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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%
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		<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%	

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		<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?	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 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%

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	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				

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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

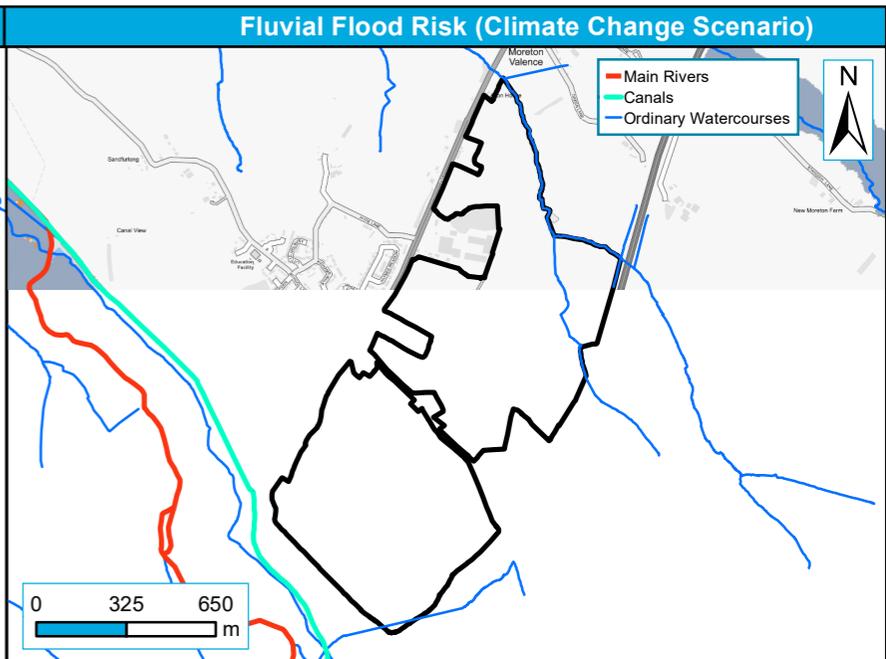
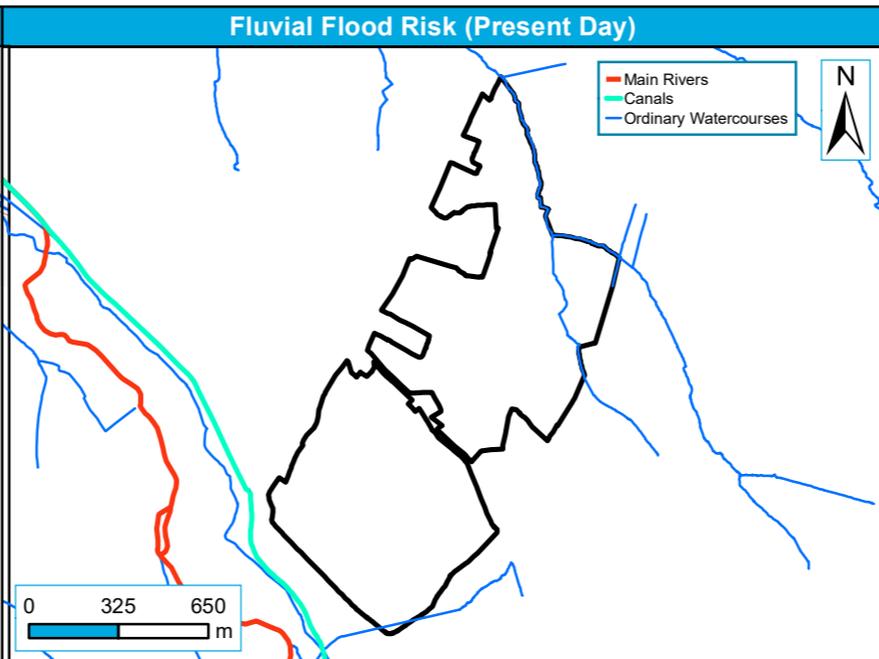
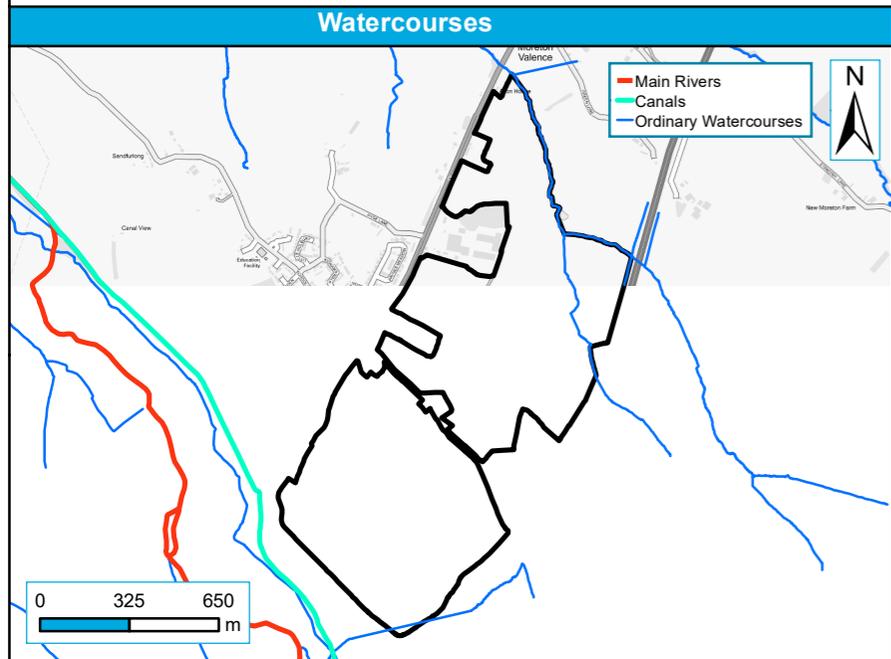
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	<p>Valence Rhyne tributary (ordinary watercourse), preserving these areas as green infrastructure, where possible.</p> <ul style="list-style-type: none"> • Development must seek opportunities to reduce overall level of flood risk at the site and should 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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Stroud District Council Strategic Flood Risk Assessment Level 2 Detailed Site Summary Tables

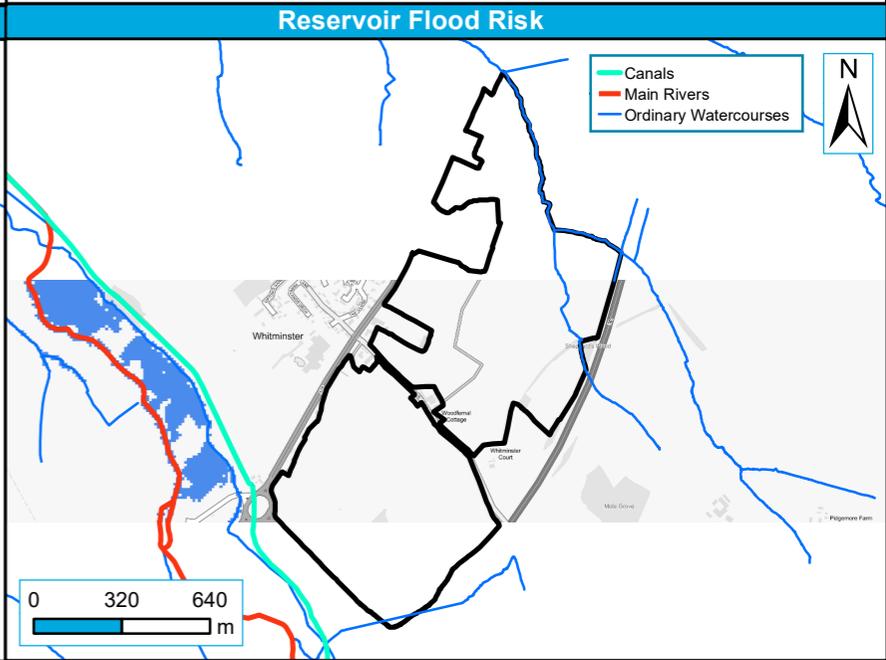
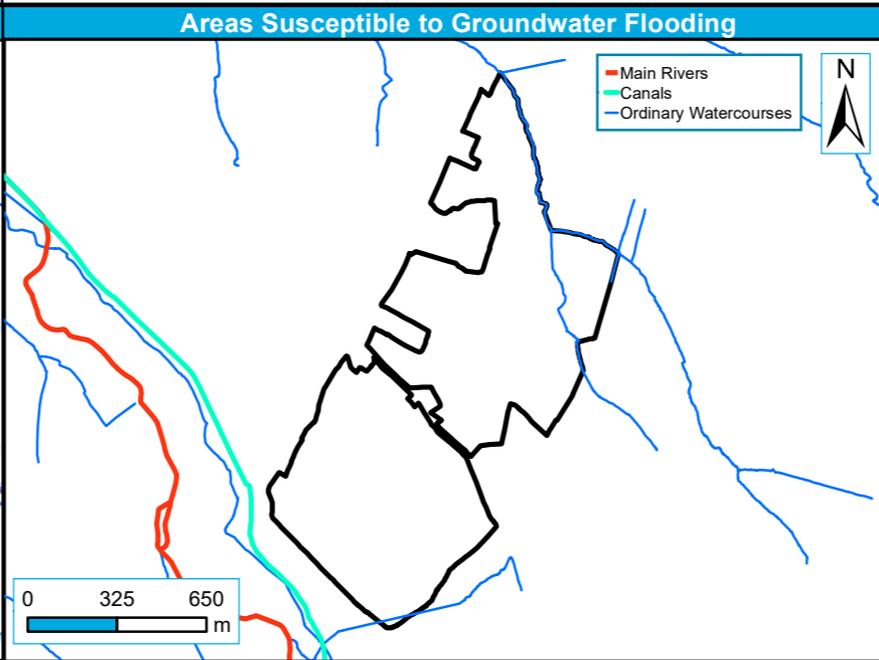
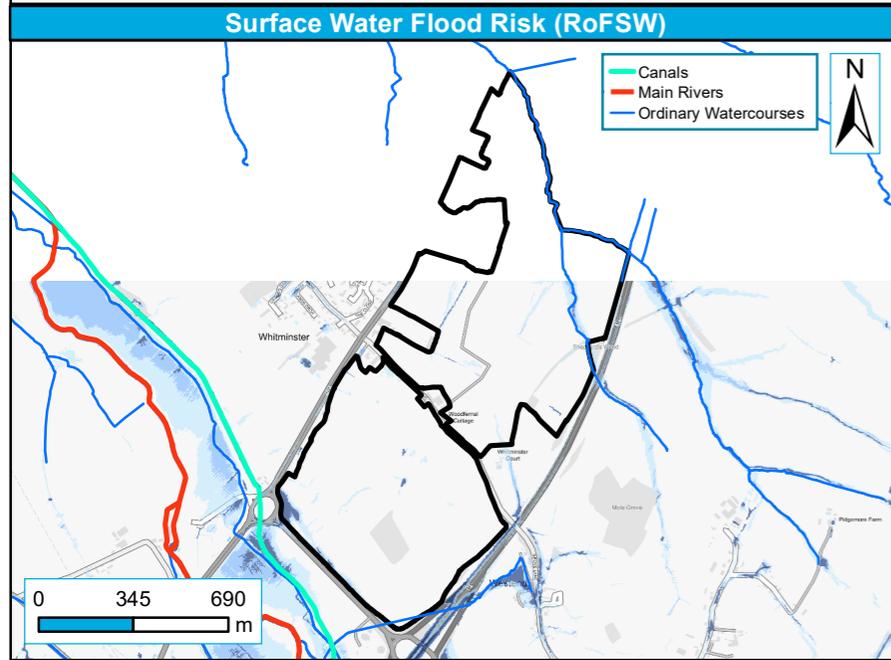
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 Level 2 Sites — Main Rivers — Ordinary Watercourses — Canal

 Level 2 Sites 1 in 100-year (1% AEP)
 1 in 1,000-year (0.1% AEP)
 Functional Floodplain (1 in 20-year or 25-year event where available, or 1 in 100-year where not)

 Level 2 Sites 1 in 100-year (1% AEP) + 35% CC
 1 in 100-year (1% AEP) 1 in 100-year (1% AEP) + 70% CC



 Level 2 Sites RoFSW 1 in 100-year extent (1%)
 RoFSW 1 in 30-year extent (3.3%) RoFSW 1 in 1000-year extent (0.1%)

 Level 2 Sites **Areas Susceptible to Groundwater Flooding**
 < 25% >= 25% < 50%
 >= 50% < 75% >= 75%

 Level 2 Sites Reservoir Flood Risk