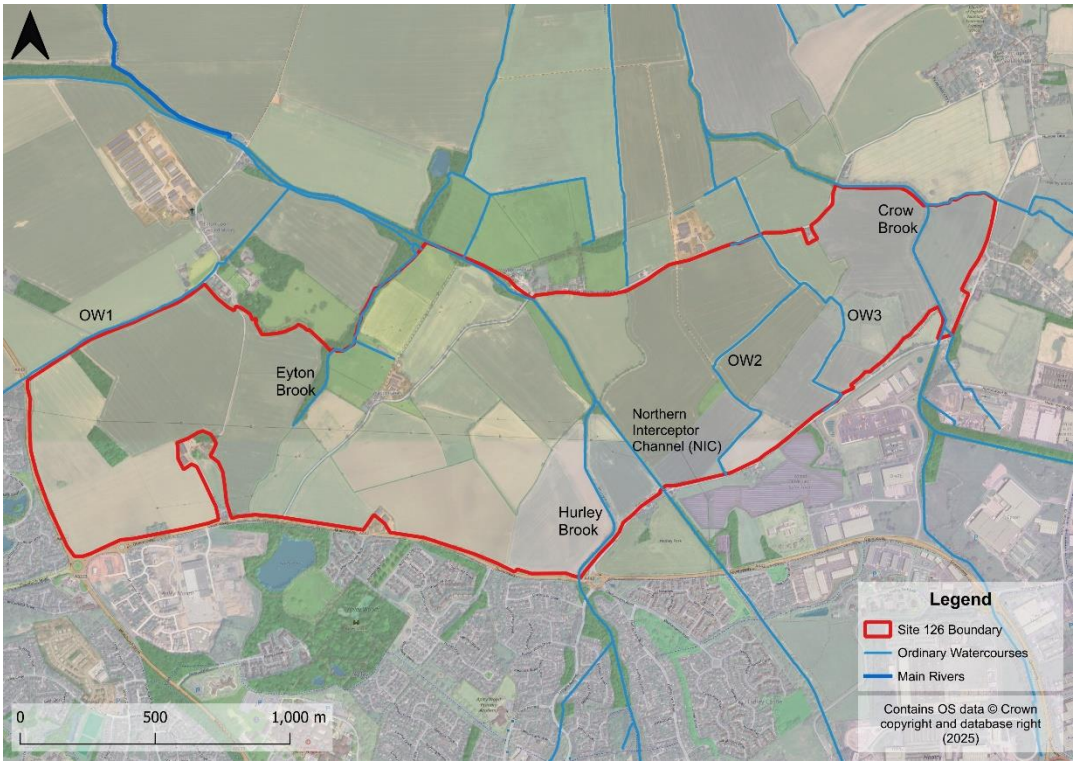
	Telford and Wrekin Council Level 2 Strategic Flood Risk Assessment Detailed Site Summary Tables
Site details	
Site Code	**126**
Address	Land North of A442 Wheat Leasows (Wappenshall)
Area	278.31
Current land use	Greenfield
Proposed land use	Mixed
Flood Risk Vulnerability	More Vulnerable
Sources of flood risk	
Location of the site within the catchment	The site is a proposed Sustainable Urban Extension (SUE) site and is located on the north of the suburbs of Apley and Hadley Castle in Telford. The site is bounded by agricultural fields to the north, Humber Lane to the east, and the A442 to the south and west. An unnamed farmyard is situated in the south-west of the site, with the boundary surrounding the buildings and the southern access route from the A442, thereby excluding these elements from the site. There are 2 Main Rivers nearby and are both north of the northern site boundary: Hurley Brook that flows north-westwards 0.54km away, and Strine Brook, which flows westwards 0.98km away. Wappenshall Lane bisects the site from southeast to northwest.
Topography	The Environment Agency 1m resolution LiDAR shows that the site generally slopes from the southeastern boundary towards the northwestern boundary. The maximum elevation is 73.92mAOD (Above Ordnance Datum) in the southeast, sloping to a minimum elevation of 58.82mAOD in the northwest. In the east of the site, a small mound is located close to the northern border with a maximum elevation of 62.61mAOD. LiDAR also indicates the presence of several drainage ditches throughout the site.
Existing drainage features	Watercourse mapping (figure 1) shows that there are several ordinary watercourses which flow through the site. The primary ordinary watercourses across the site, including Eyton Brook, Hurley Brook, the Northern Interceptor Channel (NIC) and Crow Brook. The Eyton Brook is in the western section of the site, east of Wappenshall Farm and parallel to Wappenshall Lane. It is a tributary of the Hurley Brook and flows in a northern direction and is culverted underneath the NIC. The Hurley Brook and NIC run parallel, flowing north through the centre of the site. Historically the NIC was the Trench Branch of the Shrewsbury Canal, but now acts as a surface water sewer, conveying surface water flows from Telford.

	Crow Brook is a tributary of the Strine Brook and flows north though the northeastern corner of the site.  *Figure 1: Ordinary watercourses flowing throw Site 126* The mapping also shows three unnamed ordinary watercourses which flow through the site, labelled as OW1, OW2 and OW3 on the figure 1 (above). Ordinary watercourse 1 flows along the boundary of the site in the north-west corner in an eastern direction. Both ordinary watercourses 2 and 3 are in the eastern section of the site, and appear to originate along the southern boundary before converging and flowing north and meeting with the Crow Brook.
Fluvial	**The proportion of site at risk FMFP:** FZ3 – 4% FZ2 – 9% FZ1 – 91% *The Flood Zone values quoted show the percentage of the site at flood risk from that particular Flood Zone/event, including the percentage of the site at flood risk at a higher risk zone. This is because the values quoted are the area covered by each Flood Zone/extent within the site boundary. For example: Flood Zone 2 includes Flood Zone 3. Flood Zone 1 is the remaining area outside Flood Zone 2 (FZ2+ FZ1 = 100%).* **Available data:** The Environment Agency's Flood Map for Planning has been used for this assessment. **Flood characteristics:** The Environment Agency Flood Map for Planning shows that there are areas of the site that are within Flood Zone 2 and Flood Zone 3.

	Flood Zone 2 follows the flow path of Hurley Brook but is not contained within its banks. Three additional flow paths stem from the central one. Two of these are located in the north of the site, flowing in a northeasterly and northwesterly direction. The third is located in the south of the site, flowing in a northeasterly direction. Flood Zone 2 also follows the flow path of Crow Brook but is not contained within its banks. This flooding inundates the northeastern corner of the site. Flood Zone 3 follows the flow path of Hurley Brook but is not contained within its banks. The flow path to the south is not present in Flood Zone 3. The two branching flow paths in the north are present but inundate to a lesser extent when compared to Flood Zone 2. The flow path moving in a northwesterly direction does not pass Wappenshall Lane as it does in Flood Zone 2. Flood Zone 3 also follows the flow path of Crow Brook but is not contained within its banks. The extent of this flooding is only slightly less extensive than Flood Zone 2. **2008 SFRA Modelling:** Modelling undertaken on the Hurley Brook and the Crow Brook for the Telford and Wrekin SFRA in 2008 shows a minimal increase in the fluvial flood extents presented by Environment Agency's Flood Map for Planning mapping. The hydraulic modelling for the Hurley Brook shows an area of fluvial flooding between the Hurley Brook and the NIC as well as an additional flow route east of this section flowing north. There is an increase in fluvial flood extents along the section of the Crow Brook which flows though the site, however the modelling shows that the majority of the flooding is close to the channel, with the exception of an increase in flood extent in the northern corner. Due to the limitations of the 2008 modelling it is recommended that that site specific hydraulic modelling is completed for this site.
Surface Water	**Proportion of site at risk (RoFSW):** **3.3% AEP – 2%** Max depth – 0.30 – 0.60m Max velocity – 0.50 – 1.00m/s **1% AEP – 2%** Max depth – 0.30 – 0.60m Max velocity – 0.50 – 1.00m/s **0.1% AEP – 8%** Max depth – 0.60 – 0.90m Max velocity – 1.00 – 2.00m/s **Description of surface water flooding:** The Environment Agency Risk of Flooding from Surface Water (RoFSW) mapping shows that the site is at risk during the 3.3%, 1% and 0.1% AEP flood events. It is assumed that the majority of this flood risk is associated with the multiple ordinary watercourses and drainage ditches throughout the site. During the 3.3% AEP flood event 2% of the site is at risk of surface water flooding, with anticipated maximum depths of 0.30 – 0.60m and maximum velocities of 0.50 – 1.00m/s. The majority of this flooding is designated as

	'moderate – danger for some', although a small extent of ponding west of Wappenshall Lane is designated as 'significant – danger for most'. The majority of this surface water flooding is contained within the ordinary watercourses and drainage ditches. However, there is ponding in the northwest corner of the site which is not contained in the unnamed ordinary watercourse that flows along the eastern portion of the northern boundary. A large extent of ponding occurs south of Wappenshall Lane, just south of the northern boundary and a separate area of ponding just south of Wappenshall Farm. These areas of ponding have a maximum depth and velocity of 0.30-0.60m and 0.25-0.50m/s respectively. Ponding also occurs in the northeastern corner of the site, west of the fourth unnamed watercourse and west of Crow Brook. During the 1% AEP surface water event, the extent of flooding only increases very slightly, with the percentage of the site at risk from surface water flooding remaining at 2%. Similarly, the anticipated depths and velocities are the same as for the 3.3% AEP flood event, remaining at of 0.30 – 0.60m 0.50 – 1.00m/s respectively. As in the 3.3% AEP event, surface water flooding is largely contained in the ordinary watercourses and drainage ditches. The extent of some of the ponding increases very slightly. New ponding, associated with localised low point emerge throughout the site. For the 0.1% AEP event, the extent of the site at risk from surface water flooding increases to 8% of the site. Maximum depths and velocities increase to 0.60 – 0.90m and 1.00-2.00m/s respectively. This gives the flooding a hazard rating of 'significant – danger for most'. The surface water surrounding ordinary watercourses is no longer entirely contained by the banks and greatly inundates the site surrounding these watercourses. The ponding south of Wappenshall Lane becomes a flow path connected to Hurley Brook. There is significant ponding in the centre of the northern boundary associated with Ordinary Watercourse 2. A flow path emerges in the centre of the site, east of Wappenshall farm, flowing in a northerly direction.
Reservoir	The Environment Agency's statutory reservoir flooding maps show a significant section in central and eastern areas of the site is at risk of flooding from statutory reservoirs in both dry day and wet day scenarios. Northward flows from three separate breaches in the southern boundary enables widespread inundation across to the northern boundary in both scenarios. This is due to the proximity of two reservoirs: Apley Pool approximately 70m south of the southern boundary and Middle Pool approximately 2.50km southeast of the site. Although the extents are larger in the wet day scenario, the flow paths of the two scenarios are largely similar. The only exception to this is that the wet day scenario creates a flow path to the east of the site which runs along the eastern boundary.
Groundwater	Most of the site is at a negligible risk of groundwater flooding meaning groundwater levels are at least 5m below the ground's surface. However, some of the site is at a moderate risk of groundwater flooding meaning the groundwater levels are between 0.025m and 0.50m below ground surface. This includes a large area near the centre of the site extending from the southern site boundary almost to the northern site boundary near Wappenshall Lane. Some small areas in the northwestern corner of the site, and along the southern site boundaries are classifies as having a moderate risk from groundwater flooding also. Small areas in the west also have a low risk of groundwater flooding meaning groundwater levels are between 0.5m and 5m below ground surface.

Sewers	Severn Trent Water's Sewer Flooding register was not available for this assessment.
Minewater Flooding	Mapping from the Coal Authority shows that the site falls within the area of a coal mine, and there is a risk of groundwater emergence. Further investigation, including ground investigation will be required as part of a site specific flood risk assessment.
Flood history	The site is not within the Environment Agency's recorded flood outlines dataset. Flood records provided by the Lead Local Flood Authority (LLFA) show that the site is in an area where there are 10 records of flooding.
Cumulative Impact Assessment	<u>East Section</u> Catchment – Red Strine - source to River Strine Rank – High <u>West Section</u> Catchment – Ketley Brook (inc. Hurley Brook) - source to Ketley Sands Flood Meadow Rank – High
Flood risk management infrastructure	
Defences	The Environment Agency AIMS dataset shows that the site is not protected by any formal flood defences.
Residual risk	Unnamed watercourse 1 is culverted under the A442 but due to the direction of flow, this is unlikely to pose a residual to the risk because if the culvert were to become blocked, water would build up to the west of the A442. Unnamed watercourse 2 is unlikely to pose any residual risk to the site. Hurley Brook is culverted twice, once prior to entering the site, and once as it exits the site. Due to the direction of flow, the southern culvert is not likely to pose a residual risk of flooding as any backed up water would inundate south of the A442. The northern culvert does pose a residual risk of flooding to the site as if this were to become blocked then water would back up and inundate the centre of the northern boundary. Unnamed watercourse 4 is culverted under an unnamed road along the southern boundary. This is unlikely to pose a residual risk due to the direction of flow. If the culvert were to become blocked it is likely that the south of the unnamed road would be inundated. The unnamed watercourse that is a convergence of Unnamed Watercourses 4 and 5 is culverted Wappenshall Lane. If this culvert were to become blocked then the northeast of the site would be inundated with water, posing a residual risk. The site is also at risk from flooding in the unlikely breach of failure of Apley Pool and Middle Pool.
Emergency planning	
Flood warning	The site is not within an Environment Agency Flood Alert or Flood Warning Area.
Access and egress	Vehicular access and egress to this site is possible through several routes. An access road along the northern boundary provides access and egress from an unnamed road branching eastward from Eyton Hall, east of the A442. During the 3.3% AEP event this access route is not inundated by surface water. During the 1% AEP event there is some inundation of the road east of the A442 with a

	maximum depth and velocity of 0.15-0.30 and 0.50-1.00m/s respectively, giving it a hazard score of 'low- caution'. This indicates that safe access and egress could still be possible. During the 0.1% AEP event, the extent of surface water flooding on the road east of the A442 increases slightly. The maximum depth and velocity remains at 0.15-0.30 and 0.50-1.00m/s respectively. Wappenshall Lane bisects the site, thus providing access from the south, branching north off the A442, and also from the north. During the 3.3% AEP event, surface water inundates Wappenshall Lane to the north of the site with maximum depths and velocities of 0.30-0.60m and 1.00-2.00m/s respectively. This flooding has a hazard score of 'significant – danger to most'. Therefore, safe access and egress would not be possible from the northern end of Wappenshall Lane. At the southern end of Wappenshall Lane access and egress is possible as the lane remains clear from flooding until it reaches Wappenshall Farm. There is inundation of the A442, east of where Wappenshall Lane enters the site. However, the west of the A442 remains clear of surface water flooding and therefore access and egress to the site is still possible via this route. During the 1% AEP event, access and egress is still possible via the southern end of Wappenshall Lane, so long as it is accessed via the west. During the 0.1% AEP event, roads approaching Shawbirch roundabout to the west of the A442 are flooded to a maximum depth and velocity of 0.60-0.90m and 1.00-2.00m/s making safe access and egress unlikely. An access road branches to the south of Wappenhall Lane (which comprises the central portion of the northern boundary of the site) facilitating access and egress in the north of the site. During the 3.3% AEP surface water event there is extensive surface water flooding along this portion of Wappenhall Lane, associated with unnamed ordinary watercourse 4. This flooding has a maximum depth of 0.15-0.30m and a maximum velocity of 0.50-1.00m/s. This flooding has a hazard score of 'moderate – danger to some'. During the 1% AEP event the flooding inundates the access road. The maximum depth and velocity of this flooding increases to 0.30-0.60m and 0.50-1.00m/s respectively. This flooding has a hazard score of 'moderate – danger to some'. During the 0.1% AEP event the maximum depth remains at 0.30-0.60m, but the maximum velocity increases to >2.00m/s. This flooding has a hazard score of 'significant – danger to most'. Therefore, safe access and egress is not possible via this route in any surface water AEP event. In the northeast corner of the site an access road provides access and egress from Humber Lane. During the 3.3% AEP surface water event there is a small extent of inundation of Humber Lane, directly adjacent to the access road. This has a maximum depth and velocity of 0.15-0.30m and 0.25-0.50m/s respectively and has a hazard rating of 'low- caution'. During the 1% AEP event Humber Lane is flooded more extensively and the flooding inundates the access road. The maximum depth and velocity of this is 0.15-0.30m and 0.50-1.00m/s respectively. This flooding has a hazard rating of 'moderate – danger to some'. During the 0.1% AEP event, Humber Lane is almost completely inundated to a maximum depth and velocity of 0.60-0.90m and >2.00m/s respectively. This flooding has a hazard rating of 'significant – danger for most'. Therefore, safe access and egress via this route may only be possible in the 3.3% AEP event. Along the southern boundary an access road branches off an unnamed road, opposite Horntonwood West Industrial Park. During the 3.3% surface water AEP

	event, the access road and unnamed road remain clear of surface water flooding, making the route safe for access and egress. During the 1% AEP event, there is a small extent of surface water flooding on the unnamed road, both north and south of the access road. This flooding has a maximum depth of 0.15-0.30m and a maximum velocity of 0.50-1.00m/s and has a hazard rating of 'low- caution'. During the 0.1% AEP event, the flooding to the north and south of the access road remains at the same depth as in the 1% AEP event (0.15-0.30m). However, the maximum velocity of this water increases to 1.00-2.00m/s. This flooding has a hazard score of 'moderate - danger for some'. Therefore, it is likely that safe access and egress is possible during all AEP events. A site-specific Flood Risk Assessment should be undertaken to evaluate accessibility to pedestrians and vehicles. Developers must demonstrate that safe access and egress in the 0.1% AEP surface water event, including allowance for climate change. Developers must also give consideration to safe access and egress of the site during a fluvial flood event. Given the significant flood depths and hazards associated with surface water flooding on site, a flood warning and evacuation plan should be prepared for the site.
Dry Islands	The site is not located within a dry island during any modelled flood event.
Climate change	
Implications for the site	**Management Catchment: Severn Middle Shropshire** Increased storm intensities due to climate change may increase the extent, depth, velocity, hazard, and frequency of both fluvial and surface water flooding. **Fluvial Flooding:** The site is not covered by any hydraulic modelling, however, climate change uplift of 35% has been applied to the Environment Agency Flood Map for Planning. The mapping shows that the climate change uplift is almost identical to Flood Zone 2, demonstrating that climate change will have an impact on fluvial flooding, however, this should be confirmed with hydraulic models. **Surface Water:** Climate change is predicted to increase rainfall intensity in the future by a range of between 30% and 45% (the recommended precautionary sensitive range for 2061 to 2125). This will increase the likelihood, frequency and extent of surface water flooding. The 3.3% AEP Risk of Flooding from Surface Water dataset has been re-run with a 25% climate change allowance. The 1% AEP Risk of Flooding from Surface Water dataset has been re-run with a 30% and 45% climate change allowance. The extent of the surface water flood risk for the 3.3% AEP plus 25% climate change allowance is similar to that of the current day 1% AEP event. The extent of the surface water flood risk for the 1% AEP plus 30% climate change allowance is similar to that of the current day 0.1% AEP event. The extent of the surface water flood risk for the 1% AEP plus 45% climate change slightly exceeds that of the current day 0.1% AEP event. This shows that climate change will impact the flood risk of the site.

Requirements for surface water drainage	

Broad-scale assessment of potential SuDS	**Geology & Soils**
	Geology at the site consist of:
	• Bedrock
	  ○ Bridgnorth Sandstone Formation – Sandstone (central and western areas of the site)
	  ○ Halesowen Formation - Mudstone, siltstone and sandstone (eastern areas)
	  ○ Salop Formation - Mudstone, sandstone and conglomerate (north-western area)
	• Superficial deposits
	  ○ Glaciofluvial Deposits, Devensian – Sand and gravel (western, southern and north-eastern areas of the site)
	  ○ Glaciolacustrine Deposits, Devensian - Clay and silt (northern and south-eastern areas)
	  ○ Alluvium - Clay, silt, sand and gravel (a small area in the north)
	Soils at the site consist of:
	• Slightly acid loamy and clayey soils with impeded drainage (southern and western areas of the site)
	• Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils (central northern and eastern areas)
	
	Sustainable Drainage Systems (SuDS)
	The Telford and Wrekin Sustainable Drainage Systems Handbook has more guidance on the implementation of SuDS for all types of development.
	• Groundwater levels are indicated to be at least 5m below ground level and groundwater flooding is not likely, however below ground development such as basements may still be susceptible to groundwater flooding.
	• BGS data indicates that the underlying geology is sandstone, mudstone, siltstone, sand, gravel, clay, silt, and conglomerate which is likely to be with highly variable permeability. This should be confirmed through infiltration testing. Off-site discharge in accordance with the SuDS hierarchy may be required to discharge surface water runoff from the site.
	• The site is not located within a Groundwater Source Protection Zone and there are no restrictions over the use of infiltration techniques with regard to groundwater quality.
	• The site is not located within a historic landfill site.
	• Surface water discharge rates should not exceed the existing greenfield runoff rates for the site. Opportunities to further reduce discharge rates should be considered and agreed with the LLFA. It may be possible to reduce site runoff by maximising the permeable surfaces on site using a combination of permeable surfacing and soft landscaping techniques.
	• The Risk of Flooding from Surface Water (RoFSW) mapping indicates the presence of surface water flow paths and ponding during the 3.3% AEP event. Existing flow paths should be retained and integrated with blue-green infrastructure and public open space.
	• If it is proposed to discharge runoff to a watercourse or sewer system, the condition and capacity of the receiving watercourse or asset should be confirmed through surveys and the discharge rate agreed with the asset owner.

Opportunities for wider sustainability and integrated flood risk management	• Implementation of SuDS at the site could provide opportunities to deliver multiple benefits including volume control, water quality, amenity and biodiversity. Proposals to use SuDS techniques should be discussed with relevant stakeholders, Telford and Wrekin Council (as Lead Local Flood Authority) and the Environment Agency at an early stage to understand possible constraints. • The ordinary watercourse and the natural surface water flow routes should be maintained and enhanced within the development site and incorporated into the surface water drainage strategy. • Above ground SuDS should be shallow and/or lined to ensure that groundwater does not inundate the features during high groundwater events. • Development at this site should not increase flood risk either on or off site. The design of the surface water management proposals should take into account the impacts of future climate change over the projected lifetime of the development. • Opportunities to incorporate filtration techniques such bioretention areas or rain gardens must be considered. Consideration should be made to the existing condition of receiving waterbodies and their Water Framework Directive objectives for water quality. The use of multistage SuDS treatment will clean and improve water quality of surface water runoff discharged from the site and reduce the impact on receiving water bodies. • Opportunities to incorporate source control techniques such as green roofs, permeable surfaces and rainwater harvesting must be considered in the design of the site. • The potential to utilise conveyance features such as swales to intercept and convey surface water runoff should be considered. Conveyance features should be located on common land or public open space to facilitate ease of access. Where slopes are >5%, features should follow contours or utilise check dams to slow flows.
NPPF and planning implications	
Exception Test requirements	The site is classified as 'More Vulnerable' and is within Flood Zones 1, 2 and 3, it is at risk from mine water flooding, low risk from surface water flooding, and the south of the site is at moderate risk from groundwater flooding. The Sequential Test must be passed, the criteria for which is highlighted within the Level 1 SFRA. The Exception Test is not required under the NPPF. However, it must be shown that the development will be safe for its lifetime and the risk of flooding from all sources can be managed through a sequential approach to design.
Requirements and guidance for site-specific Flood Risk Assessment	**Flood Risk Assessment:** • Consultation with Telford and Wrekin Council, Severn Trent Water, and the Environment Agency should be undertaken at an early stage. • Developers should consult with Severn Trent Water to ensure that the development aims to help achieve the targets of the Drainage and Wastewater Management Plan. • Any FRA should be carried out in line with the National Planning Policy Framework and Flood Risk and Coastal Change Planning Practice Guidance. **Guidance for site design and making development safe:** • The developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its

	lifetime. It is for the applicant to show that the development meets the objectives of the NPPF's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development. (Paragraph 052 Flood Risk and Coastal Change PPG).
	• The risk from surface water flow routes should be quantified as part of a site-specific FRA, including a drainage strategy, so runoff magnitudes from the development are not increased by development across any ephemeral surface water flow routes. A drainage strategy should help inform site layout and design to ensure runoff rates are as close as possible to greenfield rates.
	• Should built development be proposed within the design surface water flood extent, careful consideration will need to be given to flood resistance and resilience measures.
	• The risk of flooding from groundwater must be investigated and must be supported by groundwater level monitoring
	• Flood resilience and resistance measures should be implemented where appropriate during the construction phase, e.g. raising of floor levels. These measures should be assessed to make sure that flooding is not increased elsewhere.
	  ○ raise them as much as possible.
	  ○ include extra flood resistance and resilience measures.
	• Other examples of flood resistance and resilience measures include:
	  ○ using flood resistant materials that have low permeability to at least 600mm above the estimated flood level
	  ○ making sure any doors, windows or other openings are flood resistant to at least 600mm above the estimated flood level
	  ○ by raising all sensitive electrical equipment, wiring and sockets to at least 600mm above the estimated flood level.

Key messages	
The site is classified as 'More Vulnerable' and is within Flood Zones 1, 2 and 3. It is at risk from mine water flooding, low risk from surface water flooding, and the south of the site is at moderate risk from groundwater flooding. Development is likely to be able to proceed if: • Site-specific FRA demonstrates that the site is not at an increased risk of flooding in the future and that development of the site does not increase the risk of surface water flooding on the site and to neighbouring areas. • A carefully considered and integrated flood resilient and sustainable drainage design is put forward, with development steered away from the areas identified to be at risk of surface water flooding across the site. • Safe access and egress can be demonstrated in the surface water plus climate change events. This includes measures to reduce flood risk along these routes such as raising access, but not displacing floodwater elsewhere. • If flood mitigation measures are implemented then they are tested to check that they will not displace water elsewhere (for example, if land is raised to permit development on one area, compensatory flood storage will be required in another)	
Mapping Information	
Flood Zones	Flood Zones 2 and 3 have been taken from the Environment Agency's Flood Map for Planning mapping.

	The hydraulic modelling completed on the Hurley Brook and Crow Brook by Halcrow Group (2008) was used for this assessment.
Climate change	Climate change allowances have been applied Flood Zones 2 and 3 of the Environment Agency's Flood Map for Planning mapping. The Hurley Brook and Crow Brook hydraulic models (Halcrow Group, 2008) were uplifted by 20% climate change allowance as per guidance at the time. Climate change allowances have been applied to the Environment Agency's Risk of Flooding from Surface Water (RoFSW) map to indicate the impact on surface water flood risk.
Fluvial extents, depth, velocity and hazard mapping	Hurley Brook and Crow Brook hydraulic modelling undertaken by Halcrow Group (2008).
Surface Water	The Environment Agency's Risk of Flooding from Surface Water (RoFSW) dataset has been used for this assessment.
Surface water depth, velocity and hazard mapping	The Environment Agency's Risk of Flooding from Surface Water (RoFSW) dataset has been used for this assessment.
Groundwater	JBA Consulting Ltd. Groundwater Flood Mapping (2017)

	Telford and Wrekin Council Level 2 Strategic Flood Risk Assessment Detailed Site Summary Tables
Site details	
Site Code	**233**
Address	Land South of A518, Newport
Area	6.67 ha
Current land use	Greenfield
Proposed land use	Mixed Use
Flood Risk Vulnerability	More Vulnerable
Sources of flood risk	
Location of the site within the catchment	The site is located to the south of Newport. It is bounded by the A518 to the north, Pave Lane to the west and fields to the east and south. The nearest Main River is The Strine Brook, located approximately 1.6km north of the site.
Topography	The Environment Agency 1m resolution LiDAR shows that the site slopes from a maximum elevation of 84.78mAOD (Above Ordnance Datum) on the southern boundary to a minimum elevation of 80.60mAOD on the northern boundary.
Existing drainage features	Mapping does not identify any existing watercourses within the site boundary. However, mapping shows a small pond to the along the eastern boundary of the site.
Fluvial	**The proportion of site at risk FMFP:** FZ3 – 0% FZ2 – 0% FZ1 – 100% **Available data:** The Environment Agency's Flood Map for Planning has been used for this assessment. **Flood characteristics:** The site is located in Flood Zone 1 and is at negligible risk of fluvial flooding.
Surface Water	**Proportion of site at risk (RoFSW):** **3.3% AEP** – 4% Max depth – 0.15-0.30m Max velocity – 0.25-0.50m/s **1% AEP** – 9% Max depth – 0.15-0.30m Max velocity – 0.25-0.50m/s **0.1% AEP** – 21% Max depth – 0.60-0.90m Max velocity – 0.50-1.00m/s

	Description of surface water flooding: The Environment Agency Risk of Flooding from Surface Water (RoFSW) mapping shows that surface water flooding inundates the site during every AEP event. During the 3.3% AEP event 4% of the site is inundated, along the northern and eastern boundaries. This flooding has a maximum depth of 0.30m and a maximum velocity of 0.50m/s. This gives the flooding a classification of 'moderate – danger for some'. During the 1% AEP surface water event, the extent of the flooding increases to 9%, remaining along the northern and eastern boundaries. A very small extent of ponding emerges in the centre of the site. The maximum depth and velocity of this flooding remains at 0.30m and 0.50m/s respectively. This gives the flooding a classification of 'moderate – danger for some'. During the 0.1% AEP event, the extent of the flooding increases to 21% of the site. This flooding remains in the northern half of the site, with large areas of ponding along the northern and eastern boundaries. The depth and the velocity of this flooding increases to 0.90m and 1.00m/s respectively. This gives the flooding a classification of 'significant – danger for most'.
Reservoir	The Environment Agency's statutory reservoir flooding maps show the site is not at risk of flooding from any statutory reservoirs.
Groundwater	The majority of the site has a moderate risk of groundwater flooding meaning groundwater levels between 0.025m and 0.5m below ground surface.
Sewers	Severn Trent Water's Sewer Flooding register indicates that the site is in the Newport (WRW) sewage treatment catchment. The site has a high potential impact on sewerage infrastructure and a low potential impact of surface water sewerage infrastructure based on assumed runoff from the site of 5l/s/ha.
Minewater Flooding	Mapping from the Coal Authority shows that the site does not fall within the area of a coal mine, therefore it can be considered that there is a low risk of groundwater emergence.
Flood history	The site is not within the Environment Agency's recorded flood outlines dataset. Flood records provided by the Lead Local Flood Authority (LLFA) show that the site is not in an area with previous flood records.
Cumulative Impact Assessment	Catchment – Strine Brook - source to Wall Brook Rank – Medium
Flood risk management infrastructure	
Defences	The Environment Agency AIMS dataset shows that the site is not protected by any formal flood defences.
Residual risk	The site is at residual risk of flooding from the small pond, just beyond the eastern boundary. This pond could exceed its capacity and cause flooding to the site.
Emergency planning	
Flood warning	The site is not within an Environment Agency Flood Alert or Flood Warning Area.
Access and egress	Vehicular access is assumed to be possible to the south and north of the western boundary of the site, from access roads off Pave Lane. <u>South of western boundary</u> During the 3.3% AEP event there is no surface water flooding along Pave Lane and so safe access and egress will still be possible via this route.

	During the 1% AEP event, there is no surface water flooding to the south of Pave Lane and so safe access and egress is still possible. During the 0.1% surface water AEP event, a small extent of flooding inundates Pave Lane, at the entrance of the access road. This flooding has a maximum depth and velocity of 0.00-0.15m and 1.00-2.00m/s respectively. This flooding is classified as 'low-caution' and therefore vehicular access and egress is likely still possible. <u>North of western boundary</u> During the 3.3% AEP event there is surface water flooding along Pave Lane and so safe access and egress will still be possible via this route. During the 1% surface water AEP event, there is flooding on Pave Lane, at the entrance of the access road. This flooding has a maximum depth and velocity of 0.15-0.30m and 0.25-0.50m/s respectively. This flooding is classified as 'low-caution' and therefore vehicular access and egress is likely still possible. During the 0.1% surface water AEP event, the flooding at the entrance of the access road increases in maximum depth and velocity to of 0.15-0.30m and 1.00-2.00m/s respectively. This flooding is classified as 'moderate – danger for some' and therefore vehicular access and egress is not likely to be possible via this route.
Dry Islands	The site is not located within a dry island during any modelled flood event.
Climate change	
Implications for the site	**Management Catchment: Severn Middle Shropshire** **Fluvial Flooding:** The site is not covered by any available detailed hydraulic modelling, however, climate change uplift of 35% has been applied to the Environment Agency Flood Map for Planning. The mapping shows that the site will remain in Flood Zone 1, this indicates that the impact of climate change on future risk of fluvial flooding to the site is negligible. **Surface Water:** Climate change is predicted to increase rainfall intensity in the future by a range of between 30% and 45% (the recommended precautionary sensitive range for 2061 to 2125). This will increase the likelihood, frequency and extent of surface water flooding. The 3.3% AEP RoFSW dataset has been re-run with a 25% climate change allowance. The 1% AEP RoFSW dataset has been re-run with a 30% and 45% climate change allowance. The extent of the surface water flood risk for the 3.3% AEP plus 25% climate change allowance is similar to that of the current day 1% AEP event. The extent of the surface water flood risk for the 1% AEP plus 30% climate change allowance is similar to that of the current day 0.1% AEP event. The extent of the surface water flood risk for the 1% AEP plus 45% climate change slightly exceeds that of the current day 0.1% AEP event. This shows that climate change will impact the flood risk of the site.

Requirements for surface water drainage	

Broad-scale assessment of potential SuDS	**Geology & Soils**
	Geology at the site consist of:
	• Bedrock
	  ○ Chester Formation – Sandstone and conglomerate
	• Superficial deposits
	  ○ Diamicton formation– till, devesian
	Soils at the site consist of:
	• Freely draining, slightly acidic sandy soils (northern half of the site)
	• Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils (southern half of the site)
	
	Sustainable Drainage Systems (SuDS)
	• Groundwater levels are indicated to be between 0.5 and 5m below ground level and there is a risk of flooding to subsurface assets and below ground development such as basements. Groundwater monitoring is recommended to determine the seasonal variability of groundwater levels, as this may affect the design of the surface water drainage system.
	• BGS data indicates that the underlying geology is sandstone, till, devesian and conglomerate which is likely to be with highly variable permeability. This should be confirmed through infiltration testing. Off-site discharge in accordance with the SuDS hierarchy may be required to discharge surface water runoff from the site.
	• The site is located within a Groundwater Source Protection Zone. Infiltration techniques may not be suitable and should only be used following the granting of any required environmental permits from the Environment Agency for Zones 2, 3 and 4 although it is possible that infiltration may not be permitted. Proposed SuDS should be discussed with relevant stakeholders (LPA, LLFA and EA) at an early stage to understand possible opportunities and constraints.
	• The site is not located within a historic landfill site.
	• Surface water discharge rates should not exceed the existing greenfield runoff rates for the site. Opportunities to further reduce discharge rates should be considered and agreed with the LLFA. It may be possible to reduce site runoff by maximising the permeable surfaces on site using a combination of permeable surfacing and soft landscaping techniques.
	• The Risk of Flooding from Surface Water (RoFSW) mapping indicates the presence of surface water flow paths during the 3.3% AEP events. Existing flow paths should be retained and integrated with blue-green infrastructure.
	• If it is proposed to discharge runoff to a watercourse or sewer system, the condition and capacity of the receiving watercourse or asset should be confirmed through surveys and the discharge rate agreed with the asset owner.

Opportunities for wider sustainability and integrated flood risk management	• Implementation of SuDS at the site could provide opportunities to deliver multiple benefits including volume control, water quality, amenity and biodiversity. Proposals to use SuDS techniques should be discussed with relevant stakeholders, Telford and Wrekin Council (as Lead Local Flood Authority) and the Environment Agency at an early stage to understand possible constraints. • Natural surface water flow routes should be maintained and enhanced within the development site.

	• Above ground SuDS should be shallow and/or lined to ensure that groundwater does not inundate the features during high groundwater events. • Development at this site should not increase flood risk either on or off site. The design of the surface water management proposals should take into account the impacts of future climate change over the projected lifetime of the development. • Opportunities to incorporate filtration techniques such bioretention areas or rain gardens must be considered. Consideration should be made to the existing condition of receiving waterbodies and their Water Framework Directive objectives for water quality. The use of multistage SuDS treatment will clean and improve water quality of surface water runoff discharged from the site and reduce the impact on receiving water bodies. • Opportunities to incorporate source control techniques such as green roofs, permeable surfaces and rainwater harvesting must be considered in the design of the site. • The potential to utilise conveyance features such as swales to intercept and convey surface water runoff should be considered. Conveyance features should be located on common land or public open space to facilitate ease of access. Where slopes are >5%, features should follow contours or utilise check dams to slow flows.
NPPF and planning implications	
Exception Test requirements	The site is classified as 'More Vulnerable' and is within Flood Zone 1. It is at low risk from surface water and groundwater flooding. The Sequential Test must be passed, the criteria for which is highlighted within the Level 1 SFRA. The Exception Test is not required under the NPPF. However, it must be shown that the development will be safe for its lifetime and the risk of flooding from all sources can be managed through a sequential approach to design.
Requirements and guidance for site-specific Flood Risk Assessment	**Flood Risk Assessment:** • Consultation with Telford and Wrekin Council, Severn Trent Water, and the Environment Agency should be undertaken at an early stage. • Developers should consult with Severn Trent Water to ensure that the development aims to help achieve the targets of the Drainage and Wastewater Management Plan. • Any FRA should be carried out in line with the National Planning Policy Framework and Flood Risk and Coastal Change Planning Practice Guidance. **Guidance for site design and making development safe:** • The developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the development meets the objectives of the NPPF's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development. (Paragraph 052 Flood Risk and Coastal Change PPG). • The risk from surface water flow routes should be quantified as part of a site-specific FRA, including a drainage strategy, so runoff magnitudes from the development are not increased by development across any ephemeral surface water flow routes. A drainage strategy should help inform site layout and design to ensure runoff rates are as close as possible to greenfield rates.

	• Should built development be proposed within the design surface water flood extent, careful consideration will need to be given to flood resistance and resilience measures.
	• The risk of flooding from groundwater must be investigated and must be supported by groundwater level monitoring
	• Flood resilience and resistance measures should be implemented where appropriate during the construction phase, e.g. raising of floor levels. These measures should be assessed to make sure that flooding is not increased elsewhere.
	  ○ raise them as much as possible.
	  ○ include extra flood resistance and resilience measures.
	• Other examples of flood resistance and resilience measures include:
	  ○ using flood resistant materials that have low permeability to at least 600mm above the estimated flood level
	  ○ making sure any doors, windows or other openings are flood resistant to at least 600mm above the estimated flood level
	  ○ by raising all sensitive electrical equipment, wiring and sockets to at least 600mm above the estimated flood level.

Key messages

The site is in Flood Zone 1 but is classified as 'More Vulnerable' and is at moderate risk of surface water flooding and moderate risk from groundwater flooding.

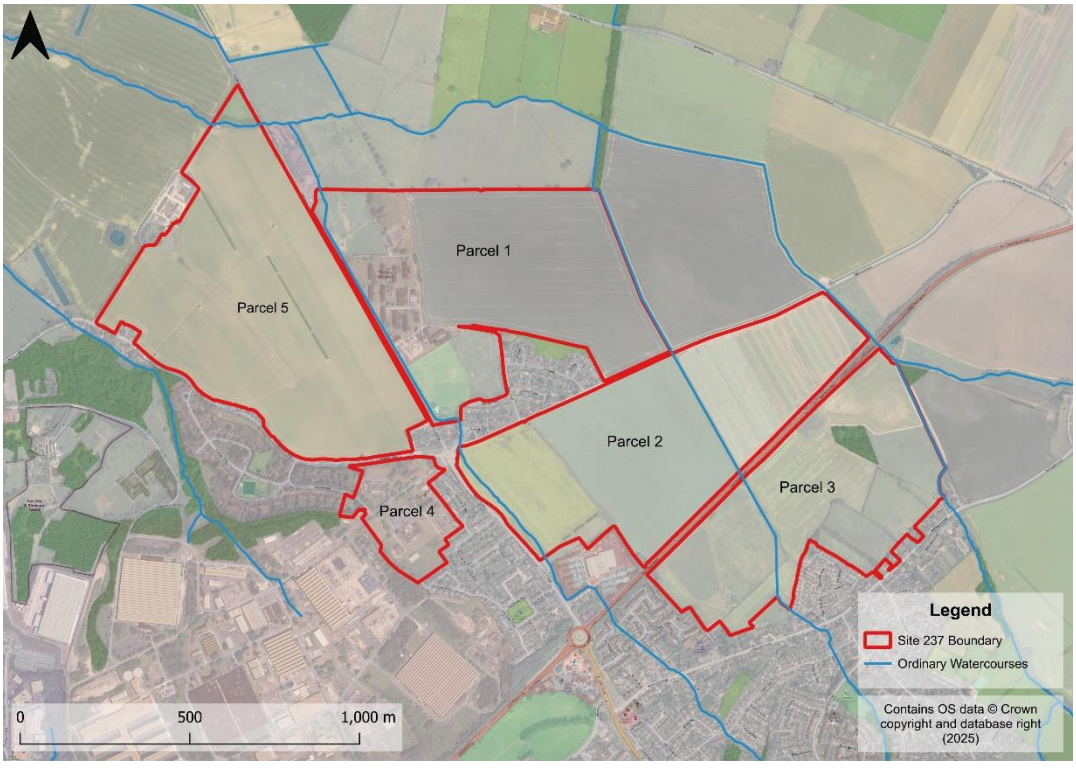
Development is likely to be able to proceed if:

- Site-specific FRA demonstrates that the site is not at an increased risk of flooding in the future and that development of the site does not increase the risk of surface water flooding on the site and to neighbouring areas.
- A carefully considered and integrated flood resilient and sustainable drainage design is put forward, with development steered away from the areas identified to be at risk of surface water flooding across the site.
- Safe access and egress can be demonstrated in the surface water plus climate change events. This includes measures to reduce flood risk along these routes such as raising access, but not displacing floodwater elsewhere.
- If flood mitigation measures are implemented then they are tested to check that they will not displace water elsewhere (for example, if land is raised to permit development on one area, compensatory flood storage will be required in another)

Mapping Information

Flood Zones	Flood Zones 2 and 3 have been taken from the Environment Agency's Flood Map for Planning mapping.
Climate change	Climate change allowances have been applied to the Environment Agency's Risk of Flooding from Surface Water (RoFSW) map to indicate the impact on surface water flood risk.
Fluvial and tidal extents, depth, velocity and hazard mapping	No detailed hydraulic modelling is available for this area.
Surface Water	The Environment Agency's Risk of Flooding from Surface Water (RoFSW) dataset has been used for this assessment.
Surface water depth, velocity and hazard mapping	The Environment Agency's Risk of Flooding from Surface Water (RoFSW) dataset has been used for this assessment.

Groundwater	JBA Consulting Ltd. Groundwater Flood Mapping (2017)

	Telford and Wrekin Council Level 2 Strategic Flood Risk Assessment Detailed Site Summary Tables
Site details	
Site Code	**237**
Address	Land North-East of Muxton
Area	181.80ha
Current land use	Greenfield and Brownfield
Proposed land use	Mixed
Flood Risk Vulnerability	More Vulnerable
Sources of flood risk	
Location of the site within the catchment	The site is a proposed Sustainable Urban Extension (SUE) site and is located north-east of MOD Donnington. The site is also located to north of Telford and the area of Muxton, and for this assessment and assist the description of flood risk the site has been split into five individual parcels of land, as shown in figure 1 below. The first parcel (parcel 1) includes the Parsons Barracks and land to the east, the second section of land (parcel 2) lies between Richards Road and New Trench Road (A518), another parcel of land (parcel 3) is located with to the south of New Trench Road (A518), the smallest parcel of land is brownfield and is located south of Humber Lane (parcel 4), and the last parcel of land is situated between Humber Lane and Donnington Drive (parcel 5).  *Figure 1. Map of numbered parcels*

	There is a network of ordinary watercourses which flow along the site boundary and through sections of the site, they are all tributaries of the Strine Brook, which flows approximately 1.5km north of the site.
Topography	The Environment Agency 1m resolution LiDAR shows that general topography of the SUE site slopes from south-east to north-west. Within the individual parcels of land, the topography differs, within parcel 1, there is an area of land though the centre of the site, which is relatively level, with levels of approximately 66.70mAOD (Above Ordinance Datum). There is a section of lower land in the north-east corner of the parcel with a level of 62.65mAOD. The area of Parsons Barracks and north along Donnington Drive is also shown as lower at 60.50mAOD. Ground levels of parcel 2 fall from the southern boundary to the northern boundary, with the lowest area in the north-east corner of the parcel. The topography along New Trench Road ranges between 72.16mAOD and 66.05mAOD, and from 66.25mAOD and 65.07mAOD along Richards Road. The LiDAR shows that the highest section of land within parcel 3 is along the boundary which runs along Wellington Road, with the highest level of 75.33mAOD. The northern boundary is lower than the site at 65.85mAOD, this is due to the presence of an ordinary watercourse. Parcel 4 is shown to be relatively level compared to the other parcels of land; ground levels range from 67.59mAOD in the eastern corner of the site to 65.47mAOD along the western boundary. Ground levels of parcel 5 range from 66.54mAOD in the south-east corner of the site to 56.90mAOD in the northern corner. The site slopes towards the watercourse, which flows through the northern corner of the site.
Existing drainage features	There is a network of ordinary watercourses and drainage ditches throughout the site. One ordinary watercourse flows north from the east of Muxton, along the eastern boundary of parcel 3, where it is joined by another ordinary watercourse flowing west of Honnington. This watercourse continues to flow north under New Trench Road (A518) and along the eastern boundary of parcel 2, it then flows under Richards Road continuing north, it then takes a sharp left, flowing parallel with parcel 1. The ordinary watercourse then flows under Donnington Drive and through the northern tip of parcel 5, this watercourse is an IDB watercourse. In the centre of parcel 3, an ordinary watercourse flows north, through the centre of parcel 2 and along the eastern boundary of parcel 1 before discharging into the ordinary watercourse north of parcel 1. The third ordinary watercourse, Wall Brook, starts south of parcel 2, along Station Road, flowing north, parallel to the road through the western section of parcels 2 and 1.
Fluvial	**The proportion of site at risk FMFP:** FZ3 – 6% FZ2 – 10% FZ1 – 90%

	The Flood Zone values quoted show the percentage of the site at flood risk from that particular Flood Zone/event, including the percentage of the site at flood risk at a higher risk zone. This is because the values quoted are the area covered by each Flood Zone/extent within the site boundary. For example: Flood Zone 2 includes Flood Zone 3. Flood Zone 1 is the remaining area outside Flood Zone 2 (FZ2+ FZ1 = 100%). **Available data:** The Environment Agency's Flood Map for Planning has been used for this assessment. **Flood characteristics:** The Environment Agency Flood Map for Planning shows that there are areas of the site that are within Flood Zone 2 and Flood Zone 3. There are three distinct areas of fluvial flooding shown by the mapping, which is assumed to be associated with three ordinary watercourse which flow through the site. The flood zones associated with the watercourse which flows through Honnington Grange to the east of the site and then flows in a north-west direction, extend into parcels 2 and 3. For parcel 2 only Flood Zone 2 extends into the site by approximately 25m. However, the north-eastern boundary of parcel 3 is in Flood zone 2 and 3, which extend into the site, towards an area of existing woodland. The watercourse which flows through the middle of the site, has Flood Zones which extend into parcels 1, 2 and 5. The western boundaries of parcels 1 and 2 are shown to be within Flood Zone 3, and the southern half of the eastern boundary of parcel 5 is within Flood Zone 3. For parcel 1, the fluvial flooding is shown to extend into the built-up area of the Parsons Barracks. The largest extent of fluvial flooding is within the south-west corner where Flood Zone 2 extends 240m into the site. At the north-west corner of parcel 2, Flood Zone 3 extends 200m into the site along the northern boundary and Flood Zone 2 extends a further 86m into the site. Along the eastern boundary of parcel 5 the Flood Zones extend approximately 40m into the site. Parcel 4 is bisected by Flood Zones 2 and 3, it appears that the flooding is routed along the road which divides the northern and southern sections of the parcel. The northern corner of parcel 5 is also shown to be within Flood Zones 2 and 3, extending approximately 125m into the site. **2008 SFRA Modelling:** Modelling undertaken on Wall Brook for the Telford and Wrekin SFRA in 2008 shows an increase in the fluvial flood extent presented by Environment Agency's Flood Map for Planning mapping. Parcels 1 and 2 are the parcels shown to be mostly impacted by flooding from the ordinary watercourses flowing through the site. The hydraulic modelling outputs show that the east and west boundaries of parcel 1 are at risk of fluvial flooding. The hydraulic modelling shows an additional flow route in the western section of parcel 2, as well as flooding through the centre of parcel 2, associated with the ordinary watercourse. Due to the limitations of the 2008 modelling it is recommended that that site specific hydraulic modelling is completed for this site.

Surface Water	**Proportion of site at risk (RoFSW):** **3.3% AEP – 2%** Max depth – 0.60 – 0.90m Max velocity – 0.25 – 0.50m/s **1% AEP – 3%** Max depth – 0.90 – 1.20m Max velocity – 0.25 – 0.50m/s **0.1% AEP – 9%** Max depth – 0.90 – 1.20m Max velocity – 1.00 – 2.00m/s **Description of surface water flooding:** The Environment Agency Risk of Flooding from Surface Water (RoFSW) mapping shows that during the 3.3% AEP event, the majority of surface water flooding is associated with the ordinary watercourses which flow through the site parcels. We can therefore use this mapping as a proxy for fluvial flooding from the ordinary watercourses. During the 3.3% AEP event there are small areas of ponding across the site which will be due to areas of lower topography. There is a large area of ponding within parcel 3, in a wooded area, with depths of up to 0.60m. During the 1% AEP event the extent of surface water flooding increases for the area of ponding in parcel 3 in the wooded area, as well as a large area of ponding within the Parsons Barracks in parcel 1 and along the northern boundary of parcel 2. The maximum depth of flooding in the ponded areas is 0.90m and 1.20m in the ordinary watercourses. The extent of surface water flooding increases to 9% of the site for the 0.1% AEP event. The extents of the ponded areas increase, however during this event there are additional areas shown to be at surface water flood risk. Within parcel 1, two flow routes have formed, flowing north towards the ordinary watercourse, with a depth of up to 0.30m and velocity of 2.00m/s. Parallel to the ordinary watercourse through the middle of parcel 2, a flow route has formed during the 0.1% AEP event with a maximum depth and velocity of 0.30m and 1.00m/s, respectively. Surface water flooding to parcel 3 increases the most compared to the other parcels during the 0.1% AEP event. A flow route from the south flows into the site and combines with the flooding originating from the wooded area, forming a flow route along the eastern boundary. This flow route also contributes to an area of flooding in the northern corner of the site, which extends approximately 125m into the site along the northern boundary with a depth of up to 0.90m. There is a second flow route which is generated off site, to the south of Wellington Road, which flows through the centre of the site at a depth of up to 0.30m. The flow route is shown to pond along the northern boundary with New Trench Street where it has been assumed the ordinary watercourse crosses under the road. At the deepest, this area of ponding has an anticipated depth of over 1.20m and a velocity of 1.00m/s. During the 0.1% AEP event the flood extent for parcel 4 is of a similar extent to Flood Zone 2, surface water flow routes are shown to follow the roads and pond in areas of hardstanding within the parcel. The depth of the flow route through the centre of the parcel is up to 0.30m with a velocity of up to 1.00m/s.

	Within parcel 5 during additional areas of ponding have formed during the 0.1% AEP event, including in the centre, in the north-west section of the site and the northern corner, with depths of up to 0.60m. Due to the topography of the parcel, a flow route in the north-eastern section of the site has formed, which flows in a northern direction to the ordinary watercourse flowing through the site, this flow route is relatively shallow in depth with the majority of it at depths of up to 0.15m and a velocity of up to 1.00m/s. To fully understand the fluvial impact from the ordinary watercourses on site, the developer should undertake full hydraulic modelling of the watercourses.
Reservoir	The Environment Agency's statutory reservoir flooding maps show the site is not at risk of flooding from any statutory reservoirs.
Groundwater	Groundwater levels are variable across the site, the majority of the site is at a moderate risk of groundwater flooding meaning groundwater levels are between 0.5m and 0.025m below the ground's surface. There are areas of the site, predominantly the northern boundary of parcel 1 and the south-west boundary of parcel 4 with low risk of groundwater flooding, as groundwater levels anticipated to be between 5m and 0.5m below the ground's surface. The western boundary of parcel 1, north-east corner of parcel 2, the majority of parcel 4 and the southern boundary of parcel 5 are at negligible risk of groundwater flooding meaning groundwater levels are more than 5m below the ground's surface.
Sewers	Severn Trent Water's Sewer Flooding register was not available for this assessment.
Minewater Flooding	Mapping from the Coal Authority shows that the site falls within the area of a coal mine and there is a risk of groundwater emergence. Further investigation, including ground investigation will be required as part of a site specific flood risk assessment.
Flood history	The site is not within the Environment Agency's recorded flood outlines dataset. Flood records provided by the Lead Local Flood Authority (LLFA) show that there are 14 records of flooding within the vicinity of the SUE site.
Cumulative Impact Assessment	<u>Parcels 1, 2, 3 and 5</u> Catchment – Wall Brook - source to Pipe Strine Rank – High <u>Parcel 4</u> Catchment – Red Strine - source to River Strine Rank – High
Flood risk management infrastructure	
Defences	The Environment Agency AIMS dataset shows that the site is not protected by any formal flood defences.
Residual risk	There are multiple culverted sections of the ordinary watercourses through the site, particularly those under New Trench Road and Richards Road, therefore there is a residual risk associated with the potential blockage of these culverts.
Emergency planning	
Flood warning	The western section of parcels 1 and 2 are within the Environment Agency Flood Alert Area for the Tern and Perry catchments.

Access and egress	It has been assumed that as there are multiple parcels of land, there will be a several points of access. The Environment Agency Flood Risk from Surface Water Hazard mapping shows that the majority of areas at risk from surface water have a hazard rating of 'low – caution'. The area of surface water flooding along the western boundary, including the of Parcel 1 has a hazard rating of 'Significant – Dangerous for most people', this is due to the anticipated depth and velocity of the surface water flood risk. The eastern section of the site, within parcels 2 and 3 also have areas which have a hazard rating of 'Significant', as with parcel 1, this is due to the depth and velocity of the area of flooding. A site-specific Flood Risk Assessment should be undertaken to evaluate accessibility to pedestrians and vehicles. Developers must demonstrate that safe access and egress in the 0.1% AEP surface water event, including allowance for climate change. Developers must also give consideration to safe access and egress of the site during a fluvial flood event. Given the significant flood depths and hazards associated with surface water flooding on site, a flood warning and evacuation plan should be prepared for the site.
Dry Islands	The site is not located within a dry island during any modelled flood event.
Climate change	
Implications for the site	**Management Catchment: Severn Middle Shropshire** Increased storm intensities due to climate change may increase the extent, depth, velocity, hazard, and frequency of both fluvial and surface water flooding. **Fluvial Flooding:** The site is not covered by any available detailed hydraulic modelling, however, climate change uplift of 35% has been applied to the Environment Agency Flood Map for Planning. The percentages are approximately equivalent to the Environment Agency's latest Higher Central and Upper climate change allowances for the Severn Middle Shropshire management catchment. The mapping shows that the climate change uplift scenario has a similar extent to the current Flood Zone 2. **Surface Water:** Climate change is predicted to increase rainfall intensity in the future by a range of between 30% and 45% (the recommended precautionary sensitive range for 2061 to 2125). This will increase the likelihood, frequency and extent of surface water flooding. The 1% AEP Risk of Flooding from Surface Water dataset has been re-run with a 45% climate change allowance, and it shows an increase in the extent of surface water flooding to the eastern section of the site, to a similar extent as the current day 0.1% AEP event surface water extent.
Requirements for surface water drainage	

Broad-scale assessment of potential SuDS	**Geology & Soils**
	Geology at the site consist of:
	• Bedrock – Bridgnorth Sandstone Formation – Sandstone.
	• Superficial deposits –
	  ○ Glaciofluvial Deposits, Devensian – Sand and gravel (parcels 1,2, 3 and 5)
	  ○ Till, Devensian – Diamicton (all parcels)

	○ Glaciolacustrine Deposits, Devensian - Clay and silt (parcels 1,2, 3 and 5) ○ Alluvium - Clay, silt, sand and gravel (parcel 1) Soils at the site consist of: • Slightly acid loamy and clayey soils with impeded drainage (parcels 1, 2, 3 and 4) • Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils (parcels 1, 4 and 5) **Sustainable Drainage Systems (SuDS)** The Telford and Wrekin Sustainable Drainage Systems Handbook has more guidance on the implementation of SuDS for all types of development. • In some parcels, groundwater levels are indicated to be less than 0.5m below ground level during a 1% AEP event. Detention and attenuation features should be designed to prevent groundwater ingress from impacting hydraulic capacity and structural integrity. Additional site investigation work may be required to support the detailed design of the drainage system. This may include groundwater monitoring to demonstrate that a sufficient unsaturated zone has been provided above the highest occurring groundwater level. Below ground development such as basements are not appropriate at this site. • The site is located within a Groundwater Source Protection Zone. Infiltration techniques may not be suitable and should only be used following the granting of any required environmental permits from the Environment Agency for Zones 2, 3 and 4, although it is possible that infiltration may not be permitted. Proposed SuDS should be discussed with relevant stakeholders (Telford and Wrekin Council as LPA and LLFA, and the Environment Agency) at an early stage to understand possible opportunities and constraints. • The site is not located within a historic landfill site. • Surface water discharge rates should not exceed pre-development discharge rates for the site and should be designed to be as close to greenfield runoff rates as reasonably practical in consultation with the LLFA. It may be possible to reduce site runoff by maximising the permeable surfaces on site using a combination of permeable surfacing and soft landscaping techniques. • The Risk of Flooding from Surface Water (RoFSW) mapping indicates the presence of many surface water flow paths throughout the site during the 0.1% AEP events. Existing flow paths should be retained and integrated with blue-green infrastructure. • If it is proposed to discharge runoff to a watercourse or sewer system, the condition and capacity of the receiving watercourse or asset should be confirmed through surveys and the discharge rate agreed with the asset owner.
Opportunities for wider sustainability and integrated flood risk management	• Implementation of SuDS at the site could provide opportunities to deliver multiple benefits including volume control, water quality, amenity and biodiversity. Proposals to use SuDS techniques should be discussed with relevant stakeholders, Telford and Wrekin Council (as Lead Local Flood Authority) and the Environment Agency at an early stage to understand possible constraints. • The ordinary watercourse and the natural surface water flow routes should be maintained and enhanced within the development site and incorporated into the surface water drainage strategy.

	• Above ground SuDS should be shallow and/or lined to ensure that groundwater does not inundate the features during high groundwater events. • Development at this site should not increase flood risk either on or off site. The design of the surface water management proposals should take into account the impacts of future climate change over the projected lifetime of the development. • Opportunities to incorporate filtration techniques such bioretention areas or rain gardens must be considered. Consideration should be made to the existing condition of receiving waterbodies and their Water Framework Directive objectives for water quality. The use of multistage SuDS treatment will clean and improve water quality of surface water runoff discharged from the site and reduce the impact on receiving water bodies. • Opportunities to incorporate source control techniques such as green roofs, permeable surfaces and rainwater harvesting must be considered in the design of the site.
NPPF and planning implications	
Exception Test requirements	The site is classified as 'More Vulnerable' and is within Flood Zone 3, 2 and 1 and is at medium risk from surface water flooding. The Local Authority will need to confirm that the Sequential Test has been carried out in line with national guidelines. The Sequential Test will need to be passed before the Exception Test is applied.
Requirements and guidance for site-specific Flood Risk Assessment	**Flood Risk Assessment:** • Consultation with Telford and Wrekin Council, Severn Trent Water, and the Environment Agency should be undertaken at an early stage. • Developers should consult with Severn Trent Water to ensure that the development aims to help achieve the targets of the Drainage and Wastewater Management Plan. • Any FRA should be carried out in line with the National Planning Policy Framework and Flood Risk and Coastal Change Planning Practice Guidance. **Guidance for site design and making development safe:** • The developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the development meets the objectives of the NPPF's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development. (Paragraph 052 Flood Risk and Coastal Change PPG). • The risk from surface water flow routes should be quantified as part of a site-specific FRA, including a drainage strategy, so runoff magnitudes from the development are not increased by development across any ephemeral surface water flow routes. A drainage strategy should help inform site layout and design to ensure runoff rates are as close as possible to greenfield rates. • Should built development be proposed within the design surface water flood extent, careful consideration will need to be given to flood resistance and resilience measures. • The risk of flooding from groundwater must be investigated and must be supported by groundwater level monitoring • Flood resilience and resistance measures should be implemented where appropriate during the construction phase, e.g. raising of floor levels.

	These measures should be assessed to make sure that flooding is not increased elsewhere. ○ raise them as much as possible. ○ include extra flood resistance and resilience measures. • Other examples of flood resistance and resilience measures include: ○ using flood resistant materials that have low permeability to at least 600mm above the estimated flood level ○ making sure any doors, windows or other openings are flood resistant to at least 600mm above the estimated flood level ○ by raising all sensitive electrical equipment, wiring and sockets to at least 600mm above the estimated flood level.

Key messages

Areas of the site are within Flood Zone 3 and 2, at medium risk of surface water flooding and high risk of groundwater flooding.

Development is likely to be able to proceed if:

- The Exception Test shall be undertaken and passed. The majority of the site is shown to be at risk during the design fluvial and surface water events. If the Exception Test is failed, development will not be able to be proceed.
- A site-specific Flood Risk Assessment that demonstrates that site users will be safe in the 0.1% surface water AEP event, and the 0.1% AEP fluvial event, plus an allowance for climate change. This will need to show that the site is not at an increased risk of flooding in the future and the development of the site does not increase the risk of surface water flooding on the site and to neighbouring properties.
- A carefully considered and integrated flood resilient and sustainable drainage design is put forward, including a site-specific Surface Water Drainage Strategy, and SuDS maintenance and management plan and supported by detailed hydraulic modelling (as above), with development to be steered away from the areas identified to be at highest risk of surface water flooding within the site. This is in line with the sequential approach to site layout.
- Ensure that safe access and egress can be provided for the 0.1% AEP surface water, and 1% fluvial events, including an allowance for climate change. As safe access and egress are likely to be impossible in the design event, a Flood Warning and Evacuation Plan should be prepared which considers the likely onset and duration of flooding and demonstrates how residents can safely be evacuated and/or shelter safely in situ during such an event.
- If flood mitigation measures are implemented then they are tested to ensure that they will not displace water elsewhere (for example, if land is raised to permit development on one area, compensatory flood storage will be required in another).

Mapping Information

Flood Zones	Flood Zones 2 and 3 have been taken from the Environment Agency's Flood Map for Planning mapping. The hydraulic modelling completed on the Wall Brook by Halcrow Group (2008) was used for this assessment.
Climate change	Climate change allowances have been applied Flood Zones 2 and 3 of the Environment Agency's Flood Map for Planning mapping. Wall Brook hydraulic modelling (Halcrow Group, 2008) was uplifted by 20% climate change allowance as per guidance at the time.

	Climate change allowances have been applied to the Environment Agency's Risk of Flooding from Surface Water (RoFSW) map to indicate the impact on surface water flood risk.
Fluvial extents, depth, velocity and hazard mapping	Wall Brook hydraulic modelling undertaken by Halcrow Group (2008).
Surface Water	The Environment Agency's Risk of Flooding from Surface Water (RoFSW) dataset has been used for this assessment.
Surface water depth, velocity and hazard mapping	The Environment Agency's Risk of Flooding from Surface Water (RoFSW) dataset has been used for this assessment.
Groundwater	JBA Consulting Ltd. Groundwater Flood Mapping (2017)

	Telford and Wrekin Council Level 2 Strategic Flood Risk Assessment Detailed Site Summary Tables
Site details	
Site Code	**251**
Address	Land South of Holyhead Road, Wellington
Area	7.30ha
Current land use	Greenfield
Proposed land use	Residential
Flood Risk Vulnerability	More Vulnerable
Sources of flood risk	
Location of the site within the catchment	The site is located to the west of Telford. The site is bounded by the M54 on its southern boundary, the B5061 (also known as Holyhead Road) on its western and northern boundaries, and a residential area on its eastern boundary. The nearest Main River is located approximately 3.62km to the northwest of the northern site boundary.
Topography	The Environment Agency 1m resolution LiDAR shows that the site slopes from an elevation of 118.55mAOD (Above Ordnance Datum) on the southern boundary to 108.06mAOD on the northern boundary. A depression indicates a ditch runs through the west of the site.
Existing drainage features	Mapping and the Environment Agency LiDAR shows that an unnamed ordinary watercourse is present in the west of the site, flowing from south to north.
Fluvial	**The proportion of site at risk FMFP:** FZ3 – 0% FZ2 – 0% FZ1 – 100% **Available data:** The Environment Agency's Flood Map for Planning has been used in this assessment. **Flood characteristics:** The site is located in Flood Zone 1 and is at negligible risk of fluvial flooding.
Surface Water	**Proportion of site at risk (RoFSW):** **3.3% AEP** – 2% Max depth – 0.60-0.90m Max velocity – >2.00m/s **1% AEP** – 4% Max depth – 0.60-0.90m Max velocity – >2.00m/s **0.1% AEP** – 14% Max depth – 0.90-1.20m

	Max velocity –1.00-2.00m/s **Description of surface water flooding:** The Environment Agency Risk of Flooding from Surface Water (RoFSW) mapping shows that 2% of the site is at risk from surface water flooding, along the northern during a 3.3% AEP surface water event. This has a maximum depth and velocity of 0.30-0.60m and 0.25-0.50m/s respectively. Surface water is also present in the west of the site, but this is likely to be entirely contained in the ditch. During the 1% AEP event, 4% of the site is inundated with surface water, ponding along the northern and eastern borders of the site. The maximum depths and velocities are 0.30-0.60m 1.00-2.00m/s respectively. The surface water present to the west of the site is still likely to be contained by the ditch. During the 0.1% AEP event, 14% of the site is inundated, mainly along the northern and eastern boundary, but with additional ponding towards the centre of the site. The maximum depths and velocities are 0.90-1.20m and 1.00-2.00m/s respectively. The surface water to the west of the site is no longer fully contained by the ditch and is ponding onto the site.
Reservoir	The Environment Agency's statutory reservoir flooding maps show the site is at risk during both the wet and dry day scenarios from the Ercall Reservoirs. In both scenarios, the north-west of the site is inundated.
Groundwater	The majority of this site is at a negligible risk of groundwater flooding meaning groundwater levels are at least 5m below the ground's surface. A very small proportion of the site, on the eastern boundary is in a low risk of groundwater flooding meaning groundwater levels are between 0.5m and 5m below ground surface.
Sewers	Severn Trent Water's Sewer Flooding register was not available for this assessment.
Minewater Flooding	Mapping from the Coal Authority shows that the site falls within the area of a coal mine, and there is a risk of groundwater emergence. Further investigation, including ground investigation will be required as part of a site specific flood risk assessment.
Flood history	The site is not within the Environment Agency's recorded flood outlines dataset. Flood records provided by the Lead Local Flood Authority (LLFA) do not show any flood records in the vicinity of the site.
Cumulative Impact Assessment	Catchment – Beanhill Brook - source to Shawbirch Rank – Medium
Flood risk management infrastructure	
Defences	The Environment Agency AIMS dataset shows that the site is not protected by any formal flood defences.
Residual risk	The ordinary watercourse that is present to the west of the site is culverted both prior to entering the site, and after leaving the site. If the culvert to the north of the site were to become blocked then water could back up and inundate the site. If the culvert to the south of the site were to become blocked it is unlikely this would impact the site. The site is at residual risk of statutory reservoir flooding in the unlikely event of a breach at the Ercall Reservoirs.

Emergency planning	
Flood warning	The site is not within an Environment Agency Flood Alert or Flood Warning Area.
Access and egress	Currently vehicular access is only possible on the northern boundary via the B5061 (also known as Holyhead Road). During the 3.3% AEP surface water event, Holyhead Road has minor ponding, to the west of the site access road with a maximum depth of 0.30-0.60m and a maximum velocity of 0.25-0.50m/s. Due to the small extent of this ponding, it is unlikely to impede access and egress to the site. During the 1% AEP event, Holyhead Road is inundated with surface water to a larger extent, with ponding to the west of the access road, and directly in front of the access road. This has a maximum depth and velocity of 0.30-0.60m and 1.00-2.00m/s respectively. The hazard associated with these depths and velocities is categorised as 'danger for some'. During the 0.1% AEP event, the depth of the surface water flooding on Holyhead increases to a maximum of 0.30-0.60m with a maximum velocity of >2.00m/s. The extent increases to the east and west of the access road. The hazard associated with these depths and velocities is categorised as 'danger for most' and so access an egress is likely to be impeded. A site-specific Flood Risk Assessment should be undertaken to evaluate accessibility to pedestrians and vehicles. Developers must demonstrate that safe access and egress in the 0.1% AEP event, including allowance for climate change.
Dry Islands	The site is not located within a dry island during any modelled flood event.
Climate change	
Implications for the site	**Management Catchment: Severn Middle Shropshire** Increased storm intensities due to climate change may increase the extent, depth, velocity, hazard, and frequency of both fluvial and surface water flooding. **Fluvial Flooding:** The site is not covered by any available detailed hydraulic modelling, however, climate change uplift of 35% has been applied to the Environment Agency Flood Map for Planning. The mapping shows that the site will remain in Flood Zone 1, this indicates that the impact of climate change on future risk of fluvial flooding to the site is negligible. **Surface Water:** Climate change is predicted to increase rainfall intensity in the future by a range of between 30% and 45% (the recommended precautionary sensitive range for 2061 to 2125). This will increase the likelihood, frequency and extent of surface water flooding. The 3.3% AEP Risk of Flooding from Surface Water dataset has been re-run with a 25% climate change allowance. The 1% AEP Risk of Flooding from Surface Water dataset has been re-run with a 30% and 45% climate change allowance. The extent of the surface water flood risk for the 3.3% AEP plus 25% climate change allowance is larger than that of the current day 1% AEP event. The extent

	of the surface water flood risk for the 1% AEP plus 30% climate change allowance is similar to that of the current day 0.1% AEP event. The extent of the surface water flood risk for the 1% AEP plus 45% climate change exceeds that of the current day 0.1% AEP event. This shows that climate change will impact this site.
Requirements for surface water drainage	
Broad-scale assessment of potential SuDS	**Geology & Soils** Geology at the site consist of: • Bedrock – Salop Formation – Mudstone, Sandstone and Conglomerate. • Superficial Deposits – Till, Devensian – Diamicton and Glaciofluvial Deposits, Devensian – Sand and Gravel. Soils at the site consist of: • Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils **Sustainable Drainage Systems (SuDS):** • The site is not considered to be susceptible to groundwater flooding, due to the nature of the local geological conditions. This should be confirmed through additional site investigation work. • BGS data indicates that the underlying geology is a combination of mudstone, sandstone, sand, gravel and conglomerate, which is likely to be free draining. This should be confirmed through infiltration testing, with the use of infiltration maximised as much as possible in accordance with the SuDS hierarchy. • The site is not located within a Groundwater Source Protection Zone and there are no restrictions over the use of infiltration techniques with regard to groundwater quality. • The site is not located within a historic landfill site. • Surface water discharge rates should not exceed the existing greenfield runoff rates for the site. Opportunities to further reduce discharge rates should be considered and agreed with the LLFA. It may be possible to reduce site runoff by maximising the permeable surfaces on site using a combination of permeable surfacing and soft landscaping techniques. • The Risk of Flooding from Surface Water (RoFSW) mapping indicates the presence of surface water flow paths during the 3.3% AEP events. Existing flow paths should be retained and integrated with blue-green infrastructure. • Groundwater level monitoring should be undertaken to understand groundwater levels and the risk of groundwater flooding. • If it is proposed to discharge runoff to a watercourse or sewer system, the condition and capacity of the receiving watercourse or asset should be confirmed through surveys and the discharge rate agreed with the asset owner.
Opportunities for wider sustainability and integrated flood risk management	• Implementation of SuDS at the site could provide opportunities to deliver multiple benefits including volume control, water quality, amenity and biodiversity. Proposals to use SuDS techniques should be discussed with relevant stakeholders (Three Rivers District Council, Hertfordshire County Council (as the LLFA) and the Environment Agency) at an early stage to understand possible constraints. • Above ground SuDS should be shallow and/or lined to ensure that groundwater does not inundate the features during high groundwater events.

	• Development at this site should not increase flood risk either on or off site. The design of the surface water management proposals should take into account the impacts of future climate change over the projected lifetime of the development. • Opportunities to incorporate filtration techniques such bioretention areas or rain gardens must be considered. Consideration should be made to the existing condition of receiving waterbodies and their Water Framework Directive objectives for water quality. The use of multistage SuDS treatment will clean and improve water quality of surface water runoff discharged from the site and reduce the impact on receiving water bodies. • Opportunities to incorporate source control techniques such as green roofs, permeable surfaces and rainwater harvesting must be considered in the design of the site.
NPPF and planning implications	
Exception Test requirements	The site is within Flood Zone 1 but is classified as 'More Vulnerable' and at risk from surface water flooding. The Sequential Test must be passed, the criteria for which is highlighted within the Level 1 SFRA. The Exception Test is not required under the NPPF. However, it must be shown that the development will be safe for its lifetime and the risk of flooding from all sources can be managed through a sequential approach to design.
Requirements and guidance for site-specific Flood Risk Assessment	**Flood Risk Assessment:** • Consultation with Telford and Wrekin Council, Severn Trent Water, and the Environment Agency should be undertaken at an early stage. • Developers should consult with Severn Trent Water to ensure that the development aims to help achieve the targets of the Drainage and Wastewater Management Plan. • Any FRA should be carried out in line with the National Planning Policy Framework and Flood Risk and Coastal Change Planning Practice Guidance. **Guidance for site design and making development safe:** • The developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the development meets the objectives of the NPPF's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development. (Paragraph 052 Flood Risk and Coastal Change PPG). • The risk from surface water flow routes should be quantified as part of a site-specific FRA, including a drainage strategy, so runoff magnitudes from the development are not increased by development across any ephemeral surface water flow routes. A drainage strategy should help inform site layout and design to ensure runoff rates are as close as possible to greenfield rates. • Should built development be proposed within the design surface water flood extent, careful consideration will need to be given to flood resistance and resilience measures. • The risk of flooding from groundwater must be investigated and must be supported by groundwater level monitoring • Flood resilience and resistance measures should be implemented where appropriate during the construction phase, e.g. raising of floor levels.

	These measures should be assessed to make sure that flooding is not increased elsewhere. ○ raise them as much as possible. ○ include extra flood resistance and resilience measures. • Other examples of flood resistance and resilience measures include: ○ using flood resistant materials that have low permeability to at least 600mm above the estimated flood level ○ making sure any doors, windows or other openings are flood resistant to at least 600mm above the estimated flood level ○ by raising all sensitive electrical equipment, wiring and sockets to at least 600mm above the estimated flood level.

Key messages

The site is located within Flood Zone 1, but is at high risk from surface water flooding and mine water flooding.

Development is likely to be able to proceed if:

- A site-specific FRA demonstrates that the site is not at an increased risk of flooding in the future and that development of the site does not increase the risk of surface water flooding on the site and to neighbouring areas.
- A carefully considered and integrated flood resilient and sustainable drainage design is put forward, with development steered away from the areas identified to be at risk of surface water flooding across the site.
- Safe access and egress can be demonstrated in the surface water plus climate change events. This includes measures to reduce flood risk along these routes such as raising access, but not displacing floodwater elsewhere.
- If flood mitigation measures are implemented then they are tested to check that they will not displace water elsewhere (for example, if land is raised to permit development on one area, compensatory flood storage will be required in another)

Mapping Information	
Flood Zones	Flood Zones 2 and 3 have been taken from the Environment Agency's Flood Map for Planning mapping.
Climate change	Climate change allowances have been applied to the Environment Agency's Risk of Flooding from Surface Water (RoFSW) map to indicate the impact on surface water flood risk.
Fluvial and tidal extents, depth, velocity and hazard mapping	No detailed hydraulic modelling is available for this area.
Surface Water	The Environment Agency's Risk of Flooding from Surface Water (RoFSW) dataset has been used for this assessment.
Surface water depth, velocity and hazard mapping	The Environment Agency's Risk of Flooding from Surface Water (RoFSW) dataset has been used for this assessment.
Groundwater	JBA Consulting Ltd. Groundwater Flood Mapping (2017)

	Telford and Wrekin Council Level 2 Strategic Flood Risk Assessment Detailed Site Summary Tables
Site details	
Site Code	**274**
Address	Land off Church Road, Lilleshall
Area	3.71ha
Current land use	Greenfield
Proposed land use	Residential
Flood Risk Vulnerability	More Vulnerable
Sources of flood risk	
Location of the site within the catchment	The site is located to the north-west of Telford. The site is bounded by Church Road on its northern side, Lilyhurst Road on its western boundary, and fields to the south and east. Strine Brook is the nearest Main River, which is located approximately 3.40km north of the site and flows from east to west parallel to the northern site boundary.
Topography	The Environment Agency 1m resolution LiDAR shows that the site slopes from an elevation of 78.65mAOD (Above Ordnance Datum) in the south towards the northern boundary at an elevation of 73.61mAOD.
Existing drainage features	Mapping identifies a series of ordinary watercourses which flow near to and along the boundary of the site. One ordinary watercourse flows along the southern boundary, with another flowing along the western boundary. There is also a series of ordinary watercourses 50m east of the site.
Fluvial	**The proportion of site at risk FMFP:** FZ3 – 2% FZ2 – 2% FZ1 – 98% **Available data:** The Environment Agency's Flood Map for Planning has been used for this assessment. **Flood characteristics:** The Environment Agency Flood Map for Planning shows that there are areas of the site that are within Flood Zone 2 and Flood Zone 3. A small extent of the western boundary is inundated in Flood Zones 2 and 3. There is also some inundation in the southeastern corner of the site. In both locations Flood Zone 3 has a slightly smaller extent.
Surface Water	**Proportion of site at risk (RoFSW):** **3.3% AEP – <1%** Max depth – 0.90 – 1.2m Max velocity – 0.25 – 0.50m/s **1% AEP – <1%**

	Max depth – >1.2m Max velocity – 0.50 – 1.00m/s **0.1% AEP – 2%** Max depth – >1.2m Max velocity – 1.00 – 2.00m/s **Description of surface water flooding:** The Environment Agency Risk of Flooding from Surface Water (RoFSW) mapping shows that the site is at a low risk during the 3.3%, 1% and 0.1% AEP flood events. It is assumed that this flood risk is associated with the unnamed ordinary watercourse on the southern site boundary. During the 3.3% AEP flood event less than 1% of the site is at risk of surface water flooding, with a flow path passing through the southeastern corner of the site. Anticipated maximum depths of this surface water flooding are 0.60 – 0.90m and maximum velocities reach up to 0.25-0.50m/s. During the 1% AEP event the extent of the flooding does not increase greatly. The maximum depth and velocity increases to 0.90-1.20m and 0.50-1.00m/s respectively. During the 0.1% AEP event, the flow path in the south-east of the site inundates the site to a slightly greater extent. A flow path is also established in the northwestern corner of the site. Ponding near the eastern boundary emerges. The maximum depth and velocity of this flooding is in the flow path on the southern boundary and reaches 0.90-1.20m and 1.00-2.00m/s respectively.
Reservoir	The Environment Agency's statutory reservoir flooding maps show the site is not at risk of flooding from any statutory reservoirs.
Groundwater	Most of this site is at a negligible risk of groundwater flooding meaning groundwater levels are at least 5m below the ground's surface. A small proportion of the site, on the northern boundary is in a moderate risk of groundwater flooding meaning groundwater levels are between 0.025m and 0.5m below ground surface.
Sewers	Severn Trent Water's Sewer Flooding register was not available for this assessment.
Minewater Flooding	Mapping from the Coal Authority shows that the site falls within the area of a coal mine and is also within an area of shallow mine workings, and there is a risk of groundwater emergence. Further investigation, including ground investigation will be required as part of a site specific flood risk assessment.
Flood history	The site is not within the Environment Agency's recorded flood outlines dataset. Flood records provided by the Lead Local Flood Authority (LLFA) show that the site is located in an area with 2 records of flooding.
Cumulative Impact Assessment	Catchment – Wall Brook - source to Pipe Strine Rank – High
Flood risk management infrastructure	
Defences	The Environment Agency AIMS dataset shows that the site is not protected by any formal flood defences.
Residual risk	An unnamed ordinary watercourse passes close to the southeastern boundary of the site, before being culverted under Lilyhurst Road. This watercourse if flowing in a northwesterly direction. This means that if the culvert were to be blocked then water could back up and potentially inundate the southwestern corner of the site.

Emergency planning	
Flood warning	The site is not within an Environment Agency Flood Alert or Flood Warning Area.
Access and egress	Currently vehicular access is only possible on the northern boundary, off Church Road. During the 3.3% AEP event the access road and Church Road remain clear from inundation of surface water and so safe access and egress via this route is possible. Although Lilyhurst road looks to be inundated with surface water, this is likely to be in a culvert, as it follows the path of the ordinary watercourse. Therefore, Lilyhurst Road is likely to not have any surface water flooding and so access to the site can still be made safely via this route. During the 1% AEP event, surface water inundates Church Road to the northeast of the site access road with a maximum depth and velocity of 0.15-0.30m and 0.50-1.00m/s respectively. This flooding has a hazard score of 'moderate – danger for some'. Lilyhurst road remains clear from surface water flooding and so provides a safe route for access and egress. During the 0.1% AEP event Church Road is inundated with surface water to a greater extent. Maximum depths and velocities reach 0.30-0.60m and 1.00-2.00m/s respectively. This flooding has a hazard score of 'significant – danger for most', making it unsafe for access and egress. Lilyhurst Road is inundated with surface water to a maximum depth and velocity of 0.15-0.30m and 1.00-2.00m/s respectively. This flooding has a hazard score of 'moderate – danger for some'. Safe access and egress for vehicles through this route may still be possible.
Dry Islands	The site is not located within a dry island during any modelled flood event.
Climate change	
Implications for the site	**Management Catchment: Severn Middle Shropshire** Increased storm intensities due to climate change may increase the extent, depth, velocity, hazard, and frequency of both fluvial and surface water flooding. **Fluvial Flooding:** The site is not covered by any available detailed hydraulic modelling, however, climate change uplift of 35% has been applied to the Environment Agency Flood Map for Planning. The mapping shows that the climate change uplift is almost identical to Flood Zone 2. **Surface Water:** Climate change is predicted to increase rainfall intensity in the future by a range of between 30% and 45% (the recommended precautionary sensitive range for 2061 to 2125). This will increase the likelihood, frequency and extent of surface water flooding. The 3.3% AEP Risk of Flooding from Surface Water dataset has been re-run with a 25% climate change allowance. The 1% AEP Risk of Flooding from Surface Water dataset has been re-run with a 30% and 45% climate change allowance. The extent of the surface water flood risk for the 3.3% AEP plus 25% climate change allowance is similar to that of the current day 1% AEP event. The extents of the surface water flood risk for the 1% AEP plus 30% and for the 1% AEP plus

	45% climate change allowance are similar to that of the current day 0.1% AEP event. This shows that climate change will impact the flood risk of the site.
Requirements for surface water drainage	

Broad-scale assessment of potential SuDS	**Geology & Soils**
	Geology at the site consist of:
	• Bedrock –
	  ○ Pennine Lower Coal Measures Formation - Mudstone, siltstone and sandstone (majority of site)
	  ○ Bridgnorth Sandstone Formation – Sandstone (small area along the northern boundary).
	• Superficial deposits – Glaciofluvial Deposits, Devensian – Sand and gravel.
	Soils at the site consist of:
	• Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils.
	
	Sustainable Drainage Systems (SuDS):
	The Telford and Wrekin Sustainable Drainage Systems Handbook has more guidance on the implementation of SuDS for all types of development.
	• Groundwater levels are indicated to be at least 5m below ground level and groundwater flooding is not likely, however below ground development such as basements may still be susceptible to groundwater flooding.
	• BGS data indicates that the underlying geology is mudstone, siltstone and sandstone which is likely to be with highly variable permeability. This should be confirmed through infiltration testing. Off-site discharge in accordance with the SuDS hierarchy may be required to discharge surface water runoff from the site.
	• The site is not within a source protection zone.
	• The site is not located within a historic landfill site.
	• Surface water discharge rates should not exceed the existing greenfield runoff rates for the site. Opportunities to further reduce discharge rates should be considered and agreed with the LLFA. It may be possible to reduce site runoff by maximising the permeable surfaces on site using a combination of permeable surfacing and soft landscaping techniques.
	• The Risk of Flooding from Surface Water (RoFSW) mapping indicates the presence of a surface water flow path along the southern boundary during the 3.3% AEP events. Existing flow paths should be retained and integrated with blue-green infrastructure.
	• If it is proposed to discharge runoff to a watercourse or sewer system, the condition and capacity of the receiving watercourse or asset should be confirmed through surveys and the discharge rate agreed with the asset owner.

Opportunities for wider sustainability and integrated flood risk management	• Implementation of SuDS at the site could provide opportunities to deliver multiple benefits including volume control, water quality, amenity and biodiversity. Proposals to use SuDS techniques should be discussed with relevant stakeholders, Telford and Wrekin Council (as Lead Local Flood Authority) and the Environment Agency at an early stage to understand possible constraints. • The ordinary watercourses and natural flow routes on the site should be maintained and enhanced as part of the surface water management.

	• Above ground SuDS should be shallow and/or lined to ensure that groundwater does not inundate the features during high groundwater events. • Development at this site should not increase flood risk either on or off site. The design of the surface water management proposals should take into account the impacts of future climate change over the projected lifetime of the development. • Opportunities to incorporate filtration techniques such bioretention areas or rain gardens must be considered. Consideration should be made to the existing condition of receiving waterbodies and their Water Framework Directive objectives for water quality. The use of multistage SuDS treatment will clean and improve water quality of surface water runoff discharged from the site and reduce the impact on receiving water bodies. • Opportunities to incorporate source control techniques such as green roofs, permeable surfaces and rainwater harvesting must be considered in the design of the site.
NPPF and planning implications	
Exception Test requirements	The site is in Flood Zones 1, 2 and 3, is at low risk of surface water flooding and at risk from mine water flooding. The Sequential Test must be passed, the criteria for which is highlighted within the Level 1 SFRA. The Exception Test is not required under the NPPF. However, it must be shown that the development will be safe for its lifetime and the risk of flooding from all sources can be managed through a sequential approach to design.
Requirements and guidance for site-specific Flood Risk Assessment	**Flood Risk Assessment:** • Consultation with Telford and Wrekin Council, Severn Trent Water, and the Environment Agency should be undertaken at an early stage. • Developers should consult with Severn Trent Water to ensure that the development aims to help achieve the targets of the Drainage and Wastewater Management Plan. • Any FRA should be carried out in line with the National Planning Policy Framework and Flood Risk and Coastal Change Planning Practice Guidance. **Guidance for site design and making development safe:** • The developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the development meets the objectives of the NPPF's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development. (Paragraph 052 Flood Risk and Coastal Change PPG). • The risk from surface water flow routes should be quantified as part of a site-specific FRA, including a drainage strategy, so runoff magnitudes from the development are not increased by development across any ephemeral surface water flow routes. A drainage strategy should help inform site layout and design to ensure runoff rates are as close as possible to greenfield rates. • Should built development be proposed within the design surface water flood extent, careful consideration will need to be given to flood resistance and resilience measures. • The risk of flooding from groundwater must be investigated and must be supported by groundwater level monitoring

	• Flood resilience and resistance measures should be implemented where appropriate during the construction phase, e.g. raising of floor levels. These measures should be assessed to make sure that flooding is not increased elsewhere.
	  ○ raise them as much as possible.
	  ○ include extra flood resistance and resilience measures.
	• Other examples of flood resistance and resilience measures include:
	  ○ using flood resistant materials that have low permeability to at least 600mm above the estimated flood level
	  ○ making sure any doors, windows or other openings are flood resistant to at least 600mm above the estimated flood level
	  ○ by raising all sensitive electrical equipment, wiring and sockets to at least 600mm above the estimated flood level.

Key messages

The site is in Flood Zones 1, 2 and 3, is at low risk of surface water flooding and at risk from mine water flooding.

Development is likely to be able to proceed if:

- A site-specific FRA demonstrates that the site is not at an increased risk of flooding in the future and that development of the site does not increase the risk of surface water flooding on the site and to neighbouring areas.
- A carefully considered and integrated flood resilient and sustainable drainage design is put forward, with development steered away from the areas identified to be at risk of surface water flooding across the site.
- Safe access and egress can be demonstrated in the surface water plus climate change events. This includes measures to reduce flood risk along these routes such as raising access, but not displacing floodwater elsewhere.
- If flood mitigation measures are implemented then they are tested to check that they will not displace water elsewhere (for example, if land is raised to permit development on one area, compensatory flood storage will be required in another)

Mapping Information

Flood Zones	Flood Zones 2 and 3 have been taken from the Environment Agency's Flood Map for Planning mapping.
Climate change	Climate change allowances have been applied to the Environment Agency's Risk of Flooding from Surface Water (RoFSW) map to indicate the impact on surface water flood risk.
Fluvial extents, depth, velocity and hazard mapping	No detailed hydraulic modelling is available for this area.
Surface Water	The Environment Agency's Risk of Flooding from Surface Water (RoFSW) dataset has been used for this assessment.
Surface water depth, velocity and hazard mapping	The Environment Agency's Risk of Flooding from Surface Water (RoFSW) dataset has been used for this assessment.
Groundwater	JBA Consulting Ltd. Groundwater Flood Mapping (2017)

	Telford and Wrekin Council Level 2 Strategic Flood Risk Assessment Detailed Site Summary Tables
Site details	
Site Code	**301**
Address	Land off Ironmasters Way
Area	5.74ha
Current land use	Mixed Use
Proposed land use	Mixed - Residential and Employment
Flood Risk Vulnerability	Less Vulnerable
Sources of flood risk	
Location of the site within the catchment	The site is located in the built-up urban area of Telford town centre, located between Telford Shopping Centre and Telford Central train station. The site is bounded by multiple roads and buildings: Windsor House to the north, Rampart Way (A5) to the east, Hollinsgate and Lawn Central to the south, and Darby House Car Parks to the west. The boundary surrounds The Quad and Kendal Court, which are located within the boundary but are excluded from the site. Wesley Brook is the nearest Main River, which is 2.60km east of the site and flows in an eastern direction.
Topography	The Environment Agency 1m resolution LiDAR shows that the site slopes from a maximum elevation of 151.84mAOD (Above Ordnance Datum) along the southwestern boundary towards a minimum elevation of 143.30mAOD on the northeastern boundary. Two mounds can be found on the site, one in the southeastern corner, with a maximum elevation of 155.13mAOD and one in the southwest corner of the site with a maximum elevation of 156.06mAOD.
Existing drainage features	Mapping does not identify any existing watercourses within the site boundary.
Fluvial	**The proportion of site at risk FMFP:** FZ3 – 0% FZ2 – 0% FZ1 – 100% **Available data:** The Environment Agency's Flood Map for Planning has been used for this assessment. **Flood characteristics:** The site is located in Flood Zone 1 and is at negligible risk of fluvial flooding.
Surface Water	**Proportion of site at risk (RoFSW):** **3.3% AEP – 2%** Max depth – 0.30 – 0.60m Max velocity – 1.00 – 2.00m/s

	1% AEP – 5% Max depth – 0.30 – 0.60m Max velocity – 1.00 – 2.00m/s **0.1% AEP – 12%** Max depth – 0.30 – 0.60m Max velocity – >2m/s **Description of surface water flooding:** The Environment Agency Risk of Flooding from Surface Water (RoFSW) mapping shows that the roads on the site (Ironmasters Way and Lawn Central) are at risk from surface water flooding during the 3.3% AEP event. There is also some ponding in the car park in the northwestern corner of the site. The maximum depth and velocity of this flooding is 0.30-0.60m and 1.00-2.00m/s respectively. During the 1% AEP event, a flow path emerges connecting the surface water flooding on Lawn Central to that on Ironmasters Way and from the car park in the northeast of the site. This is flowing in a northeasterly direction onto Rampart Way, which lies just east of the eastern boundary. The maximum depth and velocity of this surface water flooding remains at 0.30-0.60m and 1.00-2.00m/s respectively. During the 0.1% AEP event, the flow path becomes slightly more extensive, connective with some ponding that has emerged in the southeast of the site. There is additional ponding in this area with three areas of ponding emerging in Station Quarter and one emerging to the southeast of Bishton Court. The maximum depth of this flooding remains at 0.30-0.60m, but the maximum velocity increases to >2.00m/s.
Reservoir	The Environment Agency's statutory reservoir flooding maps show the site is not at risk of flooding from any statutory reservoirs.
Groundwater	The site is at a negligible risk of groundwater flooding meaning groundwater levels are at least 5m below the ground's surface.
Sewers	Severn Trent Water's Sewer Flooding register was not available for this assessment.
Minewater Flooding	Mapping from the Coal Authority shows that the site falls within the area of a coal mine, and there is a risk of groundwater emergence. Further investigation, including ground investigation will be required as part of a site specific flood risk assessment.
Flood history	The site is not within the Environment Agency's recorded flood outlines dataset. Flood records provided by the Lead Local Flood Authority (LLFA) show that the site is in an area where there are 3 records of flooding.
Cumulative Impact Assessment	Catchment – Wesley Brook (inc. Nedge Brook) - source to River Worfe Rank – Medium
Flood risk management infrastructure	
Defences	The Environment Agency AIMS dataset shows that the site is not protected by any formal flood defences.
Residual risk	The site is not at residual risk of flooding.
Emergency planning	
Flood warning	The site is not within an Environment Agency Flood Alert or Flood Warning Area.

Access and egress	Vehicular access is possible to the site via Lawn Central on the southern boundary. Due to a central reservation on Lawn central, the site can only be accessed via vehicles travelling in an easterly direction. Vehicular access is also possible via Ironmasters Way on the northern boundary and Ironmasters way on the eastern boundary, off Rampart Way. During the 3.3% AEP event, Ironmasters Way to the north of the site is clear from surface water flooding and so safe access and egress can occur via this route. Surface water inundates Ironmasters Way on the eastern boundary to a depth of 0.00-0.15m and a velocity of 1.00-2.00m/s. This has a hazard score of 'low - caution' meaning safe vehicular access and egress via this route would still be possible. The lane travelling in a western direction on Lawn Central is inundated to a maximum depth of 0.15m-0.30m and a maximum velocity of 0.00-0.25m/s. This gives it a hazard score of 'low - caution' meaning safe vehicular access and egress via this route would still be possible. During the 1% AEP event, Ironmasters Way to the north is inundated with surface water flooding to a maximum depth of 0.00-0.15m and a maximum velocity of 0.50-1.00m/s. This has a hazard score of 'low - caution' meaning safe vehicular access and egress via this route would still be possible. The surface water on Ironmasters Way on the eastern boundary increases to a depth of 0.15-0.30m and remains at a velocity of 1.00-2.00m/s. This has a hazard score of 'moderate – danger to some' meaning safe vehicular access and egress via this route would likely still be possible. The lane travelling in a western direction on Lawn Central is inundated to a maximum depth of 0.30m-0.60m and a maximum velocity of 0.25-0.50m/s. This gives it a hazard score of 'moderate – danger to some' meaning safe vehicular access and egress via this route would likely still be possible. During the 0.1% AEP event, Ironmasters Way to the north is inundated with surface water flooding to a maximum depth of 0.15-0.30m and a maximum velocity of 1.00-2.00m/s. This has a hazard score of 'low - caution' meaning safe vehicular access and egress via this route would still be possible. The surface water on Ironmasters Way on the eastern boundary increases to a depth of 0.30-0.60m and remains at a velocity of >2.00m/s. This has a hazard score of 'significant – danger to most' meaning safe vehicular access and egress via this route would not be possible. The lane travelling in a western direction on Lawn Central is inundated to a maximum depth of 0.30m-0.60m and a maximum velocity of 0.50-1.00m/s. This has a hazard score of 'significant – danger to most' meaning safe vehicular access and egress via this route would not be possible.
Dry Islands	The site is not located within a dry island during any modelled flood event.
Climate change	
Implications for the site	**Management Catchment: Severn Middle Worcestershire** Increased storm intensities due to climate change may increase the extent, depth, velocity, hazard, and frequency of both fluvial and surface water flooding. **Fluvial Flooding:** The site is not covered by any hydraulic modelling, however, climate change uplift of 35% has been applied to the Environment Agency Flood Map for Planning. The mapping shows that the climate change uplift is almost identical to Flood Zone 2. **Surface Water:**

	Climate change is predicted to increase rainfall intensity in the future by a range of between 30% and 45% (the recommended precautionary sensitive range for 2061 to 2125). This will increase the likelihood, frequency and extent of surface water flooding. The 3.3% AEP Risk of Flooding from Surface Water dataset has been re-run with a 25% climate change allowance. The 1% AEP Risk of Flooding from Surface Water dataset has been re-run with a 30% and 45% climate change allowance. The extent of the surface water flood risk for the 3.3% AEP plus 25% climate change allowance is similar to that of the current day 1% AEP event. The extent of the surface water flood risk for the 1% AEP plus 30% climate change allowance is similar to that of the current day 0.1% AEP event. The extent of the surface water flood risk for the 1% AEP plus 45% climate change slightly exceeds that of the current day 0.1% AEP event. This shows that climate change will impact the flood risk of the site.
Requirements for surface water drainage	
Broad-scale assessment of potential SuDS	**Geology & Soils** Geology at the site consist of: • Bedrock – Halesowen Formation - Sandstone. • Superficial deposits – Till, Devensian - Diamicton Soils at the site consist of: • Slightly acid loamy and clayey soils with impeded drainage **Sustainable Drainage Systems (SuDS)** The Telford and Wrekin Sustainable Drainage Systems Handbook has more guidance on the implementation of SuDS for all types of development. • Groundwater levels are indicated to be at least 5m below ground level and groundwater flooding is not likely, however below ground development such as basements may still be susceptible to groundwater flooding. • BGS data indicates that the underlying geology is Halesowen Formation, Till and Devensian, which is likely to be with highly variable permeability. This should be confirmed through infiltration testing. Off-site discharge in accordance with the SuDS hierarchy may be required to discharge surface water runoff from the site. • The site is not within a source protection zone. • The site is not located within a historic landfill site. • Surface water discharge rates should not exceed pre-development discharge rates for the site and should be designed to be as close to greenfield runoff rates as reasonably practical in consultation with the LLFA. It may be possible to reduce site runoff by maximising the permeable surfaces on site using a combination of permeable surfacing and soft landscaping techniques. • The Risk of Flooding from Surface Water (RoFSW) mapping indicates the presence of a surface water flow path along the eastern boundary during the 3.3% AEP events. Existing flow paths should be retained and integrated with blue-green infrastructure. • If it is proposed to discharge runoff to a watercourse or sewer system, the condition and capacity of the receiving watercourse or asset should be confirmed through surveys and the discharge rate agreed with the asset owner.

Opportunities for wider sustainability and integrated flood risk management	• Implementation of SuDS at the site could provide opportunities to deliver multiple benefits including volume control, water quality, amenity and biodiversity. Proposals to use SuDS techniques should be discussed with relevant stakeholders, Telford and Wrekin Council (as Lead Local Flood Authority) and the Environment Agency at an early stage to understand possible constraints. • Above ground SuDS should be shallow and/or lined to ensure that groundwater does not inundate the features during high groundwater events. • Development at this site should not increase flood risk either on or off site. The design of the surface water management proposals should take into account the impacts of future climate change over the projected lifetime of the development. • Opportunities to incorporate filtration techniques such bioretention areas or rain gardens must be considered. Consideration should be made to the existing condition of receiving waterbodies and their Water Framework Directive objectives for water quality. The use of multistage SuDS treatment will clean and improve water quality of surface water runoff discharged from the site and reduce the impact on receiving water bodies. • Opportunities to incorporate source control techniques such as green roofs, permeable surfaces and rainwater harvesting must be considered in the design of the site. • The potential to utilise conveyance features such as swales to intercept and convey surface water runoff should be considered. Conveyance features should be located on common land or public open space to facilitate ease of access. Where slopes are >5%, features should follow contours or utilise check dams to slow flows.
NPPF and planning implications	
Exception Test requirements	The site is classified as 'More Vulnerable' and is within Flood Zone 1. It is at risk from mine flooding and at low risk from surface water flooding. The Sequential Test must be passed, the criteria for which is highlighted within the Level 1 SFRA. The Exception Test is not required under the NPPF. However, it must be shown that the development will be safe for its lifetime and the risk of flooding from all sources can be managed through a sequential approach to design.
Requirements and guidance for site-specific Flood Risk Assessment	**Flood Risk Assessment:** • Consultation with Telford and Wrekin Council, Severn Trent Water, and the Environment Agency should be undertaken at an early stage. • Developers should consult with Severn Trent Water to ensure that the development aims to help achieve the targets of the Drainage and Wastewater Management Plan. • Any FRA should be carried out in line with the National Planning Policy Framework and Flood Risk and Coastal Change Planning Practice Guidance. **Guidance for site design and making development safe:** • The developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the development meets the objectives of the NPPF's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively

	through the lifetime of the development. (Paragraph 052 Flood Risk and Coastal Change PPG).
	• The risk from surface water flow routes should be quantified as part of a site-specific FRA, including a drainage strategy, so runoff magnitudes from the development are not increased by development across any ephemeral surface water flow routes. A drainage strategy should help inform site layout and design to ensure runoff rates are as close as possible to greenfield rates.
	• Should built development be proposed within the design surface water flood extent, careful consideration will need to be given to flood resistance and resilience measures.
	• The risk of flooding from groundwater must be investigated and must be supported by groundwater level monitoring
	• Flood resilience and resistance measures should be implemented where appropriate during the construction phase, e.g. raising of floor levels. These measures should be assessed to make sure that flooding is not increased elsewhere.
	  ○ raise them as much as possible.
	  ○ include extra flood resistance and resilience measures.
	• Other examples of flood resistance and resilience measures include:
	  ○ using flood resistant materials that have low permeability to at least 600mm above the estimated flood level
	  ○ making sure any doors, windows or other openings are flood resistant to at least 600mm above the estimated flood level
	  ○ by raising all sensitive electrical equipment, wiring and sockets to at least 600mm above the estimated flood level.

Key messages

The site is in Flood Zone 1 but is at risk from mine flooding and at low risk of surface water.

Development is likely to be able to proceed if:

- site-specific FRA demonstrates that the site is not at an increased risk of flooding in the future and that development of the site does not increase the risk of surface water flooding on the site and to neighbouring areas.
- A carefully considered and integrated flood resilient and sustainable drainage design is put forward, with development steered away from the areas identified to be at risk of surface water flooding across the site.
- Safe access and egress can be demonstrated in the surface water plus climate change events. This includes measures to reduce flood risk along these routes such as raising access, but not displacing floodwater elsewhere.
- If flood mitigation measures are implemented then they are tested to check that they will not displace water elsewhere (for example, if land is raised to permit development on one area, compensatory flood storage will be required in another)

Mapping Information

Flood Zones	Flood Zones 2 and 3 have been taken from the Environment Agency's Flood Map for Planning mapping.
Climate change	Climate change allowances have been applied to the Environment Agency's Risk of Flooding from Surface Water (RoFSW) map to indicate the impact on surface water flood risk.
Fluvial extents, depth, velocity	No detailed hydraulic modelling is available for this area.

and hazard mapping	
Surface Water	The Environment Agency's Risk of Flooding from Surface Water (RoFSW) dataset has been used for this assessment.
Surface water depth, velocity and hazard mapping	The Environment Agency's Risk of Flooding from Surface Water (RoFSW) dataset has been used for this assessment.
Groundwater	JBA Consulting Ltd. Groundwater Flood Mapping (2017)

	Telford and Wrekin Council Level 2 Strategic Flood Risk Assessment Detailed Site Summary Tables
Site details	
Site Code	**313**
Address	Land North of Middle Farm, Field Aston
Area	10.43
Current land use	Greenfield
Proposed land use	Mixed
Flood Risk Vulnerability	More Vulnerable
Sources of flood risk	
Location of the site within the catchment	The site is located to the south of Newport. It is bounded by a residential area to the south, and fields to the north, east and west. The nearest Main River is the Strine Brook, located approximately 1.7km northwest of the site.
Topography	The Environment Agency 1m resolution LiDAR shows that the site slopes from a maximum elevation of 85.58mAOD (Above Ordnance Datum) on the southern boundary to a minimum elevation of 81.17mAOD on the northern boundary. There is a line of slightly higher elevation that runs through the site from south to north with a maximum elevation of 84.05mAOD. In the northwest of the site, close to the western boundary, there is a depression with a minimum elevation of 80.57mAOD. Satellite imagery shows this to be a pond.
Existing drainage features	Mapping does not identify any existing watercourses within the site boundary, there is an ordinary watercourse 95m southeast of the site boundary, there is also a pond located in the northwest of the site.
Fluvial	**The proportion of site at risk FMFP:** FZ3 – 0% FZ2 – 0% FZ1 – 100% **Available data:** The Environment Agency's Flood Map for Planning has been used for this assessment. **Flood characteristics:** The site is located in Flood Zone 1 and is at negligible risk of fluvial flooding.
Surface Water	**Proportion of site at risk (RoFSW):** **3.3% AEP** – 1% Max depth – 0.30-0.60m Max velocity – 0.25-0.50m/s **1% AEP** – 2% Max depth – 0.30-0.60m Max velocity – 0.25-0.50m/s

	0.1% AEP – 12% Max depth – 0.30-0.60m Max velocity – 0.50-1.00m/s **Description of surface water flooding:** The Environment Agency Risk of Flooding from Surface Water (RoFSW) mapping shows that surface water flooding inundates the site during every AEP event. During the 3.3% AEP event 1% of the site is inundated, with ponding in the west of the site. There is also ponding in the northwest of the site surrounding the pond. This surface water is shown to exceed the banks of the pond and inundate the site. This flooding has a maximum depth of 0.60m and a maximum velocity of 0.50m/s. This gives the flooding a classification of 'moderate – danger for some'. During the 1% AEP surface water event, the extent of the flooding increases to 2%, with the extents of the ponding in the west and northwest of the site increasing slightly. The maximum depth and velocity of this flooding remains at 0.60m and 0.50m/s respectively. This gives the flooding a classification of 'moderate – danger for some'. During the 0.1% AEP event, the extent of the flooding increases to 12% of the site. The ponding in the northwest is slightly more extensive. The ponding in the west is much more extensive and has become a flow path. Four new areas in the south of the site are shown to be at risk during this AEP event. The maximum depth of this flooding remains at 0.60m but the velocity increases to 1.00m/s. This gives the flooding a classification of 'moderate – danger for some'.
Reservoir	The Environment Agency's statutory reservoir flooding mapping shows that the site is inundated in both the dry-day and wet-day scenarios. The source of this potential is the Field Aston reservoir located approximately 300.00m to the east of the southern boundary of the site. This potential inundation is located on the eastern boundary of the site and the extents of both scenarios are very similar, with the wet day scenario being slightly more extensive.
Groundwater	The north, middle and south of the site is classified as having a low risk of groundwater flooding. This means groundwater levels are between 0.5m and 5m below ground surface. The east, middle and west of the site is classifies as having a medium risk of groundwater flooding. This means groundwater levels are between 0.025m and 0.5m below ground surface.
Sewers	Severn Trent Water's Sewer Flooding register indicates that the site is in the Newport (WRW) sewage treatment catchment. The site has a high potential impact on sewerage infrastructure and a low potential impact of surface water sewerage infrastructure.
Minewater Flooding	Mapping from the Coal Authority shows that the site does not fall within the area of a coal mine, therefore it can be considered that there is a low risk of groundwater emergence.
Flood history	The site is not within the Environment Agency's recorded flood outlines dataset. Flood records provided by the Lead Local Flood Authority (LLFA) show that the site is not in an area with previous flood records.

Cumulative Impact Assessment	Catchment – Strine Brook - source to Wall Brook Rank – Medium
Flood risk management infrastructure	
Defences	The Environment Agency AIMS dataset shows that the site is not protected by any formal flood defences.
Residual risk	The site is at residual risk of flooding from the small pond located in the northwest of the site. This pond could exceed its capacity due to surface water and therefore the western boundary of the site is at residual risk from flooding. The site is also at residual risk of statutory reservoir flooding in the unlikely event of a breach at Field Aston Reservoir.
Emergency planning	
Flood warning	The site is not within an Environment Agency Flood Alert or Flood Warning Area.
Access and egress	Vehicular access is assumed to be possible on the southern boundary, from Field Aston Lane. During the 3.3% AEP event there is no surface water flooding to the west of Field Aston Lane and so safe access and egress is possible via this route. During the 1% AEP event, there is surface water flooding on Field Aston Lane, at the access and egress point for the site. This flooding has a maximum depth of 0.00-0.15m and a maximum velocity of 0.50-1.00m/s. This flooding is classified as 'low-caution' and therefore vehicular access and egress is likely still possible. During the 0.1% surface water AEP event, the flooding along Field Aston Lane is more extensive but the maximum depth of this flooding remains at 0.00-0.15m. The maximum velocity increases to 1.00-2.00m/s. This flooding is classified as 'low-caution' and therefore vehicular access and egress is likely still possible.
Dry Islands	The site is not located within a dry island during any modelled flood event.
Climate change	
Implications for the site	**Management Catchment: Severn Middle Shropshire** **Fluvial Flooding:** The site is not covered by any available detailed hydraulic modelling, however, climate change uplift of 35% has been applied to the Environment Agency Flood Map for Planning. The mapping shows that the site will remain in Flood Zone 1, this indicates that the impact of climate change on future risk of fluvial flooding to the site is negligible. **Surface Water:** Climate change is predicted to increase rainfall intensity in the future by a range of between 30% and 45% (the recommended precautionary sensitive range for 2061 to 2125). This will increase the likelihood, frequency and extent of surface water flooding. The 3.3% AEP Risk of Flooding from Surface Water dataset has been re-run with a 25% climate change allowance. The 1% AEP Risk of Flooding from Surface Water dataset has been re-run with a 30% and 45% climate change allowance.

	The extent of the surface water flood risk for the 3.3% AEP plus 25% climate change allowance is greater that of the current day 1% AEP event. The extent of the surface water flood risk for the 1% AEP plus 30% climate change allowance is similar in extent to that of the current day 0.1% AEP event. The extent of the surface water flood risk for the 1% AEP plus 45% climate change is slightly more than that of the current day 0.1% AEP event. This shows that climate change will impact the flood risk of the site.
Requirements for surface water drainage	

Broad-scale assessment of potential SuDS	**Geology & Soils**
	Geology at the site consist of:
	• Bedrock
	  ○ Chester Formation – Sandstone and conglomerate
	• Superficial deposits
	  ○ Diamicton formation– till, devesian
	Soils at the site consist of:
	• Freely draining, slightly acidic sandy soils (northern half of the site)
	• Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils (southern half of the site)
	
	Sustainable Drainage Systems (SuDS)
	• Groundwater levels are indicated to be between 0.5 and 5m below ground level and there is a risk of flooding to subsurface assets and below ground development such as basements. Groundwater monitoring is recommended to determine the seasonal variability of groundwater levels, as this may affect the design of the surface water drainage system.
	• BGS data indicates that the underlying geology is sandstone, till, devesian and conglomerate which is likely to be with highly variable permeability. This should be confirmed through infiltration testing. Off-site discharge in accordance with the SuDS hierarchy may be required to discharge surface water runoff from the site.
	• The site is located within a Groundwater Source Protection Zone. Infiltration techniques may not be suitable and should only be used following the granting of any required environmental permits from the Environment Agency for Zones 2, 3 and 4 although it is possible that infiltration may not be permitted. Proposed SuDS should be discussed with relevant stakeholders (LPA, LLFA and EA) at an early stage to understand possible opportunities and constraints.
	• The site is not located within a historic landfill site.
	• Surface water discharge rates should not exceed the existing greenfield runoff rates for the site. Opportunities to further reduce discharge rates should be considered and agreed with the LLFA. It may be possible to reduce site runoff by maximising the permeable surfaces on site using a combination of permeable surfacing and soft landscaping techniques.
	• The Risk of Flooding from Surface Water (RoFSW) mapping indicates the presence of surface water flow paths during the 3.3% AEP events. Existing flow paths should be retained and integrated with blue-green infrastructure.
	• If it is proposed to discharge runoff to a watercourse or sewer system, the condition and capacity of the receiving watercourse or asset should be confirmed through surveys and the discharge rate agreed with the asset owner.

Opportunities for wider sustainability and integrated flood risk management	• Implementation of SuDS at the site could provide opportunities to deliver multiple benefits including volume control, water quality, amenity and biodiversity. Proposals to use SuDS techniques should be discussed with relevant stakeholders, Telford and Wrekin Council (as Lead Local Flood Authority) and the Environment Agency at an early stage to understand possible constraints. • Natural surface water flow routes should be maintained and enhanced within the development site. • Above ground SuDS should be shallow and/or lined to ensure that groundwater does not inundate the features during high groundwater events. • Development at this site should not increase flood risk either on or off site. The design of the surface water management proposals should take into account the impacts of future climate change over the projected lifetime of the development. • Opportunities to incorporate filtration techniques such bioretention areas or rain gardens must be considered. Consideration should be made to the existing condition of receiving waterbodies and their Water Framework Directive objectives for water quality. The use of multistage SuDS treatment will clean and improve water quality of surface water runoff discharged from the site and reduce the impact on receiving water bodies. • Opportunities to incorporate source control techniques such as green roofs, permeable surfaces and rainwater harvesting must be considered in the design of the site. • The potential to utilise conveyance features such as swales to intercept and convey surface water runoff should be considered. Conveyance features should be located on common land or public open space to facilitate ease of access. Where slopes are >5%, features should follow contours or utilise check dams to slow flows.
NPPF and planning implications	
Exception Test requirements	The site is classified as 'More Vulnerable' and is within Flood Zone 1. It is at low risk from surface water and medium risk from groundwater flooding. The Sequential Test must be passed, the criteria for which is highlighted within the Level 1 SFRA. The Exception Test is not required under the NPPF. However, it must be shown that the development will be safe for its lifetime and the risk of flooding from all sources can be managed through a sequential approach to design.
Requirements and guidance for site-specific Flood Risk Assessment	**Flood Risk Assessment:** • Consultation with Telford and Wrekin Council, Severn Trent Water, and the Environment Agency should be undertaken at an early stage. • Developers should consult with Severn Trent Water to ensure that the development aims to help achieve the targets of the Drainage and Wastewater Management Plan. • Any FRA should be carried out in line with the National Planning Policy Framework and Flood Risk and Coastal Change Planning Practice Guidance. **Guidance for site design and making development safe:** • The developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the development meets the objectives of the NPPF's policy on flood risk. For example, how the operation

	of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development. (Paragraph 052 Flood Risk and Coastal Change PPG).
	• The risk from surface water flow routes should be quantified as part of a site-specific FRA, including a drainage strategy, so runoff magnitudes from the development are not increased by development across any ephemeral surface water flow routes. A drainage strategy should help inform site layout and design to ensure runoff rates are as close as possible to greenfield rates.
	• Should built development be proposed within the design surface water flood extent, careful consideration will need to be given to flood resistance and resilience measures.
	• The risk of flooding from groundwater must be investigated and must be supported by groundwater level monitoring
	• Flood resilience and resistance measures should be implemented where appropriate during the construction phase, e.g. raising of floor levels. These measures should be assessed to make sure that flooding is not increased elsewhere.
	  ○ raise them as much as possible.
	  ○ include extra flood resistance and resilience measures.
	• Other examples of flood resistance and resilience measures include:
	  ○ using flood resistant materials that have low permeability to at least 600mm above the estimated flood level
	  ○ making sure any doors, windows or other openings are flood resistant to at least 600mm above the estimated flood level
	  ○ by raising all sensitive electrical equipment, wiring and sockets to at least 600mm above the estimated flood level.

Key messages	
The site is in Flood Zone 1 but is classified as 'More Vulnerable' and is at low risk of surface water flooding and at medium risk from groundwater flooding. Development is likely to be able to proceed if: • Site-specific FRA demonstrates that the site is not at an increased risk of flooding in the future and that development of the site does not increase the risk of surface water flooding on the site and to neighbouring areas. • A carefully considered and integrated flood resilient and sustainable drainage design is put forward, with development steered away from the areas identified to be at risk of surface water flooding across the site. • Safe access and egress can be demonstrated in the surface water plus climate change events. This includes measures to reduce flood risk along these routes such as raising access, but not displacing floodwater elsewhere. • If flood mitigation measures are implemented then they are tested to check that they will not displace water elsewhere (for example, if land is raised to permit development on one area, compensatory flood storage will be required in another)	
Mapping Information	
Flood Zones	Flood Zones 2 and 3 have been taken from the Environment Agency's Flood Map for Planning mapping.
Climate change	Climate change allowances have been applied to the Environment Agency's Risk of Flooding from Surface Water (RoFSW) map to indicate the impact on surface water flood risk.

Fluvial and tidal extents, depth, velocity and hazard mapping	No detailed hydraulic modelling is available for this area.
Surface Water	The Environment Agency's Risk of Flooding from Surface Water (RoFSW) dataset has been used for this assessment.
Surface water depth, velocity and hazard mapping	The Environment Agency's Risk of Flooding from Surface Water (RoFSW) dataset has been used for this assessment.
Groundwater	JBA Consulting Ltd. Groundwater Flood Mapping (2017)

	Telford and Wrekin Council Level 2 Strategic Flood Risk Assessment Detailed Site Summary Tables
Site details	
Site Code	**398**
Address	Land north of A518, Newport, TF10 7XL
Area	4.47ha
Current land use	Greenfield
Proposed land use	Employment
Flood Risk Vulnerability	Less Vulnerable
Sources of flood risk	
Location of the site within the catchment	The site is located to the south-west of Newport, south of the A518 and west of the A41. The Strine Brook flows approximately 1.7km north of the site.
Topography	The Environment Agency 1m resolution LiDAR shows that the site slopes from the southern boundary to the northern boundary. The levels range from 78.22mAOD (Above Ordnance Datum) to 73.85mAOD in the north-west corner.
Existing drainage features	Mapping and the Environment Agency LiDAR shows an ordinary watercourse entering the site at the south-east corner of the site, flowing approximately halfway through the site before flowing west bisecting the site. The watercourse changes direction again and flows along the north-west boundary before crossing under the A518.
Fluvial	**The proportion of site at risk FMFP:** FZ3 – 0% FZ2 – 0% FZ1 – 0% **Available data:** The Environment Agency's Flood Map for Planning has been used for this assessment. **Flood characteristics:** The site is located in Flood Zone 1 and is at negligible risk of fluvial flooding.
Surface Water	**Proportion of site at risk (RoFSW):** **3.3% AEP – 12%** Max depth – >1.2m Max velocity – 0.50 – 1.00m/s **1% AEP – 29%** Max depth – >1.2m Max velocity – 0.50 – 1.00m/s **0.1% AEP – 65%** Max depth – >1.2m

	Max velocity – 0.50 – 1.00m/s **Description of surface water flood risk:** The Environment Agency Risk of Flooding from Surface Water (RoFSW) mapping shows that the majority of the surface water flood risk associated with the 3.3% AEP event is in the northern section of the site. This flood risk is associated with the ordinary watercourse along the western boundary. The mapping also shows to small areas of ponding in the centre the site due to lower topography. Flood depths for the 3.3% AEP event vary across the area of flood risk, from 0.15m to over 1.2m, with the deepest section shown in the north-west corner of the site. The velocity of the flood area also varies from 0.00m/s to 1m/s. The maximum hazard rating has been calculated as 'Significant – dangerous for most people', this is due to deep and fast flowing water. During the 1% AEP event the extent of the flooded area to the north extends further into the site, the flood depths and velocities remain the same as the 3.3% AEP event. The mapping also shows a flow route flowing north through the centre of the site, originating offsite to the south. The flow route measures up to 20m in width and has an anticipated depth of up to 0.15m and a maximum velocity of 1.00m/s. As with the 3.3% AEP event the hazard rating is 'Significant – dangerous for most people'. The extent of the flow route through the site during the 0.1% AEP event increases to 70m in width with depths of up to 0.30m. The flooding to the north of the site also extends further into the site, meaning that 65% of the site is at surface water flood risk during the 0.1% AEP event. The velocity and hazard rating remain at 1.00m/s and 'Significant – dangerous for most people' respectively.
Reservoir	The Environment Agency's statutory reservoir flooding mapping shows that a large extent of the site is at risk from statutory reservoir flooding during both the dry-day and wet-day scenarios if there was a breach from the Field Aston reservoir. The reservoir is located approximately 275m south of the site. As part of a site-specific Flood Risk Assessment, an agreed emergency plan should identify appropriate safe access and egress routes from the site, in the event of a reservoir breach.
Groundwater	Groundwater mapping shows that centre section of the site is at low risk of groundwater flooding during a 1% AEP groundwater event. Groundwater levels are estimated to be between 0.5 and 5m below ground level, there is a risk of flooding to subsurface assets and below ground development such as basements. The southern and northern sections of the site are at medium risk of groundwater flooding during the 1% AEP event, with groundwater levels estimated to be between 0.025 and 0.5m below ground. A site-specific flood risk assessment should confirm the groundwater flooding risk to the site. This is likely to require ground investigations. Mitigation for seasonal high groundwater levels must be considered in design of the site, for example by raising finished floor levels to an appropriate height above ground level.
Sewers	Severn Trent Water's Sewer Flooding register was not available for this assessment.

Minewater Flooding	Mapping from the Coal Authority shows that the site does not fall within the area of a coal mine, therefore it can be considered that there is a low risk of groundwater emergence.
Flood history	The site is not within the Environment Agency's recorded flood outlines dataset. Flood records provided by the Lead Local Flood Authority (LLFA) do not show any flood records in the vicinity of the site.
Cumulative Impact Assessment	Catchment – Strine Brook - source to Wall Brook Rank – Medium
Flood risk management infrastructure	
Defences	The Environment Agency AIMS dataset shows that the site is not protected by any formal flood defences.
Residual risk	The site is at risk of statutory reservoir flooding in the unlikely event of a breach at the Field Aston reservoir. There is an additional residual risk associated with blockage of the culvert which flows under the A518 to the north of the site.
Emergency planning	
Flood warning	The site is not within an Environment Agency Flood Alert or Flood Warning Area.
Access and egress	It has been assumed that access and egress from the site would be via the A518 to the north of the site. For all surface water flood events there is a hazard rating of 'Significant – dangerous for most people' due to the depth and velocity of the surface water flooding, therefore vehicular and pedestrian access and egress is not possible from this location. It should also be noted that the section of the A518, between the two roundabouts has a hazard rating of 'Moderate – dangerous for some' for both the 3.3% and 1% AEP events. The hazard rating for the 0.1% AEP event increases to 'Significant – dangerous for most people', with the extent of the flooding too. A site-specific Flood Risk Assessment should be undertaken to evaluate accessibility to pedestrians and vehicles. Developers must demonstrate that safe access and egress in the 0.1% AEP event, including allowance for climate change. Given the significant flood depths and hazards associated with surface water flooding on site, a flood warning and evacuation plan should be prepared for the site.
Dry Islands	The site is not located within a dry island during any modelled flood event.
Climate change	
Implications for the site	**Management Catchment: Severn Middle Shropshire** Increased storm intensities due to climate change may increase the extent, depth, velocity, hazard, and frequency of both fluvial and surface water flooding. **Fluvial Flooding:** The site is not covered by any available detailed hydraulic modelling, however, climate change uplift of 35% has been applied to the Environment Agency Flood Map for Planning. The mapping shows that the site will remain in Flood Zone 1, this indicates that the impact of climate change on future risk of fluvial flooding to the site is negligible. **Surface Water:** Climate change is predicted to increase rainfall intensity in the future by a range of between 30% and 45% (the recommended precautionary sensitive range for

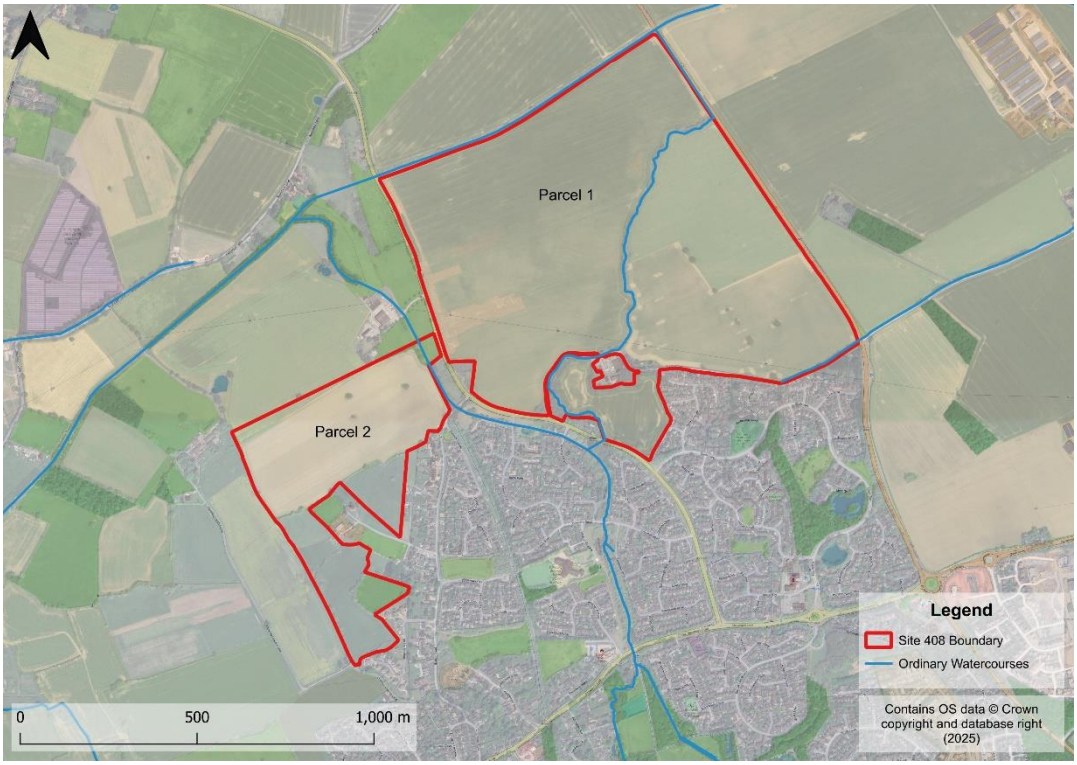
	2061 to 2125). This will increase the likelihood, frequency and extent of surface water flooding. The 1% AEP Risk of Flooding from Surface Water dataset has been re-run with a 30% and 45% climate change allowance. The extent of the surface water flood risk for both climate change allowances increase across the site, to a similar extent as the current day 0.1% AEP event surface water extent.
Requirements for surface water drainage	
Broad-scale assessment of potential SuDS	**Geology & Soils** Geology at the site consist of: • Bedrock – Chester Formation – Sandstone and conglomerate. • Superficial deposits –Till, Devensian –Diamicton. Soils at the site consist of: • Northern section of site - Free draining slightly acid sandy soil. • Southern section of site - Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils. **Sustainable Drainage Systems (SuDS):** The Telford and Wrekin Sustainable Drainage Systems Handbook has more guidance on the implementation of SuDS for all types of development. • Groundwater levels are indicated to be less than 0.5m below ground level during a 1% AEP event. Detention and attenuation features should be designed to prevent groundwater ingress from impacting hydraulic capacity and structural integrity. Additional site investigation work may be required to support the detailed design of the drainage system. This may include groundwater monitoring to demonstrate that a sufficient unsaturated zone has been provided above the highest occurring groundwater level. Below ground development such as basements are not appropriate at this site. • Groundwater level monitoring should be undertaken to understand groundwater levels at the site and how it may impact the site. • The site is located within a Groundwater Source Protection Zone. Infiltration techniques may not be suitable and should only be used following the granting of any required environmental permits from the Environment Agency for Zones 2, 3 and 4 although it is possible that infiltration may not be permitted. Proposed SuDS should be discussed with relevant stakeholders (LPA, LLFA and EA) at an early stage to understand possible opportunities and constraints. • The site is not located within a historic landfill site. • Surface water discharge rates should not exceed pre-development discharge rates for the site and should be designed to be as close to greenfield runoff rates as reasonably practical in consultation with the LLFA. It may be possible to reduce site runoff by maximising the permeable surfaces on site using a combination of permeable surfacing and soft landscaping techniques. • The Risk of Flooding from Surface Water (RoFSW) mapping indicates the presence of a surface water flow path along the eastern boundary during the 0.1% AEP events. Existing flow paths should be retained and integrated with blue-green infrastructure. • If it is proposed to discharge runoff to a watercourse, the condition and capacity of the receiving watercourse or asset should be confirmed through surveys and the discharge rate agreed with the asset owner.
Opportunities for wider	• Implementation of SuDS at the site could provide opportunities to deliver multiple benefits including volume control, water quality, amenity and

sustainability and integrated flood risk management	biodiversity. Proposals to use SuDS techniques should be discussed with relevant stakeholders, Telford and Wrekin Council (as Lead Local Flood Authority) and the Environment Agency at an early stage to understand possible constraints. • Above ground SuDS must not be located in areas at existing risk of surface water flooding. • Above ground SuDS should be shallow and/or lined to ensure that groundwater does not inundate the features during high groundwater events. • Development at this site should not increase flood risk either on or off site. The design of the surface water management proposals should take into account the impacts of future climate change over the projected lifetime of the development. • Opportunities to incorporate filtration techniques such bioretention areas or rain gardens must be considered. Consideration should be made to the existing condition of receiving waterbodies and their Water Framework Directive objectives for water quality. The use of multistage SuDS treatment will clean and improve water quality of surface water runoff discharged from the site and reduce the impact on receiving water bodies. • Opportunities to incorporate source control techniques such as green roofs, permeable surfaces and rainwater harvesting must be considered in the design of the site.
NPPF and planning implications	
Exception Test requirements	The site is classified as 'More Vulnerable' and is within Flood Zone 1, but at risk from high risk of surface water flooding and low-moderate risk from groundwater flooding. The Sequential Test must be passed, the criteria for which is highlighted within the Level 1 SFRA. The Exception Test is not required under the NPPF. However, it must be shown that the development will be safe for its lifetime and the risk of flooding from all sources can be managed through a sequential approach to design.
Requirements and guidance for site-specific Flood Risk Assessment	**Flood Risk Assessment:** • Consultation with Telford and Wrekin Council, Severn Trent Water, and the Environment Agency should be undertaken at an early stage. • Developers should consult with Severn Trent Water to ensure that the development aims to help achieve the targets of the Drainage and Wastewater Management Plan. • Any FRA should be carried out in line with the National Planning Policy Framework and Flood Risk and Coastal Change Planning Practice Guidance. **Guidance for site design and making development safe:** • The developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the development meets the objectives of the NPPF's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development. (Paragraph 052 Flood Risk and Coastal Change PPG). • The risk from surface water flow routes should be quantified as part of a site-specific FRA, including a drainage strategy, so runoff magnitudes from the development are not increased by development across any ephemeral

	surface water flow routes. A drainage strategy should help inform site layout and design to ensure runoff rates are as close as possible to greenfield rates.
	• Should built development be proposed within the design surface water flood extent, careful consideration will need to be given to flood resistance and resilience measures.
	• The risk of flooding from groundwater must be investigated and must be supported by groundwater level monitoring
	• Flood resilience and resistance measures should be implemented where appropriate during the construction phase, e.g. raising of floor levels. These measures should be assessed to make sure that flooding is not increased elsewhere.
	  ○ raise them as much as possible.
	  ○ include extra flood resistance and resilience measures.
	• Other examples of flood resistance and resilience measures include:
	  ○ using flood resistant materials that have low permeability to at least 600mm above the estimated flood level
	  ○ making sure any doors, windows or other openings are flood resistant to at least 600mm above the estimated flood level
	  ○ by raising all sensitive electrical equipment, wiring and sockets to at least 600mm above the estimated flood level.

Key messages	
The site is in Flood Zone 1 but is at from high risk of surface water flooding and low-moderate risk from groundwater flooding. Development is likely to be able to proceed if: • A site-specific FRA demonstrates that the site is not at an increased risk of flooding in the future and that development of the site does not increase the risk of surface water flooding on the site and to neighbouring areas. • A carefully considered and integrated flood resilient and sustainable drainage design is put forward, with development steered away from the areas identified to be at risk of surface water flooding across the site. • Safe access and egress can be demonstrated in the surface water plus climate change events. This includes measures to reduce flood risk along these routes such as raising access, but not displacing floodwater elsewhere. • If flood mitigation measures are implemented then they are tested to check that they will not displace water elsewhere (for example, if land is raised to permit development on one area, compensatory flood storage will be required in another)	
Mapping Information	
Flood Zones	Flood Zones 2 and 3 have been taken from the Environment Agency's Flood Map for Planning mapping.
Climate change	Climate change allowances have been applied to the Environment Agency's Flood Map for Planning mapping. Climate change allowances have been applied to the Environment Agency's Risk of Flooding from Surface Water (RoFSW) map to indicate the impact on surface water flood risk.
Fluvial extents, depth, velocity and hazard mapping	No detailed hydraulic modelling is available for this area.

Surface Water	The Environment Agency's Risk of Flooding from Surface Water (RoFSW) dataset has been used for this assessment.
Surface water depth, velocity and hazard mapping	The Environment Agency's Risk of Flooding from Surface Water (RoFSW) dataset has been used for this assessment.
Groundwater	JBA Consulting Ltd. Groundwater Flood Mapping (2017)

	Telford and Wrekin Council Level 2 Strategic Flood Risk Assessment Detailed Site Summary Tables
Site details	
Site Code	**408**
Address	Land at Bratton
Area	112.47ha
Current land use	Greenfield
Proposed land use	Mixed
Flood Risk Vulnerability	More Vulnerable
Sources of flood risk	
Location of the site within the catchment	The site is a proposed Sustainable Urban Extension (SUE) site and is located to the west of the Telford and Wrekin Council area and north-west of Telford. For this assessment and assist the description of flood risk the site is split up into 2 parcels, Parcel 1 to the east of the B5063 and Parcel 2 to the west (shown in Figure 1).  *Figure 1. Map of Parcels* Parcel 1 is bounded by a tributary to the Hurley Brook to the north, the A442 to the east, and Wrockwardine Road to the south. A farmyard is situated in the central southern part of the parcel, with the boundary surrounding the buildings and the access route from the B5063, thereby excluding these elements from the

	site. The nearest Main River is Hurley Brook, which flows westwards approximately 0.70km north-east of the site. Parcel 2 is bounded by agricultural fields on the northern site boundary, and Cheshire Coppice Lane forms the western boundary. A residential area is along the southern boundary, and the east of the site is bounded by proposed site 707 and the B5063. The River Tern is the nearest Main River, which flows southwards approximately 1.25km west of the north-western corner of the area.
Topography	The Environment Agency 1m resolution LiDAR shows that Parcel 1 slopes from the southern boundary, with a maximum elevation of 63.94mAOD, towards the northern boundary, with a minimum elevation of 56.28mAOD. Parcel 2 slopes from a maximum elevation of 64.55mAOD in the south of the parcel, to a minimum elevation of 60.49mAOD to the north of the parcel.
Existing drainage features	Mapping identifies a tributary of the Hurley Brook flows through the centre of Parcel 1 in a northerly direction. The northern boundary of Parcel 1 is comprised of an unnamed ordinary water course flowing from east to west, which looks to be a tributary to Hurley Brook. Mapping also shows that an ordinary watercourse flowing west to east along a section of the southern boundary. There is also an ordinary watercourse which flows along the north-easter section of the site and bisects this section of the site.
Fluvial	**The proportion of site at risk FMFP:** FZ3 – 11% FZ2 – 16% FZ1 – 84% **Available data:** The Environment Agency's Flood Map for Planning has been used for this assessment. **Flood characteristics:** Parcel 2 is entirely in Flood Zone 1, however the Environment Agency Flood Map for Planning shows that there are areas of Parcel 1 that are within Flood Zone 2 and Flood Zone 3. These flood zones are associated with the unnamed ordinary watercourse which bisects the site. Flood Zone 2 follows the path of the ordinary watercourse inundating the site. A flow path emerges from the central ordinary watercourse, flowing north towards the unnamed ordinary watercourse along the northern boundary of the parcel. There is a large extent of inundation in the northeastern corner of the parcel and this is likely to be due to the two culverts restricting waterflow. Flood Zone 3 is smaller in extent, following the path of the central ordinary watercourse. The flow path between the central watercourse and the ordinary watercourse along the northern boundary of the parcel is not present in Flood Zone 3. Ponding occurs in the northeastern corner of the parcel but this is less extensive than in Flood Zone 2. **2008 SFRA Modelling:** Modelling undertaken for the Telford and Wrekin SFRA in 2008 shows that the extent of the fluvial flooding within Parcel 1 is greater in the southern section of the site compared to the Environment Agency Flood Map for Planning mapping.

	Due to the limitations of the 2008 modelling it is recommended that that site specific hydraulic modelling is completed for this site.
Surface Water	**Proportion of site at risk (RoFSW):** **3.3% AEP – 1%** Max depth – 0.30 – 0.60m Max velocity – 0.50 – 1.00m/s **1% AEP – 2%** Max depth – 0.30 – 0.60m Max velocity – 0.50 - 1.00m/s **0.1% AEP – 12%** Max depth – 0.60 - 0.90m Max velocity – 1.00 - 2.00m/s **Description of surface water flooding:** <u>Parcel 1</u> The Environment Agency Risk of Flooding from Surface Water (RoFSW) mapping shows that Parcel 1 is at risk during the 3.3%, 1% and 0.1% AEP flood events. During the 3.3% AEP surface water event, 1% of the site is inundated, with anticipated depths and velocities of 0.30-0.60m and 0.50-1.00m/s respectively. The majority of this flooding is adjacent to the ordinary water course, but with some ponding to the east of the parcel. During the 1% AEP event, anticipated depths and velocities remain the same as in the 3.3% AEP event. However, the extent of the surface water flooding increases to 2% of the site, with further ponding in the south of the parcel. For the 1% AEP event the anticipated depths and velocities increase to 0.60-0.90m and 1.00-2.00m/s respectively. The extent of the surface water flooding increases to 12% of the site, with extensive additional ponding along the western boundary. New flow paths are present along the northern boundary, associated with the ordinary water course. The flow path that was present during the 3.3% AEP event and which flows through the middle of the site, is much more extensive. A flow path is present to the southeast of the site, flowing in a northerly direction. <u>Parcel 2</u> The Environment Agency Risk of Flooding from Surface Water (RoFSW) mapping shows that Parcel 1 is at risk during the 3.3%, 1% and 0.1% AEP flood events. During the 3.3% AEP event, several sites of ponding are present throughout the parcel, including in two drainage ditches on the southern boundary. The majority of this ponding does not exceed 0.15-0.30m in depth and 0.00-0.25m/s in velocity. However, ponding in the south of the site has a maximum depth and velocity of 0.30-0.60m and 1.00-2.00m/s respectively. During the 1% AEP the ponding is more extensive than in the 3.3% AEP surface water event. A flow path is present in the south of the parcel, flowing in a westerly direction. The maximum depth and velocity during this surface water 1% AEP event is 0.60-0.90m and 1.00-2.00m/s respectively. During the 0.1% AEP existing ponding increases in extent and additional ponding emerges. The flow path in the south of the parcel increases in extent. The

	maximum depth and velocity of this surface water flooding is 0.90-1.20m and 1.00-2.00m/s respectively.
Reservoir	The Environment Agency's statutory reservoir flooding maps show Parcel 1 is at risk of widespread flooding from the Ercall Reservoir in both the wet and dry day scenarios. Parcel 2 is not at risk from the dry day scenario but is at risk during the wet day scenario. <u>Parcel 1</u> During the dry day scenario, water flows in a northerly direction, following the path of the unnamed ordinary watercourse that bisects the site. The water is not contained within the banks of this watercourse and inundates the site. Water pools in the northeast of the site as the drainage ditch which comprises the northern boundary of the parcel, and the culvert under the A442 are at maximum capacity. Further inundation occurs during the wet day scenario, with the flow path through the centre of the site, greatly increasing in extent. A flow path is present along the western and northern boundaries of the parcel, associated with the unnamed ordinary watercourse which makes up the parcel's northern boundary. <u>Parcel 2</u> Parcel 2 is not at risk during the dry day scenario. During the wet day scenario, a flow path is present in the south of the parcel, flowing from east to west. An additional flow path is present along the eastern boundary of the parcel, flowing from south to north.
Groundwater	The site is at a negligible risk of groundwater flooding meaning groundwater levels are at least 5m below the ground's surface.
Sewers	Severn Trent's Sewer Flooding register was not available for this assessment.
Minewater Flooding	Mapping from the Coal Authority shows that the site falls within the area of a coal mine, and there is a risk of groundwater emergence. Further investigation, including ground investigation will be required as part of a site specific flood risk assessment.
Flood history	The site is not within the Environment Agency's recorded flood outlines dataset. Flood records provided by the Lead Local Flood Authority (LLFA) show that the site is in an area where there are 10 records of flooding.
Cumulative Impact Assessment	<u>Parcel 1</u> Catchment – Ketley Brook (inc. Hurley Brook) - source to Ketley Sands Flood Meadow Rank – High <u>Parcel 2</u> Catchment – Beanhill Brook - source to Shawbirch Rank – Medium
Flood risk management infrastructure	
Defences	The Environment Agency AIMS dataset shows that the site is not protected by any formal flood defences.
Residual risk	<u>Parcel 1</u> Parcel one is at residual risk from both the ordinary watercourse which bisects the parcel, and the ordinary watercourse which runs along the northern boundary. Both of these watercourses are culverted under the A442. If the culverts were to

	become blocked then water would back up and inundate the northeast corner of the parcel, and potentially the whole northern boundary. <u>Parcel 2</u> Parcel 2 is does not have a residual risk of flooding. Although there is an unnamed ordinary watercourse running approximately 315.60m north of the northern site boundary, it is unlikely that this will pose a residual risk to the site as the LiDAR shows that the site is elevated by about 10mAOD. Therefore, if this watercourse were to become blocked, it is likely that water will flow in a northerly direction, away from the site. Both parcels are at residual risk of statutory reservoir flooding in the unlikely event of a breach at the Ercall Reservoirs.
Emergency planning	
Flood warning	<u>Parcel 1</u> The parcel is not within an Environment Agency Flood Warning Area. However, the centre of the site, surrounding the unnamed ordinary watercourse is allocated as a Flood Alert Area. <u>Parcel 2</u> The parcel is not within an Environment Agency Flood Alert or Flood Warning Area.
Access and egress	<u>Parcel 1</u> Currently vehicular access and egress is possible through an access road off the B5063 to the south of the parcel and a track which runs through a field to the north of the parcel. The access road to the south of the site which currently provides access to the parcel has been excluded from the parcel boundary and so has not been included in this assessment. Therefore, this assessment of access and egress for Parcel 1 will only consider the access road to the north of the parcel. The track to the north of the parcel is only accessible through Fresh Wind Farm which lies to the west of the A442. The track uses a bridge to cross the unnamed ordinary watercourse that runs along the northern boundary, in order to access the parcel. During the 3.3% AEP event there is no surface water flooding of the track or A442 and therefore access and egress would still be possible. During the 1% AEP surface water event water inundates the bridge crossing the unnamed ordinary watercourse to a maximum depth and velocity of 0.30-0.60m and 1.00-2.00m/s respectively. This gives the flooding a hazard score of 'moderate – danger to some'. A flow path also emerges to the south of the A442 with a maximum depth of 0.15-0.30m and a maximum velocity of 1.00-2.00m/s. This gives it a hazard score of 'low-caution'. However, since there is no flooding to the north of the A442, access and egress is likely to still be possible. During the 0.1% AEP surface water event the majority of the track leading to the parcel is inundated with water. The maximum depth and velocity of this flooding is 0.60-0.90m and 1.00-2.00m/s respectively, being located on the bridge. This gives it a hazard score of 'significant – danger for most'. Therefore, safe access

	and egress is not possible via this route. The flow path on the south of the A442 increases in depth to 0.30-0.60, with the maximum velocity remaining at 1.00-2.00m/s. This gives it a hazard score of 'significant – danger for most'. However, the north of the A442 remains clear from surface water flooding. <u>Parcel 2</u> Currently vehicular access to Parcel 2 is possible from an access road off Cooke Farm, which lies to the east of the B5063. This track (hereafter referred to as Access Road 1) accesses the parcel in the northeastern corner, along the northern boundary. A second track (hereafter referred to as Access Road 2) can access the parcel, also from Cooke Farm, approximately 154.00m east from Access Road 1, along the northern boundary. During the 3.3% AEP event Access Road 1 is not inundated with surface water. There is no surface water flooding on the B5063 either, making this a safe route for access and egress. However, Access Road 2 is inundated to a maximum depth and velocity of 0.30-0.60m and 0.00-0.25m/s respectively. This flooding has a hazard score of 'moderate – danger for some'. During the 1% AEP event Access Road 1 and the B5063 remains clear from surface water flooding, making it safe for access and egress. The flooding on Access Road 2 remains at a depth and velocity of 0.30-0.60m and 0.00-0.25m/s respectively, however, the extent of the flooding increases. During the 0.1% AEP event, Access Road 1 remains clear from surface water flooding. However, the B5063 to the south of Cooke Farm is inundated with a maximum depth and velocity of 0.30-0.60m and 0.50-1.00m/s respectively. This flooding has a hazard score of 'significant – danger for most'. The B5063 to the north of Cooke Farm is not inundated and so this route would be suggested for safe access and egress. The flooding on Access Road 2 remains at a depth and velocity of 0.30-0.60m and 0.00-0.25m/s respectively, however, the extent of the surface water flooding increases. Due to the presence of surface water in every assessed AEP event on Access Road 2, Access Road 1 would be the preferred route for access and egress.
Dry Islands	The site is not located within a dry island during any modelled flood event.
Climate change	
Implications for the site	**Management Catchment: Severn Middle Shropshire** Increased storm intensities due to climate change may increase the extent, depth, velocity, hazard, and frequency of both fluvial and surface water flooding. **Fluvial Flooding:** The site is not covered by any available detailed hydraulic modelling, however, climate change uplift of 35% has been applied to the Environment Agency Flood Map for Planning. The mapping shows that Parcel 2 will remain in Flood Zone 1. The climate change uplift for Parcel 1 is almost identical to Flood Zone 2. **Surface Water:** Climate change is predicted to increase rainfall intensity in the future by a range of between 30% and 45% (the recommended precautionary sensitive range for 2061 to 2125). This will increase the likelihood, frequency and extent of surface water flooding.

	The 3.3% AEP RoFSW dataset has been re-run with a 25% climate change allowance. The 1% AEP RoFSW dataset has been re-run with a 30% and 45% climate change allowance. The extent of the surface water flood risk for the 3.3% AEP plus 25% climate change allowance is similar to that of the current day 1% AEP event. The extent of the surface water flood risk for the 1% AEP plus 30% climate change allowance is similar to that of the current day 0.1% AEP event. The extent of the surface water flood risk for the 1% AEP plus 45% climate change slightly exceeds that of the current day 0.1% AEP event. This shows that climate change will impact the flood risk of the site.
Requirements for surface water drainage	

Broad-scale assessment of potential SuDS	**Geology & Soils**
	Geology at the site consist of:
	• Bedrock – Bridgnorth Sandstone Formation – Sandstone.
	• Superficial deposits:
	  ○ Parcel 1 – Glaciolacustrine Deposits, Devensian - Clay and silt to the north of the parcel and Glaciofluvial Deposits, Devensian – Sand and gravel to the south of the parcel
	  ○ Parcel 2 - Glaciofluvial Deposits, Devensian – Sand and gravel
	Soils at the site consist of:
	• Parcel 1 – The north of the parcel consists of slightly acid loamy and clayey soils with impeded drainage. The south of the parcel consists of slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils
	• Parcel 2 - Slightly acid loamy and clayey soils with impeded drainage (east and west of B5063)
	
	Sustainable Drainage Systems (SuDS)
	The Telford and Wrekin Sustainable Drainage Systems Handbook has more guidance on the implementation of SuDS for all types of development.
	• Groundwater levels are indicated to be at least 5m below ground level and groundwater flooding is not likely, however below ground development such as basements may still be susceptible to groundwater flooding. The site is not within a source protection zone.
	• BGS data indicates that the underlying geology is Bridgnorth Sandstone Formation; Glaciolacustrine Deposits, Devensian; and Glaciofluvial Deposits, Devensian, which is likely to have highly variable permeability. This should be confirmed through infiltration testing. Off-site discharge in accordance with the SuDS hierarchy may be required to discharge surface water runoff from the site.
	• The site is located within a Groundwater Source Protection Zone. Infiltration techniques may not be suitable and should only be used following the granting of any required environmental permits from the Environment Agency for Zones 2, 3 and 4 although it is possible that infiltration may not be permitted. Proposed SuDS should be discussed with relevant stakeholders (LPA, LLFA and EA) at an early stage to understand possible opportunities and constraints.
	• The site is not located within a historic landfill site.
	• Surface water discharge rates should not exceed the existing greenfield runoff rates for the site. Opportunities to further reduce discharge rates should be considered and agreed with the LLFA. It may be possible to

	reduce site runoff by maximising the permeable surfaces on site using a combination of permeable surfacing and soft landscaping techniques. • The Risk of Flooding from Surface Water (RoFSW) mapping indicates the presence of surface water flow paths during the 3.3% AEP event. Existing flow paths should be retained and integrated with blue-green infrastructure and public open space. • If it is proposed to discharge runoff to a watercourse or sewer system, the condition and capacity of the receiving watercourse or asset should be confirmed through surveys and the discharge rate agreed with the asset owner.
Opportunities for wider sustainability and integrated flood risk management	• Implementation of SuDS at the site could provide opportunities to deliver multiple benefits including volume control, water quality, amenity and biodiversity. Proposals to use SuDS techniques should be discussed with relevant stakeholders, Telford and Wrekin Council (as Lead Local Flood Authority) and the Environment Agency at an early stage to understand possible constraints. • The ordinary watercourse and the natural surface water flow routes should be maintained and enhanced within the development site and incorporated into the surface water drainage strategy. • Above ground SuDS should be shallow and/or lined to ensure that groundwater does not inundate the features during high groundwater events. • Development at this site should not increase flood risk either on or off site. The design of the surface water management proposals should take into account the impacts of future climate change over the projected lifetime of the development. • Opportunities to incorporate filtration techniques such bioretention areas or rain gardens must be considered. Consideration should be made to the existing condition of receiving waterbodies and their Water Framework Directive objectives for water quality. The use of multistage SuDS treatment will clean and improve water quality of surface water runoff discharged from the site and reduce the impact on receiving water bodies. • Opportunities to incorporate source control techniques such as green roofs, permeable surfaces and rainwater harvesting must be considered in the design of the site. • The potential to utilise conveyance features such as swales to intercept and convey surface water runoff should be considered. Conveyance features should be located on common land or public open space to facilitate ease of access. Where slopes are >5%, features should follow contours or utilise check dams to slow flows.
NPPF and planning implications	
Exception Test requirements	The site is classified as 'More Vulnerable', is within Flood Zones 1, 2 and 3 and is at risk from surface water and potential minewater flooding. The Sequential Test must be passed, the criteria for which is highlighted within the Level 1 SFRA. The Exception Test is not required under the NPPF. However, it must be shown that the development will be safe for its lifetime and the risk of flooding from all sources can be managed through a sequential approach to design.
Requirements and guidance for site-	**Flood Risk Assessment:** • Consultation with Telford and Wrekin Council, Severn Trent Water, and the Environment Agency should be undertaken at an early stage.

specific Flood Risk Assessment	• Developers should consult with Severn Trent Water to ensure that the development aims to help achieve the targets of the Drainage and Wastewater Management Plan.
	• Any FRA should be carried out in line with the National Planning Policy Framework and Flood Risk and Coastal Change Planning Practice Guidance.
	Guidance for site design and making development safe:
	• The developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the development meets the objectives of the NPPF's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development. (Paragraph 052 Flood Risk and Coastal Change PPG).
	• The risk from surface water flow routes should be quantified as part of a site-specific FRA, including a drainage strategy, so runoff magnitudes from the development are not increased by development across any ephemeral surface water flow routes. A drainage strategy should help inform site layout and design to ensure runoff rates are as close as possible to greenfield rates.
	• Should built development be proposed within the design surface water flood extent, careful consideration will need to be given to flood resistance and resilience measures.
	• The risk of flooding from minewater must be investigated and must be supported by groundwater level monitoring
	• Flood resilience and resistance measures should be implemented where appropriate during the construction phase, e.g. raising of floor levels. These measures should be assessed to make sure that flooding is not increased elsewhere.
	  ○ raise them as much as possible.
	  ○ include extra flood resistance and resilience measures.
	• Other examples of flood resistance and resilience measures include:
	  ○ using flood resistant materials that have low permeability to at least 600mm above the estimated flood level
	  ○ making sure any doors, windows or other openings are flood resistant to at least 600mm above the estimated flood level
	  ○ by raising all sensitive electrical equipment, wiring and sockets to at least 600mm above the estimated flood level.

Key messages

The site is in Flood Zones 1, 2 and 3 and is at medium risk of surface water flooding and risk from potential minewater flooding.

Development is likely to be able to proceed if:

- Site-specific FRA demonstrates that the site is not at an increased risk of flooding in the future and that development of the site does not increase the risk of surface water flooding on the site and to neighbouring areas.
- A carefully considered and integrated flood resilient and sustainable drainage design is put forward, with development steered away from the areas identified to be at risk of surface water flooding across the site.
- Safe access and egress can be demonstrated in the surface water plus climate change events. This includes measures to reduce flood risk along these routes such as raising access, but not displacing floodwater elsewhere.

• If flood mitigation measures are implemented then they are tested to check that they will not displace water elsewhere (for example, if land is raised to permit development on one area, compensatory flood storage will be required in another)	
Mapping Information	
Flood Zones	Flood Zones 2 and 3 have been taken from the Environment Agency's Flood Map for Planning mapping. The hydraulic modelling completed on the Hurley Brook Tributary by Halcrow Group (2008) was used for this assessment.
Climate change	Climate change allowances have been applied Flood Zones 2 and 3 of the Environment Agency's Flood Map for Planning mapping. Hurley Brook Tributary hydraulic modelling (Halcrow Group, 2008) was uplifted by 20% climate change allowance as per guidance at the time. Climate change allowances have been applied to the Environment Agency's Risk of Flooding from Surface Water (RoFSW) map to indicate the impact on surface water flood risk.
Fluvial extents, depth, velocity and hazard mapping	Hurley Brook Tributary hydraulic modelling undertaken by Halcrow Group (2008).
Surface Water	The Environment Agency's Risk of Flooding from Surface Water (RoFSW) dataset has been used for this assessment.
Surface water depth, velocity and hazard mapping	The Environment Agency's Risk of Flooding from Surface Water (RoFSW) dataset has been used for this assessment.
Groundwater	JBA Consulting Ltd. Groundwater Flood Mapping (2017)

	Telford and Wrekin Council Level 2 Strategic Flood Risk Assessment Detailed Site Summary Tables
Site details	
Site Code	**424**
Address	Brandon Avenue, Shawbirch
Area	1.22ha
Current land use	Greenfield
Proposed land use	Residential
Flood Risk Vulnerability	More Vulnerable
Sources of flood risk	
Location of the site within the catchment	The site is located to the west of the Telford and Wrekin Council area and is in the north-westerly corner of Telford's urban area. The Silkin Way cycle path forms the western boundary of the site with Davenport Drive and Shawbirch Road as its northern and southern boundaries respectively. The car park for Shawbirch Medical Centre comprises its eastern boundary. The River Tern is the nearest Main River, which is located approximately 2.25km west of the site and flows westwards.
Topography	The Environment Agency 1m resolution LiDAR shows that the site slopes from a maximum elevation of 74.43mAOD (Above Ordnance Datum) on the southern boundary to a minimum elevation of 71.19mAOD on the northern boundary.
Existing drainage features	Mapping does not identify any existing watercourses within the site boundary.
Fluvial	**The proportion of site at risk FMFP:** FZ3 – 0% FZ2 – 0% FZ1 – 100% **Available data:** The Environment Agency's Flood Map for Planning has been used for this assessment. **Flood characteristics:** The site is located in Flood Zone 1 and is at negligible risk of fluvial flooding.
Surface Water	**Proportion of site at risk (RoFSW):** **3.3% AEP – 1%** Max depth – 0.15 – 0.30m Max velocity – 0.25 – 0.50m/s **1% AEP – 1%** Max depth – 0.15 – 0.30m Max velocity – 0.50 – 1.00m/s **0.1% AEP – 20%**

	Max depth – 0.30 – 0.60m Max velocity – 1.00 - 2.00m/s **Description of surface water flooding:** The Environment Agency Risk of Flooding from Surface Water (RoFSW) mapping shows that the site is at risk during the 3.3%, 1% and 0.1% AEP flood events. During the 3.3% AEP flood event 1% of the site is at risk of surface water flooding, ponding in the northwestern corner. The anticipated maximum depths are 0.15 – 0.30m and maximum velocities reach up to 0.25-0.50m/s. For the 1% AEP event the flood extent increases slightly in the northwestern corner of the site. The maximum depth remains at 0.15-0.30, but the maximum velocity increases to 0.50-1.00m/s. During the 0.1% AEP event, the western edge of the site is greatly inundated. This has a maximum depth and velocity of 0.30-0.60m and 1.00-2.00m/s respectively.
Reservoir	The Environment Agency's statutory reservoir flooding maps show the site is not at risk during the dry day scenario but is at risk during the wet day scenario from the Ercall Reservoirs. During the wet day scenario, the north and western areas of the site is inundated as water flows northwards.
Groundwater	This site is at a negligible risk of groundwater flooding meaning groundwater levels are at least 5m below the ground's surface.
Sewers	Severn Trent Water's Sewer Flooding register was not available for this assessment.
Minewater Flooding	Mapping from the Coal Authority shows that the site does not fall within the area of a coal mine, therefore it can be considered that there is a low risk of groundwater emergence.
Flood history	The site is not within the Environment Agency's recorded flood outlines dataset. Flood records provided by the Lead Local Flood Authority (LLFA) show that the site is in an area where there are 9 records of flooding.
Cumulative Impact Assessment	Catchment – Beanhill Brook - source to Shawbirch Rank – Medium
Flood risk management infrastructure	
Defences	The Environment Agency AIMS dataset shows that the site is not protected by any formal flood defences.
Residual risk	The site is at residual risk of statutory reservoir flooding in the unlikely event of a breach at the Ercall Reservoirs.
Emergency planning	
Flood warning	The site is not within an Environment Agency Flood Alert or Flood Warning Area.
Access and egress	Currently there is no vehicular access to the site. It has been assumed that the site will be accessed via the Brandon Avenue to the north. Brandon Avenue has a small extent of surface water flooding during the 3.3% AEP event. This is to a maximum depth and velocity of 0.15-0.30m and 0.25-0.50m/s respectively. The flooding has a hazard score of 'moderate – danger for some' and so could impede safe access and egress.

	During the 1% AEP event, surface water inundates Brandon Avenue to a slightly greater extent. The maximum depth of this surface water flooding is 0.30-0.90m and the maximum velocity remains at 0.25-0.50m/s. The flooding has a hazard score of 'moderate – danger for some' and so could impede safe access and egress. During the 0.1% AEP event, the maximum depth of surface water flooding on Brandon Avenue remains at 0.30-0.90m and the maximum velocity remains at 0.25-0.50m/s. The flooding has a hazard score of 'moderate – danger for some' and so could impede safe access and egress. A site-specific Flood Risk Assessment should be undertaken to evaluate accessibility to pedestrians and vehicles. Developers must demonstrate that safe access and egress in the 0.1% AEP event, including allowance for climate change.
Dry Islands	The site is not located within a dry island during any modelled flood event.
Climate change	
Implications for the site	**Management Catchment: Severn Middle Shropshire** Increased storm intensities due to climate change may increase the extent, depth, velocity, hazard, and frequency of both fluvial and surface water flooding. **Fluvial Flooding:** The site is not covered by any available detailed hydraulic modelling, however, climate change uplift of 35% has been applied to the Environment Agency Flood Map for Planning. The mapping shows that the site will remain in Flood Zone 1, this indicates that the impact of climate change on future risk of fluvial flooding to the site is negligible. **Surface Water:** Climate change is predicted to increase rainfall intensity in the future by a range of between 30% and 45% (the recommended precautionary sensitive range for 2061 to 2125). This will increase the likelihood, frequency and extent of surface water flooding. The 3.3% AEP Risk of Flooding from Surface Water dataset has been re-run with a 25% climate change allowance. The 1% AEP Risk of Flooding from Surface Water dataset has been re-run with a 30% and 45% climate change allowance. The extent of the surface water flood risk for the 3.3% AEP plus 25% climate change allowance is greater that of the current day 1% AEP event. The extent of the surface water flood risk for the 1% AEP plus 30% climate change allowance sits between that of the current day 1% AEP event and the 0.1% AEP event. The extent of the surface water flood risk for the 1% AEP plus 45% climate change is slightly less than that of the current day 0.1% AEP event. This shows that climate change will impact the flood risk of the site.
Requirements for surface water drainage	
Broad-scale assessment of potential SuDS	**Geology & Soils** Geology at the site consist of: • Bedrock – Uriconian Group - Basaltic-rock. • Superficial deposits – Glaciofluvial Deposits, Devensian – Sand and gravel.

	Soils at the site consist of: • Slightly acid loamy and clayey soils with impeded drainage (eastern side) • Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils (western side) **Sustainable Drainage Systems (SuDS)** The Telford and Wrekin Sustainable Drainage Systems Handbook has more guidance on the implementation of SuDS for all types of development. • Groundwater levels are indicated to be at least 5m below ground level and groundwater flooding is not likely, however below ground development such as basements may still be susceptible to groundwater flooding. • BGS data indicates that the underlying geology is basaltic rock, sand and gravel which is likely to be with highly variable permeability. This should be confirmed through infiltration testing. Off-site discharge in accordance with the SuDS hierarchy may be required to discharge surface water runoff from the site. • The site is not within a source protection zone. • The site is not located within a historic landfill site. • Surface water discharge rates should not exceed the existing greenfield runoff rates for the site. Opportunities to further reduce discharge rates should be considered and agreed with the LLFA. It may be possible to reduce site runoff by maximising the permeable surfaces on site using a combination of permeable surfacing and soft landscaping techniques. • The Risk of Flooding from Surface Water (RoFSW) mapping indicates the presence of a surface water flow path along the southern boundary during the 3.3% AEP events. Existing flow paths should be retained and integrated with blue-green infrastructure. • If it is proposed to discharge runoff to a watercourse or sewer system, the condition and capacity of the receiving watercourse or asset should be confirmed through surveys and the discharge rate agreed with the asset owner.
Opportunities for wider sustainability and integrated flood risk management	• Implementation of SuDS at the site could provide opportunities to deliver multiple benefits including volume control, water quality, amenity and biodiversity. Proposals to use SuDS techniques should be discussed with relevant stakeholders (Three Rivers District Council, Hertfordshire County Council (as the LLFA) and the Environment Agency) at an early stage to understand possible constraints. • Natural surface water flow routes should be maintained and enhanced within the development site. • Above ground SuDS should be shallow and/or lined to ensure that groundwater does not inundate the features during high groundwater events. • Development at this site should not increase flood risk either on or off site. The design of the surface water management proposals should take into account the impacts of future climate change over the projected lifetime of the development. • Opportunities to incorporate filtration techniques such bioretention areas or rain gardens must be considered. Consideration should be made to the existing condition of receiving waterbodies and their Water Framework Directive objectives for water quality. The use of multistage SuDS treatment will clean and improve water quality of surface water runoff discharged from the site and reduce the impact on receiving water bodies.

	• Opportunities to incorporate source control techniques such as green roofs, permeable surfaces and rainwater harvesting must be considered in the design of the site.
NPPF and planning implications	
Exception Test requirements	The site is classified as 'More Vulnerable' and is within Flood Zone 1, but at low risk from surface water flooding. The Sequential Test must be passed, the criteria for which is highlighted within the Level 1 SFRA. The Exception Test is not required under the NPPF. However, it must be shown that the development will be safe for its lifetime and the risk of flooding from all sources can be managed through a sequential approach to design.

Requirements and guidance for site-specific Flood Risk Assessment	**Flood Risk Assessment:**
	• Consultation with Telford and Wrekin Council, Severn Trent Water, and the Environment Agency should be undertaken at an early stage.
	• Developers should consult with Severn Trent Water to ensure that the development aims to help achieve the targets of the Drainage and Wastewater Management Plan.
	• Any FRA should be carried out in line with the National Planning Policy Framework and Flood Risk and Coastal Change Planning Practice Guidance.
	Guidance for site design and making development safe:
	• The developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the development meets the objectives of the NPPF's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development. (Paragraph 052 Flood Risk and Coastal Change PPG).
	• The risk from surface water flow routes should be quantified as part of a site-specific FRA, including a drainage strategy, so runoff magnitudes from the development are not increased by development across any ephemeral surface water flow routes. A drainage strategy should help inform site layout and design to ensure runoff rates are as close as possible to greenfield rates.
	• Should built development be proposed within the design surface water flood extent, careful consideration will need to be given to flood resistance and resilience measures.
	• The risk of flooding from groundwater must be investigated and must be supported by groundwater level monitoring
	• Flood resilience and resistance measures should be implemented where appropriate during the construction phase, e.g. raising of floor levels. These measures should be assessed to make sure that flooding is not increased elsewhere.
	  ○ raise them as much as possible.
	  ○ include extra flood resistance and resilience measures.
	• Other examples of flood resistance and resilience measures include:
	  ○ using flood resistant materials that have low permeability to at least 600mm above the estimated flood level
	  ○ making sure any doors, windows or other openings are flood resistant to at least 600mm above the estimated flood level
	  ○ by raising all sensitive electrical equipment, wiring and sockets to at least 600mm above the estimated flood level.

Key messages
The site is in Flood Zone 1 but is at low risk of surface water flooding. Development is likely to be able to proceed if: • A site-specific FRA demonstrates that the site is not at an increased risk of flooding in the future and that development of the site does not increase the risk of surface water flooding on the site and to neighbouring areas. • A carefully considered and integrated flood resilient and sustainable drainage design is put forward, with development steered away from the areas identified to be at risk of surface water flooding across the site. • Safe access and egress can be demonstrated in the surface water plus climate change events. This includes measures to reduce flood risk along these routes such as raising access, but not displacing floodwater elsewhere. • If flood mitigation measures are implemented then they are tested to check that they will not displace water elsewhere (for example, if land is raised to permit development on one area, compensatory flood storage will be required in another)

Mapping Information	
Flood Zones	Flood Zones 2 and 3 have been taken from the Environment Agency's Flood Map for Planning mapping.
Climate change	Climate change allowances have been applied to the Environment Agency's Risk of Flooding from Surface Water (RoFSW) map to indicate the impact on surface water flood risk.
Fluvial extents, depth, velocity and hazard mapping	No detailed hydraulic modelling is available for this area.
Surface Water	The Environment Agency's Risk of Flooding from Surface Water (RoFSW) dataset has been used for this assessment.
Surface water depth, velocity and hazard mapping	The Environment Agency's Risk of Flooding from Surface Water (RoFSW) dataset has been used for this assessment.
Groundwater	JBA Consulting Ltd. Groundwater Flood Mapping (2017)

	Telford and Wrekin Council Level 2 Strategic Flood Risk Assessment Detailed Site Summary Tables
Site details	
Site Code	**449**
Address	Land East of Dawley Road, Lawley
Area	5.11ha
Current land use	Greenfield
Proposed land use	Residential
Flood Risk Vulnerability	More Vulnerable
Sources of flood risk	
Location of the site within the catchment	The site is located to the north-west of Lawley Village, west of Telford. The site is bordered by a residential area to the south and east, a small woodland to the north and Dawley Road to the west. The River Severn is the nearest main river located approximately 4.60km south-west of the site.
Topography	The Environment Agency 1m resolution LiDAR shows that the southern section of the site is part of a local high area, with a maximum level across along the northern boundary of 180.78mAOD (Above Ordnance Datum). The LiDAR shows that the site slopes considerably towards the wooded area in the northern corner of the site, where the lowest level is 159.49mAOD.
Existing drainage features	Mapping does not identify any existing watercourses within the site boundary, however, the Ketley Brook, an ordinary watercourse, is within 200m of the north-east boundary of the site.
Fluvial	**The proportion of site at risk FMFP:** FZ3 – 0% FZ2 – 0% FZ1 – 100% **Available data:** The Environment Agency's Flood Map for Planning has been used for this assessment. **Flood characteristics:** The site is located in Flood Zone 1 and is at negligible risk of fluvial flooding.
Surface Water	**Proportion of site at risk (RoFSW):** **3.3% AEP – 0%** Max depth – N/A Max velocity – N/A **1% AEP – <1%** Max depth – 0.15 – 0.30m Max velocity – 0.50 – 1.00m/s **0.1% AEP – 9%**

	Max depth – 0.15 – 0.30m Max velocity – 1.00 – 2.00m/s **Description of surface water flooding:** The Environment Agency Risk of Flooding from Surface Water (RoFSW) mapping shows that during the 1% AEP event, that there is an area of surface water flooding to the north-east of the site, which slightly encroaches into the site with a depth of up to 0.15m. During the 0.1% the mapping shows a surface water flow route, which originates offsite, to the south-west of the site, flowing across Dawley Road and entering the site halfway along the western boundary. The flow route follows the topography of the site and flows north across the site before leaving through the northern boundary to join with Ketley Brook. The flow route has a maximum depth of 0.30m, a velocity of 2.00m/s and a hazard rating of 'Low – caution'.
Reservoir	The Environment Agency's statutory reservoir flooding maps show the site is not at risk of flooding from any statutory reservoirs.
Groundwater	All of this site is at a negligible risk of groundwater flooding meaning groundwater levels are at least 5m below the ground's surface.
Sewers	Severn Trent Water's Sewer Flooding register was not available for this assessment.
Minewater Flooding	Mapping from the Coal Authority shows that the site falls within the area of a coal mine and is also within an area of shallow mine workings, and there is a risk of groundwater emergence. Further investigation, including ground investigation will be required as part of a site specific flood risk assessment.
Flood history	The site is not within the Environment Agency's recorded flood outlines dataset. Flood records provided by the Lead Local Flood Authority (LLFA) show that the site is in an area where there are 4 records of flooding.
Cumulative Impact Assessment	Catchment – Ketley Brook (inc. Hurley Brook) - source to Ketley Sands Flood Meadow Rank – High
Flood risk management infrastructure	
Defences	The Environment Agency AIMS dataset shows that the site is not protected by any formal flood defences.
Residual risk	The site is not at residual risk of flooding.
Emergency planning	
Flood warning	The site is not within an Environment Agency Flood Alert or Flood Warning Area.
Access and egress	There are two flow routes across Dawley Road, which will impact the safe access and egress from the site. The first flow routes is the flow route which flows through the site during the 0.1% AEP event, before entering the site it flows over Dawley Road. A hazard rating of 'Moderate – dangerous for some' has been given to the section of the road that floods, this means that pedestrian access and egress will not be possible during a flood event, however, vehicular access may still be possible. To the north-west of the site there is another flow route which crosses Dawley Road, the hazard rating of this flow route is 'Significant – dangerous for most', during the 0.1% AEP surface water flood event, pedestrian and vehicular access will not be possible.

	A site-specific Flood Risk Assessment should be undertaken to evaluate accessibility to pedestrians and vehicles. Developers must demonstrate that safe access and egress in the 0.1% AEP event, including allowance for climate change.
Dry Islands	The site is not located within a dry island during any modelled flood event.
Climate change	
Implications for the site	**Management Catchment: Severn Middle Worcestershire** Increased storm intensities due to climate change may increase the extent, depth, velocity, hazard, and frequency of both fluvial and surface water flooding. **Fluvial Flooding:** The site is not covered by any available detailed hydraulic modelling, however, climate change uplift of 35% has been applied to the Environment Agency Flood Map for Planning. The mapping shows that the site will remain in Flood Zone 1, this indicates that the impact of climate change on future risk of fluvial flooding to the site is negligible. **Surface Water:** Climate change is predicted to increase rainfall intensity in the future by a range of between 30% and 45% (the recommended precautionary sensitive range for 2061 to 2125). This will increase the likelihood, frequency and extent of surface water flooding. The 1% AEP Risk of Flooding from Surface Water dataset has been re-run with a 45% climate change allowance, which shows that a surface water flow route will form across the site, flowing north, with a similar extent as the current day 0.1% AEP event flow route.
Requirements for surface water drainage	

Broad-scale assessment of potential SuDS	**Geology & Soils**
	Geology at the site consist of:
	• Bedrock –
	  ○ Pennine Middle Coal Measures Formation – Sandstone (southern area)
	  ○ Pennine Middle Coal Measures Formation - Mudstone, siltstone and sandstone (central area)
	  ○ Pennine Lower Coal Measures Formation - Mudstone, siltstone and sandstone (northern area)
	• Superficial deposits –
	  ○ Glaciofluvial Sheet Deposits, Devensian – Sand and gravel (southern area)
	  ○ Till, Devensian – Diamicton (central and northern areas)
	Soils at the site consist of:
	• Restored soils mostly from quarry and opencast spoil with loamy texture
	
	Sustainable Drainage Systems (SuDS)
	The Telford and Wrekin Sustainable Drainage Systems Handbook has more guidance on the implementation of SuDS for all types of development.
	• Groundwater levels are indicated to be at least 5m below ground level and groundwater flooding is not likely, however there may be risk of groundwater emergence due to mine water flooding. Additional site investigation work may be required to support the detailed design of the drainage system. This may include groundwater monitoring to

	demonstrate that a sufficient unsaturated zone has been provided above the highest occurring groundwater level. • The site is not within a source protection zone. • The site is not located within a historic landfill site. • Surface water discharge rates should not exceed pre-development discharge rates for the site and should be designed to be as close to greenfield runoff rates as reasonably practical in consultation with the LLFA. It may be possible to reduce site runoff by maximising the permeable surfaces on site using a combination of permeable surfacing and soft landscaping techniques. • The Risk of Flooding from Surface Water (RoFSW) mapping indicates the presence of a surface water flow path through the site during the 0.1% AEP events. Existing flow paths should be retained and integrated with blue-green infrastructure. • If it is proposed to discharge runoff to a watercourse or sewer system, the condition and capacity of the receiving watercourse or asset should be confirmed through surveys and the discharge rate agreed with the asset owner.
Opportunities for wider sustainability and integrated flood risk management	• Implementation of SuDS at the site could provide opportunities to deliver multiple benefits including volume control, water quality, amenity and biodiversity. Proposals to use SuDS techniques should be discussed with relevant stakeholders, Telford and Wrekin Council (as Lead Local Flood Authority) and the Environment Agency at an early stage to understand possible constraints. • Natural surface water flow routes should be maintained and enhanced within the development site. • Above ground SuDS should be shallow and/or lined to ensure that groundwater does not inundate the features during high groundwater events. • Development at this site should not increase flood risk either on or off site. The design of the surface water management proposals should take into account the impacts of future climate change over the projected lifetime of the development. • Consideration should be made to the existing condition of receiving waterbodies and their Water Framework Directive objectives for water quality, especially at this site, due to the high levels of zinc originating from the mine workings • Opportunities to incorporate filtration techniques such bioretention areas or rain gardens must be considered. The use of multistage SuDS treatment will clean and improve water quality of surface water runoff discharged from the site and reduce the impact on receiving water bodies. • Opportunities to incorporate source control techniques such as green roofs, permeable surfaces and rainwater harvesting must be considered in the design of the site.
NPPF and planning implications	
Exception Test requirements	The site is classified as ‘More Vulnerable’ and is within Flood Zone 1, but at risk from surface water flooding. The Sequential Test must be passed, the criteria for which is highlighted within the Level 1 SFRA. The Exception Test is not required under the NPPF. However, it must be shown that the development will be safe for its lifetime and the risk of

	flooding from all sources can be managed through a sequential approach to design.

Requirements and guidance for site-specific Flood Risk Assessment	**Flood Risk Assessment:**
	• Consultation with Telford and Wrekin Council, Severn Trent Water, and the Environment Agency should be undertaken at an early stage.
	• Developers should consult with Severn Trent Water to ensure that the development aims to help achieve the targets of the Drainage and Wastewater Management Plan.
	• Any FRA should be carried out in line with the National Planning Policy Framework and Flood Risk and Coastal Change Planning Practice Guidance.
	Guidance for site design and making development safe:
	• The developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the development meets the objectives of the NPPF's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development. (Paragraph 052 Flood Risk and Coastal Change PPG).
	• The risk from the surface water flow route should be quantified as part of a site-specific FRA, including a drainage strategy, so runoff magnitudes from the development are not increased by development across any ephemeral surface water flow routes. A drainage strategy should help inform site layout and design to ensure runoff rates are as close as possible to greenfield rates.
	• Should built development be proposed within the design surface water flood extent, careful consideration will need to be given to flood resistance and resilience measures.
	• The risk of flooding from groundwater must be investigated and must be supported by groundwater level monitoring
	• Flood resilience and resistance measures should be implemented where appropriate during the construction phase, e.g. raising of floor levels. These measures should be assessed to make sure that flooding is not increased elsewhere.
	  ○ raise them as much as possible.
	  ○ include extra flood resistance and resilience measures.
	• Other examples of flood resistance and resilience measures include:
	  ○ using flood resistant materials that have low permeability to at least 600mm above the estimated flood level
	  ○ making sure any doors, windows or other openings are flood resistant to at least 600mm above the estimated flood level
	  ○ by raising all sensitive electrical equipment, wiring and sockets to at least 600mm above the estimated flood level.

Key messages

The site is in Flood Zone 1 but is at risk of surface water flooding.

Development is likely to be able to proceed if:

- A site-specific FRA demonstrates that the site is not at an increased risk of flooding in the future and that development of the site does not increase the risk of surface water flooding on the site and to neighbouring areas.

- A carefully considered and integrated flood resilient and sustainable drainage design is put forward, with development steered away from the areas identified to be at risk of surface water flooding across the site.
- Safe access and egress can be demonstrated in the surface water plus climate change events. This includes measures to reduce flood risk along these routes such as raising access, but not displacing floodwater elsewhere.
- If flood mitigation measures are implemented then they are tested to check that they will not displace water elsewhere (for example, if land is raised to permit development on one area, compensatory flood storage will be required in another)

Mapping Information	
Flood Zones	Flood Zones 2 and 3 have been taken from the Environment Agency's Flood Map for Planning mapping.
Climate change	Climate change allowances have been applied to the Environment Agency's Risk of Flooding from Surface Water (RoFSW) map to indicate the impact on surface water flood risk.
Fluvial extents, depth, velocity and hazard mapping	No detailed hydraulic modelling is available for this area.
Surface Water	The Environment Agency's Risk of Flooding from Surface Water (RoFSW) dataset has been used for this assessment.
Surface water depth, velocity and hazard mapping	The Environment Agency's Risk of Flooding from Surface Water (RoFSW) dataset has been used for this assessment.
Groundwater	JBA Consulting Ltd. Groundwater Flood Mapping (2017)

	Telford and Wrekin Council Level 2 Strategic Flood Risk Assessment Detailed Site Summary Tables
Site details	
Site Code	**459**
Address	Malinslee Telford
Area	2.06ha
Current land use	Mixed Use
Proposed land use	Residential
Flood Risk Vulnerability	More Vulnerable
Sources of flood risk	
Location of the site within the catchment	The site is located to the southeast of the Telford and Wrekin Council area and to the east of the centre of Telford. The site is bounded by the B4373 (also known as Dawley Green Way) along its southwestern boundary and the B5072 (also known as West Centre Way) along its northeastern boundary. Along its southeastern boundary, the site is bounded by an unnamed wooded area. The nearest Main River is locate 3.90km to the east of the southeastern boundary.
Topography	The Environment Agency 1m resolution LiDAR shows that the site slopes from a maximum elevation of 198.43mAOD (Above Ordnance Datum) on the southeastern boundary to a minimum elevation of 191.75mAOD along the northeastern boundary.
Existing drainage features	Mapping does not identify any existing watercourses within the site boundary.
Fluvial	**The proportion of site at risk FMFP:** FZ3 – 0% FZ2 – 0% FZ1 – 100% **Available data:** The Environment Agency's Flood Map for Planning has been used in this assessment. **Flood characteristics:** The site is located in Flood Zone 1 and is at negligible risk of fluvial flooding.
Surface Water	**Proportion of site at risk (RoFSW):** **3.3% AEP – 3%** Max depth – 0.30 - 0.60m Max velocity – 0.00 – 0.25m/s **1% AEP – 5%** Max depth – 0.30 – 0.60m Max velocity – 0.25 – 0.50m/s

	0.1% AEP – 20% Max depth – 0.90 – 1.20m Max velocity – 1.00 – 2.00m/s **Description of surface water flooding:** The Environment Agency Risk of Flooding from Surface Water (RoFSW) mapping shows that the east of the site is at risk from surface water flooding during the 3.3%, 1% and 0.1% AEP flood events. It is assumed that this flood risk is associated with the drainage ditch which runs parallel to the site boundary. During the 3.3% AEP event, surface water inundates 3% of the site in total, ponding in the north of the site. The maximum depth and velocity of this ponding is 0.30-0.60m and 0.00-0.25m/s respectively. During the 1% AEP event the extent of inundation increases to 5% of the total site area but maximum depths and velocities increase to 0.30-0.60m and 0.25-0.50m/s respectively. During the 0.1% AEP event the extent of inundation increases to 20% of the total site area, to the north of the site but with some flow paths emerging in the south. This ponding has a maximum depth and velocity of 0.60-0.90m and 1.00-2.00m/s respectively.
Reservoir	The Environment Agency's reservoir flooding maps show the site is not at risk of flooding from any reservoirs.
Groundwater	The site is at a negligible risk of groundwater flooding meaning groundwater levels are at least 5m below the ground's surface.
Sewers	Severn Trent Water's Sewer Flooding register was not available for this assessment.
Minewater Flooding	Mapping from the Coal Authority shows that the site falls within the area of a coal mine and is also within an area of shallow mine workings, and there is a risk of groundwater emergence. Further investigation, including ground investigation will be required as part of a site specific flood risk assessment.
Flood history	The site is not within the Environment Agency's recorded flood outlines dataset. Flood records provided by the Lead Local Flood Authority (LLFA) show that the site is in an area where there are 4 records of flooding.
Cumulative Impact Assessment	Catchment – Wesley Brook (inc. Nedge Brook) - source to River Worfe Rank – Medium
Flood risk management infrastructure	
Defences	The Environment Agency AIMS dataset shows that the site is not protected by any formal flood defences.
Residual risk	The site is not at residual risk of flooding.
Emergency planning	
Flood warning	The site is not within an Environment Agency Flood Alert or Flood Warning Area.
Access and egress	Currently vehicular access is only possible on the southeastern boundary, via Park Road. Park Road is not impacted by surface water flooding during the 3.3% or 1% AEP events and so access and egress is still likely to be possible.

	During the 0.1% AEP event, a flow path is present along Park Road flowing from south to north. This has a maximum depth and velocity of 0.15-0.30m and 1.00-2.00m/s respectively, resulting in 'moderate - danger for some' flood hazard rating. This could impact access and egress. A site-specific Flood Risk Assessment should be undertaken to evaluate accessibility to pedestrians and vehicles. Developers must demonstrate that safe access and egress in the 0.1% AEP event, including allowance for climate change.
Dry Islands	The site is not located within a dry island during any modelled flood event.
Climate change	
Implications for the site	**Management Catchment: Severn Middle Shropshire** Increased storm intensities due to climate change may increase the extent, depth, velocity, hazard, and frequency of both fluvial and surface water flooding. **Fluvial Flooding:** The site is not covered by any available detailed hydraulic modelling, however, climate change uplift of 35% has been applied to the Environment Agency Flood Map for Planning. The mapping shows that the site will remain in Flood Zone 1, this indicates that the impact of climate change on future risk of fluvial flooding to the site is negligible. **Surface Water:** Climate change is predicted to increase rainfall intensity in the future by a range of between 30% and 45% (the recommended precautionary sensitive range for 2061 to 2125). This will increase the likelihood, frequency and extent of surface water flooding. The 3.3% AEP Risk of Flooding from Surface Water dataset has been re-run with a 25% climate change allowance. The 1% AEP Risk of Flooding from Surface Water dataset has been re-run with a 30% and 45% climate change allowance. The extent of the surface water flood risk for the 3.3% AEP plus 25% climate change allowance is similar to that of the current day 1% AEP event. The extent of the surface water flood risk for the 1% AEP plus 30% climate change allowance is similar to that of the current day 0.1% AEP event. The extent of the surface water flood risk for the 1% AEP plus 45% climate change slightly exceeds that of the current day 0.1% AEP event. This shows that climate change will impact the flood risk of the site.
Requirements for surface water drainage	
Broad-scale assessment of potential SuDS	**Geology & Soils** Geology at the site consist of: • Bedrock – Pennine Middle Coal Measures Formation - Mudstone, siltstone and sandstone. • Superficial deposits – Till, Devensian – Diamicton. Soils at the site consist of: • Slightly acid loamy and clayey soils with impeded drainage **Sustainable Drainage Systems (SuDS)** The Telford and Wrekin Sustainable Drainage Systems Handbook has more guidance on the implementation of SuDS for all types of development.

	• Groundwater levels are indicated to be at least 5m below ground level and groundwater flooding is not likely, however below ground development such as basements may still be susceptible to groundwater flooding. • The site is not within a source protection zone. • The site is not located within a historic landfill site. • Surface water discharge rates should not exceed pre-development discharge rates for the site and should be designed to be as close to greenfield runoff rates as reasonably practical in consultation with the LLFA. It may be possible to reduce site runoff by maximising the permeable surfaces on site using a combination of permeable surfacing and soft landscaping techniques. • The Risk of Flooding from Surface Water (RoFSW) mapping indicates the presence of surface water ponding to the north of the site during all AEP events. Existing flow paths should be retained and integrated with blue-green infrastructure. • If it is proposed to discharge runoff to a watercourse or sewer system, the condition and capacity of the receiving watercourse or asset should be confirmed through surveys and the discharge rate agreed with the asset owner.
Opportunities for wider sustainability and integrated flood risk management	• Implementation of SuDS at the site could provide opportunities to deliver multiple benefits including volume control, water quality, amenity and biodiversity. Proposals to use SuDS techniques should be discussed with relevant stakeholders, Telford and Wrekin Council (as Lead Local Flood Authority) and the Environment Agency at an early stage to understand possible constraints. • Above ground SuDS should be shallow and/or lined to ensure that groundwater does not inundate the features during high groundwater events. • Development at this site should not increase flood risk either on or off site. The design of the surface water management proposals should take into account the impacts of future climate change over the projected lifetime of the development. • Opportunities to incorporate filtration techniques such bioretention areas or rain gardens must be considered. Consideration should be made to the existing condition of receiving waterbodies and their Water Framework Directive objectives for water quality. The use of multistage SuDS treatment will clean and improve water quality of surface water runoff discharged from the site and reduce the impact on receiving water bodies. • Opportunities to incorporate source control techniques such as green roofs, permeable surfaces and rainwater harvesting must be considered in the design of the site.
NPPF and planning implications	
Exception Test requirements	The site is in Flood Zone 1 but is at low risk of surface water flooding at mine water flooding. The Sequential Test must be passed, the criteria for which is highlighted within the Level 1 SFRA. The Exception Test is not required under the NPPF. However, it must be shown that the development will be safe for its lifetime and the risk of flooding from all sources can be managed through a sequential approach to design.

Requirements and guidance for site-specific Flood Risk Assessment	**Flood Risk Assessment:**
	• Consultation with Telford and Wrekin Council, Severn Trent Water, and the Environment Agency should be undertaken at an early stage.
	• Developers should consult with Severn Trent Water to ensure that the development aims to help achieve the targets of the Drainage and Wastewater Management Plan.
	• Any FRA should be carried out in line with the National Planning Policy Framework and Flood Risk and Coastal Change Planning Practice Guidance.
	Guidance for site design and making development safe:
	• The developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the development meets the objectives of the NPPF's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development. (Paragraph 052 Flood Risk and Coastal Change PPG).
	• The risk from surface water flow routes should be quantified as part of a site-specific FRA, including a drainage strategy, so runoff magnitudes from the development are not increased by development across any ephemeral surface water flow routes. A drainage strategy should help inform site layout and design to ensure runoff rates are as close as possible to greenfield rates.
	• Should built development be proposed within the design surface water flood extent, careful consideration will need to be given to flood resistance and resilience measures.
	• The risk of flooding from groundwater must be investigated and must be supported by groundwater level monitoring
	• Flood resilience and resistance measures should be implemented where appropriate during the construction phase, e.g. raising of floor levels. These measures should be assessed to make sure that flooding is not increased elsewhere.
	  ○ raise them as much as possible.
	  ○ include extra flood resistance and resilience measures.
	• Other examples of flood resistance and resilience measures include:
	  ○ using flood resistant materials that have low permeability to at least 600mm above the estimated flood level
	  ○ making sure any doors, windows or other openings are flood resistant to at least 600mm above the estimated flood level
	  ○ by raising all sensitive electrical equipment, wiring and sockets to at least 600mm above the estimated flood level.

Key messages

The site is in Flood Zone 1 but is at low risk of surface water flooding at mine water flooding.

Development is likely to be able to proceed if:

- site-specific FRA demonstrates that the site is not at an increased risk of flooding in the future and that development of the site does not increase the risk of surface water flooding on the site and to neighbouring areas.
- A carefully considered and integrated flood resilient and sustainable drainage design is put forward, with development steered away from the areas identified to be at risk of surface water flooding across the site.

• Safe access and egress can be demonstrated in the surface water plus climate change events. This includes measures to reduce flood risk along these routes such as raising access, but not displacing floodwater elsewhere. • If flood mitigation measures are implemented then they are tested to check that they will not displace water elsewhere (for example, if land is raised to permit development on one area, compensatory flood storage will be required in another)	
Mapping Information	
Flood Zones	Flood Zones 2 and 3 have been taken from the Environment Agency's Flood Map for Planning mapping.
Climate change	Climate change allowances have been applied to the Environment Agency's Risk of Flooding from Surface Water (RoFSW) map to indicate the impact on surface water flood risk.
Fluvial extents, depth, velocity and hazard mapping	No detailed hydraulic modelling is available for this area.
Surface Water	The Environment Agency's Risk of Flooding from Surface Water (RoFSW) dataset has been used for this assessment.
Surface water depth, velocity and hazard mapping	The Environment Agency's Risk of Flooding from Surface Water (RoFSW) dataset has been used for this assessment.
Groundwater	JBA Consulting Ltd. Groundwater Flood Mapping (2017)

	Telford and Wrekin Council Level 2 Strategic Flood Risk Assessment Detailed Site Summary Tables
Site details	
Site Code	**462**
Address	Land Southeast of Newport Town Centre
Area	2.90 ha
Current land use	Greenfield
Proposed land use	Mixed
Flood Risk Vulnerability	More Vulnerable
Sources of flood risk	
Location of the site within the catchment	The site is located to the east of Newport. It is bounded by the A41 to the west, fields to the east and north. The nearest Main River is The Strine Brook, located approximately 1.7m northwest of the site.
Topography	The Environment Agency 1m resolution LiDAR shows that the site slopes from a maximum elevation of 77.16mAOD (Above Ordnance Datum) along the southern boundary to a minimum elevation of 73.89mAOD along the northwestern boundary. Within the site there are five small areas of elevation, which look to be mounds of earth. Two are located in the northern half of the site and three in the southern half, with a maximum elevation of 76.78mAOD. In the northeastern corner of the site, just outside the site boundary to the east, there is a small length of elevation leading to a bridge which passes over the Newport to Stafford Greenway cycleway.
Existing drainage features	Mapping does not identify any existing watercourses within the site boundary, however there is a series of drainage ditches to the east of the site.
Fluvial	**The proportion of site at risk FMFP:** FZ3 – 0% FZ2 – 0% FZ1 – 100% **Available data:** The Environment Agency's Flood Map for Planning has been used for this assessment. **Flood characteristics:** The site is located in Flood Zone 1 and is at negligible risk of fluvial flooding.
Surface Water	**Proportion of site at risk (RoFSW):** **3.3% AEP** – 2% Max depth – 0.30-0.60m Max velocity – 1.00-2.00m/s **1% AEP** – 3%

	Max depth – 0.30-0.60m Max velocity – 1.00-2.00m/s **0.1% AEP** – 19% Max depth – 0.30-0.60m Max velocity – 1.00-2.00m/s **Description of surface water flooding:** The Environment Agency Risk of Flooding from Surface Water (RoFSW) mapping shows that surface water flooding inundates the site during every AEP event. During the 3.3% AEP event 2% of the site, along the north of the western boundary of the site is at risk of surface water flooding. This flooding has a maximum depth of 0.60m and a maximum velocity of 2.00m/s and has a hazard classification of 'significant – danger for most'. During the 1% AEP surface water event, the extent of the flooding increases to 3%, remaining in the north of the western boundary of the site. The depth and velocity of this flooding remains at 0.60m and 2.00m/s respectively. This gives the flooding a classification of 'significant – danger for most'. During the 0.1% AEP event, the extent of the flooding increases to 19% of the site along the north of the western boundary. Ponding also occurs in the south of the western boundary. The depth and the velocity of this flooding remains at 0.60m and 2.00m/s respectively. This gives the flooding a classification of 'significant – danger for most'.
Reservoir	The Environment Agency's statutory reservoir flooding mapping shows that the site is inundated in both the dry-day and wet-day scenarios. The source of this potential is the Field Aston reservoir located approximately 526.00m to the south of the southern boundary of the site. During the dry-day scenario the western boundary of the site is inundated in a similar pattern to the 0.1% surface water flooding. During the wet-day scenario the flooding is slightly more extensive but remains along the western boundary, encroaching into the centre of the site.
Groundwater	The majority of the site has a moderate risk of groundwater flooding meaning groundwater levels between 0.025m and 0.5m below ground surface. There is a very small portion of the site, on the southwestern boarder that has a low risk of groundwater flooding meaning groundwater levels between 0.5m and 5m below ground surface.
Sewers	Severn Trent Water's Sewer Flooding register was not available for this assessment.
Minewater Flooding	Mapping from the Coal Authority shows that the site does not fall within the area of a coal mine, therefore it can be considered that there is a low risk of groundwater emergence.
Flood history	The site is not within the Environment Agency's recorded flood outlines dataset. Flood records provided by the Lead Local Flood Authority (LLFA) show that the site is not in an area with previous flood records.
Cumulative Impact Assessment	Catchment – Strine Brook - source to Wall Brook Rank – Medium

Flood risk management infrastructure	
Defences	The Environment Agency AIMS dataset shows that the site is not protected by any formal flood defences.
Residual risk	The site is at residual risk of statutory reservoir flooding in the unlikely event of a breach at Field Aston Reservoir.
Emergency planning	
Flood warning	The site is not within an Environment Agency Flood Alert or Flood Warning Area.
Access and egress	Vehicular access is assumed to be possible in the south of the site from an access road that runs parallel to the east of the A41. During the 3.3% AEP event there is surface water flooding along the access road to a maximum depth of 0.00-0.15m and a maximum velocity of 1.00-2.00m/s. This flooding has a hazard classification of 'Low – Caution'. There is a small extent of flooding on the A41 with a maximum depth and velocity of 0.00-0.15m and 1.00-2.00m/s. This flooding has a hazard classification of 'Low – Caution' and so safe access and egress is likely still possible. During the 1% surface water AEP event, the flooding along this access road is more extensive but the maximum depth and velocity remains at 0.00-0.15m and 1.00-2.00m/s. The flooding on the A41 is more extensive and depths increase to 0.15-0.30m and velocities increase to 1.00-2.00m/s. This flooding is classified as 'Moderate – danger for some' with vehicular access and egress potentially still being possible. During the 0.1% surface water AEP event, the maximum depth and velocity of the flooding on the access road increases to 0.30-0.60m and >2.00m/s. The flooding on the A41 increases to a maximum depth and velocity of 0.15-0.30m and 1.00-2.00m/s. This flooding is classified as 'Significant – danger for most' and so safe access and egress is not possible.
Dry Islands	The site is not located within a dry island during any modelled flood event.
Climate change	
Implications for the site	**Management Catchment: Severn Middle Shropshire** **Fluvial Flooding:** The site is not covered by any available detailed hydraulic modelling, however, climate change uplift of 35% has been applied to the Environment Agency Flood Map for Planning. The mapping shows that the site will remain in Flood Zone 1, this indicates that the impact of climate change on future risk of fluvial flooding to the site is negligible. **Surface Water:** Climate change is predicted to increase rainfall intensity in the future by a range of between 30% and 45% (the recommended precautionary sensitive range for 2061 to 2125). This will increase the likelihood, frequency and extent of surface water flooding. The 3.3% AEP RoFSW dataset has been re-run with a 25% climate change allowance. The 1% AEP RoFSW dataset has been re-run with a 30% and 45% climate change allowance.

	The extent of the surface water flood risk for the 3.3% AEP plus 25% climate change allowance is greater than that of the current day 1% AEP event. The extent of the surface water flood risk for the 1% AEP plus 30% climate change allowance is similar to that of the current day 0.1% AEP event. The extent of the surface water flood risk for the 1% AEP plus 45% climate change slightly exceeds that of the current day 0.1% AEP event. This shows that climate change will impact the flood risk of the site.
Requirements for surface water drainage	

Broad-scale assessment of potential SuDS	**Geology & Soils**
	Geology at the site consist of:
	• Bedrock
	  ○ Chester Formation – Sandstone and conglomerate (whole site)
	• Superficial deposits
	  ○ Diamicton formation– till, devesian (south of the site)
	  ○ There is no data available for the superficial deposits in the north of the site.
	Soils at the site consist of:
	• Freely draining, slightly acidic sandy soils (northern half of the site)
	• Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils (southern half of the site)
	
	Sustainable Drainage Systems (SuDS):
	• Groundwater levels are indicated to be between 0.5 and 5m below ground level and there is a risk of flooding to subsurface assets and below ground development such as basements. Groundwater monitoring is recommended to determine the seasonal variability of groundwater levels, as this may affect the design of the surface water drainage system.
	• BGS data indicates that the underlying geology is sandstone, till, devesian and conglomerate which is likely to be with highly variable permeability. This should be confirmed through infiltration testing. Off-site discharge in accordance with the SuDS hierarchy may be required to discharge surface water runoff from the site.
	• The site is located within a Groundwater Source Protection Zone. Infiltration techniques may not be suitable and should only be used following the granting of any required environmental permits from the Environment Agency for Zones 2, 3 and 4 although it is possible that infiltration may not be permitted. Proposed SuDS should be discussed with relevant stakeholders (LPA, LLFA and EA) at an early stage to understand possible opportunities and constraints.
	• The site is not located within a historic landfill site.
	• Surface water discharge rates should not exceed the existing greenfield runoff rates for the site. Opportunities to further reduce discharge rates should be considered and agreed with the LLFA. It may be possible to reduce site runoff by maximising the permeable surfaces on site using a combination of permeable surfacing and soft landscaping techniques.
	• The RoFSW mapping indicates the presence of surface water flow paths during the 3.3% AEP events. Existing flow paths should be retained and integrated with blue-green infrastructure.
	• If it is proposed to discharge runoff to a watercourse or sewer system, the condition and capacity of the receiving watercourse or asset should be confirmed through surveys and the discharge rate agreed with the asset owner.

Opportunities for wider sustainability and integrated flood risk management	• Implementation of SuDS at the site could provide opportunities to deliver multiple benefits including volume control, water quality, amenity and biodiversity. Proposals to use SuDS techniques should be discussed with relevant stakeholders, Telford and Wrekin Council (as Lead Local Flood Authority) and the Environment Agency at an early stage to understand possible constraints. • Above ground SuDS should be shallow and/or lined to ensure that groundwater does not inundate the features during high groundwater events. • Natural surface water flow routes should be maintained and enhanced within the development site. • Development at this site should not increase flood risk either on or off site. The design of the surface water management proposals should take into account the impacts of future climate change over the projected lifetime of the development. • Opportunities to incorporate filtration techniques such bioretention areas or rain gardens must be considered. Consideration should be made to the existing condition of receiving waterbodies and their Water Framework Directive objectives for water quality. The use of multistage SuDS treatment will clean and improve water quality of surface water runoff discharged from the site and reduce the impact on receiving water bodies. • Opportunities to incorporate source control techniques such as green roofs, permeable surfaces and rainwater harvesting must be considered in the design of the site. • The potential to utilise conveyance features such as swales to intercept and convey surface water runoff should be considered. Conveyance features should be located on common land or public open space to facilitate ease of access. Where slopes are >5%, features should follow contours or utilise check dams to slow flows.
NPPF and planning implications	
Exception Test requirements	The site is classified as 'More Vulnerable' and is within Flood Zone 1. It is at low risk from surface water and groundwater flooding. The Sequential Test must be passed, the criteria for which is highlighted within the Level 1 SFRA. The Exception Test is not required under the NPPF. However, it must be shown that the development will be safe for its lifetime and the risk of flooding from all sources can be managed through a sequential approach to design.
Requirements and guidance for site-specific Flood Risk Assessment	**Flood Risk Assessment:** • Consultation with Telford and Wrekin Council, Severn Trent Water, and the Environment Agency should be undertaken at an early stage. • Developers should consult with Severn Trent Water to ensure that the development aims to help achieve the targets of the Drainage and Wastewater Management Plan. • Any FRA should be carried out in line with the National Planning Policy Framework and Flood Risk and Coastal Change Planning Practice Guidance. **Guidance for site design and making development safe:** • The developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the development meets the objectives of the NPPF's policy on flood risk. For example, how the operation

	of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development. (Paragraph 052 Flood Risk and Coastal Change PPG).
	• The risk from surface water flow routes should be quantified as part of a site-specific FRA, including a drainage strategy, so runoff magnitudes from the development are not increased by development across any ephemeral surface water flow routes. A drainage strategy should help inform site layout and design to ensure runoff rates are as close as possible to greenfield rates.
	• Should built development be proposed within the design surface water flood extent, careful consideration will need to be given to flood resistance and resilience measures.
	• The risk of flooding from groundwater must be investigated and must be supported by groundwater level monitoring
	• Flood resilience and resistance measures should be implemented where appropriate during the construction phase, e.g. raising of floor levels. These measures should be assessed to make sure that flooding is not increased elsewhere.
	  ○ raise them as much as possible.
	  ○ include extra flood resistance and resilience measures.
	• Other examples of flood resistance and resilience measures include:
	  ○ using flood resistant materials that have low permeability to at least 600mm above the estimated flood level
	  ○ making sure any doors, windows or other openings are flood resistant to at least 600mm above the estimated flood level
	  ○ by raising all sensitive electrical equipment, wiring and sockets to at least 600mm above the estimated flood level.

Key messages	
The site is in Flood Zone 1 but is classified as 'More Vulnerable' and is at low risk of surface water flooding and at low risk from groundwater flooding. Development is likely to be able to proceed if: • Site-specific FRA demonstrates that the site is not at an increased risk of flooding in the future and that development of the site does not increase the risk of surface water flooding on the site and to neighbouring areas. • A carefully considered and integrated flood resilient and sustainable drainage design is put forward, with development steered away from the areas identified to be at risk of surface water flooding across the site. • Safe access and egress can be demonstrated in the surface water plus climate change events. This includes measures to reduce flood risk along these routes such as raising access, but not displacing floodwater elsewhere. • If flood mitigation measures are implemented then they are tested to check that they will not displace water elsewhere (for example, if land is raised to permit development on one area, compensatory flood storage will be required in another)	
Mapping Information	
Flood Zones	Flood Zones 2 and 3 have been taken from the Environment Agency's Flood Map for Planning mapping.
Climate change	Climate change allowances have been applied to the Environment Agency's Risk of Flooding from Surface Water (RoFSW) map to indicate the impact on surface water flood risk.
Fluvial and tidal extents, depth,	No detailed hydraulic modelling is available for this area.

velocity and hazard mapping	
Surface Water	The Environment Agency's Risk of Flooding from Surface Water (RoFSW) dataset has been used for this assessment.
Surface water depth, velocity and hazard mapping	The Environment Agency's Risk of Flooding from Surface Water (RoFSW) dataset has been used for this assessment.
Groundwater	JBA Consulting Ltd. Groundwater Flood Mapping (2017)

	Telford and Wrekin Council Level 2 Strategic Flood Risk Assessment Detailed Site Summary Tables
Site details	
Site Code	**473**
Address	Land east of Dawley Road, Lawley
Area	20.19ha
Current land use	Greenfield
Proposed land use	Employment
Flood Risk Vulnerability	Less Vulnerable
Sources of flood risk	
Location of the site within the catchment	The site is located to the west of Lawley Furnaces and south of the M54. Dawley Road runs along the west site boundary and Arleston Lane runs along part of the east boundary. There is an ordinary watercourse, Ketley Brook, which flows south to north though the eastern section of the site.
Topography	The Environment Agency 1m resolution LiDAR shows that the site slopes from an elevation of 160.20mAOD (Above Ordnance Datum) on the western boundary to 123.79mAOD on the eastern boundary. Towards the east of the site there is a band of depression, which is likely a ditch, with a minimum elevation of 119.40mAOD.
Existing drainage features	Mapping and the Environment Agency LiDAR shows that an ordinary watercourse called Ketley Brook runs through the east of the site, from south to north.
Fluvial	**The proportion of site at risk FMFP:** FZ3 – 0% FZ2 – 0% FZ1 – 100% **Available data:** The Environment Agency's Flood Map for Planning has been used for this assessment. **Flood characteristics:** The site is located in Flood Zone 1 and is at negligible risk of fluvial flooding.
Surface Water	**Proportion of site at risk (RoFSW):** **3.3% AEP** – 1% Max depth – 0.30 - 0.60m Max velocity – 1.00 – 2.00m/s **1% AEP** – 1% Max depth – 0.60 - 0.90m Max velocity – >2.00m/s **0.1% AEP** – 4%

	Max depth – >1.20m Max velocity – >2.00m/s **Description of surface water flooding:** The Environment Agency Risk of Flooding from Surface Water (RoFSW) mapping shows that the east of the site is at risk from surface water flooding during the 3.3%, 1% and 0.1% AEP flood events. It is assumed that this flood risk is associated with the drainage ditch which runs parallel to the site boundary. During the 3.3% AEP event surface water inundates 1% of the site in total. The maximum depth and velocity of this flow path is 0.30-0.60m and 1.00-2.00m/s respectively. During the 1% AEP event the extent of inundation remains at 1% of the total site area but maximum depths and velocities increase to 0.60-0.90m and >2.00m/s respectively. It appears that this flow path is contained within the ditch. During the 0.1% AEP event the extent of inundation increases to 4% of the total site area, mainly in the flow path located in the depressed land. This flow path has a maximum depth and velocity of >1.20m and >2.00m/s respectively. Mapping shows that the extent of this flow exceeds the boundaries of the ditch/depression. Surface water ponding is also present to the west of the flow path with maximum depths and velocities of 0.00-0.15m and 1.00-2.00m/s respectively.
Reservoir	The Environment Agency's statutory reservoir flooding maps show the site is not at risk of flooding from any statutory reservoirs.
Groundwater	The site is at a negligible risk of groundwater flooding meaning groundwater levels are at least 5m below the ground's surface.
Sewers	Severn Trent Water's Sewer Flooding register was not available for this assessment.
Minewater Flooding	Mapping from the Coal Authority shows that the site falls within the area of a coal mine and is also within an area of shallow mine workings, and there is a risk of groundwater emergence. Further investigation, including ground investigation will be required as part of a site specific flood risk assessment.
Flood history	The site is not within the Environment Agency's recorded flood outlines dataset. Flood records provided by the Lead Local Flood Authority (LLFA) show that the site is in an area where there are 24 records of flooding.
Cumulative Impact Assessment	Catchment – Ketley Brook (inc. Hurley Brook) - source to Ketley Sands Flood Meadow Rank – High
Flood risk management infrastructure	
Defences	The Environment Agency AIMS dataset shows that the site is not protected by any formal flood defences.
Residual risk	If the drainage ditch which bisects the site from south to north is blocked, there is a residual risk of flooding.
Emergency planning	
Flood warning	The site is not within an Environment Agency Flood Alert or Flood Warning Area.
Access and egress	Currently vehicular access is only possible on the western boundary, from an access road off Dawley Road.

	Dawley Road is not impacted by surface water flooding during the 3.3% AEP event. During the 1% AEP event, two flow paths bisect the road north and south of the site's access road, flowing from west to east. These have a maximum depth and velocity of 0.15-0.30m and 1.00-2.00m/s respectively, resulting in a 'significant - danger for most' flood hazard rating which could impact pedestrian and vehicular access and egress. During the 0.1% AEP event, a flow path is present along Dawley Road flowing from south to north. This has a maximum depth and velocity of 0.30-0.60m and >2.00m/s respectively, resulting in 'extreme - danger for all' flood hazard rating. This is likely to impact access and egress. A site-specific Flood Risk Assessment should be undertaken to evaluate accessibility to pedestrians and vehicles. Developers must demonstrate that safe access and egress in the 0.1% AEP event, including allowance for climate change.
Dry Islands	The site is not located within a dry island during any modelled flood event.
Climate change	
Implications for the site	**Management Catchment: Severn Middle Shropshire** Increased storm intensities due to climate change may increase the extent, depth, velocity, hazard, and frequency of both fluvial and surface water flooding. **Fluvial Flooding:** The site is not covered by any available detailed hydraulic modelling, however, climate change uplift of 35% has been applied to the Environment Agency Flood Map for Planning. The mapping shows that the site will remain in Flood Zone 1, this indicates that the impact of climate change on future risk of fluvial flooding to the site is negligible. **Surface Water:** Climate change is predicted to increase rainfall intensity in the future by a range of between 30% and 45% (the recommended precautionary sensitive range for 2061 to 2125). This will increase the likelihood, frequency and extent of surface water flooding. The 3.3% AEP RoFSW dataset has been re-run with a 25% climate change allowance. The 1% AEP RoFSW dataset has been re-run with a 30% and 45% climate change allowance. The extent of the surface water flood risk for the 3.3% AEP plus 25% climate change allowance is similar to that of the current day 1% AEP event. The extent of the surface water flood risk for the 1% AEP plus 30% climate change allowance is similar to that of the current day 0.1% AEP event. The extent of the surface water flood risk for the 1% AEP plus 45% climate change exceeds that of the current day 0.1% AEP event. This shows that climate change will impact the flood risk of the site.

Requirements for surface water drainage	
Broad-scale assessment of potential SuDS	**Geology & Soils** Geology at the site consists of: • Bedrock – Pennine Lower Coal measures Formation – Mud, Sandstone and Siltstone. • Superficial deposits – Devensian – Sand and Gravel Soil at the site consists of: • Soil – Restored soils mostly from quarry and opencast spoil - Loamy in texture **Sustainable Drainage Systems (SuDS)** • The site is not considered to be susceptible to groundwater flooding, due to the nature of the local geological conditions. This should be confirmed through additional site investigation work. • BGS data indicates that the underlying geology is a mixture of mud, sandstone, siltstone, sand and gravel, which is likely to be free draining. However, the bed rock is not likely to be free draining. This should be confirmed through infiltration testing, with the use of infiltration maximised as much as possible in accordance with the SuDS hierarchy. • The site is not located within a Groundwater Source Protection Zone and there are no restrictions over the use of infiltration techniques with regard to groundwater quality. • The site is not located within a historic landfill site. • Surface water discharge rates should not exceed the existing greenfield runoff rates for the site. Opportunities to further reduce discharge rates should be considered and agreed with the LLFA. It may be possible to reduce site runoff by maximising the permeable surfaces on site using a combination of permeable surfacing and soft landscaping techniques. • The Risk of Flooding from Surface Water (RoFSW) mapping indicates the presence of surface water flow paths during the 3.3%, 1% and 0.1% AEP events. Existing flow paths should be retained and integrated with blue-green infrastructure. • If it is proposed to discharge runoff to a watercourse or sewer system, the condition and capacity of the receiving watercourse or asset should be confirmed through surveys and the discharge rate agreed with the asset owner.
Opportunities for wider sustainability and integrated flood risk management	• Implementation of SuDS at the site could provide opportunities to deliver multiple benefits including volume control, water quality, amenity and biodiversity. Proposals to use SuDS techniques should be discussed with relevant stakeholders (Telford and Wrekin Council and the Environment Agency) at an early stage to understand possible constraints. • Above ground SuDS should be shallow and/or lined to ensure that groundwater does not inundate the features during high groundwater events. • Natural surface water flow routes should be maintained and enhanced within the development site. • Development at this site should not increase flood risk either on or off site. The design of the surface water management proposals should take into account the impacts of future climate change over the projected lifetime of the development. • Opportunities to incorporate filtration techniques such bioretention areas or rain gardens must be considered. Consideration should be made to the

	existing condition of receiving waterbodies and their Water Framework Directive objectives for water quality. The use of multistage SuDS treatment will clean and improve water quality of surface water runoff discharged from the site and reduce the impact on receiving water bodies. • Opportunities to incorporate source control techniques such as green roofs, permeable surfaces and rainwater harvesting must be considered in the design of the site.
NPPF and planning implications	
Exception Test requirements	The site is classified as 'Less Vulnerable' and is within Flood Zone 1, but at risk from surface water flooding. The Sequential Test must be passed, the criteria for which is highlighted within the Level 1 SFRA. The Exception Test is not required under the NPPF. However, it must be shown that the development will be safe for its lifetime and the risk of flooding from all sources can be managed through a sequential approach to design.

Requirements and guidance for site-specific Flood Risk Assessment	**Flood Risk Assessment:**
	• Consultation with Telford and Wrekin Council, Severn Trent Water, and the Environment Agency should be undertaken at an early stage.
	• Developers should consult with Severn Trent Water to ensure that the development aims to help achieve the targets of the Drainage and Wastewater Management Plan.
	• Any FRA should be carried out in line with the National Planning Policy Framework and Flood Risk and Coastal Change Planning Practice Guidance.
	Guidance for site design and making development safe:
	• The developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the development meets the objectives of the NPPF's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development. (Paragraph 052 Flood Risk and Coastal Change PPG).
	• The risk from surface water flow routes should be quantified as part of a site-specific FRA, including a drainage strategy, so runoff magnitudes from the development are not increased by development across any ephemeral surface water flow routes. A drainage strategy should help inform site layout and design to ensure runoff rates are as close as possible to greenfield rates.
	• Should built development be proposed within the design surface water flood extent, careful consideration will need to be given to flood resistance and resilience measures.
	• The risk of flooding from groundwater must be investigated and must be supported by groundwater level monitoring
	• Flood resilience and resistance measures should be implemented where appropriate during the construction phase, e.g. raising of floor levels. These measures should be assessed to make sure that flooding is not increased elsewhere.
	  ○ raise them as much as possible.
	  ○ include extra flood resistance and resilience measures.
	• Other examples of flood resistance and resilience measures include:
	  ○ using flood resistant materials that have low permeability to at least 600mm above the estimated flood level

	○ making sure any doors, windows or other openings are flood resistant to at least 600mm above the estimated flood level ○ by raising all sensitive electrical equipment, wiring and sockets to at least 600mm above the estimated flood level.

Key messages

The site is in Flood Zone 1 but is at medium risk of surface water flooding and mine water flooding.

Development is likely to be able to proceed if:

- Site-specific FRA demonstrates that the site is not at an increased risk of flooding in the future and that development of the site does not increase the risk of surface water flooding on the site and to neighbouring areas.
- A carefully considered and integrated flood resilient and sustainable drainage design is put forward, with development steered away from the areas identified to be at risk of surface water flooding across the site.
- Safe access and egress can be demonstrated in the surface water plus climate change events. This includes measures to reduce flood risk along these routes such as raising access, but not displacing floodwater elsewhere.
- If flood mitigation measures are implemented then they are tested to check that they will not displace water elsewhere (for example, if land is raised to permit development on one area, compensatory flood storage will be required in another)

Mapping Information

Flood Zones	Flood Zones 2 and 3 have been taken from the Environment Agency's Flood Map for Planning mapping.
Climate change	Climate change allowances have been applied to the Environment Agency's Risk of Flooding from Surface Water (RoFSW) map to indicate the impact on surface water flood risk.
Fluvial and tidal extents, depth, velocity and hazard mapping	No detailed hydraulic modelling is available for this area.
Surface Water	The Environment Agency's Risk of Flooding from Surface Water (RoFSW) dataset has been used for this assessment.
Surface water depth, velocity and hazard mapping	The Environment Agency's Risk of Flooding from Surface Water (RoFSW) dataset has been used for this assessment.
Groundwater	JBA Consulting Ltd. Groundwater Flood Mapping (2017)

	Telford and Wrekin Council Level 2 Strategic Flood Risk Assessment Detailed Site Summary Tables
Site details	
Site Code	**515**
Address	Blue Willow Car Park, Telford
Area	1.02ha
Current land use	Brownfield – Car Park
Proposed land use	Mixed
Flood Risk Vulnerability	More Vulnerable
Sources of flood risk	
Location of the site within the catchment	The site is situated in the built-up urban area of Telford town centre, to the west of Telford Shopping Centre. The site is bounded by Telford County Court to the north, Woodhouse Central [Road] to the east, Malinsgate [Road] to the south, and Malinsgate Police Station to the west. Wesley Brook is the nearest Main River flowing eastwards approximately 3.60km east of the site.
Topography	The Environment Agency 1m resolution LiDAR shows that the site slopes from the western boundary towards the eastern boundary. Levels along the southern boundary fall from 167.12mAOD (Above Ordnance Datum) to 161.75mAOD. The surrounding roads of Woodhouse Central and Malinsgate are higher than the levels of the site, with levels of 163.83mAOD and 169.30mAOD respectively.
Existing drainage features	Mapping does not identify any existing watercourses within the site boundary.
Fluvial	**The proportion of site at risk FMFP:** FZ3 – 0% FZ2 – 0% FZ1 – 100% **Available data:** The Environment Agency's Flood Map for Planning has been used in this assessment. **Flood characteristics:** The site is located in Flood Zone 1 and is at negligible risk of fluvial flooding.
Surface Water	**Proportion of site at risk (RoFSW):** **3.3% AEP – 5%** Max depth – 0.30 – 0.60m Max velocity – 0.25 – 0.50m/s **1% AEP – 6%** Max depth – 0.30 – 0.60m Max velocity – 0.25 – 0.50m/s **0.1% AEP – 9%**

	Max depth – 0.60 – 0.90m Max velocity – 1.00 – 2.00m/s **Description of surface water flooding:** The Environment Agency Risk of Flooding from Surface Water (RoFSW) mapping shows that the during the 3.3% AEP event surface water ponds along the south-east boundary of the site, where site levels are lower than the surrounding levels. The area of ponding has an anticipated depth of up to 0.60m and a velocity of 0.50m/s. During the 3.3% AEP event there is also an area of flooding to north-east of the site, this is associated with an existing underpass, and in areas will reach a depth of 0.90m. During the 1% AEP event, the depth and velocity of the flooding remain the same as the 3.3% AEP event, however the extent increases north-east along the south-east boundary of the site. The depth of the flooding in the underpass increases to up to 1.20m. During the 0.1% AEP event the extent of the flooding along the south-east boundary further increases, towards the underpass where it merges with the flooding of the underpass. The flood extent also encroaches into the north-east corner of the site, to a depth of 0.60m. The interaction between the flooding of the underpass and the site should be investigated by the developer to ensure that flood risk is not increase on or off site.
Reservoir	The Environment Agency's statutory reservoir flooding maps show the site is not at risk of flooding from any statutory reservoirs.
Groundwater	The site is at a negligible risk of groundwater flooding meaning groundwater levels are at least 5m below the ground's surface.
Sewers	Severn Trent Water's Sewer Flooding register was not available for this assessment.
Minewater Flooding	Mapping from the Coal Authority shows that the site falls within the area of a coal mine and there is a risk of groundwater emergence. Further investigation, including ground investigation will be required as part of a site specific flood risk assessment.
Flood history	The site is not within the Environment Agency's recorded flood outlines dataset. Flood records provided by the Lead Local Flood Authority (LLFA) show that the site is in an area where there are 7 records of flooding.
Cumulative Impact Assessment	Catchment – Wesley Brook (inc. Nedge Brook) - source to River Worfe Rank – Medium
Flood risk management infrastructure	
Defences	The Environment Agency AIMS dataset shows that the site is not protected by any formal flood defences.
Residual risk	The site is not at residual risk of flooding.
Emergency planning	
Flood warning	The site is not within an Environment Agency Flood Alert or Flood Warning Area.
Access and egress	It has been assumed that the site will be accessed via the existing entrance off of Woodhouse Central, during the 0.1% event there is a small flow route which

	extends across the access road. This flow route has a hazard rating of 'Low – caution'. Pedestrian access and egress through the underpass will not be possible during the 3.3%, 1% and 0.1% AEP events as all events have a hazard rating of 'Significant – dangerous for most'. A site-specific Flood Risk Assessment should be undertaken to evaluate accessibility to pedestrians and vehicles. Developers must demonstrate that safe access and egress in the 0.1% AEP event, including allowance for climate change.
Dry Islands	The site is not located within a dry island during any modelled flood event.
Climate change	
Implications for the site	**Management Catchment: Severn Middle Worcestershire** Increased storm intensities due to climate change may increase the extent, depth, velocity, hazard, and frequency of both fluvial and surface water flooding. **Fluvial Flooding:** The site is not covered by any available detailed hydraulic modelling, however, climate change uplift of 35% has been applied to the Environment Agency Flood Map for Planning. The mapping shows that the site will remain in Flood Zone 1, this indicates that the impact of climate change on future risk of fluvial flooding to the site is negligible. **Surface Water:** Climate change is predicted to increase rainfall intensity in the future by a range of between 30% and 45% (the recommended precautionary sensitive range for 2061 to 2125). This will increase the likelihood, frequency and extent of surface water flooding. The 1% AEP Risk of Flooding from Surface Water dataset has been re-run with a 45% climate change allowance, and it shows an increase in the extent of surface water flooding along the south-east boundary towards the existing underpass, this is a similar extent as the current day 0.1% AEP event surface water extent.
Requirements for surface water drainage	
Broad-scale assessment of potential SuDS	**Geology & Soils** Geology at the site consist of: • Bedrock – Halesowen Formation - Mudstone, siltstone and sandstone. • Superficial deposits – no information available Soils at the site consist of: • Slightly acid loamy and clayey soils with impeded drainage **Sustainable Drainage Systems (SuDS)** The Telford and Wrekin Sustainable Drainage Systems Handbook has more guidance on the implementation of SuDS for all types of development. • Groundwater levels are indicated to be at least 5m below ground level and groundwater flooding is not likely, however below ground development such as basements may still be susceptible to groundwater flooding. • The site is not within a source protection zone. • The site is not located within a historic landfill site. • Surface water discharge rates should not exceed pre-development discharge rates for the site and should be designed to be as close to

	greenfield runoff rates as reasonably practical in consultation with the LLFA. It may be possible to reduce site runoff by maximising the permeable surfaces on site using a combination of permeable surfacing and soft landscaping techniques. • The Risk of Flooding from Surface Water (RoFSW) mapping indicates the presence of a surface water flow path along the south-east boundary during the 0.1% AEP events. Existing flow paths should be retained and integrated with blue-green infrastructure. • If it is proposed to discharge runoff to a watercourse or sewer system, the condition and capacity of the receiving watercourse or asset should be confirmed through surveys and the discharge rate agreed with the asset owner.
Opportunities for wider sustainability and integrated flood risk management	• Implementation of SuDS at the site could provide opportunities to deliver multiple benefits including volume control, water quality, amenity and biodiversity. Proposals to use SuDS techniques should be discussed with relevant stakeholders, Telford and Wrekin Council (as Lead Local Flood Authority) and the Environment Agency at an early stage to understand possible constraints. • Above ground SuDS should be shallow and/or lined to ensure that groundwater does not inundate the features during high groundwater events. • Development at this site should not increase flood risk either on or off site. The design of the surface water management proposals should take into account the impacts of future climate change over the projected lifetime of the development. • Opportunities to incorporate filtration techniques such bioretention areas or rain gardens must be considered. Consideration should be made to the existing condition of receiving waterbodies and their Water Framework Directive objectives for water quality. The use of multistage SuDS treatment will clean and improve water quality of surface water runoff discharged from the site and reduce the impact on receiving water bodies. • Opportunities to incorporate source control techniques such as green roofs, permeable surfaces and rainwater harvesting must be considered in the design of the site.
NPPF and planning implications	
Exception Test requirements	The site is classified as ‘More Vulnerable’ and is within Flood Zone 1, but at high risk from surface water flooding. The Sequential Test must be passed, the criteria for which is highlighted within the Level 1 SFRA. The Exception Test is not required under the NPPF. However, it must be shown that the development will be safe for its lifetime and the risk of flooding from all sources can be managed through a sequential approach to design.
Requirements and guidance for site-specific Flood Risk Assessment	**Flood Risk Assessment:** • Consultation with Telford and Wrekin Council, Severn Trent Water, and the Environment Agency should be undertaken at an early stage. • Developers should consult with Severn Trent Water to ensure that the development aims to help achieve the targets of the Drainage and Wastewater Management Plan. • Any FRA should be carried out in line with the National Planning Policy Framework and Flood Risk and Coastal Change Planning Practice Guidance.

	Guidance for site design and making development safe:
	• The developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the development meets the objectives of the NPPF's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development. (Paragraph 052 Flood Risk and Coastal Change PPG).
	• The risk from surface water flow routes should be quantified as part of a site-specific FRA, including a drainage strategy, so runoff magnitudes from the development are not increased by development across any ephemeral surface water flow routes. A drainage strategy should help inform site layout and design to ensure runoff rates are as close as possible to greenfield rates.
	• Should built development be proposed within the design surface water flood extent, careful consideration will need to be given to flood resistance and resilience measures.
	• Flood resilience and resistance measures should be implemented where appropriate during the construction phase, e.g. raising of floor levels. These measures should be assessed to make sure that flooding is not increased elsewhere.
	  ○ raise them as much as possible.
	  ○ include extra flood resistance and resilience measures.
	• Other examples of flood resistance and resilience measures include:
	  ○ using flood resistant materials that have low permeability to at least 600mm above the estimated flood level
	  ○ making sure any doors, windows or other openings are flood resistant to at least 600mm above the estimated flood level
	  ○ by raising all sensitive electrical equipment, wiring and sockets to at least 600mm above the estimated flood level.

Key messages	
The site is in Flood Zone 1 but is at high risk of surface water flooding: Development is likely to be able to proceed if: • Site-specific FRA demonstrates that the site is not at an increased risk of flooding in the future and that development of the site does not increase the risk of surface water flooding on the site and to neighbouring areas. • A carefully considered and integrated flood resilient and sustainable drainage design is put forward, with development steered away from the areas identified to be at risk of surface water flooding across the site. • Safe access and egress can be demonstrated in the surface water plus climate change events. This includes measures to reduce flood risk along these routes such as raising access, but not displacing floodwater elsewhere. • If flood mitigation measures are implemented then they are tested to check that they will not displace water elsewhere (for example, if land is raised to permit development on one area, compensatory flood storage will be required in another)	
Mapping Information	
Flood Zones	Flood Zones 2 and 3 have been taken from the Environment Agency's Flood Map for Planning mapping.

Climate change	Climate change allowances have been applied to the Environment Agency's Risk of Flooding from Surface Water (RoFSW) map to indicate the impact on surface water flood risk.
Fluvial extents, depth, velocity and hazard mapping	No detailed hydraulic modelling is available for this area.
Surface Water	The Environment Agency's Risk of Flooding from Surface Water (RoFSW) dataset has been used for this assessment.
Surface water depth, velocity and hazard mapping	The Environment Agency's Risk of Flooding from Surface Water (RoFSW) dataset has been used for this assessment.
Groundwater	JBA Consulting Ltd. Groundwater Flood Mapping (2017)

Mapping Information	
Flood Zones	Flood Zones 2 and 3 have been taken from the Environment Agency's Flood Map for Planning mapping.
Climate change	Climate change allowances have been applied to the Environment Agency's Risk of Flooding from Surface Water (RoFSW) map to indicate the impact on surface water flood risk.
Fluvial extents, depth, velocity and hazard mapping	No detailed hydraulic modelling is available for this area.
Surface Water	The Environment Agency's Risk of Flooding from Surface Water (RoFSW) dataset has been used for this assessment.
Surface water depth, velocity and hazard mapping	The Environment Agency's Risk of Flooding from Surface Water (RoFSW) dataset has been used for this assessment.
Groundwater	JBA Consulting Ltd. Groundwater Flood Mapping (2017)

	Telford and Wrekin Council Level 2 Strategic Flood Risk Assessment Detailed Site Summary Tables
Site details	
Site Code	**689**
Address	Land southern side of Water Upton, TF6 6NL
Area	1.68ha
Current land use	Greenfield
Proposed land use	Residential
Flood Risk Vulnerability	More Vulnerable
Sources of flood risk	
Location of the site within the catchment	The site is located to the north of the Telford and Wrekin Council area and to the south of the village of Waters Upton. The A442 forms the western boundary of the site, and the River Tern flows 500m to the west.
Topography	The Environment Agency 1m resolution LiDAR shows that the site slopes from the western boundary towards the eastern boundary. Levels along the southern boundary fall from 57.92mAOD (Above Ordnance Datum) to 55.75mAOD.
Existing drainage features	Mapping that there are two ordinary watercourses in the vicinity of the site, both flowing south from Waters Upton, the first forms the eastern boundary of the site. The second is approximately 60m north-east of the site and runs parallel to the first ordinary watercourse, before taking a sharp turn and converging with the first ordinary watercourse along the south-eastern corner of the site.
Fluvial	**The proportion of site at risk FMFP:** FZ3 – 0% FZ2 – 0% FZ1 – 0% **Fluvial model outputs:** 3.3% AEP fluvial event – 0% 1% AEP fluvial event – 0% 0.1% AEP fluvial event – 0% **Available data:** The Environment Agency's Flood Map for Planning and the River Tern hydraulic modelling from 2004 has been used for this assessment. **Flood characteristics:** The site is located in Flood Zone 1 and is at negligible risk of fluvial flooding.
Surface Water	**Proportion of site at risk (RoFSW):** **3.3% AEP – <1%** Max depth – 0.15 – 0.30m

	Max velocity – 0.00 – 0.25m/s **1% AEP – 2%** Max depth – 0.15 – 0.30m Max velocity – 0.00 – 0.25m/s **0.1% AEP – 14%** Max depth – 0.30 – 0.60m Max velocity – 0.25 – 0.50m/s **Description of surface water flooding:** The Environment Agency Risk of Flooding from Surface Water (RoFSW) mapping shows that the eastern boundary of the site is at risk during the 3.3%, 1% and 0.1% AEP flood events. It is assumed that this flood risk is associated with the drainage ditch which runs parallel to the site boundary. During the 3.3% AEP flood event less than 1% of the site is at risk of surface water flooding, with anticipated depths of 0.15 – 0.30m and maximum velocities of up to 0.25m/s. For the 1% AEP event the flood extent reaches further into the site, however the anticipated depths and velocities are the same as for the 3.3% AEP flood event. The flood extent for the 0.1% event extend 30m into the site at the north-east corner and 17m at the south-east corner. The mapping shows depths of up to 0.6m and maximum velocities of 0.5m/s. The hazard rating for the 0.1% AEP event has been calculated as 'Moderate – Dangerous for some'.
Reservoir	The Environment Agency's statutory reservoir flooding maps show the site is not at risk of flooding from any statutory reservoirs.
Groundwater	The site is at moderate risk of groundwater flooding. During the 1% AEP groundwater event the groundwater levels are estimated to be between 0.025m and 0.5m below ground level. As a result, within the site there is a risk of groundwater flooding to surface and subsurface assets, as well as the possibility of groundwater emerging at the surface locally. Mitigation for seasonal high groundwater levels must be considered in design of the site, for example by raising finished floor levels to an appropriate height above ground level.
Sewers	Severn Trent Water's Sewer Flooding register was not available for this assessment.
Minewater Flooding	Mapping from the Coal Authority shows that the site does not fall within the area of a coal mine, therefore it can be considered that there is a low risk of groundwater emergence.
Flood history	The site is not within the Environment Agency's recorded flood outlines dataset. Flood records provided by the Lead Local Flood Authority (LLFA) do not show any flood records in the vicinity of the site.
Cumulative Impact Assessment	Catchment – Strine - Pipe Strine to River Tern Rank – Low
Flood risk management infrastructure	
Defences	The Environment Agency AIMS dataset shows that the site is not protected by any formal flood defences.
Residual risk	The site is not at residual risk of flooding.
Emergency planning	
Flood warning	The site is not within an Environment Agency Flood Alert or Flood Warning Area.

Access and egress	It has been assumed that the site will be accessed via the A442, the road is not shown to be at risk of flooding and therefore it is not anticipated that there will be any access and egress issues associated with this road.
Dry Islands	The site is not located within a dry island during any modelled flood event.
Climate change	
Implications for the site	**Management Catchment: Severn Middle Shropshire** Increased storm intensities due to climate change may increase the extent, depth, velocity, hazard, and frequency of both fluvial and surface water flooding. **Fluvial Flooding:** Climate change uplifts of 25%, 35% and 70% have been applied to the River Tern model (2004) for the 1% AEP event to assess the impact of climate change on fluvial flooding. The percentages are approximately equivalent to the Environment Agency's latest Higher Central and Upper climate change allowances for the Severn Middle Shropshire management catchment. The mapping shows that the site will remain in Flood Zone 1, this indicates that the impact of climate change on future risk of fluvial flooding to the site is negligible. **Surface Water:** Climate change is predicted to increase rainfall intensity in the future by a range of between 30% and 45% (the recommended precautionary sensitive range for 2061 to 2125). This will increase the likelihood, frequency and extent of surface water flooding. The 1% AEP Risk of Flooding from Surface Water dataset has been re-run with a 45% climate change allowance, and it shows an increase in the extent of surface water flooding to the eastern section of the site, to a similar extent as the current day 0.1% AEP event surface water extent.
Requirements for surface water drainage	
Broad-scale assessment of potential SuDS	**Geology & Soils** Geology at the site consist of: • Bedrock – Bridgnorth Sandstone Formation – Sandstone. • Superficial deposits – Glaciofluvial Sheet Deposits, Devensian – Sand and gravel. Soils at the site consist of: • Free draining slightly acid sandy soil **Sustainable Drainage Systems (SuDS)** The Telford and Wrekin Sustainable Drainage Systems Handbook has more guidance on the implementation of SuDS for all types of development. • Groundwater levels are indicated to be less than 0.5m below ground level during a 1% AEP event. Detention and attenuation features should be designed to prevent groundwater ingress from impacting hydraulic capacity and structural integrity. Additional site investigation work may be required to support the detailed design of the drainage system. This may include groundwater monitoring to demonstrate that a sufficient unsaturated zone has been provided above the highest occurring groundwater level. Below ground development such as basements are not appropriate at this site. • The site is not within a source protection zone. • The site is not located within a historic landfill site. • Surface water discharge rates should not exceed pre-development discharge rates for the site and should be designed to be as close to

	greenfield runoff rates as reasonably practical in consultation with the LLFA. It may be possible to reduce site runoff by maximising the permeable surfaces on site using a combination of permeable surfacing and soft landscaping techniques. • The Risk of Flooding from Surface Water (RoFSW) mapping indicates the presence of a surface water flow path along the eastern boundary during the 0.1% AEP events. Existing flow paths should be retained and integrated with blue-green infrastructure. • If it is proposed to discharge runoff to a watercourse or sewer system, the condition and capacity of the receiving watercourse or asset should be confirmed through surveys and the discharge rate agreed with the asset owner.
Opportunities for wider sustainability and integrated flood risk management	• Implementation of SuDS at the site could provide opportunities to deliver multiple benefits including volume control, water quality, amenity and biodiversity. Proposals to use SuDS techniques should be discussed with relevant stakeholders, Telford and Wrekin Council (as Lead Local Flood Authority) and the Environment Agency at an early stage to understand possible constraints. • The ordinary watercourse and the natural surface water flow routes should be maintained and enhanced within the development site and incorporated into the surface water drainage strategy. • Above ground SuDS should be shallow and/or lined to ensure that groundwater does not inundate the features during high groundwater events. • Development at this site should not increase flood risk either on or off site. The design of the surface water management proposals should take into account the impacts of future climate change over the projected lifetime of the development. • Opportunities to incorporate filtration techniques such bioretention areas or rain gardens must be considered. Consideration should be made to the existing condition of receiving waterbodies and their Water Framework Directive objectives for water quality. The use of multistage SuDS treatment will clean and improve water quality of surface water runoff discharged from the site and reduce the impact on receiving water bodies. • Opportunities to incorporate source control techniques such as green roofs, permeable surfaces and rainwater harvesting must be considered in the design of the site.
NPPF and planning implications	
Exception Test requirements	The site is classified as ‘More Vulnerable’ and is within Flood Zone 1, but at risk from surface water flooding and groundwater flooding. The Sequential Test must be passed, the criteria for which is highlighted within the Level 1 SFRA. The Exception Test is not required under the NPPF. However, it must be shown that the development will be safe for its lifetime and the risk of flooding from all sources can be managed through a sequential approach to design.
Requirements and guidance for site-specific Flood Risk Assessment	**Flood Risk Assessment:** • Consultation with Telford and Wrekin Council, Severn Trent Water, and the Environment Agency should be undertaken at an early stage. • Developers should consult with Severn Trent Water to ensure that the development aims to help achieve the targets of the Drainage and Wastewater Management Plan.

- Any FRA should be carried out in line with the National Planning Policy Framework and Flood Risk and Coastal Change Planning Practice Guidance.

Guidance for site design and making development safe:

- The developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the development meets the objectives of the NPPF's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development. (Paragraph 052 Flood Risk and Coastal Change PPG).
- The risk from surface water flow routes should be quantified as part of a site-specific FRA, including a drainage strategy, so runoff magnitudes from the development are not increased by development across any ephemeral surface water flow routes. A drainage strategy should help inform site layout and design to ensure runoff rates are as close as possible to greenfield rates.
- Should built development be proposed within the design surface water flood extent, careful consideration will need to be given to flood resistance and resilience measures.
- The risk of flooding from groundwater must be investigated and must be supported by groundwater level monitoring
- Flood resilience and resistance measures should be implemented where appropriate during the construction phase, e.g. raising of floor levels. These measures should be assessed to make sure that flooding is not increased elsewhere.
    - raise them as much as possible.
    - include extra flood resistance and resilience measures.
- Other examples of flood resistance and resilience measures include:
    - using flood resistant materials that have low permeability to at least 600mm above the estimated flood level
    - making sure any doors, windows or other openings are flood resistant to at least 600mm above the estimated flood level
    - by raising all sensitive electrical equipment, wiring and sockets to at least 600mm above the estimated flood level.

Key messages

The site is in Flood Zone 1 but is at low risk of surface water flooding and moderate risk of groundwater flooding.

Development is likely to be able to proceed if:

- A site-specific FRA demonstrates that the site is not at an increased risk of flooding in the future and that development of the site does not increase the risk of surface water flooding on the site and to neighbouring areas.
- A carefully considered and integrated flood resilient and sustainable drainage design is put forward, with development steered away from the areas identified to be at risk of surface water flooding across the site.
- Safe access and egress can be demonstrated in the surface water plus climate change events. This includes measures to reduce flood risk along these routes such as raising access, but not displacing floodwater elsewhere.
- If flood mitigation measures are implemented then they are tested to check that they will not displace water elsewhere (for example, if land is raised to permit development on one area, compensatory flood storage will be required in another)

Mapping Information	
Flood Zones	Flood Zones 2 and 3 have been taken from the Environment Agency's Flood Map for Planning mapping and the River Tern hydraulic modelling from 2004.
Climate change	Climate change allowances have been applied to the Environment Agency's Risk of Flooding from Surface Water (RoFSW) map to indicate the impact on surface water flood risk.
Fluvial extents, depth, velocity and hazard mapping	The River Tern hydraulic modelling from 2004 has been used for this assessment.
Surface Water	The Environment Agency's Risk of Flooding from Surface Water (RoFSW) dataset has been used for this assessment.
Surface water depth, velocity and hazard mapping	The Environment Agency's Risk of Flooding from Surface Water (RoFSW) dataset has been used for this assessment.
Groundwater	JBA Consulting Ltd. Groundwater Flood Mapping (2017)

	Telford and Wrekin Council Level 2 Strategic Flood Risk Assessment Detailed Site Summary Tables
Site details	
Site Code	**699**
Address	Tafs Salop Ltd, Gower Street, St Georges
Area	3.24 ha
Current land use	Brownfield
Proposed land use	Residential
Flood Risk Vulnerability	More Vulnerable
Sources of flood risk	
Location of the site within the catchment	The site is located to the northeast of Telford. The site is bounded by a residential area to its eastern, southern and western boundaries, with Wrockwardine Wood to its north. The nearest watercourse is located approximately 1.47km to the northwest of the northern site boundary. It is flowing in a northerly direction, away from the site.
Topography	The Environment Agency 1m resolution LiDAR shows that the site slopes from an elevation of 140.89mAOD (Above Ordnance Datum) on the southern boundary to 136.53mAOD on the northern boundary. The eastern 'branch' of the site slopes to a minimum elevation of 133.95mAOD.
Existing drainage features	Mapping and the Environment Agency LiDAR shows that an unnamed ordinary watercourse is present in the east of the site. LiDAR indicates that this is likely to flow in a northerly direction.
Fluvial	**The proportion of site at risk FMFP:** FZ3 – 0% FZ2 – 0% FZ1 – 100% **Available data:** The Environment Agency's Flood Map for Planning has been used for this assessment. **Flood characteristics:** The site is located in Flood Zone 1 and is at negligible risk of fluvial flooding.
Surface Water	**Proportion of site at risk (RoFSW):** **3.3% AEP** – 0% Max depth – N/A Max velocity – N/A **1% AEP** – 1% Max depth – 0.15-0.30m Max velocity – 0.25-0.5m/s **0.1% AEP** – 14%

	Max depth – 0.30-0.60m Max velocity – 1.00-2.00m/s **Description of surface water flooding:** The Environment Agency Risk of Flooding from Surface Water (RoFSW) mapping shows that the centre of the site is at risk during the 1% and 0.1% AEP flood events. The site is not at risk form surface water flooding during the 3.3% AEP event. During the 1% AEP event, 1% of the site is inundated with surface water, ponding in the centre. The maximum depths and velocities are 0.15-0.30m and 0.25-0.50m/s respectively. During the 0.1% AEP event, 14% of the site is inundated. Flow paths emerge flowing from south to north. The maximum depths and velocities are 0.30-0.60m and 1.00-2.00m/s respectively.
Reservoir	The Environment Agency's statutory reservoir flooding maps show the site is not at risk of flooding from any reservoirs.
Groundwater	The site is at a negligible risk of groundwater flooding meaning groundwater levels are at least 5m below the ground's surface.
Sewers	Severn Trent Water's Sewer Flooding register was not available for this assessment.
Minewater Flooding	Mapping from the Coal Authority shows that the site falls within the area of a coal mine and is also within an area of shallow mine workings, and there is a risk of groundwater emergence. Further investigation, including ground investigation will be required as part of a site specific flood risk assessment.
Flood history	The site is not within the Environment Agency's recorded flood outlines dataset. Flood records provided by the Lead Local Flood Authority (LLFA) show that the site is in an area where there are 2 records of flooding.
Cumulative Impact Assessment	Catchment – Red Strine - source to River Strine Rank – High
Flood risk management infrastructure	
Defences	The Environment Agency AIMS dataset shows that the site is not protected by any formal flood defences.
Residual risk	The site is not at residual risk from flooding.
Emergency planning	
Flood warning	The site is not within an Environment Agency Flood Alert or Flood Warning Area.
Access and egress	Currently vehicular access is only possible on the eastern boundary via Gower Street. Pedestrian access is also possible from a footpath which bisects the site from The Nabb to Gower Street. Gower Street is not impacted by surface water flooding during the 3.3% AEP event. Access to the footpath off The Nabb is impacted by flooding, with a maximum depth of 0.15-0.30m and a maximum velocity of 0.25-0.5m. This would impede pedestrian access to the site as this flood hazard is designated as a 'danger for some'. During the 1% AEP event, Gower Street is inundated with surface water with a maximum depth of 0.00-0.15m and a maximum velocity of 1.00-2.00m/s, making it a 'danger for some'. The flooding surrounding the footpath joining The Nabb

	does not increase in depth and velocity, although the extent increases slightly, but remains pooled around The Nabb. During the 0.1% AEP event, the depth of the surface water flooding on Gower Street increases to a maximum of 0.15-0.30m with a maximum velocity of >2.00m/s. Flood extents continue up Moss Road, likely making the site inaccessible by vehicle. The extent of flooding preventing pedestrian access increases to cover almost the entire length of the footpath. This has a maximum depth and velocity of 0.30-0.60m and 1.00-2.00m/s respectively, which would likely impede access and egress. A site-specific Flood Risk Assessment should be undertaken to evaluate accessibility to pedestrians and vehicles. Developers must demonstrate that safe access and egress in the 0.1% AEP event, including allowance for climate change.
Dry Islands	The site is not located within a dry island during any modelled flood event.
Climate change	
Implications for the site	**Management Catchment: Severn Middle Shropshire** Increased storm intensities due to climate change may increase the extent, depth, velocity, hazard, and frequency of both fluvial and surface water flooding. **Fluvial Flooding:** The site is not covered by any available detailed hydraulic modelling, however, climate change uplift of 35% has been applied to the Environment Agency Flood Map for Planning. The mapping shows that the site will remain in Flood Zone 1, this indicates that the impact of climate change on future risk of fluvial flooding to the site is negligible. **Surface Water:** Climate change is predicted to increase rainfall intensity in the future by a range of between 30% and 45% (the recommended precautionary sensitive range for 2061 to 2125). This will increase the likelihood, frequency and extent of surface water flooding. The 3.3% AEP Risk of Flooding from Surface Water dataset has been re-run with a 25% climate change allowance. The 1% AEP Risk of Flooding from Surface Water dataset has been re-run with a 30% and 45% climate change allowance. The extent of the surface water flood risk for the 3.3% AEP plus 25% climate change allowance is larger than that of the current day 1% AEP event. The extent of the surface water flood risk for the 1% AEP plus 30% climate change allowance is similar to that of the current day 0.1% AEP event. The extent of the surface water flood risk for the 1% AEP plus 45% climate change slightly exceeds that of the current day 0.1% AEP event. This shows that climate change will impact this site.
Requirements for surface water drainage	
Broad-scale assessment of potential SuDS	**Geology & Soils** Geology at the site consist of: • Bedrock - Pennine Middle Coal Measures Formation – Mudstone, Sandstone and Siltstone. • Superficial Deposits – data is not available.

	Soils at the site consist of: • Loamy soil with some clay, which will slightly impede drainage **Sustainable Drainage Systems (SuDS):** • The site is not considered to be susceptible to groundwater flooding, due to the nature of the local geological conditions. This should be confirmed through additional site investigation work. • BGS data indicates that the underlying geology is a combination of Mudstone, Sandstone and Siltstone which is likely to be free draining. This should be confirmed through infiltration testing, with the use of infiltration maximised as much as possible in accordance with the SuDS hierarchy. • The site is not located within a Groundwater Source Protection Zone and there are no restrictions over the use of infiltration techniques with regard to groundwater quality. • The site is not located within a historic landfill site. • Surface water discharge rates should not exceed pre-development discharge rates for the site and should be designed to be as close to greenfield runoff rates as reasonably practical in consultation with the LLFA. It may be possible to reduce site runoff by maximising the permeable surfaces on site using a combination of permeable surfacing and soft landscaping techniques. • The Risk of Flooding from Surface Water (RoFSW) mapping indicates the presence of surface water flow paths during the 0.1% AEP events. Existing flow paths should be retained and integrated with blue-green infrastructure. • If it is proposed to discharge runoff to a watercourse or sewer system, the condition and capacity of the receiving watercourse or asset should be confirmed through surveys and the discharge rate agreed with the asset owner.
Opportunities for wider sustainability and integrated flood risk management	• Implementation of SuDS at the site could provide opportunities to deliver multiple benefits including volume control, water quality, amenity and biodiversity. Proposals to use SuDS techniques should be discussed with relevant stakeholders (Three Rivers District Council, Hertfordshire County Council (as the LLFA) and the Environment Agency) at an early stage to understand possible constraints. • Development at this site should not increase flood risk either on or off site. The design of the surface water management proposals should take into account the impacts of future climate change over the projected lifetime of the development. • Opportunities to incorporate filtration techniques such bioretention areas or rain gardens must be considered. Consideration should be made to the existing condition of receiving waterbodies and their Water Framework Directive objectives for water quality. The use of multistage SuDS treatment will clean and improve water quality of surface water runoff discharged from the site and reduce the impact on receiving water bodies. • Opportunities to incorporate source control techniques such as green roofs, permeable surfaces and rainwater harvesting must be considered in the design of the site.
NPPF and planning implications	
Exception Test requirements	The site is within Flood Zone 1, but is classified as ‘More Vulnerable’ and at risk from surface water flooding.

	The Sequential Test must be passed, the criteria for which is highlighted within the Level 1 SFRA. The Exception Test is not required under the NPPF. However, it must be shown that the development will be safe for its lifetime and the risk of flooding from all sources can be managed through a sequential approach to design.

Requirements and guidance for site-specific Flood Risk Assessment	**Flood Risk Assessment:**
	• Consultation with Telford and Wrekin Council, Severn Trent Water, and the Environment Agency should be undertaken at an early stage.
	• Developers should consult with Severn Trent Water to ensure that the development aims to help achieve the targets of the Drainage and Wastewater Management Plan.
	• Any FRA should be carried out in line with the National Planning Policy Framework and Flood Risk and Coastal Change Planning Practice Guidance.
	Guidance for site design and making development safe:
	• The developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the development meets the objectives of the NPPF's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development. (Paragraph 052 Flood Risk and Coastal Change PPG).
	• The risk from surface water flow routes should be quantified as part of a site-specific FRA, including a drainage strategy, so runoff magnitudes from the development are not increased by development across any ephemeral surface water flow routes. A drainage strategy should help inform site layout and design to ensure runoff rates are as close as possible to greenfield rates.
	• Should built development be proposed within the design surface water flood extent, careful consideration will need to be given to flood resistance and resilience measures.
	• The risk of flooding from groundwater must be investigated and must be supported by groundwater level monitoring
	• Flood resilience and resistance measures should be implemented where appropriate during the construction phase, e.g. raising of floor levels. These measures should be assessed to make sure that flooding is not increased elsewhere.
	  ○ raise them as much as possible.
	  ○ include extra flood resistance and resilience measures.
	• Other examples of flood resistance and resilience measures include:
	  ○ using flood resistant materials that have low permeability to at least 600mm above the estimated flood level
	  ○ making sure any doors, windows or other openings are flood resistant to at least 600mm above the estimated flood level
	  ○ by raising all sensitive electrical equipment, wiring and sockets to at least 600mm above the estimated flood level.

Key messages
The site is located within Flood Zone 1 but is at high risk from surface water flooding and mine water flooding. Development is likely to be able to proceed if:

- site-specific FRA demonstrates that the site is not at an increased risk of flooding in the future and that development of the site does not increase the risk of surface water flooding on the site and to neighbouring areas.
- A carefully considered and integrated flood resilient and sustainable drainage design is put forward, with development steered away from the areas identified to be at risk of surface water flooding across the site.
- Safe access and egress can be demonstrated in the surface water plus climate change events. This includes measures to reduce flood risk along these routes such as raising access but not displacing floodwater elsewhere.
- If flood mitigation measures are implemented then they are tested to check that they will not displace water elsewhere (for example, if land is raised to permit development on one area, compensatory flood storage will be required in another)

Mapping Information	
Flood Zones	Flood Zones 2 and 3 have been taken from the Environment Agency's Flood Map for Planning mapping.
Climate change	Climate change allowances have been applied to the Environment Agency's Risk of Flooding from Surface Water (RoFSW) map to indicate the impact on surface water flood risk.
Fluvial and tidal extents, depth, velocity and hazard mapping	No detailed hydraulic modelling is available for this area.
Surface Water	The Environment Agency's Risk of Flooding from Surface Water (RoFSW) dataset has been used for this assessment.
Surface water depth, velocity and hazard mapping	The Environment Agency's Risk of Flooding from Surface Water (RoFSW) dataset has been used for this assessment.
Groundwater	JBA Consulting Ltd. Groundwater Flood Mapping (2017)

	Telford and Wrekin Council Level 2 Strategic Flood Risk Assessment Detailed Site Summary Tables
Site details	
Site Code	**702**
Address	Land South of Old Vicarage, Church Street
Area	0.58ha
Current land use	Greenfield
Proposed land use	Residential
Flood Risk Vulnerability	More Vulnerable
Sources of flood risk	
Location of the site within the catchment	The site is located in eastern Telford, in the suburb of St Georges. Church Street forms the southern boundary, with residential areas on the northern and eastern boundary and St Georges Recreation Ground to the west. The nearest Main River is Wesley Brook, which flows in a south-westerly direction approximately 2.15km south-west of the site.
Topography	The Environment Agency 1m resolution LiDAR shows that the site slopes from the northern boundary towards the southern boundary. Levels along the eastern boundary fall from 175.29.92mAOD (Above Ordnance Datum) to 173.36mAOD, whilst levels along the western boundary fall from 174.72mAOD to 173.75mAOD; the lowest levels of the site are in the south-east corner.
Existing drainage features	Mapping does not identify any existing watercourses within the site boundary.
Fluvial	**The proportion of site at risk FMFP:** FZ3 – 0% FZ2 – 0% FZ1 – 100% **Available data:** The Environment Agency's Flood Map for Planning has been used in this assessment. **Flood characteristics:** The site is located in Flood Zone 1 and is at negligible risk of fluvial flooding.
Surface Water	**Proportion of site at risk (RoFSW):** **3.3% AEP – 5%** Max depth – 0.30 – 0.60m Max velocity – 0.00 – 0.25m/s **1% AEP – 8%** Max depth – 0.30 – 0.60m Max velocity – 0.25 – 0.50m/s **0.1% AEP – 16%**

	Max depth – 0.60 – 0.90m Max velocity – 0.50 – 1.00m/s **Description of surface water flooding:** The Environment Agency Risk of Flooding from Surface Water (RoFSW) mapping shows that the surface water ponds in the topographic low spot in the south-west corner of the site for the 3.3%, 1% and 0.1% AEP events. During the 3.3% AEP event 5% of the site is at risk of surface water flooding, with depths of up to 0.60m and a velocity of up to 0.25m/s. The anticipated depth of flooding during the 1% AEP event remains up to 0.60m, however the velocity and extent of the flooding increase. The velocity increases to a maximum of 0.50m/s and the ponding extends further into the site as well as along the southern boundary of the site. During the 0.1% AEP surface water flood event, the extent of the flooding increases to cover the south-east corner of the site to a depth of up to 0.90m and a velocity of 0.50m/s.
Reservoir	The Environment Agency's statutory reservoir flooding maps show the site is not at risk of flooding from any statutory reservoirs.
Groundwater	All of this site is at a negligible risk of groundwater flooding meaning groundwater levels are at least 5m below the ground's surface.
Sewers	Severn Trent Water's Sewer Flooding register was not available for this assessment.
Minewater Flooding	Mapping from the Coal Authority shows that the site falls within the area of a coal mine and there is a risk of groundwater emergence. Further investigation, including ground investigation will be required as part of a site specific flood risk assessment.
Flood history	The site is not within the Environment Agency's recorded flood outlines dataset. Flood records provided by the Lead Local Flood Authority (LLFA) show that the site is in an area where there are 5 records of flooding.
Cumulative Impact Assessment	Catchment – Tern - River Meese to River Roden Rank – Medium
Flood risk management infrastructure	
Defences	The Environment Agency AIMS dataset shows that the site is not protected by any formal flood defences.
Residual risk	The site is not at residual risk of flooding.
Emergency planning	
Flood warning	The site is not within an Environment Agency Flood Alert or Flood Warning Area.
Access and egress	The surface water flood risk on the site has a hazard rating of 'Significant – dangerous for most', which means that pedestrian and vehicular access will not be possible through this section of the site. Access and egress from the site will be from Church Street, there are not any areas of the road at risk from surface water flooding therefore there are no impacts to safe access and egress. A site-specific Flood Risk Assessment should be undertaken to evaluate accessibility to pedestrians and vehicles. Developers must demonstrate that safe

	access and egress in the 0.1% AEP event, including allowance for climate change.
Dry Islands	The site is not located within a dry island during any modelled flood event.
Climate change	
Implications for the site	**Management Catchment: Severn Middle Worcestershire** Increased storm intensities due to climate change may increase the extent, depth, velocity, hazard, and frequency of both fluvial and surface water flooding. **Fluvial Flooding:** The site is not covered by any available detailed hydraulic modelling, however, climate change uplift of 35% has been applied to the Environment Agency Flood Map for Planning. The mapping shows that the site will remain in Flood Zone 1, this indicates that the impact of climate change on future risk of fluvial flooding to the site is negligible. **Surface Water:** Climate change is predicted to increase rainfall intensity in the future by a range of between 30% and 45% (the recommended precautionary sensitive range for 2061 to 2125). This will increase the likelihood, frequency and extent of surface water flooding. The 1% AEP Risk of Flooding from Surface Water dataset has been re-run with a 45% climate change allowance, and it shows an increase in the extent of surface water flooding to the south-east section of the site, to a similar extent as the current day 0.1% AEP event surface water extent.
Requirements for surface water drainage	
Broad-scale assessment of potential SuDS	**Geology & Soils** Geology at the site consist of: • Bedrock – Halesowen Formation - Mudstone, siltstone and sandstone • Superficial deposits – N/A (no information is available) Soils at the site consist of: • Slightly acid loamy and clayey soils with impeded drainage **Sustainable Drainage Systems (SuDS)** The Telford and Wrekin Sustainable Drainage Systems Handbook has more guidance on the implementation of SuDS for all types of development. • Groundwater levels are indicated to be at least 5m below ground level and groundwater flooding is not likely, however below ground development such as basements may still be susceptible to groundwater flooding. Additional site investigation work may be required to support the detailed design of the drainage system. • The site is not within a source protection zone. • The site is not located within a historic landfill site. • Surface water discharge rates should not exceed pre-development discharge rates for the site and should be designed to be as close to greenfield runoff rates as reasonably practical in consultation with the LLFA. It may be possible to reduce site runoff by maximising the permeable surfaces on site using a combination of permeable surfacing and soft landscaping techniques. • If it is proposed to discharge runoff to a watercourse or sewer system, the condition and capacity of the receiving watercourse or asset should be

	confirmed through surveys and the discharge rate agreed with the asset owner.
Opportunities for wider sustainability and integrated flood risk management	• Implementation of SuDS at the site could provide opportunities to deliver multiple benefits including volume control, water quality, amenity and biodiversity. Proposals to use SuDS techniques should be discussed with relevant stakeholders, Telford and Wrekin Council (as Lead Local Flood Authority) and the Environment Agency at an early stage to understand possible constraints. • Development at this site should not increase flood risk either on or off site. The design of the surface water management proposals should take into account the impacts of future climate change over the projected lifetime of the development. • Opportunities to incorporate filtration techniques such as bioretention areas or rain gardens must be considered. Consideration should be made to the existing condition of receiving waterbodies and their Water Framework Directive objectives for water quality. The use of multistage SuDS treatment will clean and improve water quality of surface water runoff discharged from the site and reduce the impact on receiving water bodies. • Opportunities to incorporate source control techniques such as green roofs, permeable surfaces and rainwater harvesting must be considered in the design of the site.
NPPF and planning implications	
Exception Test requirements	The site is classified as 'More Vulnerable' and is within Flood Zone 1, but at high risk from surface water flooding. The Sequential Test must be passed, the criteria for which is highlighted within the Level 1 SFRA. The Exception Test is not required under the NPPF. However, it must be shown that the development will be safe for its lifetime and the risk of flooding from all sources can be managed through a sequential approach to design.
Requirements and guidance for site-specific Flood Risk Assessment	**Flood Risk Assessment:** • Consultation with Telford and Wrekin Council, Severn Trent Water, and the Environment Agency should be undertaken at an early stage. • Developers should consult with Severn Trent Water to ensure that the development aims to help achieve the targets of the Drainage and Wastewater Management Plan. • Any FRA should be carried out in line with the National Planning Policy Framework and Flood Risk and Coastal Change Planning Practice Guidance. **Guidance for site design and making development safe:** • The developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the development meets the objectives of the NPPF's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development. (Paragraph 052 Flood Risk and Coastal Change PPG). • The risk from surface water flow routes should be quantified as part of a site-specific FRA, including a drainage strategy, so runoff magnitudes from the development are not increased by development across any ephemeral surface water flow routes. A drainage strategy should help inform site layout and design to ensure runoff rates are as close as possible to greenfield rates.

	• Should built development be proposed within the design surface water flood extent, careful consideration will need to be given to flood resistance and resilience measures.
	• Flood resilience and resistance measures should be implemented where appropriate during the construction phase, e.g. raising of floor levels. These measures should be assessed to make sure that flooding is not increased elsewhere.
	  ○ raise them as much as possible.
	  ○ include extra flood resistance and resilience measures.
	• Other examples of flood resistance and resilience measures include:
	  ○ using flood resistant materials that have low permeability to at least 600mm above the estimated flood level
	  ○ making sure any doors, windows or other openings are flood resistant to at least 600mm above the estimated flood level
	  ○ by raising all sensitive electrical equipment, wiring and sockets to at least 600mm above the estimated flood level.

Key messages

The site is in Flood Zone 1 but is at high risk of surface water flooding.

Development is likely to be able to proceed if:

- site-specific FRA demonstrates that the site is not at an increased risk of flooding in the future and that development of the site does not increase the risk of surface water flooding on the site and to neighbouring areas.
- A carefully considered and integrated flood resilient and sustainable drainage design is put forward, with development steered away from the areas identified to be at risk of surface water flooding across the site.
- Safe access and egress can be demonstrated in the surface water plus climate change events. This includes measures to reduce flood risk along these routes such as raising access, but not displacing floodwater elsewhere.
- If flood mitigation measures are implemented then they are tested to check that they will not displace water elsewhere (for example, if land is raised to permit development on one area, compensatory flood storage will be required in another)

Mapping Information

Flood Zones	Flood Zones 2 and 3 have been taken from the Environment Agency's Flood Map for Planning mapping.
Climate change	Climate change allowances have been applied to the Environment Agency's Risk of Flooding from Surface Water (RoFSW) map to indicate the impact on surface water flood risk.
Fluvial extents, depth, velocity and hazard mapping	No detailed hydraulic modelling is available for this area.
Surface Water	The Environment Agency's Risk of Flooding from Surface Water (RoFSW) dataset has been used for this assessment.
Surface water depth, velocity and hazard mapping	The Environment Agency's Risk of Flooding from Surface Water (RoFSW) dataset has been used for this assessment.
Groundwater	JBA Consulting Ltd. Groundwater Flood Mapping (2017)

	Telford and Wrekin Council Level 2 Strategic Flood Risk Assessment Detailed Site Summary Tables
Site details	
Site Code	**707**
Address	Little Dessert Shop
Area	0.55ha
Current land use	Greenfield
Proposed land use	Residential
Flood Risk Vulnerability	More Vulnerable
Sources of flood risk	
Location of the site within the catchment	The site is located north-west of Telford and is bordered by agricultural fields to the north and west. The B5063 is along the eastern boundary of the site, and Bratton Road is along the southern boundary. The nearest Main River is the River Tern, flowing in a southerly direction 1.85km to the west of the site.
Topography	The Environment Agency 1m resolution LiDAR shows that the site has a small mound located in the centre of the site, with an elevation of 63.84mAOD (Above Ordnance Datum). The site slopes slightly from the southern boundary to the northern boundary, where levels along the western boundary fall from 62.83mAOD to 62.13mAOD; this is the lowest elevation of the site.
Existing drainage features	Mapping shows an ordinary watercourse flowing south to north, along the western boundary of the site.
Fluvial	**The proportion of site at risk FMFP:** FZ3 – 0% FZ2 – 0% FZ1 – 100% **Available data:** The Environment Agency's Flood Map for Planning has been used in this assessment. **Flood characteristics:** The site is located in Flood Zone 1 and is at negligible risk of fluvial flooding.
Surface Water	**Proportion of site at risk (RoFSW):** 3.3% AEP – 0% Max depth – N/A Max velocity – N/A 1% AEP – 46% Max depth – 0.30 – 0.60m Max velocity – 0.25 – 0.50m/s 0.1% AEP – 85% Max depth – 0.60 – 0.90m

	Max velocity – 1.00 – 2.00m/s **Description of surface water flooding:** The Environment Agency Risk of Flooding from Surface Water (RoFSW) mapping shows that during the 1% AEP event nearly half of the site is at risk from surface water flooding. Flooding to the northern section of the site appears to be an area of ponding with a depth of up to 0.60m. The mapping also shows that the south-west area of the site is also at risk of surface water flooding, this appears to be part of a flow route which originates south of the site on Bratton Road. On site the depth of the flooding is shown to be up to 0.60m with a velocity of 0.50m/s. During the 0.1% AEP event, the majority of the site is at risk of surface water flooding. The extent of the flow route during the 1% AEP event from the south of the site has increased and merged with the area of flooding to the north of the site, forming a larger flow route, flowing north and off site along the B5063. The mapping shows that the depth of the flow route is predominantly 0.60m, with a section along the western boundary shown to have a depth of up to 0.90m. The flow route has variable velocities from 0.25-2.00m/s across the site. The areas of the site not at risk of surface water flooding during the 0.1% AEP event are area of higher topography in the centre of the site. The site is at significant risk from surface water flooding and developers will need to carefully consider this risk and demonstrate users of the site can be kept safe during the lifetime of the development through a detailed site-specific FRA, including detailed hydraulic modelling.
Reservoir	The Environment Agency's statutory reservoir flooding maps shows almost the whole site is at risk of flooding from the Ercall Reservoirs.
Groundwater	This site is at a negligible risk of groundwater flooding meaning groundwater levels are at least 5m below the ground's surface.
Sewers	Severn Trent Water's Sewer Flooding register was not available for this assessment. However, it should be noted that there is an sewer tunnel beneath the site.
Minewater Flooding	Mapping from the Coal Authority shows that the site falls within the area of a coal mine and there is a risk of groundwater emergence. Further investigation, including ground investigation will be required as part of a site specific flood risk assessment.
Flood history	The site is not within the Environment Agency's recorded flood outlines dataset. Flood records provided by the Lead Local Flood Authority (LLFA) show that the site is in an area where there are 9 records of flooding.
Cumulative Impact Assessment	Catchment – Beanhill Brook - source to Shawbirch Rank – Medium
Flood risk management infrastructure	
Defences	The Environment Agency AIMS dataset shows that the site is not protected by any formal flood defences.
Residual risk	The site is at residual risk of statutory reservoir flooding in the unlikely event of a breach at the Ercall Reservoirs.
Emergency planning	
Flood warning	The site is not within an Environment Agency Flood Alert or Flood Warning Area.
Access and egress	During the 1% AEP surface water event, access and egress via Bratton Road and Dulwich Grange will not be possible as the flow route in this area has a hazard

	rating of 'Significant – dangerous for most'. Access and egress north along the B5063 will be possible as there are not any areas of the road at flood risk during the 1% AEP surface water event. It should be noted that there is an area the B5063 shown to be at risk of flooding approximately 400m south-east of the site, with a hazard rating of 'Significant – dangerous for most'. During the 0.1% AEP event, all access routes from the site, along Bratton Road, Dulwich Grange and the B5063 have a hazard rating of 'Significant – dangerous for most', this means that pedestrian and vehicular access is not possible. A site-specific Flood Risk Assessment should be undertaken to evaluate accessibility to pedestrians and vehicles. Developers must demonstrate that safe access and egress in the 0.1% AEP event, including allowance for climate change. Given extent and hazards associated with surface water flooding on site, a flood warning and evacuation plan should be prepared for the site.
Dry Islands	The site is not located within a dry island during any modelled flood event.
Climate change	
Implications for the site	**Management Catchment: Severn Middle Shropshire** Increased storm intensities due to climate change may increase the extent, depth, velocity, hazard, and frequency of both fluvial and surface water flooding. **Fluvial Flooding:** The site is not covered by any available detailed hydraulic modelling, however, climate change uplift of 35% has been applied to the Environment Agency Flood Map for Planning. The mapping shows that the site will remain in Flood Zone 1, this indicates that the impact of climate change on future risk of fluvial flooding to the site is negligible. **Surface Water:** Climate change is predicted to increase rainfall intensity in the future by a range of between 30% and 45% (the recommended precautionary sensitive range for 2061 to 2125). This will increase the likelihood, frequency and extent of surface water flooding. The 1% AEP Risk of Flooding from Surface Water dataset has been re-run with a 45% climate change allowance, and it shows an increase in the extent of the surface water flow route through the site, to a similar extent as the current day 0.1% AEP event surface water extent.
Requirements for surface water drainage	
Broad-scale assessment of potential SuDS	**Geology & Soils** Geology at the site consist of: • Bedrock – Bridgnorth Sandstone Formation – Sandstone. • Superficial deposits – Glaciofluvial Deposits, Devensian – Sand and gravel. Soils at the site consist of: • Slightly acid loamy and clayey soils with impeded drainage **Sustainable Drainage Systems (SuDS)** The Telford and Wrekin Sustainable Drainage Systems Handbook has more guidance on the implementation of SuDS for all types of development. • Groundwater levels are indicated to be at least 5m below ground level and groundwater flooding is not likely, however below ground development such as basements may still be susceptible to groundwater flooding.

	• The site is located within a Groundwater Source Protection Zone. Infiltration techniques may not be suitable and should only be used following the granting of any required environmental permits from the Environment Agency for Zones 2, 3 and 4 although it is possible that infiltration may not be permitted. Proposed SuDS should be discussed with relevant stakeholders (Telford and Wrekin Council and the Environment Agency) at an early stage to understand possible opportunities and constraints. • The site is not located within a historic landfill site. • BGS data indicates that the underlying geology is sandstone which is likely to be free draining. This should be confirmed through infiltration testing, with the use of infiltration maximised as much as possible in accordance with the SuDS hierarchy. • The Risk of Flooding from Surface Water (RoFSW) mapping indicates the presence of surface water flow paths during the 1% AEP event. Existing flow paths should be retained and integrated with blue-green infrastructure and public open space. • Surface water discharge rates should not exceed the existing greenfield runoff rates for the site. Opportunities to further reduce discharge rates should be considered and agreed with the LLFA. It may be possible to reduce site runoff by maximising the permeable surfaces on site using a combination of permeable surfacing and soft landscaping techniques. • If it is proposed to discharge runoff to a watercourse or sewer system, the condition and capacity of the receiving watercourse or asset should be confirmed through surveys and the discharge rate agreed with the asset owner.
Opportunities for wider sustainability and integrated flood risk management	• Implementation of SuDS at the site could provide opportunities to deliver multiple benefits including volume control, water quality, amenity and biodiversity. Proposals to use SuDS techniques should be discussed with relevant stakeholders, Telford and Wrekin Council (as Lead Local Flood Authority) and the Environment Agency at an early stage to understand possible constraints. • The ordinary watercourse and the natural surface water flow routes should be maintained and enhanced within the development site and incorporated into the surface water drainage strategy. • Above ground SuDS should be shallow and/or lined to ensure that groundwater does not inundate the features during high groundwater events. • Development at this site should not increase flood risk either on or off site. The design of the surface water management proposals should take into account the impacts of future climate change over the projected lifetime of the development. • Opportunities to incorporate filtration techniques such bioretention areas or rain gardens must be considered. Consideration should be made to the existing condition of receiving waterbodies and their Water Framework Directive objectives for water quality. The use of multistage SuDS treatment will clean and improve water quality of surface water runoff discharged from the site and reduce the impact on receiving water bodies. • Opportunities to incorporate source control techniques such as green roofs, permeable surfaces and rainwater harvesting must be considered in the design of the site.

NPPF and planning implications	
Exception Test requirements	The site is classified as 'More Vulnerable' and is within Flood Zone 1, however is at significant risk of surface water flooding, with 46% of site at risk during the 1% AEP event and 85% of the site at risk during the 0.1% AEP event. The Sequential Test must be passed, the criteria for which is highlighted within the Level 1 SFRA. The Exception Test is not required under the NPPF. However, it must be shown that the development will be safe for its lifetime and the risk of flooding from all sources can be managed through a sequential approach to design.

Requirements and guidance for site-specific Flood Risk Assessment	**Flood Risk Assessment:**
	• Consultation with Telford and Wrekin Council, Severn Trent Water, and the Environment Agency should be undertaken at an early stage.
	• Developers should consult with Severn Trent Water to ensure that the development aims to help achieve the targets of the Drainage and Wastewater Management Plan.
	• Any FRA should be carried out in line with the National Planning Policy Framework and Flood Risk and Coastal Change Planning Practice Guidance.
	Guidance for site design and making development safe:
	• The developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the development meets the objectives of the NPPF's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development. (Paragraph 052 Flood Risk and Coastal Change PPG).
	• The risk from surface water flow routes should be quantified as part of a site-specific FRA, including a drainage strategy, so runoff magnitudes from the development are not increased by development across any ephemeral surface water flow routes. A drainage strategy should help inform site layout and design to ensure runoff rates are as close as possible to greenfield rates.
	• Should built development be proposed within the design surface water flood extent, careful consideration will need to be given to flood resistance and resilience measures.
	• Flood resilience and resistance measures should be implemented where appropriate during the construction phase, e.g. raising of floor levels. These measures should be assessed to make sure that flooding is not increased elsewhere.
	  ○ raise them as much as possible.
	  ○ include extra flood resistance and resilience measures.
	• Other examples of flood resistance and resilience measures include:
	  ○ using flood resistant materials that have low permeability to at least 600mm above the estimated flood level
	  ○ making sure any doors, windows or other openings are flood resistant to at least 600mm above the estimated flood level
	  ○ by raising all sensitive electrical equipment, wiring and sockets to at least 600mm above the estimated flood level.

Key messages
The site is classified as 'More Vulnerable' and is within Flood Zone 1, however is at significant risk of surface water flooding, with 46% of site at risk during the 1% AEP event and 85% of the site at risk during the 0.1% AEP event. Development is likely to be able to proceed if: • A site-specific Flood Risk Assessment that demonstrates that site users will be safe in the 0.1% surface water AEP event, plus an allowance for climate change. This will need to show that the site is not at an increased risk of flooding in the future and the development of the site does not increase the risk of surface water flooding on the site and to neighbouring properties. • A site-specific FRA demonstrates that the site is not at an increased risk of flooding in the future and that development of the site does not increase the risk of surface water flooding on the site and to neighbouring areas. • A carefully considered and integrated flood resilient and sustainable drainage design is put forward, with development steered away from the areas identified to be at risk of surface water flooding across the site. • Safe access and egress can be demonstrated in the surface water plus climate change events. This includes measures to reduce flood risk along these routes such as raising access, but not displacing floodwater elsewhere. • If flood mitigation measures are implemented then they are tested to check that they will not displace water elsewhere (for example, if land is raised to permit development on one area, compensatory flood storage will be required in another)

Mapping Information	
Flood Zones	Flood Zones 2 and 3 have been taken from the Environment Agency's Flood Map for Planning mapping and the River Tern hydraulic modelling from 2004.
Climate change	Climate change allowances have been applied to the Environment Agency's Risk of Flooding from Surface Water (RoFSW) map to indicate the impact on surface water flood risk.
Fluvial extents, depth, velocity and hazard mapping	No detailed hydraulic modelling is available for this area.
Surface Water	The Environment Agency's Risk of Flooding from Surface Water (RoFSW) dataset has been used for this assessment.
Surface water depth, velocity and hazard mapping	The Environment Agency's Risk of Flooding from Surface Water (RoFSW) dataset has been used for this assessment.
Groundwater	JBA Consulting Ltd. Groundwater Flood Mapping (2017)

	Telford and Wrekin Council Level 2 Strategic Flood Risk Assessment Detailed Site Summary Tables
Site details	
Site Code	**717**
Address	Telford Station
Area	2.99ha
Current land use	Brownfield – Train Station and Car Park
Proposed land use	Mixed
Flood Risk Vulnerability	More Vulnerable
Sources of flood risk	
Location of the site within the catchment	The site is located in a built-up urban area to the north-east of Telford town centre. The site is bounded by M54 to the north, Euston Way to the east, the Hollinswood Roundabout to the south, and Queensway (A442) forms the western boundary of the site. The nearest Main River is Wesley Brook, flowing eastwards approximately 2.3km east of the eastern site boundary.
Topography	The Environment Agency 1m resolution LiDAR shows the site slopes from a maximum elevation of 142.80mAOD (Above Ordnance Datum) at the south-eastern boundary to 133.98mAOD in the northwestern corner of the site. The railway running north-south has a lower elevation of 134.12mAOD. Within the northern section of the site, there is a grass bank, which slopes from 139.21mAOD to 134.85mAOD towards the site centre.
Existing drainage features	Mapping does not identify any existing watercourses within the site boundary.
Fluvial	**The proportion of site at risk FMFP:** FZ3 – 0% FZ2 – 0% FZ1 – 100% **Available data:** The Environment Agency's Flood Map for Planning has been used for this assessment. **Flood characteristics:** The site is located in Flood Zone 1 and is at negligible risk of fluvial flooding.
Surface Water	**Proportion of site at risk (RoFSW):** **3.3% AEP – 10%** Max depth – 0.60 – 0.90m Max velocity – 0.50 – 1.00m/s **1% AEP – 18%** Max depth – 0.90 – 1.20m Max velocity – 1.00 – 2.00m/s **0.1% AEP – 48%**

	Max depth – >1.20m Max velocity – >2.00m/s **Description of surface water flooding:** The Environment Agency Risk of Flooding from Surface Water (RoFSW) mapping shows that during the 3.3% surface water AEP event a flow path runs from south north along the train tracks. This has a maximum depth of 0.30-0.60m and a maximum velocity of 0.25-0.50m/s. There is ponding in the southwest of the site, just west of the train tracks which has a maximum depth of 0.60-0.90m and a maximum velocity of 0.50-1.00m/s. A second area of ponding is present in the northeast of the site, inundating the north of the existing car park to a maximum depth and velocity of 0.30-0.60m and 0.50-1.00m/s respectively. During the 1% AEP surface water event, the flow path on the train tracks remains at a depth of 0.30-0.60m and 0.50-1.00m/s. The ponding to the southwest of the site increases in extent and the maximum depth increases to 0.90-1.20m, however, the maximum velocity remains at 0.50-1.00m/s. The area of ponding in the car park increases in extent, inundating the centre of the car park. The maximum depth and velocity of this flooding remains at 0.30-0.60m and 0.50-1.00m/s. Ponding at the north of the site emerges with a maximum depth and velocity of 0.60-0.90m and 1.00-2.00m/s. Ponding in the southeastern corner of the site emerges, following the path of Euston Way. This has a maximum depth of 0.00-0.15m and a maximum velocity of 0.50-1.00m/s. During the 0.1% AEP event there near half of the site is at risk of surface water flooding. The train tracks are completely submerged to a maximum depth of >1.20m and a maximum velocity of 1.00-2.00m/s. There is a large extent of ponding to the north of the site with a maximum depth of >1.20m and a maximum velocity of 1.00-2.00m/s. The car park of the station also has a large extent of ponding, inundating the northern half of the car park entirely. This has a maximum depth and velocity of 0.60-0.90m and 1.00-2.00m/s respectively. The southwestern corner of the site has a medium extent of surface water which extends beyond the train tracks, pooling into the car park. This flooding has a maximum depth and velocity of >1.20m and 1.00-2.00m/s respectively.
Reservoir	The Environment Agency's statutory reservoir flooding maps show the site is not at risk of flooding from any statutory reservoirs.
Groundwater	This site is at a negligible risk of groundwater flooding meaning groundwater levels are at least 5m below the ground's surface.
Sewers	Severn Trent's Sewer Flooding register was not available for this assessment. It has however been identified that there is an existing Severn Trent foul sewer through the centre of the site.
Minewater Flooding	Mapping from the Coal Authority shows that the site falls within the area of a coal mine, and there is a risk of groundwater emergence. Further investigation, including ground investigation will be required as part of a site specific flood risk assessment.
Flood history	The site is not within the Environment Agency's recorded flood outlines dataset. Flood records provided by the Lead Local Flood Authority (LLFA) show that the site is in an area where there are 10 records of flooding.
Cumulative Impact Assessment	Catchment – Wesley Brook (inc. Nedge Brook) - source to River Worfe Rank – Medium

Flood risk management infrastructure	
Defences	The Environment Agency AIMS dataset shows that the site is not protected by any formal flood defences.
Residual risk	The site is not at residual risk of flooding.
Emergency planning	
Flood warning	The site is not within an Environment Agency Flood Alert or Flood Warning Area.
Access and egress	Access and egress to the site is possible via multiple routes, using multiple modes of transport. Vehicular access is possible via Euston Way which leads off Hollinswood Roundabout. Pedestrian access is possible via an elevated walkway, known as Silver Shallow Bridge, which passes over the A442. This bridge can be accessed via Ironmasters Way, to the west of the railway station. It is assumed that there is a stairwell at the other end of the bridge, leading directly into the train station. A wheelchair access ramp to the bridge slopes down the grass bank in the north of the site. Finally, the station can be accessed via rail, with the railway tracks operating in northern and southern directions. <u>Euston Road</u> Euston Road is free from surface water inundation during the 3.3% AEP event so this is a route for safe access and egress. During the 1% AEP event there is some shallow surface water flooding along this road, to a maximum depth of 0.00-0.15m and a maximum velocity of 1.00-2.00m/s. The hazard rating of this flooding is classified as 'low-caution' and would provide a route for safe access and egress. During the 0.1% AEP event, the flooding on Euston Road remains at a depth of 0.00-0.15m and a velocity of 1.00-2.00m/s The hazard rating of this flooding is classified as 'low-caution' and would provide a route for safe access and egress. <u>Silver Shallow Bridge</u> Silver Shallow Bridge is elevated above the A442 and so remains clear from surface water flooding in all AEP events however, the entry and exit points of the bridge are impacted. During the 3.3% AEP event Ironmasters Way remains clear from surface water flooding and so the bridge is accessible from this route. At the railway station end of the bridge it is assumed that the stairwell leads straight into the station and because the station is free from surface water flooding in all AEP events, the stairwell is assumed to be a route of safe access and egress in all AEP events. However, the wheelchair access route is directed onto Euston Way, before entering the station. During the 3.3% AEP event the section of Euston Way between the end of Silver Shallow Bridge and the station, is flooded to a maximum depth and velocity of 0.30-0.60m and 0.50-1.00m/s. This has a hazard classification of 'moderate- danger for some', and therefore pedestrian access would not be possible during this event. During the 1% AEP event Ironmasters Way is inundated to a maximum depth and velocity of 0.00-0.15m and 0.25-0.50m/s. This flooding has a hazard classification of 'low- caution'. The flooding on the wheelchair access route on the other side of the bridge remains at a depth and velocity of 0.30-0.60m and 0.25-0.50m/s respectively. This flooding has a hazard classification of 'moderate- danger for some'

	During the 0.1% AEP event, Ironmasters Way is inundated to a maximum depth and velocity of 0.15-0.30m and 1.00-2.00m/s. This has a hazard classification of – 'low- caution'. The wheelchair access route at the other end of the bridge is flooded to a depth and velocity of 0.60-0.90m and 0.25-0.50m/s. This has a hazard classification of 'significant – danger for most', and therefore pedestrian and vehicular access would not be possible Therefore, during the 3.3%. 1% and 0.1% AEP events safe access and egress is possible, but only via the stairwell route. Additionally, although access and egress are technically possible during the 0.1% AEP event, it takes you to the station which is then a dry island surrounded by surface water flooding in all directions. For wheelchair users, safe access and egress is only possible during the 3.3% and 1% AEP event. <u>Rail</u> During all surface water AEP events the train tracks are shown to be flooded, it is likely that trains would not run and therefore this cannot be used as an access and egress route.
Dry Islands	The site is not located within a dry island during any modelled flood event.
Climate change	
Implications for the site	**Management Catchment: Severn Middle Worcestershire** Increased storm intensities due to climate change may increase the extent, depth, velocity, hazard, and frequency of both fluvial and surface water flooding. **Fluvial Flooding:** The site is not covered by any hydraulic modelling, however, climate change uplift of 35% has been applied to the Environment Agency Flood Map for Planning. The mapping shows that the site will remain in Flood Zone 1, this indicates that the impact of climate change on future risk of fluvial flooding to the site is negligible. **Surface Water:** Climate change is predicted to increase rainfall intensity in the future by a range of between 30% and 45% (the recommended precautionary sensitive range for 2061 to 2125). This will increase the likelihood, frequency and extent of surface water flooding. The 3.3% AEP Risk of Flooding from Surface Water dataset has been re-run with a 25% climate change allowance. The 1% AEP Risk of Flooding from Surface Water dataset has been re-run with a 30% and 45% climate change allowance. The extent of the surface water flood risk for the 3.3% AEP plus 25% climate change allowance is slightly greater than that of the current day 1% AEP event. The extent of the surface water flood risk for the 1% AEP plus 30% climate change allowance is similar to that of the current day 0.1% AEP event. The extent of the surface water flood risk for the 1% AEP plus 45% climate change slightly exceeds that of the current day 0.1% AEP event. This shows that climate change will impact the flood risk of the site.

Requirements for surface water drainage	
Broad-scale assessment of potential SuDS	**Geology & Soils** Geology at the site consist of: • Bedrock – Halesowen Formation - Mudstone, siltstone and sandstone. • Superficial deposits – Glaciolacustrine Deposits, Devensian - Clay and silt. Soils at the site consist of: • Slightly acid loamy and clayey soils with impeded drainage **Sustainable Drainage Systems (SuDS):** The Telford and Wrekin Sustainable Drainage Systems Handbook has more guidance on the implementation of SuDS for all types of development. • Groundwater levels are indicated to be at least 5m below ground level and groundwater flooding is not likely, however below ground development such as basements may still be susceptible to groundwater flooding. • BGS data indicates that the underlying geology is mudstone, siltstone, sandstone, clay and sand which is likely to be with highly variable permeability. This should be confirmed through infiltration testing. Off-site discharge in accordance with the SuDS hierarchy may be required to discharge surface water runoff from the site. • The site is not located within a Groundwater Source Protection Zone and there are no restrictions over the use of infiltration techniques with regard to groundwater quality. • The site is not located within a historic landfill site. • Surface water discharge rates should not exceed pre-development discharge rates for the site and should be designed to be as close to greenfield runoff rates as reasonably practical in consultation with the LLFA. It may be possible to reduce site runoff by maximising the permeable surfaces on site using a combination of permeable surfacing and soft landscaping techniques. • The Risk of Flooding from Surface Water (RoFSW) mapping indicates the presence of a surface water flow path along the eastern boundary during the 3.3% AEP events. Existing flow paths should be retained and integrated with blue-green infrastructure. • If it is proposed to discharge runoff to a watercourse or sewer system, the condition and capacity of the receiving watercourse or asset should be confirmed through surveys and the discharge rate agreed with the asset owner.
Opportunities for wider sustainability and integrated flood risk management	• Implementation of SuDS at the site could provide opportunities to deliver multiple benefits including volume control, water quality, amenity and biodiversity. Proposals to use SuDS techniques should be discussed with relevant stakeholders, Telford and Wrekin Council (as Lead Local Flood Authority) and the Environment Agency at an early stage to understand possible constraints. • Natural surface water flow routes should be maintained and enhanced within the development site. • Above ground SuDS should be shallow and/or lined to ensure that groundwater does not inundate the features during high groundwater events. • Development at this site should not increase flood risk either on or off site. The design of the surface water management proposals should take into

	account the impacts of future climate change over the projected lifetime of the development. • Opportunities to incorporate filtration techniques such bioretention areas or rain gardens must be considered. Consideration should be made to the existing condition of receiving waterbodies and their Water Framework Directive objectives for water quality. The use of multistage SuDS treatment will clean and improve water quality of surface water runoff discharged from the site and reduce the impact on receiving water bodies. • Opportunities to incorporate source control techniques such as green roofs, permeable surfaces and rainwater harvesting must be considered in the design of the site. • The potential to utilise conveyance features such as swales to intercept and convey surface water runoff should be considered. Conveyance features should be located on common land or public open space to facilitate ease of access. Where slopes are >5%, features should follow contours or utilise check dams to slow flows.
NPPF and planning implications	
Exception Test requirements	The site is classified as 'More Vulnerable' and is within Flood Zone 1, but at high risk from surface water flooding and mine water flooding. The Sequential Test must be passed, the criteria for which is highlighted within the Level 1 SFRA. The Exception Test is not required under the NPPF. However, it must be shown that the development will be safe for its lifetime and the risk of flooding from all sources can be managed through a sequential approach to design.
Requirements and guidance for site-specific Flood Risk Assessment	**Flood Risk Assessment:** • Consultation with Telford and Wrekin Council, Severn Trent, and the Environment Agency should be undertaken at an early stage. • Developers should consult with Severn Trent to ensure that the development aims to help achieve the targets of the Drainage and Wastewater Management Plan. • Any FRA should be carried out in line with the National Planning Policy Framework and Flood Risk and Coastal Change Planning Practice Guidance. **Guidance for site design and making development safe:** • The developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the development meets the objectives of the NPPF's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development. (Paragraph 052 Flood Risk and Coastal Change PPG). • The risk from surface water flow routes should be quantified as part of a site-specific FRA, including a drainage strategy, so runoff magnitudes from the development are not increased by development across any ephemeral surface water flow routes. A drainage strategy should help inform site layout and design to ensure runoff rates are as close as possible to greenfield rates. • Should built development be proposed within the design surface water flood extent, careful consideration will need to be given to flood resistance and resilience measures. • Flood resilience and resistance measures should be implemented where appropriate during the construction phase, e.g. raising of floor levels.

	These measures should be assessed to make sure that flooding is not increased elsewhere. ○ raise them as much as possible. ○ include extra flood resistance and resilience measures. • Other examples of flood resistance and resilience measures include: ○ using flood resistant materials that have low permeability to at least 600mm above the estimated flood level ○ making sure any doors, windows or other openings are flood resistant to at least 600mm above the estimated flood level ○ by raising all sensitive electrical equipment, wiring and sockets to at least 600mm above the estimated flood level.

Key messages

The site is classified as 'More Vulnerable' and is within Flood Zone 1, but at high risk from surface water flooding and mine water flooding.

Development is likely to be able to proceed if:

- A site-specific FRA demonstrates that the site is not at an increased risk of flooding in the future and that development of the site does not increase the risk of surface water flooding on the site and to neighbouring areas.
- A carefully considered and integrated flood resilient and sustainable drainage design is put forward, with development steered away from the areas identified to be at risk of surface water flooding across the site.
- Safe access and egress can be demonstrated in the surface water plus climate change events. This includes measures to reduce flood risk along these routes such as raising access, but not displacing floodwater elsewhere.
- If flood mitigation measures are implemented then they are tested to check that they will not displace water elsewhere (for example, if land is raised to permit development on one area, compensatory flood storage will be required in another)

Mapping Information	
Flood Zones	Flood Zones 2 and 3 have been taken from the Environment Agency's Flood Map for Planning mapping.
Climate change	Climate change allowances have been applied to the Environment Agency's Risk of Flooding from Surface Water (RoFSW) map to indicate the impact on surface water flood risk.
Fluvial extents, depth, velocity and hazard mapping	No detailed hydraulic modelling is available for this area.
Surface Water	The Environment Agency's Risk of Flooding from Surface Water (RoFSW) dataset has been used for this assessment.
Surface water depth, velocity and hazard mapping	The Environment Agency's Risk of Flooding from Surface Water (RoFSW) dataset has been used for this assessment.
Groundwater	JBA Consulting Ltd. Groundwater Flood Mapping (2017)

	Telford and Wrekin Council Level 2 Strategic Flood Risk Assessment Detailed Site Summary Tables
Site details	
Site Code	**718**
Address	AGA Site, Coalbrookdale
Area	3.9ha
Current land use	Brownfield
Proposed land use	Residential
Flood Risk Vulnerability	More Vulnerable
Sources of flood risk	
Location of the site within the catchment	The site is located on the former AGA site, in the village of Coalbrookdale, to the south of Telford. To the west of the site is an area of woodland named Captain's Coppice which has the historical Wellington to Craven Arms railway line through it. Wellington Road and Dale Road to the East and South respectively. There is a Main River along the western boundary of the site, the majority of which appears to be culverted through the site. The River Severn is 700m south of the site.
Topography	The Environment Agency 1m resolution LiDAR shows that the site is relatively flat at around 66.5mAOD (Above Ordnance Datum). The northern section of the site is surrounded by higher land, whereas the southern section of the site is higher than the surrounding land. In the north-east corner of the site, the LiDAR shows that Wellington Road to the east is over 7m higher. To the west of the site, the railway line is 6.5m higher than the site. Along the southern boundary of the site, towards Dale Road, there is a steep drop from 65.38mAOD to 57.12mAOD.
Existing drainage features	The Environment Agency's Main River mapping shows that there is a Main River which enters the site along the northern boundary in the north-west corner. Mapping appears to show that the river may be culverted for much of the length site.
Fluvial	**The proportion of site at risk FMFP:** FZ3 – 77% FZ2 – 85% FZ1 – 15% *The Flood Zone values quoted show the percentage of the site at flood risk from that particular Flood Zone/event, including the percentage of the site at flood risk at a higher risk zone. This is because the values quoted are the area covered by each Flood Zone/extent within the site boundary. For example: Flood Zone 2 includes Flood Zone 3. Flood Zone 1 is the remaining area outside Flood Zone 2 (FZ2+ FZ1 = 100%).*

	Available data: The Environment Agency's Flood Map for Planning and the Coalbrookdale (2012) hydraulic model has been used in this assessment. **Flood characteristics:** The Environment Agency's Flood Map for Planning and the Coalbrookdale (2012) hydraulic model show that majority of the site is at risk of flooding from the Coal Brook. Overall, 77% of the site is within Flood Zone 3 with 48% of the site being shown to be with Flood Zone 3b (functional floodplain). The northern section of the site and along the western boundary are in the functional floodplain. Flood Zone 2 extends into those areas not within Flood Zone 3 with an additional 8% of the site at risk. Small sections in the centre of the site and along the southern boundary are shown to not be at fluvial flood risk. The site is at significant fluvial flood risk and developers will need to carefully consider this risk and demonstrate users of the site can be kept safe during the lifetime of the development through a detailed site-specific FRA, including detailed hydraulic modelling.
Surface Water	**Proportion of site at risk (RoFSW):** **3.3% AEP – 7%** Max depth – >1.2m Max velocity – 0.25 – 0.50m/s **1% AEP – 28%** Max depth – >1.2m Max velocity – 0.50 – 1.00m/s **0.1% AEP – 68%** Max depth – >1.2m Max velocity – >2.00/s **Description of surface water flooding:** The Environment Agency Risk of Flooding from Surface Water (RoFSW) mapping shows that during the 3.3% AEP event, there are six areas at risk of surface water flooding. For the majority of the areas this is ponding due to these areas being lower than the surrounding land. The is also surface water flooding associated with the watercourse in the north-west corner of the site, which is anticipated to have depths over 1.20m and a maximum velocity of 0.50m/s. During the 1% AEP event, the extent of the flooding associated with the watercourse increases further into the site, impacting the north-western section of the site, with anticipated depths over 1.2m. A flow route also forms during the 1% AEP event, it originates to the north of the site and enters in the north-east corner, flowing along slope between the site and Wellington Road. Following the topography of the site, the flow route flows diagonally across the site towards the south-west corner where is flows offsite. Flood depths of the flow range between 0.15m and 0.60m and velocities between 0.25m/s and 1.00m/s. There is also a section of ponding at the site entrance which extends across the site boundary with depths of up to 1.20m and has a hazard rating of 'Significant – dangerous for most'. The whole northern half and south-west section of the site is at risk of surface water flooding during the 0.1% AEP event, with a total of 68% of the site at risk of flooding from surface water. The deepest area of flooding remains in the north-west corner with depths over 1.20m. The mapping shows that the extent of the

	flow route increases across the site during the 0.1% AEP event and that the depth with be up to 0.90m. The area of ponding in the site entrance extends further into the site during the 0.1% AEP event and is deeper at over 1.20m. The site is at significant risk from surface water flooding and developers will need to carefully consider this risk and demonstrate users of the site can be kept safe during the lifetime of the development through a detailed site-specific FRA, including detailed hydraulic modelling.
Reservoir	The Environment Agency's statutory reservoir flooding mapping shows that the site is at risk from statutory reservoir flooding during the wet-day scenario, from Horsehay Pool reservoir. As part of a site-specific Flood Risk Assessment, an agreed emergency plan should identify appropriate safe access and egress routes from the site, in the event of a reservoir breach.
Groundwater	Groundwater levels are indicated to be at least 5m below ground level and groundwater flood risk is negligible. Below ground development such as basements may still be susceptible to groundwater flooding.
Sewers	Severn Trent Water's Sewer Flooding register was not available for this assessment.
Minewater Flooding	Mapping from the Coal Authority shows that the site falls within the area of a coal mine and there is a risk of groundwater emergence. Further investigation, including ground investigation will be required as part of a site specific flood risk assessment.
Flood history	The site is not within the Environment Agency's recorded flood outlines dataset. Flood records provided by the Lead Local Flood Authority (LLFA) show that the site is in an area where there are 8 records of flooding.
Cumulative Impact Assessment	Catchment – Lyde Brook (inc. Coalbrook) - source to River Severn Rank – High
Flood risk management infrastructure	
Defences	The Environment Agency AIMS dataset shows that the site is not protected by any formal flood defences.
Residual risk	The Environment Agency AIMS dataset shows that there is a trash screen the Coal Brook as it flows off site in south-west corner, therefore there is a residual risk of blooding associated with the blockage of the trash screen. There is also a residual risk associated with the blockage of the culverted watercourse along the western boundary of the site. The site is at risk of reservoir flooding in the unlikely event of a breach at Horsehay Pool Reservoir.
Emergency planning	
Flood warning	The northern section of the site is covered by the Environment Agency River Severn in Shropshire Flood Alert area. The site is also covered by the Coalbrook flood warning system which is currently managed by Telford and Wrekin Council.
Access and egress	It has been assumed that the site will be accessed via the existing site entrance, off of Wellington Road. There is an area of ponding in this area which extends into the site, therefore access and egress must be addressed.

	For all AEP events, the hazard rating for the surface water flooding at the entrance has been calculated as 'Significant – dangerous for most people', therefore during these events vehicular and pedestrian access and egress is not possible. It should also be noted that during the 0.1% AEP event Wellington Road and Dale Road, south of the site, have a hazard rating of 'Moderate – dangerous for some', this is due to the velocity of the surface water flooding. A site-specific Flood Risk Assessment should be undertaken to evaluate accessibility to pedestrians and vehicles. Developers must demonstrate that safe access and egress in the 0.1% AEP event, including allowance for climate change. Given the significant flood depths and hazards associated with surface water flooding on site, a flood warning and evacuation plan should be prepared for the site.
Dry Islands	The site is not located within a dry island during any modelled flood event.
Climate change	
Implications for the site	**Management Catchment: Severn Middle Worcestershire** Increased storm intensities due to climate change may increase the extent, depth, velocity, hazard, and frequency of both fluvial and surface water flooding. **Fluvial Flooding:** Climate change uplifts of 25%, 35% and 70% have been applied to the Coalbrookdale hydraulic model (2012) for the 1% AEP event to assess the impact of climate change on fluvial flooding. The modelling shows that the extent of Flood Zone 3 will increase for all climate change uplifts, greater than the current Flood Zone 2 extent. **Surface Water:** Climate change is predicted to increase rainfall intensity in the future by a range of between 30% and 45% (the recommended precautionary sensitive range for 2061 to 2125). This will increase the likelihood, frequency and extent of surface water flooding. The 1% AEP Risk of Flooding from Surface Water dataset has been re-run with a 45% climate change allowance and shows that the extent of surface water flooding exceeds that of the current day 0.1% AEP event. This shows that climate change will impact the flood risk of the site.
Requirements for surface water drainage	
Broad-scale assessment of potential SuDS	**Geology & Soils** Geology at the site consist of: • Bedrock – Coalbrookdale Formation - Mudstone. • Superficial deposits – none recorded. Soils at the site consist of: • Slightly acid loamy and clayey soils with impeded drainage **Sustainable Drainage Systems (SuDS)** The Telford and Wrekin Sustainable Drainage Systems Handbook has further guidance on the implementation of SuDS for all types of development. • This site is within a No-Soakaway Zone where Telford and Wrekin Council has identified that due to instability issues associated with mine working, no infiltration will be permitted on this site.

	• Proposed attenuation features such as basins, ponds and tanks should be located outside of Flood Zone 3 to avoid the potential risks to the hydraulic capacity or structural integrity of these features. Surface water outfalls that discharge into the Coal Brook may be susceptible to surcharging due to water levels in the Coal Brook and River Severn. The impacts of flood flows will need to be considered in terms of the attenuation storage requirements of the site and placement of the outfalls. • Surface water discharge rates should not exceed pre-development discharge rates for the site and should be designed to be as close to greenfield runoff rates as reasonably practical in consultation with the LLFA. It may be possible to reduce site runoff by maximising the permeable surfaces on site using a combination of permeable surfacing and soft landscaping techniques. • The southern section of the site has been designated by the Environment Agency as being a historic landfill site. A thorough ground investigation will be required as part of a detailed site-specific FRA; to determine potential mitigation for contamination and the impact this may have on SuDS. As such, proposed SuDS should be discussed with the relevant stakeholders Telford and Wrekin Council (as Lead Local Flood Authority and Local Planning Authority) and the Environment Agency at an early stage to understand possible constraints. • The site is not within a source protection zone. • The Risk of Flooding from Surface Water (RoFSW) mapping indicates the presence of a surface water flow path along the eastern boundary during the 1% AEP events. Existing flow paths should be retained and integrated with blue-green infrastructure. • The condition and capacity of the receiving watercourse should be confirmed through surveys and the discharge rate agreed with the asset owner.
Opportunities for wider sustainability and integrated flood risk management	• Implementation of SuDS at the site could provide opportunities to deliver multiple benefits including volume control, water quality, amenity and biodiversity. Proposals to use SuDS techniques should be discussed with relevant stakeholders, Telford and Wrekin Council (as Lead Local Flood Authority and Local Planning Authority) and the Environment Agency at an early stage to understand possible constraints. • Natural surface water flow routes should be maintained and enhanced within the development site. • Development at this site should not increase flood risk either on or off site. The design of the surface water management proposals should take into account the impacts of future climate change over the projected lifetime of the development. • The use of multistage SuDS treatment will clean and improve water quality of surface water runoff discharged from the site and reduce the impact on receiving water bodies. • Opportunities to incorporate source control techniques such as green roofs, permeable surfaces and rainwater harvesting must be considered in the design of the site.
NPPF and planning implications	
Exception Test requirements	The site is classified as ‘More Vulnerable’ and is within Flood Zone 3, 2 and 1 and is at high risk from surface water flooding. The Local Authority will need to confirm that the Sequential Test has been carried out in line with national guidelines. The Sequential Test will need to be passed before the Exception Test is applied.

	The site is classified as 'More Vulnerable' with 48% of the site within Flood Zone 3b (functional floodplain), at high risk of surface water flooding and groundwater flooding, the Exception Test is required for this site.
Requirements and guidance for site-specific Flood Risk Assessment	**Flood Risk Assessment:** At the planning application stage, a site-specific FRA will be required as the proposed development site is at risk of flooding from surface water and groundwater. The FRA must include: • All sources of flooding, especially fluvial and surface water flooding must be considered as part of a site-specific FRA. • Demonstration that safe access and egress for the 0.1% AEP event • Consultation with Telford and Wrekin Council, Severn Trent Water, and the Environment Agency should be undertaken at an early stage. • Detailed modelling will be required to confirm Flood Zone and climate change extents (see 'Available modelled data'). The Environment Agency and Telford and Wrekin Council 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. • The development should be designed with mitigation measures in place where required. • Developers should consult with Severn Trent Water to ensure that the development aims to help achieve the targets of the Drainage and Wastewater Management Plan. • Any FRA should be carried out in line with the National Planning Policy Framework and Flood Risk and Coastal Change Planning Practice Guidance. **Guidance for site design and making development safe:** • The developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the development meets the objectives of the NPPF's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development. (Paragraph 052 Flood Risk and Coastal Change PPG). • The developer will need to investigate the culverted watercourse along the western boundary of the site, and demonstrate the condition, length and capacity. The culvert should be opened up and integrated into the surface water drainage scheme for the site. ○ An 8m wide buffer should be maintained between the riverbank or culverted watercourse and any built structures, to enable the riparian owners to access and maintain the channel and asset. • The risk from surface water flow routes should be quantified as part of a site-specific FRA, including a drainage strategy, so runoff magnitudes from the development are not increased by development across any ephemeral surface water flow routes. A drainage strategy should help inform site layout and design to ensure runoff rates are as close as possible to greenfield • The risk of flooding from groundwater must be investigated and must be supported by groundwater level monitoring • Flood resilience and resistance measures should be implemented where appropriate during the construction phase, e.g. raising of floor levels.

	These measures should be assessed to make sure that flooding is not increased elsewhere. ○ raise them as much as possible. ○ include extra flood resistance and resilience measures. • Other examples of flood resistance and resilience measures include: ○ using flood resistant materials that have low permeability to at least 600mm above the estimated flood level ○ making sure any doors, windows or other openings are flood resistant to at least 600mm above the estimated flood level ○ by raising all sensitive electrical equipment, wiring and sockets to at least 600mm above the estimated flood level.

Key messages

The site is at significant risk of fluvial flooding as it is located in Flood Zones 2 and 3, 48% of the site is located in functional floodplain. Areas of the site are also at high risk of surface water flooding with 68% of the site at low risk of surface water flooding. These issues pose significant obstacles for development, as such, development may be able to proceed if:

- The Exception Test shall be undertaken and passed. The majority of the site is shown to be at risk during the design fluvial and surface water events. If the Exception Test is failed, development will not be able to be proceed.
- A site-specific Flood Risk Assessment that demonstrates that site users will be safe in the 0.1% surface water AEP event, and the 0.1% AEP fluvial event, plus an allowance for climate change. This will need to show that the site is not at an increased risk of flooding in the future and the development of the site does not increase the risk of surface water flooding on the site and to neighbouring properties.
- A carefully considered and integrated flood resilient and sustainable drainage design is put forward, including a site-specific Surface Water Drainage Strategy, and SuDS maintenance and management plan and supported by detailed hydraulic modelling (as above), with development to be steered away from the areas identified to be at highest risk of surface water flooding within the site. This is in line with the sequential approach to site layout.
- Ensure that safe access and egress can be provided for the 0.1% AEP surface water, and 1% fluvial events, including an allowance for climate change. As safe access and egress are likely to be impossible in the design event, a Flood Warning and Evacuation Plan should be prepared which considers the likely onset and duration of flooding and demonstrates how residents can safely be evacuated and/or shelter safely in situ during such an event.
- If flood mitigation measures are implemented then they are tested to ensure that they will not displace water elsewhere (for example, if land is raised to permit development on one area, compensatory flood storage will be required in another).
- No infiltration SuDS are proposed.

Mapping Information	
Flood Zones	Flood Zones 2 and 3 have been taken from the Environment Agency's Flood Map for Planning mapping and the Coalbrookdale hydraulic modelling from 2012.
Climate change	Climate change allowances have been applied to the Coalbrookdale hydraulic modelling from 2012 to indicate the impact of climate change on fluvial flood risk. Climate change allowances have been applied to the Environment Agency's Risk of Flooding from Surface Water (RoFSW) map to indicate the impact on surface water flood risk.
Fluvial extents, depth, velocity	The Coalbrookdale hydraulic modelling from 2012 has been used for this assessment.

and hazard mapping	
Surface Water	The Environment Agency's Risk of Flooding from Surface Water (RoFSW) dataset has been used for this assessment.
Surface water depth, velocity and hazard mapping	The Environment Agency's Risk of Flooding from Surface Water (RoFSW) dataset has been used for this assessment.
Groundwater	JBA Consulting Ltd. Groundwater Flood Mapping (2017)