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

Site details	
Site Code	**GT1**
Address	Former Bushbury Reservoir, Showell Road
Area	2.42
Current land use	Greenfield
Proposed land use	Gypsy and Traveller residential site
Flood Risk Vulnerability	Highly Vulnerable
Sources of flood risk	
Location of the site within the catchment	The site is bounded by two elevated rail tracks along the eastern and western boundaries, with Showell Road along the southern boundary. The site is an infilled reservoir that was filled in approximately pre-2015. The site is located within urbanised upstream reach of the Smestow Brook catchment. There is a culverted unnamed ordinary watercourse approximately 100m south of the site that flows south-west and forms a tributary to the brook, with the culverted confluence approximately 400m from the site.
Topography	Environment Agency 1m resolution LiDAR across the site shows that the majority of the site is relatively flat, around 122m AOD in the central area of the site. This area is surrounded by a lower elevation with the high ground of the rail tracks impounding the site. Maximum elevations are 128.3m AOD at the elevated ground at the south-western corner of the site, with minimum elevations are 119.7m AOD in the same area. 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.
Existing drainage features	There are no drainage features within the site, and the elevated tracks are likely to impound water within the site. The site 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 – 0%** **FZ2 – 0%** **FZ1 – 100%** *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: Flood Zones are determined from the Environment Agency's Flood Map for Planning (FMfP). **Flood characteristics:** The site is situated entirely within Flood Zone 1 and is highly unlikely to encounter fluvial flood at the site.
Surface Water	**Proportion of site at risk (RoFfSW):** **3.3% AEP** – 20.99% Max depth – 0.3 – 0.6m Max velocity – <0.25m/s **1% AEP** – 50.52% Max depth – 0.6 – 0.9m Max velocity – 0.5 – 1.0m/s **0.1% AEP** – 73.63% Max depth – >1.2m Max velocity – >2.0m/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 affected by all AEP events. However, developers should seek new surface water modelling to accurately assess surface water flood risk to the site as part of a site-specific SFRA. This is due to RoFSW mapping at the site appearing to be based on the presence of the reservoir before it was filled and is no longer representative of risk at the site. In the 3.3% AEP event, there are two large areas of ponding in the central and southern areas of the site. Maximum depths within these two ponds are between 0.3 to 0.6m. with a velocity that does not exceed 0.25m/s. The two instances of ponding each have a maximum hazard rating of 'Danger to Some'. In the 1% AEP event, the central area is predominantly one large area of ponding within the area bounded by lower topography in the site, additionally a flow path from Showell Road connects to the ponding. There are dry islands present in the lower half of the site. Maximum depths within the site are between 0.6 to 0.9m in the northern and southernmost areas of the ponding, and maximum velocities between 0.5 to 1.0m/s are present within the same areas and the flow path from the road. The ponding has a maximum hazard rating of 'Danger to Most'. In the 0.1% AEP event, the majority of the site, with the exception of the topographical high areas for the rail tracks, is covered by surface water extent and connects to the flow path along Showell Road. This extent has a maximum depth that exceeds 1.2m, with a maximum velocity that exceed 2.0m/s at the southern boundary where the extent and flow path connect. The predominant hazard rating is 'Danger to Most', with a maximum hazard rating of 'Danger to All' at the southern boundary and southern area of the site. All though it is not represented, the elevated rail tracks are likely to impound surface water in the site. It is also recommended that the land owner should undertake surface water modelling and Integrated Catchment Modelling (ICM) at the site as part of a site-specific FRA to accurately asses risk to the site.

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 northern half of site has groundwater level less than 0.025m below the ground surface level, while the southern half is shown to be at no risk. In the northern half, groundwater levels are indicated to be at or very near (within 0.025m) ground level and there is a risk of groundwater flooding at the surface during a 1% AEP event, which may flow to and pool within topographic low spots. 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.
Sewers	The site is located within a postcode area with 17 incidences of sewer flooding from 1997,1999, 2000, 2005, 2015, 2016, 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 Smestow Brook tributary approximately 130m east of the site. The culvert poses a residual risk to the site in the event of a blockage, which could cause water to back up and encroach on the site. Through a Flood Risk Assessment (FRA) developers should undertake modelling of blockage scenarios for the culverts within close proximity to the site.
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 through Showell Road at the southern boundary, with the east and west boundaries inaccessible due to the raised rail tracks. However, it is to be noted that surface flood risk to the site is likely to be unrepresentative and actual surface water flood risk should be confirmed by developers in a site-specific FRA through new surface water modelling. In the 3.3% AEP surface water event, access and egress within and to the site are maintained. In the 1% AEP surface water event, access and egress within the site are severely impeded, however access to the site remains. In the 0.1% AEP surface water event, access and egress within and to the site are severely impeded. A fast flowing (velocity exceeding 2.0m/s) and relatively deep (with predominant depths between 0.6 to 1.2) flow path along Showell Road is present at the site's southern boundary. This has a hazard rating of 'Danger to All'. The design surface water flood event (1% AEP plus 40% climate change), extents are similar to that of the 0.1% AEP surface water event, and as such is likely to have similar access and egress issues. Maximum depths at the

	southern boundary along Showell Road are 0.9m, a maximum velocity of 3.5m/s, with a hazard rating of 'Danger for All' along the majority of Showell Road and the southern Boundary. 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. The Flood Warning and Evacuation Plan should consider the 'Highly Vulnerable' nature of the site and the impoundment caused by the elevated rail tracks.
Dry Islands	A dry island is present in the southern half of the site during the 1% AEP surface water event. However, developers should confirm this with surface water modelling.
Climate change	
Implications for the site	**Management Catchment: Severn Midde Worcestershire** Increased storm intensities due to climate change may increase the extent, depth, velocity, hazard, and frequency of both fluvial and surface water flooding **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 + 40% CC. The extent of the design event has increased significantly, with the extent similar to that of the present day 0.1% AEP event. The design event has a maximum depth of 2.0m at the southern boundary and in the northern area of the site. With a significant increase in extent, the site is shown to be very sensitive to increased surface water flood risk due to climate change. This should be confirmed by developers as part of new surface water modelling at the site as part of a site-specific FRA. 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 sandstone and interbedded conglomerate of undifferentiated Triassic Rock
	  ○ Superficial deposits in the western half of the site are comprised of glacial sands and gravels, with the eastern half comprised of diamicton till.
	• The soil is comprised of slowly permeable, seasonally wet, slightly acidic but base rich loamy and clayey soils.
	
	SuDS
	• Groundwater levels are indicated to be at or very near (within 0.025m) ground level and there is a risk of groundwater flooding at the surface during a 1% AEP event, which may flow to and pool within topographic low spots. 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. 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. • 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 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. • There is no historic landfill within the site. • The site is within the River Stour (Worcestershire) – confluence Smestow Brook to confluence of River Severn Nitrate Vulnerability Zone, and 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. • 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.
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. The NPPF classifies Gypsy and Traveller Sites as "Highly Vulnerable". While the site is within Flood Zone 1, the site has significant surface water flood risk and significant access and egress issues. As such, it is strongly recommended that the Exception Test is applied at this site.
Requirements and guidance for site-specific Flood Risk Assessment	**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).
- Developers should undertake new surface water modelling at the site as part of a site-specific FRA, as the RoFSW mapping at the site is likely to be unrepresentative due to the reservoir being infilled after the maps were produces.
- 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 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. 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.

Key messages

The site is classified as 'Highly Vulnerable' and set to serve people who are more likely to be severely affected by flooding. The site is most affected by the 1% AEP, 0.1% AEP, and design (1% AEP plus 40% climate change allowance) surface water events, with the raised rail tracks likely to impound water within the site. There are severe access and egress issues within the site during theses events, and access to the site is severely impeded during the 0.1% AEP and design surface water events. The RoFSW mapping at the site is likely to be unrepresentative of surface water risk to the site and developers should undertake new surface water modelling at the site as part of a site-specific FRA. There is groundwater emergence risk to the northern half of the site, and there is residual risk posed by the culverted Smestow Brook Tributary. It may be appropriate to develop the site provided:

- 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 surface water events, including an allowance for climate change. This will need to use detailed surface water modelling 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. As part of this, developers should undertake new surface water modelling at the site due to the reservoir being infilled, making current RoFSW mapping at the site likely to be highly unrepresentative of actual risk to the site. Through a Flood Risk Assessment (FRA) land owners should undertake modelling of blockage scenarios for the culverts within close proximity to the site. Additionally, it is recommended that developers seek a new topographic survey of the site and its vicinity as part of the FRA.
- 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.
- 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.
- 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 EA's RoFSW dataset.
Surface Water	The and 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.