	St Albans City and District Council **Level 2 Strategic Flood Risk Assessment** **Detailed Site Summary Table**
Site details	
Site Code	**M26**
Address	Former Highway Chippings Depot, Lower Luton Road
Area	0.33ha
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 on the northwestern edge of Wheathampsted, a village to the north of St Albans. The site is just to the south of the B653, Lower Luton Road. Kingfisher Close makes up the sites eastern boundary. Residential areas are situated to the south and east to the site. To the north and west of the site the land use is predominantly arable farms land. The River Lee borders the site to the southwest. This section of the River Lee, stretching from Luton Hoo Lakes to Hertford, is 31.7 km long and covers a catchment area of 98.6 km². The catchment is mainly rural but includes some urban areas, such as the northeastern area of Harpenden and the village of Wheathampstead. The River Lee is part of the broader Lee Upper Management Catchment, which covers an area of 1,025 km². Within this Management Catchment, the site lies in the western upstream area.
Topography	Environment Agency 1m resolution LIDAR across the site shows the elevation slopes downward towards the northwest. Elevations range between 80mAOD in the northwest of the site to 86mAOD in the eastern region of the site. The mean elevation is 83mAOD. The site is raised above the surrounding area, with elevations just beyond the site boundary being approximately 79mAOD
Existing drainage features	While there are no existing drainage features within the site that are visible on topographic mapping or aerial imagery, the River Lee (Upper Reaches) touches the sites western boundary and flows south of the site. Additionally, there is a flood storage area located to the south of the site between the site and the River Lee.
Fluvial	**The proportion of site at risk FMFP:** FZ3b – 0% FZ3a – 0% FZ2 – 32%

	FZ1 – 68% 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 Zone mapping has been used in this assessment, alongside the Upper Lee (2010) 1D hydraulic model received for this Level 2 SFRA. Only the modelled flood extents were available for the Upper Lee model, no hazard, depth or velocity grids were available as the model was 1D only over the study area. **Flood characteristics:** The western area of the site is within the Environment Agency's Flood Zone 2 (0.1% AEP event), the Flood Zone is based on historic flood outlines rather than detailed model results. In the defended modelled 0.1% event in the Upper Lee model the site is shown not to be at risk, as the flood extent is just beyond the sites western and southern boundaries. This is due to the flood storage area located to the south of the site. The Environment Agency's Upper Lee model is undergoing a full revision. No results were available at the time of preparation of this report. It is possible that the predicted fluvial flood risk to the site may change as a result of this remodelling.
Surface Water	**Proportion of site at risk (RoFSW):** **3.3% AEP** – 0% Max depth – N/A Max velocity – N/A **1% AEP** – 0% Max depth – N/A Max velocity – N/A **0.1% AEP** – 1% Max depth – 0.60 - 0.90m Max velocity – 0.50 - 1.00m/s **Available data:** The Environment Agency's Risk of Flooding from Surface Water (RoFSW) map has been used within this assessment. **Description of surface water flow paths:** Risk of Flooding from Surface Water data for this site shows that the site is unaffected by surface water flooding in the 3.3% and 1% AEP events. During the 0.1% AEP event, surface water only covers 1% of the site. This is located along a small section of the northwest boundary, due to an area of surface water ponding to the northwest of the site. The surface water

	within the site reaches a maximum depth of between 0.60 to 0.90m and maximum velocity of between 0.50 to 1.00m/s.
Reservoir	A small portion of the site is shown to be at risk of Dry Day and Wet Day reservoir flooding according to the Environment Agency's reservoir flood mapping. During the Wet Day scenario, flood risk is posed along the northwestern boundary of the site, covering 2% of the site, from the Luton Hoo Lake Lower managed and operated by Luton Hoo Park Limited. During the Dry Day, only 1% of the site along the northwestern boundary is at risk of flooding from Luton Hoo Lake Lower. These reservoirs are deemed as high-risk, and in the very unlikely event that the reservoirs fail, it is predicted that there is a risk to life.
Groundwater	The site has varying levels of groundwater risk. In the eastern area, which covers 77% of the site, the groundwater risk is low, with groundwater located 0.5 to 5 meters below ground level. The western area closer to the River Lee has a greater risk of groundwater flooding. The area nearest the river, making up 17% of the site, is at high risk, with groundwater less than 0.025 meters below ground level. The remaining 6% of the site, also in the western area, has a moderate risk, with groundwater between 0.025 to 0.5 meters below ground level.
Sewers	The site is located within a postcode area with 19 historic incidences of sewer flooding, according to the Thames Water Hydraulic Sewer Flood Risk Register.
Flood history	The site is shown to be within the Environment Agency's Historic Flood Map. The map shows that in 1947, 1979 and 2007 the main channel of the River Lee exceeded and inundated the west of the site.
Flood risk management infrastructure	
Defences	The Environment Agency AIMS dataset shows that the site is protected by no formal flood defences.
Residual risk	The site is not protected by any defences or flood risk management infrastructure, therefore there is no residual risk of failure.
Emergency planning	
Flood warning	The site is located in an Environment Agency Flood Warning Area, the northeastern boundary, 062FWF46Harpendn, River Lee at Harpenden and Wheathampstead including East Hyde. The site is also covered by the 062WAF46UpperLee, River Lee at Luton, Harpenden including Wheathampstead and East Hyde Flood Alert Area.

Access and egress	The site is accessed via the B653 to the north and Kingfisher close to the east. West of the site, the B653 is partly within Flood Zones 2, 3a, and 3b, indicating a risk of fluvial flooding. Detailed modelling is needed to determine the depth, velocity, and hazard of potential floods, but this information is currently unavailable as the existing model is only 1D and is being updated by the Environment Agency. As a result, access and egress along this route may be impeded. However, the B653 to the east is not at risk of flooding, ensuring that vehicular and pedestrian access and egress remain possible in that direction. During the 1% AEP surface water event a flow path forms along the B653 with a flood depth <0.6m and a maximum velocity between 1.00 – 2.00m/s. The resulting flood hazard is “significant” in areas, therefore vehicular and pedestrian access is unlikely to be possible along the B653 in a westerly direction of the site. Safe access is appropriate in an easterly direction as the flood hazard is “low” in all modelled events.
Dry Islands	The site is not located on a dry island.
Climate change	
Implications for the site	**Management Catchment: Upper Lee** Increased storm intensities due to climate change may increase the extent, depth, velocity, hazard, and frequency of both fluvial and surface water flooding **Fluvial:** The Upper Lee 1% AEP fluvial event has been used as a proxy for the 3.3% AEP plus climate change event, as no results were available at the time of preparation of this report for the EA updated Upper Lee model. The 0.1% AEP fluvial event has been used as a proxy for the 1% plus climate change event. As a result, 32% of the site, specifically in the western side of the site is at risk of fluvial flooding. It is possible that the predicted fluvial flood risk to the site may change as a result of the Upper Lee remodelling. **Surface Water:** In the 1% AEP plus 40% climate change event the flood extent is similar to that in the 0.1% AEP event, only affecting the sites northwestern corner. The maximum flood depth, velocity and hazard within the site is 0.31m, and 0.12m/s. The site is therefore unlikely to be at significant risk of surface water flooding in future as a result of 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 surface water drainage and integrated flood risk management	

Broad-scale assessment of potential SuDS	**Geology & Soils**
	• **Geology of the site consist of:**
	  ○ Bedrock – Bedrock geology of the site is Lewes Nodular Chalk Formation and Seaford Chalk Formation - Chalk. A type of sedimentary rock
	  ○ Superficial deposit – The superficial deposits consist of River Terrace deposits (undifferentiated) of sand and gravel.
	• **Soils at the site consist of:**
	  ○ Freely draining slightly acid but base-rich soils.
	
	Sustainable Drainage Systems (SuDS)
	• Groundwater levels are indicated to be between 0.5 and 5m below ground level for 50% off the site, but part of the site close to the floodplain is at higher risk with groundwater less than 0.025m below the ground. This indicates that there is a risk of flooding to subsurface assets and below ground development such as basements. Detention and attenuation features in areas with shallow groundwater should be designed to prevent groundwater ingress from impacting hydraulic capacity and structural integrity. 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 chalk with superficial deposits of clay, silt, sand and gravel which, is likely to be free draining. This should be confirmed through infiltration testing, and groundwater monitoring throughout a winter period.
	• The entire site is mostly located within Groundwater Source Protection Zone 1 (SPZ) and infiltration techniques may not appropriate for anything other than clean roof drainage. If infiltration is proposed for anything other than clean roof drainage a hydrogeological risk assessment should be undertaken, to ensure that the system does not pose an unacceptable risk to the source of supply. Proposed SuDS should be discussed with relevant stakeholders (LPA, LLFA and EA) at an early stage to understand possible opportunities and constraints. The Groundwater Source Protection Zone guidence is currently undergoing a review, therefore developers should ensure they are using the latest guidence regarding this.
	• The site is not located within a historic landfill site.
	• Where possible, proposed attenuation features such as basins, ponds and tanks should be located outside of Flood Zone 2 to avoid the potential risks to the hydraulic capacity or structural integrity of these features. Surface water outfalls that discharge into the River Lee may be susceptible to surcharging due to water levels in the River Lee. 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 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 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. 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 • Where appropriate, 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 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 residential development as 'More Vulnerable'. The exception test is required for this site because part of the site is within Flood Zone 2 and the development type is 'More Vulnerable'.

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 site is:
	  ○ Within fluvial flood zones 2
	  ○ At risk of other sources of flooding (groundwater and reservoir)
	• All sources of flooding should be considered as part of a site-specific FRA. Consideration of groundwater risk is likely to require ground investigations to confirm the risk to the site.
	• Consultation with St Albans City and District Council, Hertfordshire County Council (Lead Local Flood Authority), Thames Water, and the Environment Agency should be undertaken at an early stage.

- Any FRA should be carried out in line with the National Planning Policy Framework (NPPF); Flood Risk and Coastal Change Planning Practice Guidance (PPG); St Albans City and District Council's Local Plan Policies and Hertfordshire County Council's Guidance for Developers.
- The development should be designed with mitigation measures in place where required.

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).
- 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.
- Planning permission is required to surface more than 5 square metres of unpaved ground using a material that cannot absorb water.
- Mitigation for seasonal high groundwater levels must be considered for the wester area of the site (for example by raising finished floor levels to an appropriate height above ground level).
- Due to the high groundwater flood risk for most of the site, basements are not advised
- The design of the development and its SuDS schemes must consider the seasonally high groundwater table, within the norther area of the site. Infiltration techniques may be ineffective and may pose a pollution risk. SuDS may need to be shallow and take up larger areas. Above ground conveyance and attenuation can be used but care must be taken that groundwater does not enter the SuDS feature and reduce the storage capacity and structural integrity of the design.
- 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 Exception Test will be required for this site, and St Albans City and District Council will need to carefully consider the benefits of developing the site against the flood risks from fluvial, reservoir and groundwater sources. Development may be possible provided the flood risk part of the Exception Test can be satisfied as below:

- 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.
- Development is steered away from the area of fluvial flood risk in the southwestern side of the site.
- 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 fluvial 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).

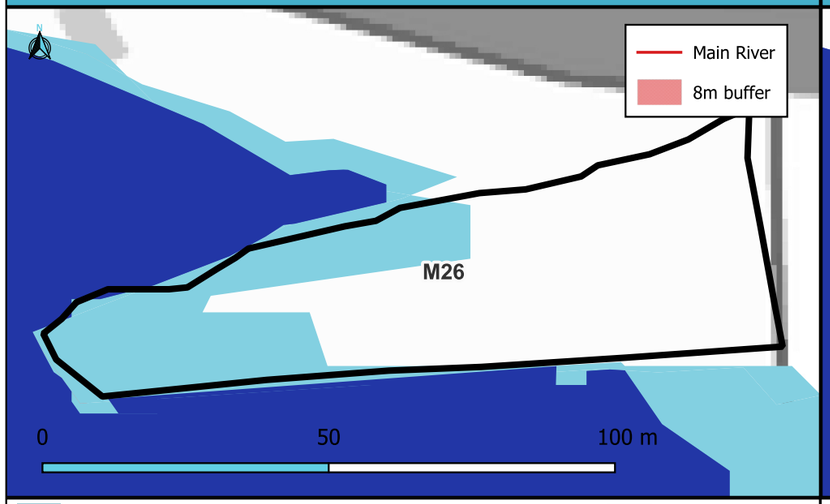
Mapping Information

Flood Zones	Flood Zones 2 and 3a have been taken from the Environment Agency's Flood Map for Planning mapping. Flood Zone 3b has been created from the existing Flood Zone 3a (1 in 100 year) to represent the functional floodplain.
Climate change	The 1% AEP and 0.1% fluvial events from the Upper Lee (2010) model have been used as proxies for the climate change events. The 1% AEP event represents Flood Zone 3b plus (22%) climate change event and the 0.1% AEP event used to represent Flood Zone 3a plus (22%) climate change. The functional floodplain Flood Zone 3b will need to be reviewed and defined for development sites at the site-specific Flood Risk Assessment (FRA) stage, potentially through more detailed hydraulic modelling. The Environment Agency's Upper Lee model is undergoing a full revision, but was no results were available at the time of preparation of this report.
Fluvial depth, velocity and hazard mapping	Depth, velocity, and hazard data was not available as the model was 1D only.
Surface Water	The Environment Agency's Risk of Flooding from Surface Water dataset has been used for this assessment.
Surface water depth, velocity and hazard mapping	The surface water depth, velocity, and hazard mapping for the 3.3%, 1% and 0.1% AEP events (considered to be high, medium, and low risk) have been taken from Environment Agency's RoFSW dataset.

Site Reference	M26
Site Name	Highway Chipping Depot, Lower Luton Road, AL4 8JJ

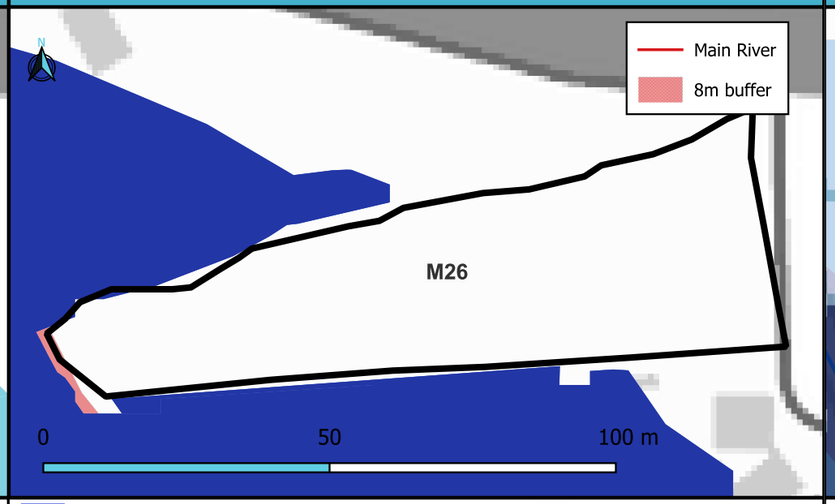
St Albans District Council
Strategic Flood Risk Assessment
Level 2 Detailed Site Summary

Flood Zone Map (present day)



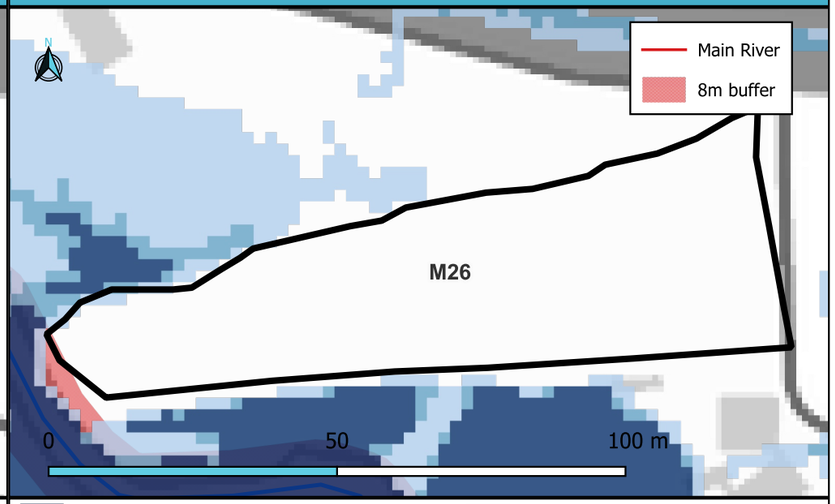
- Flood Zone 2 (Between 1% and 0.1% AEP)
- Flood Zone 3a (Between 3.33% and 1% AEP)
- Flood Zone 3b (Less than 3.33% AEP)
- Site boundary

Flood Zone 3b + Climate Change



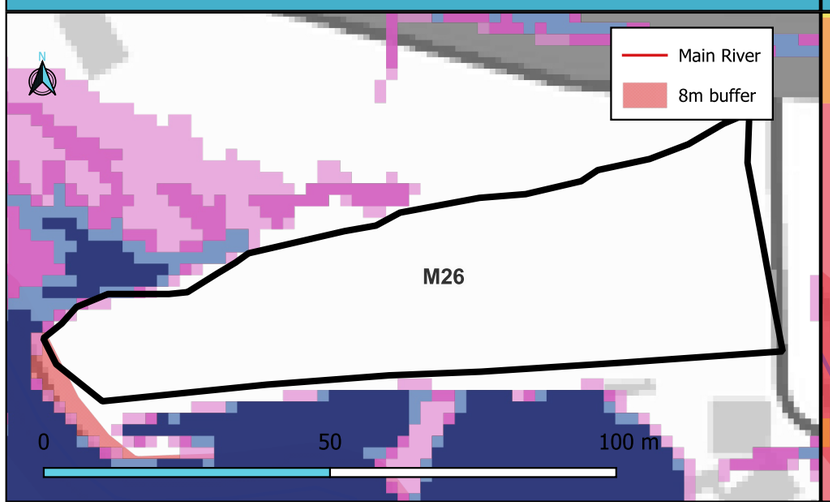
- Flood Zone 3b + 21% (Central allowance)
- Flood Zone 3b + 35% (Higher allowance)
- Flood Zone 3b
- Site boundary

Surface Water Map (RoFSW)



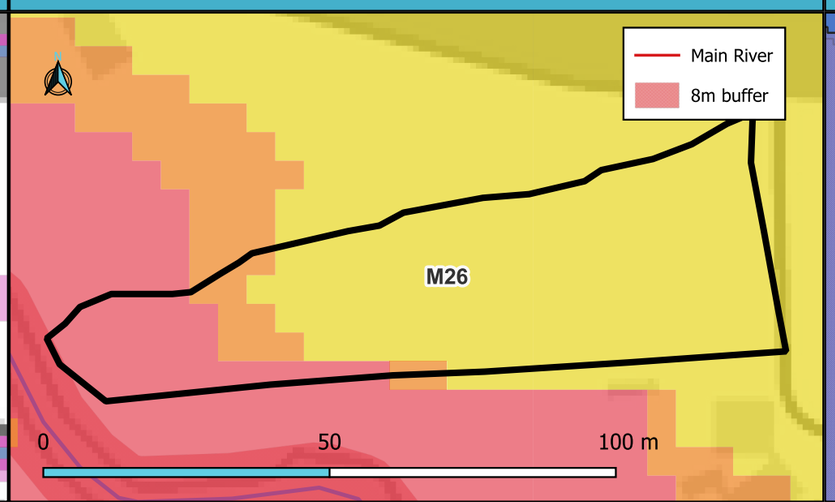
- RoFSW 1 in 30-year (3.33% AEP)
- RoFSW 1 in 100-year (1% AEP)
- RoFSW 1 in 1000-year (0.1% AEP)
- Site boundary

Surface Water Map + Climate Change



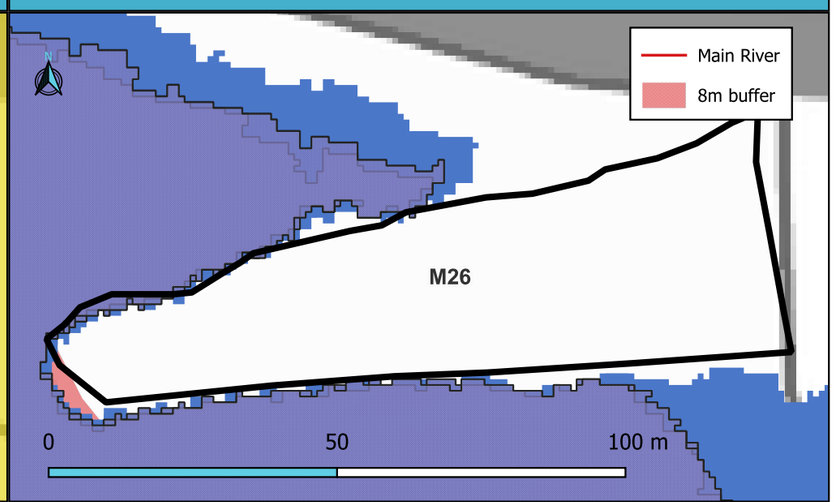
- RoFSW 1 in 30-year (3.33% AEP)
- RoFSW 1 in 30-year (3.33% AEP) plus 40%
- RoFSW 1 in 100-year (1% AEP)
- RoFSW 1 in 100-year 1% AEP plus 40%
- Site boundary

Groundwater (Gw) Flood Risk 1% AEP



- GW levels <0.025m below ground
- GW levels 0.025m to 0.5m below ground
- GW levels 0.5 to 5m below ground
- GW levels atleast 5m below ground
- Site boundary

Reservoir Flood Risk

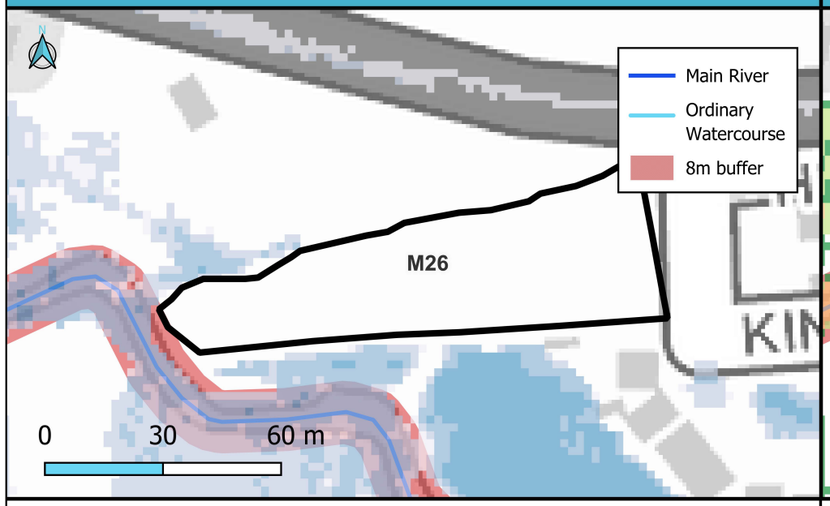


- Reservoir 'Dry Day' flood extent
- Reservoir 'Wet Day' flood extent
- Site boundary
- Reservoir - Fluvial contribution to flood extent

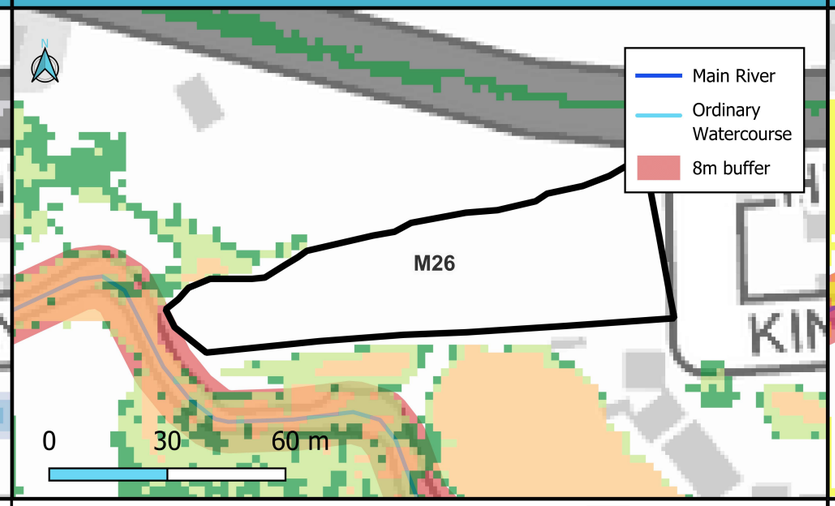
Site Reference	M26
Site Name	Former Highway Chippings Depot, Lower Luton Road

St Albans District Council
Strategic Flood Risk Assessment
Level 2 Detailed Site Summary

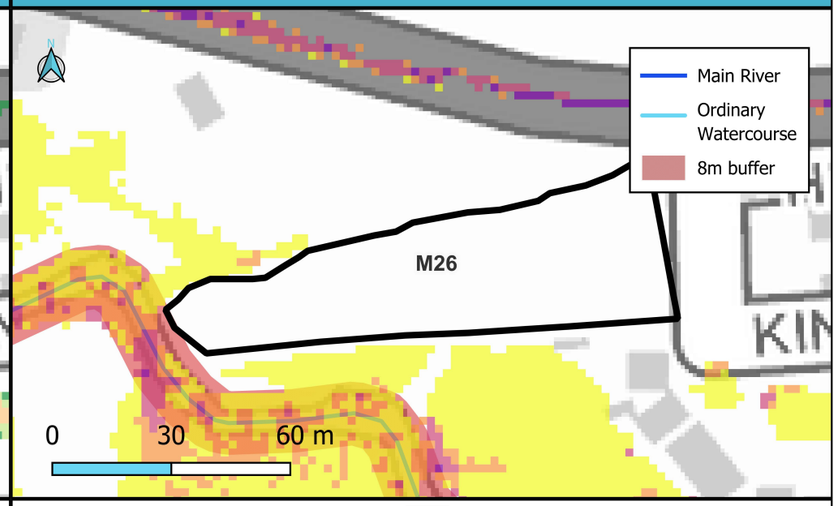
RoFSW Max Depth - 1% AEP



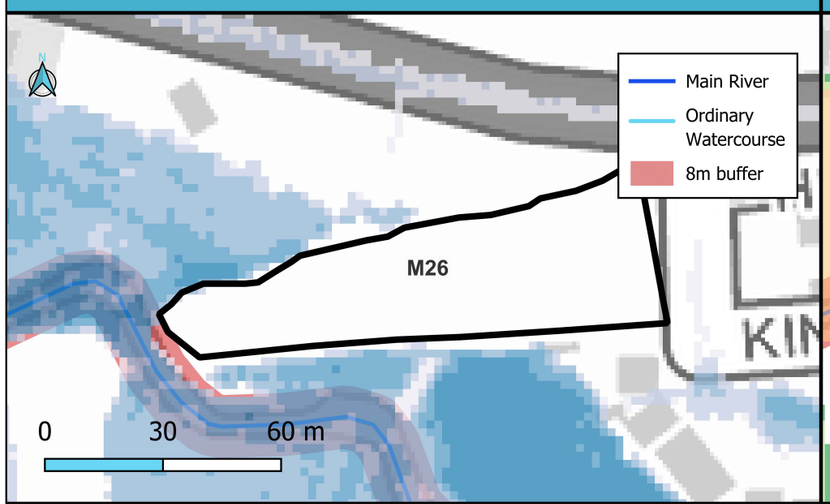
RoFSW Max Hazard - 1% AEP



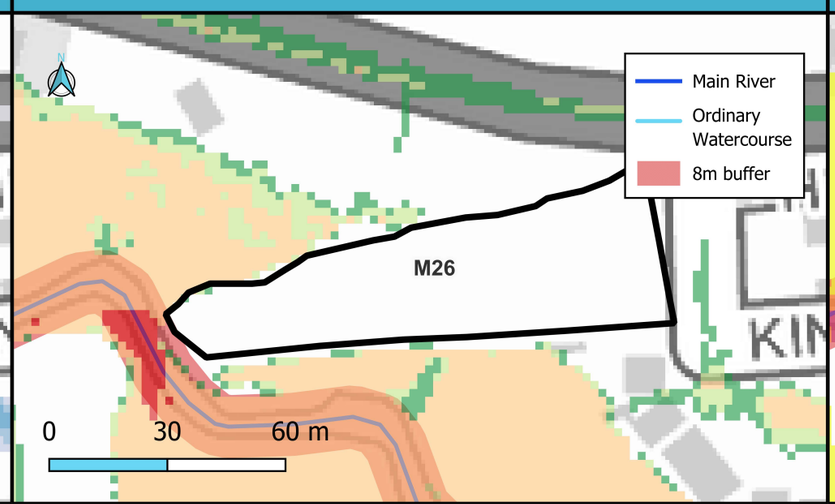
RoFSW Max Velocity - 1% AEP



RoFSW Max Depth - 1% AEP + 40% CC



RoFSW Max Hazard - 1% AEP + 40% CC



RoFSW Max Velocity - 1% AEP + 40% CC