City of Wolverhampton Council Level 2 Strategic Flood Risk Assessment Detailed Site Summary Tables

Site details	
Site Code	**H21**
Address	Former Stowheath Centres, Stowheath Lane
Area	1.52ha
Current land use	Brownfield land with green areas
Proposed land use	Housing
Flood Risk Vulnerability	More Vulnerable
Sources of flood risk	
Location of the site within the catchment	The site is bounded by Culwick Street along the northern boundary and Stowheath Lane at the eastern boundary, the site is then bounded by residential housing along the southern and western boundaries. The site is located within the urbanised upstream reach of the River Tame catchment, with the confluence of the River Tame and a tributary culverted underneath the site in the northern area of the site.
Topography	Environment Agency 1m resolution LiDAR across the site shows that the site is relatively flat across the site with an elevation around 134.3m AOD. The site is situated within a densely populated, developed urban area and LiDAR data is unlikely to be representative of the actual site topography, this may have an impact on some of the flood risk datasets used in this assessment. It is recommended that developers undertake a new topographic survey at the site.
Existing drainage features	There are no drainage features within the site and is likely to drain into the surface water sewer network where there are urban extents, which is in turn likely to then drain into the River Tame.
Critical Drainage Area	The site is not located within a Critical Drainage Area (CDA).
Fluvial	**The proportion of site at risk FMFP:** **FZ3 – 3.60%** **FZ2 – 14.18%** **FZ1 – 85.82%** *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%).* **Defended model outputs:** **2% AEP fluvial event – 1.78%** **1% AEP fluvial event – 3.55%** **0.1% AEP fluvial event – 14.14%**

	Modelled results show the percentage of site at risk from a given AEP flood event. Note that the 2% AEP fluvial event should be used as a more conservative proxy for the functional floodplain/FZ3b. **Available data:** Flood Zones are determined from the Environment Agency's Flood Map for Planning (FMfP). The Waddens Brook (2017) 1D-2D ESTRY-TUFLOW detailed hydraulic model for the River Tame and Waddens Brook has been used within this assessment of fluvial flooding. For this model, only extents have been provided, as such, depths, velocities and hazard ratings are unavailable. **Flood characteristics:** Flood Zone 3 encroaches the site along the eastern boundary, with Flood Zone 2 also encroaching further into the site from the eastern boundary. Additionally, Flood Zone 2 encroaches into the southern-most corner of the site. At the site, extents from the 2% AEP event (acting as a conservative proxy for the 3.3% AEP fluvial event) and 1% AEP fluvial event from the Waddens Brook model encroach a very small amount of the site at the eastern boundary, with the remainder of the site unaffected. In the 0.1% AEP event from the Waddens Brook model, extents encroach at the southern-most corner, with extents in the eastern area of the site encroaching from the eastern boundary. Risk to the site from the Waddens Brook extents will need to be confirmed, developers should undertake fluvial modelling at the site as part of a site-specific FRA. Results of the modelling should include depths, velocities and hazard rating of extents generated. It is recommended that developers undertake fluvial modelling at the site to accurately assess flood risk to the site as part of a site-specific FRA.
Surface Water	**Proportion of site at risk (RoFfSW):** **3.3% AEP** – 0.14% **1% AEP** – 2.64% Max depth – 0.15 – 0.3m Max velocity – <0.25m/s **0.1% AEP** – 48.82% Max depth – 0.6 – 0.9m Max velocity – 0.25 – 0.5m/s *The % SW extents quoted show the % of the site at surface water risk from that particular event, including the percentage of the site at flood risk at a higher risk zone (e.g. 100-year includes the 30-year %).* **Available data:** The Environment Agency's Risk of Flooding from Surface Water mapping was used in this assessment. **Description of surface water flow paths:** The site is unaffected by the 3.3% AEP event. In the 1% AEP event, extents encroach from a flow path at the eastern boundary with a maximum depth between 0.15 to 0.3m and velocity less that 0.25m/s. The maximum hazard rating of the extent within the site is 'Danger to Some'. In the 0.1% AEP event, surface water flow paths that merge at and within the site are present throughout the site, particularly in the northern, central and eastern areas. Two dry islands form at the northern (rounded) corner of the

	site and within the south-eastern area of the site, with the south-western and central-western areas predominantly unaffected by the extents. Maximum depths are between 0.6 to 0.9m at the eastern boundary, with maximum velocities between 0.25 to 0.5m/s throughout the extent within the site. The maximum hazard rating is 'Danger to Most' within the eastern area and along the eastern boundary.
Reservoir	The site is shown to not be at risk of Dry Day and Wet Day reservoir flooding according to the Environment Agency's reservoir flood mapping.
Groundwater	The JBA Groundwater Flood Emergence Mapping (5m resolution) shows the site is at no risk form groundwater emergence.
Sewers	The site is located within a postcode area with 7 incidences of sewer flooding from 2005, 2006, and 2018 according to the Severn Trent Water Hydraulic Sewer Flood Risk Register.
Flood history	The site is not located in or near historic flood outlines in accordance with flood records provided by City of Wolverhampton Council and the Environment Agency's Historic Flood Map and Recorded Flood Outline Map datasets.
Flood risk management infrastructure	
Defences	The Environment Agency AIMS dataset that there no flood defence within or near the site.
Residual risk	The site encounters residual risk from the culverted River Tame and tributary which converge within the northern area of the site. These culverts pose a residual risk to the site in the event of a blockage, which could cause water to back up and encroach on the site. Developers should undertake modelling of blockage scenarios for the culverts at the site.
Emergency planning	
Flood warning	The site is not within an Environment Agency Flood Alert or Flood Warning Area.
Access and egress	Access to site is currently through a singular access point at the centre point of the eastern boundary that leads to Stowheath Lane. Developers at the site may add more access point to the site through Stowheath Lane and Culwick Street. **Fluvial Flooding** In the 2% AEP and 1% AEP event, access and egress are maintained within the site. Access to the site may be impeded from the eastern boundary as extents are present across Stowheath Lane across the current access point and along the eastern boundary of the site. However, potential access from Culwick Street remains possible, and access to the site is otherwise maintained in all directions. In the 0.1% AEP event, access and egress are maintained within the site. Access to the site may be impeded from the eastern boundary and the northern corner where extents are present along Stowheath Lane and the junction of Culwick Lane at the site. Potential access to the site remains possible from Culwick Lane from the site. The fluvial design (1% AEP plus 20% climate change allowance) event, access and egress are maintained within the site. Access to the site may be impeded from the eastern boundary as extents are present across Stowheath Lane across the current access point and along the eastern boundary of the site. However, potential access from Culwick Street remains possible, and access to the site is otherwise maintained in all directions. Developers should confirm depths, velocities, and hazard ratings of fluvial flooding at the site as part of a site-specific FRA to determine the severity of

	the flooding. If depths, velocities, and the hazard ratings are significant, access and egress will be impeded. **Surface Water Flooding** In the 3.3% AEP event, access and egress are maintained within the site. Access to the site from Stowheath Lane is limited, with a flow path present along the road. Maximum depths are between 0.3 to 0.6m, with velocities between 0.25 to 0.5m/s, and a hazard rating of 'Danger to Some'. In the 1% AEP event, access and egress are maintained within the site. Access to the site from Stowheath Lane is limited with maximum depths between 0.3 to 0.6m, maximum velocities between 0.5 to 1.0m/s, and a maximum hazard rating of 'Danger to Most' near the eastern boundary. Additionally, there is a flow path along Culwick Lane, with similar maximum depths, velocities, and hazard ratings. In the 0.1% AEP event, access and egress are not maintained within the site. Access and egress are severely impeded, as is access to the site from both Culwick Street and Stowheath Lane. Maximum depths along these roads are between 0.6 to 0.9m, maximum velocities are between 0.5 to 1.0m/s with a maximum hazard rating of 'Danger to Most'. The surface water design (1% plus 40% climate change allowance) event has extents similar to the 0.1% AEP event and is likely to face the same access and egress issues Access to the site's vicinity is also impeded in all directions. Maximum depths are 1.2m along Culwick Street and 1.0m along Stowheath Lane, the maximum velocity is 1.8m/s along Stowheath Lane with a hazard rating of 'Danger to Most'. Arrangements for safe access and egress will need to be demonstrated for the 1% AEP plus an allowance for climate change rainfall events, using the depth, velocity, and hazard outputs. Any raising of access routes should not impede surface water flows or contribute to increasing flood risk off-site. If detailed modelling (including consideration of breach scenarios) suggests that the site is at significant risk of flooding which affects access routes, a Flood Warning and Evacuation Plan will be required.
Dry Islands	The majority of the site is a dry island and contains dry islands during the 0.1% AEP and design (1% AEP plus 40% climate change allowance) surface water events.
Climate change	
Implications for the site	**Management Catchment: Tame, Anker and Mease** 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 (Waddens Brook [2017]):** The design event for peak river flows is the central climate change allowance for the 2080s epoch, as such the design event is the 1% AEP plus 20% climate change allowance. The extent is similar to the present day 1% AEP event, with a slight increase in extents. Thus, the site is not sensitive to increased fluvial flood risk due to climate change. **Surface Water:** The design event for rainfall intensities is the upper climate allowance for the 2070s epoch. As such the design event is the 1% AEP plus 40% climate change allowance. The extent of the design event is similar to that of the present day 0.1% AEP event, with maximum depths of 0.77m at the central point of the eastern boundary. With an increase in extent, the site is shown to be slightly sensitive to increased surface water flood risk due to climate change.

	Development proposals at the site must address the potential changes associated with climate change and be designed to be safe for the intended lifetime. The provisions for safe access and egress must also address the potential increase in severity and frequency of flooding.
Requirements for drainage control and impact mitigation	

Broad-scale assessment of possible SuDS	**Geology & Soils**
	• The geology consists of:
	  ○ Bedrock formed of mudstone, siltstone, sandstone, coal, ironstone and ferricrete, which forms the Pennine Middle Coal and the South Wales Middle Coal Measures Formations.
	  ○ There are no superficial deposits at the site.
	• The soil is comprised of slowly permeable, seasonally wet, acidic loamy and clayey soils.
	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 with site investigations.
	• BGS data suggests that the underlying geology is likely to have variable permeability and should be confirmed through infiltration testing. Off-site discharge in accordance with the SuDS hierarchy may be required to discharge surface water runoff.
	• The site is not in a Groundwater Source Protection Zone, nor does it have any historic landfill within the site.
	• The site is within the River Trent (source to confluence with Derwent) Nitrate Vulnerability Zone (NDZ), and partially in an undifferentiated Secondary Superficial Aquifer Designation Zone. As such, infiltration techniques may not be appropriate at the site in order to preserve water quality.
	• In accordance with information provided by Severn Trent Water, surface water should be managed through SuDS and any excess flow discharged to the Tame Tunnel (Wolverhampton Arm). Although there are constraints on SuDS at the site (due to the presence of the NVZ and the Secondary Superficial Aquifer Designation Zone), any designs from developers should be investigated and tested to ensure they are appropriate to the site.

Opportunities for wider sustainability benefits 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. This could provide wider sustainability benefits to the site and surrounding area. Proposals to use SuDS techniques should be discussed with relevant stakeholders (LPA, LLFA and EA) at an early stage to understand possible constraints. • Development at this site should not increase flood risk either on or off site. The design of the surface water management proposals should take into account the impacts of future climate change over the projected lifetime of the development • 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 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. As the site is within Flood Zone 3 and Flood Zone 2, classified as 'More Vulnerable' and has some surface water and fluvial flood risk, with significant access and egress issues. The Exception Test is required at this site.
Requirements and guidance for	**Flood Risk Assessment:**

site-specific Flood Risk Assessment	Section 2 of the Level 2 SFRA and Sections 2 and 3 of the Level 1 SFRA have more guidance on this section and any relevant policies and information applicable to development within Wolverhampton. • Consultation with City of Wolverhampton 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. • Development plans should use their Level 1 and 2 SFRA for Wolverhampton, as well as the Local Flood Risk Management Strategies to identify cumulative flood risk issues. It should also promote an integrated approach to water management. Drainage should be designed and implemented in ways that promote multiple benefits. • Any FRA should be carried out in line with the National Planning Policy Framework; Flood Risk and Coastal Change Planning Practice Guidance; Birmingham City Council's Local Plan Policies and Sustainable Drainage Design and Evaluation Guide for developers. • **From the Black Country Core Strategy – Policy ENV5 (2011)** The Wolverhampton Local Plan succeeds the Black Country Core Strategy building upon policies from the Strategy. Until the Local Plan is adopted the Strategy still applies. Developers should ensure the correct policy is applied. The following development principles will apply to assist in both reducing the extent and impact of flooding: ○ incorporate Sustainable Drainage Systems (SuDS), unless it would be impractical to do so, in order to significantly reduce surface water run-off and improve water quality. The type of SuDS used will be dependent on ground conditions; ○ on sites requiring a Flood Risk Assessment, reduce surface water flows back to equivalent greenfield rates; ○ create new green space, increase tree cover and/or provide green roofs. **Guidance for site design and making development safe:** • The developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the development meets the objectives of the NPPF's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development. (Para 048 Flood Risk and Coastal Change PPG). • Should built development be proposed within the 1% AEP surface water flood extent, careful consideration will need to be given to flood resistance and resilience measures. • Developers should wherever possible open up underground culverts, and in a manner which improved biodiversity, amenity and natural drainage in accordance with the current River Basin Management Plans for the area • Development must not take place over culverted watercourses and a suitable easement must be provided from the outside edge of the culvert. • Where there is known or suspected culverted watercourse(s) either on or immediately downstream of a site, and where the Level 1 SFRA highlights that there may be a risk of flooding, developers should: ○ Confirm the location and presence of the watercourse (or otherwise) through ground-truthing strategic datasets and undertaking an assessment of the culvert extent and location ○ Confirm by survey, modelling and mapping the flood extents of the watercourse(s), as many of the flood outlines associated with such watercourses have been carried out at a broad scale and may not account specific local features, such as culverts, bridges and detailed topographical survey. ○ Design the development to accommodate the floodplain of the watercourse and mitigate against flooding to properties to the

site. This should include a consideration of residual flood risk e.g. if a culvert were to block downstream.

- 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.
- Arrangements for safe access and egress will need to be demonstrated for the 1% AEP pluvial events with an appropriate allowance for climate change, using the depth, velocity, and hazard outputs.
- In accordance with information supplied by Severn Trent Water, the site is likely to be served by two wastewater treatment works:
    - the Barnhurst wastewater treatment works, which has been assessed as "not expected be an issue… (to estimated spare capacity)" and "no scope to provide additional capacity" for surface water discharge into watercourses.
    - the Minworth Works wastewater treatment works, which has been assessed to have 'marginal concern… (to estimated spare capacity) subject to development size" and "limited scope to provide additional capacity" for surface water discharge into watercourses.

  As such surface water disposal measures (detailed in the broad-scale assessments of SuDS section) should be undertaken by the developer.
- Developers should adhere to CWC's guidance on SuDS as laid out in Policy ENV 13 – Sustainable Drainage Systems (SuDS) and Surface Water Management:
    - All developments must incorporate Sustainable Drainage Systems (SuDS) and provide for their adequate adoption, ongoing maintenance, and management over the lifetime of the development, in accordance with any surface water drainage strategy required for the development under Policy ENV12.
    - SuDS must be designed in accordance with Local Lead Flood Authority standards, as follows:
        - demonstrate application of the surface water discharge hierarchy: Re-Use (Water Harvesting); Infiltration; Discharge to a watercourse; Discharge to a surface water sewer; Discharge to a combined sewer;
        - manage surface run-off as close to the source as possible to reduce flood risk and improve water quality;
        - include mitigation within storage calculations for future climate change, designed to 100yr + Climate Change (currently 40%);
        - designed to accord with the Environment Agency's Guidance on Flood Risk and Coastal Change, Construction Industry Research and Information Association (CIRIA) guidance, and Department for Environment Food & Rural Affairs (DEFRA) non-statutory technical standards;
        - designed to be daylight (open), natural and contribute to the conservation and enhancement of biodiversity and green infrastructure in the wider area, as far as is practical and viable.
    - For all major developments, surface water flows must be reduced back to equivalent greenfield rates. If greenfield runoff rates are not considered to be feasible for viability or other reasons, then the developer must submit evidence demonstrating what the constraints to achieving this are and how their development will accommodate runoff rates that are as close as reasonably possible to greenfield rates.
    - For all minor developments, a minimum reduction of 30% over pre-development run-off rates will be required. Under no

	circumstances will post-development runoff rates that are greater than pre-development run-off rates be permitted. ○ A hydrogeological risk assessment must be provided where infiltration SuDS is proposed for anything other than clean roof drainage in a Source Protection Zone 1. • Consultation with RMAs early on should be implemented to ensure an appropriate flood evacuation plan is put in place for the site. • 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. If the floor levels cannot be raised to meet the minimum requirements, developers will need to: ○ raise them as much as possible. ○ consider moving vulnerable uses to upper floors. ○ 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.

Key messages

The site is affected by all fluvial AEP events including the fluvial design event (1% AEP plus 20% climate change allowance), and the 0.1% AEP surface water event and the surface water design event (1% plus 40% climate change allowance). Dry islands form within and at the site during the surface water events, and severe access and egress issues within and to the site are present within the surface water events. The site encounters residual risk from the culverted River Tame and its tributary that are present within the site. Development may proceed if:

- The Exception Test shall be undertaken and passed. The vast majority of the site is shown to be at risk during the design surface water event, therefore part "b" of the Exception Test must be satisfied. If the Exceptions Test is failed, development is unlikely to be able to be proceed.
- A site-specific Flood Risk Assessment demonstrates that site users will be safe in the 1% AEP fluvial and surface water events, including an allowance for climate change. This will need to use detailed surface water modelling, and any interaction with the culverted River Tame to show 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 off site. Additionally, it is recommended that developers seek a new topographic survey of the site and its vicinity, a model of the culverted River Tame, and re-run the Waddens Brook hydraulic model to ascertain the depths, velocities, and hazard ratings of extents at the site. Developers should consult the Environment Agency to ensure latest model are used. Depending on the age of the model, additional updates including consideration of breach scenarios may be required.
- Safe access and egress can be demonstrated in the 1% AEP plus upper climate change surface water events. If this is not possible, an appropriate Flood Warning and Evacuation Plan is needed.
- In accordance with information provided by Severn Trent Water, surface water should be managed through SuDS and any excess flow discharged to the Tame Tunnel (Wolverhampton Arm).
- 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 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.
- Raise residential finished floor levels 600mm above the 1 in 100-year plus climate change flood level. Protect and promote areas for future flood alleviation schemes.
- 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	
The key datasets used to make planning recommendations for this site were the Environment Agency's Flood Map for Planning and the Environment Agency's Risk of Flooding from Surface Water map. More details regarding data used for this assessment can be found below.	
Flood Zones	Flood Zones 2 and 3 have been taken from the Environment Agency's Flood Map for Planning mapping.
Climate change	The latest climate change allowances (updated May 2022) have been applied to the Waddens Brook (2017) fluvial model and the EA's RoFSW dataset.
Fluvial extents, depth, velocity and hazard mapping	Fluvial extents were provided as part of the Waddens Brook (2017) model; however, depth, velocity, and hazard outputs were unavailable.
Surface Water	The Environment Agency's Risk of Flooding from Surface Water (RoFSW) map has been used to define areas at risk from surface water flooding.
Surface water depth, velocity and hazard mapping	The Environment Agency's Risk of Flooding from Surface Water (RoFSW) has been used to define areas at risk from surface water flooding.