This model was not available to assess as part of the Level 2 SFRA, but should be used to inform subsequent site-specific FRAs.</p> <p>Flood characteristics: The majority of the site is at very low risk of fluvial flooding from Main Rivers, and is located within Flood Zone 1. The south west boundary of the southern parcel is located within Flood Zone 2. It should be noted that the modelled 0.1% AEP fluvial event on the River Frome does not enter the site boundary. However, within the vicinity of the site, Flood Zone 2 is based on the historic extent of the July 1968 and July 2007 flood events. It is likely that there is some marginal flooding adjacent to the watercourses in the northern site parcel, and in the south east corner of the southern land parcel.</p>		
	Surface Water	Proportion of site at risk (RoFSW)		
		3.3% AEP (1 in 30)	1% AEP (1 in 100)	0.1% AEP (1 in 1,000)
		3%	6%	15%
	<p>Description of surface water flow paths: Areas of the site are at high risk of surface water flooding. The south west corner and boundary of the site is at risk of flooding during a 3.3% AEP (1 in 30) rainfall event, with ponding predicted to occur against the roundabout on A38 Clay Pits Hill and against the A419. The area of ponding extends along the south western boundary of the site during a 0.1% AEP (1 in 1,000) rainfall event. Additional isolated areas of ponding are also predicted to form within the southern land parcel during a 3.3% AEP (1 in 30) rainfall event.</p> <p>A large surface water flow path flows north westwards through the northern land parcel, and along the north eastern boundary of the site during the 3.3% AEP (1 in 30) rainfall event. The RoFSW mapping coincides with the fluvial flood risk associated with the Moreton Valence Rhyne. During the 1% AEP (1 in 100) and 0.1% AEP (1 in 1,000) rainfall events, the extent of flooding increases.</p> <p>Additional surface water flow paths form in the south east and south west corners of the northern parcel during the 0.1% AEP (1 in 1,000) rainfall event, flowing into the ordinary watercourse tributary.</p>			
Groundwater	Areas Susceptible to Groundwater Flooding Map class (risk of groundwater emergence)			
	ASTGWF - Category 2 >=25% <50%	ASTGWF - Category 3 >=50% <75%	ASTGWF - Category 4 >=75%	
	45%	0%	1%	

Site code	WHI007 / WHI011
Site name	Land north of Grove End Farm, Whitminster

		<p>The majority of the northern land parcel is located in 1km² grid squares with a <25% likelihood of groundwater emergence, and is therefore identified as at low risk.</p> <p>The southern land parcel is located within a 1km² grid square with a 25 – 50% a likelihood of groundwater emergence, and borders a grid square with a >75% likelihood of groundwater emergence. It is therefore identified as at moderate-to-high risk.</p>			
	Reservoir	The site is not at risk of reservoir flooding.			
	Canal	<p>The Stroudwater Canal is located approximately 105m south of the site. The site slopes away from the canal, and therefore the risk of flooding to the site from Stroudwater Canal is considered to be low. However, the residual risk of flooding to the site, in the event of a breach or overtopping on the canal should be assessed in further detail within a site-specific Flood Risk Assessment. The latest restoration plans for the canal should also be taken into account.</p>			
Flood risk management infrastructure	Defences	Defence Type	Standard of Protection	Condition	
		There are no defences within, or within close proximity of, the site boundary.			
	Residual risk	Culvert / structure blockage?	<p>The ordinary watercourse tributary of the Moreton Valence Rhyne is culverted beneath the A36, immediately north west of the site. Using the RoFSW mapping as a proxy, blockage of this structure could potentially cause flooding to the north west corner of the site.</p> <p>The impact of this blockage on the residual risk to the site should be assessed in detail within a site-specific Flood Risk Assessment.</p>		
		Impounded water body failure?	The site is not at risk of flooding, in the event of a reservoir breach.		
		Defence breach / overtopping?	<p style="text-align: center;">Breach Zone</p> <p>There are no defences which pose a residual risk to the site, in the event of breach or overtopping.</p>		
Emergency planning	Flood warning	The southern land parcel is located within the Environment Agency Rivers Frome and Cam Flood Alert Area. It is not located within any Flood Warning Areas.			
	Access and egress	<p>The site may be accessed via A38 at the west of the site, or via Grove Lane. Grove Lane is located within Flood Zone 1, and is therefore at very low fluvial flood risk. Adjacent to the site, the A38 is located within Flood Zone 1, and is at low risk of fluvial flooding. However, south west of the site, fluvial flooding is expected to affect the road during the 1% AEP (1 in 100) and 0.1% AEP (1 in 1,000) fluvial event. Therefore, southbound access to the site is likely to be affected during a fluvial flood event.</p> <p>Grove Lane is at very low risk of surface water flooding, with one small, isolated area of ponding predicted to form on the road during the 0.1% AEP (1 in 1,000) event. Surface water flooding is predicted to affect the A38 during the 3.3% AEP (1 in 30) and greater rainfall events, particularly at the north west corner of the site.</p>			
Climate Change	Climate change allowances for '2080s'	River Basin District	Central	Higher Central	Upper End
		Severn	25%	35%	70%

Site code	WHI007 / WHI011
Site name	Land north of Grove End Farm, Whitminster

	Implications for the site	Modelling shows that the extents of Flood Zone 3a + 35% CC and + 70% CC on the River Frome extend beyond that of Flood Zone 3a, but do not extend beyond Flood Zone 2, or enter the site. Therefore, climate change is not predicted to impact the proposed site.		
Requirement for drainage control and impact mitigation	Bedrock Geology	The site is underlain by Lias Formation Mudstone.		
	Superficial Geology	The southern parcel is overlain by river terrace deposits of sand and gravel.		
	Soils	Lime-rich loamy and clayey soils with impeded drainage.		
	SuDS	<ul style="list-style-type: none"> As a large, relatively undeveloped site, opportunities should be taken to incorporate above ground SuDS features, which provide multiple benefits. A high-level assessment of SuDS suitability carried out as part of the Level 1 SFRA suggests that the site is best suited to conveyance features, such as swales and rills, or detention features, such as ponds and wetlands. Attenuation features must be located outside areas of fluvial flood risk. The site geology is impermeable in nature, therefore there is likely to be limited potential for discharge of surface water by infiltration. There may be potential for shallow infiltration methods within the permeable river terrace deposits in the southern parcel. However, the potential for infiltration should be investigated within site-specific infiltration testing. 		
	Groundwater Source Protection Zone	The site is not within a groundwater Source Protection Zone.		
	Historic Landfill Site	There are no historical landfill sites within the proposed boundary.		
	Opportunities for flood risk betterment	Development should seek to strictly limit the rate and volumes of surface water leaving the site, to help to reduce and delay the timing of flows entering the River Frome, Moreton Valence Rhyne and Epney Rhyne.		
	Cumulative impacts of development	Water Framework Directive Catchment	Sensitivity to cumulative impacts	Implications
Epney Rhyne – source to confluence with River Severn Estuary		High	Assessments performed for FRA should address potential catchment scale implications of additional volumes of runoff generated by development	
Frome – Ebley Mill to confluence with River Severn		High		
Sequential Test and Exception Test requirements				

Site code	WHI007 / WHI011
Site name	Land north of Grove End Farm, Whitminster

Recommendations for Local Plan policy	<p>The Sequential Test must be satisfied. Only once the Sequential Test is satisfied should the Exception Test be applied. It is anticipated that proposed development will be sequentially located within Flood Zone 1. For this site, the Exception Test must be satisfied:</p> <ul style="list-style-type: none"> • If More Vulnerable and Essential Infrastructure is located in FZ3a or FZ3a plus climate change. • If Highly Vulnerable development is located in FZ2. <p>If Essential Infrastructure is located in Flood Zone 3b then it must be demonstrated that the exception test is satisfied. Development will not be permitted in the following scenarios:</p> <ul style="list-style-type: none"> • Highly Vulnerable development within FZ3a or FZ3a plus climate change and FZ3b. • More Vulnerable and Less Vulnerable development within FZ3b.
	<p>Recommendations for requirements of site-specific Flood Risk Assessment, including guidance for developers</p> <p>Flood risk assessment:</p> <ul style="list-style-type: none"> • Consultation with the Local Authority and the Environment Agency should be undertaken at an early stage. • A site-specific flood risk assessment will be required because the site is within Flood Zone 2 and 3 and at risk from sources of flooding other than rivers and the sea. Government guidance on flood risk assessments must be followed (https://www.gov.uk/guidance/floodrisk-assessment-for-planning-applications). • The impact of the development on flood risk from all sources both on and off-site must be considered and modelled where appropriate. It is recommended that a detailed hydraulic model of the Moreton Valence Rhyne tributary and River Frome tributary ordinary watercourses are developed, to accurately understand risk to the site. • Climate change should be assessed using recommended climate change allowances at the time of the assessment (https://www.gov.uk/guidance/flood-risk-assessmentsclimate-change-allowances) for the type of development and level of risk. The current allowances were published in February 2016 but may be subject to change in the future. • Detailed modelling will be required to confirm Flood Zone and climate change extents for the Moreton Valence Rhyne tributary and River Frome tributary (see 'Available modelled data'). The Environment Agency and LLFA should be consulted to obtain the latest hydraulic modelling information for the site at the time of the flood risk assessment. They will advise as to whether existing detailed models need to be updated. • Blockage modelling should be conducted to assess the residual risk associated with potential blockage of the culvert on the Moreton Valence Rhyne tributary below the A38. • Modelling should be conducted to assess the residual risk associated with breach or overtopping of the Stroudwater Canal. • The ongoing restoration of Stroudwater Canal must be taken into account, and the latest available modelling used to inform site-specific FRAs. At the time of writing, this is the 1D-2D model (ESTRY-TUFLOW) developed by Katherine Colby Hydrologists (2018). • The site is located within a catchment identified as highly sensitive to the cumulative impact of development. The effects which development of the site may have on flood risk within the catchment will need to be considered within a site-specific flood risk assessment. The FRA should include consideration of effects on potential sensitive receptors off-site and if necessary, include additional mitigation, so there are no adverse cumulative effects • Appropriate storage of surface water runoff will need to be provided, and assessments should identify opportunities to provide off-site betterment, to help offset the cumulative impact of development. For example, this may include contribution to the delivery of schemes within the catchment, such as flood alleviation schemes, Natural Flood Management, SuDS retrofit or river restoration. <p>Guidance for site design and making development safe:</p> <ul style="list-style-type: none"> • A site-specific surface water drainage strategy will be required. • The site should be designed using a sequential approach. Development should be steered away from surface water flow routes and the floodplains of the River Frome and Moreton

Site code	WHI007 / WHI011
Site name	Land north of Grove End Farm, Whitminster

	<p>Valence Rhyne tributary (ordinary watercourse), preserving these areas as green infrastructure, where possible.</p> <ul style="list-style-type: none"> • Development must seek opportunities to reduce overall level of flood risk at the site and should seek to reduce the levels of flood risk downstream. • Consultation with Gloucestershire County Council as Lead Local Flood Authority (LLFA) and the Stroud District Council Drainage Engineer on surface water drainage of the site and potential SuDS features should be undertaken at an early stage. • Development must seek opportunities to reduce overall level of flood risk both on and off-site, for example by reducing volume and rate of runoff and creating space for flooding. • 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. • The site layout and drainage design must ensure that surface water flows resulting from rainfall in excess of a 1 in 100-year event are managed via exceedance routes that minimise the risks to people and property. • Safe access and egress should be demonstrated in the 1 in 100-year plus climate change fluvial and rainfall events. 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.
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