	St Albans City and District Council Level 2 Strategic Flood Risk Assessment Detailed Site Summary Table
Site details	
Site Code	**P2**
Address	Land at North Orbital Road, AL2 1DL
Area	3.34ha
Current land use	Commercial
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 southern edge of St Albans, north of London Colney. It is situated just off the North Orbital Road (A414), which forms the site's southern boundary. Birklands Lane runs along the western boundary, while the northern and eastern boundaries are bordered by residential housing. The site is within the Upper Colne and Ellen Brook catchment, which covers an area of 95.5km², with the River Colne located approximately 1.8 km to the south of the site. The site is within the lower catchment, which is primarily urban, located within the southern area of St Albans. The site also falls within the Colne Management Catchment, which covers a much larger area of 1,040 km².
Topography	Environment Agency 1m resolution LIDAR across the site shows that topography varies. The lowest elevations are found in the north-west corner of the site at around 76.8m AOD. In comparison the highest elevation is situated in the south-eastern corner at around 81.1m AOD. The site generally slopes downward from east to west with the majority of the site between 77.2 to 79.9 m AOD.
Existing drainage features	There are no existing drainage features within the site that are visible on topographic mapping or aerial imagery.
Fluvial	**The proportion of site at risk FMFP:** FZ3b – 0% FZ3a – 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:** The Environment Agency's Flood Zone mapping has been used in this assessment. The site lies outside the 0.1% AEP flood extents from the Environment Agency's Upper Colne (2010) Model. No detailed hydraulic modelling was available for this site. **Flood characteristics:** The site is located within 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 – 0.15-0.30 m/s **1% AEP** – 3% Max depth – 0.30 – 0.60m Max velocity – 0.25 – 0.50 m/s **0.1% AEP** – 7% Max depth – 0.60 – 0.90m Max velocity - 0.50 – 1.00 m/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:** The site is affected by surface water flooding in all AEP events. During the 3.3% AEP event, surface water flooding only covers 2% of the site, an area of ponding in the north-west corner, which reaches a maximum depth of between 0.30 to 0.60m. The flooding then increases to 3% during the 1% AEP event, with an additional area of ponding in the centre of the site along the existing building boundary. To the west of the site by Birklands Lane there is a flow route present flowing southwards suggesting there may be a ditch present that joins the London Colney stream to the south of the A414. Most flood water velocity within the site is <0.25m/s reaching a maximum of 0.25 – 0.50m/s. The resulting flood hazard is predominantly 'very low' but in the area of ponding in the north-west corner is classed as danger to some. The 0.1% AEP event, the percentage flooded increases slightly to cover 7% of the site. This includes a larger area of ponding water in the north-west corner as well as in the centre of the site. A small surface water flow path is also present along the part of the southern boundary flowing west towards Birklands Lane. The flood velocities vary across the site mostly <0.25m/s in the centre and northern areas, with the flow path along the

	southern boundary reach 0.50 – 1.00 m/s. The flood depths mainly consist of between <0.15m to 0.60m with a maximum flood depth in the north-west corner of 0.60 to 0.90m. The resulting flood hazard is 'very low' to 'danger to most' the latter of which is situated in the north-west corner and a small area within the centre of the site.
Reservoir	The site is not shown to be at risk from the Environment Agency Reservoir Flood Extents.
Groundwater	JBA Groundwater mapping shows that majority of the site is at moderate risk of groundwater flooding, as 94% of the site has groundwater levels between 0.025-0.5m below ground level. The remaining 7% of the site, situated in the southeastern corner is not at risk with groundwater levels >5m below ground level. The risk form groundwater will need to be investigated further as part of a site-specific flood risk assessment and is likely to require ground investigations to confirm the risk.
Sewers	The site is located within a postcode area with 23 incidences of sewer flooding, according to the Thames Water Hydraulic Sewer Flood Risk Register.
Flood history	There are no reported flood incidents reported by the Environment Agency, St Albans District Council or Hertfordshire County Council within the site.
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 residual risk.
Emergency planning	
Flood warning	The site is not located within either an Environment Agency Flood Warning or Flood Alert Area.
Access and egress	Access and egress to the site is currently via a slip road on the eastbound carriageway of the A414, North Orbital. There is no surface water flooding on the access road during the 3.3% surface water event. In the 1% AEP and 0.1% AEP events the access road to the site from the North Orbital Road has a small area of surface water flooding. However, depths are predicted to be <0.15m and the resulting hazard classified as 'very low', so will not impede access
Dry Islands	The site not located on a dry island.

Climate change	
Implications for the site	**Management Catchment: Colne Management Catchment** 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 latest climate change allowances have been applied to the Upper Colne (2010) and London Colney (2018) models to indicate the impact of fluvial flood risk. Mapping shows that the site is within Flood Zone 1 and with the latest climate change allowances applied fluvial flood risk to the site remains negligible. **Surface Water:** The latest climate change allowances have been applied to the Risk of Flooding from Surface Water map to indicate the impact on pluvial flood risk. The 1% AEP plus 40% climate change corresponds to the 1% AEP upper end allowance for peak rainfall intensity for the 2070s epoch and is therefore the 'design event' scenario. In the 1% AEP plus 40% climate change event the flood extent is similar to that of the 0.1% AEP event. With ponding along the western side of the current main building, and a small flow path in the southwestern corner of the site. In addition to a flow path across the northeastern corner. The maximum flood depth reaches 0.5m, maximum velocity 0.6 and flood hazard 'Danger for some'. 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 at the site consist of:
	  ○ Bedrock - Bedrock geology of the site is Lewes Nodular Chalk Formation and Seaford Chalk Formation. This is a sedimentary bedrock.
	• Soils at the site consist of:
	  ○ The soil in the area is slightly acid loamy and clayey soils with impeded drainage.
	
	Sustainable Drainage Systems (SuDS)
	• Groundwater levels are indicated to be less than 0.5m below ground level. 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 indicates that the underlying geology is chalk which is likely to be free draining. Although, groundwater mapping indicates that the site is at moderate risk of groundwater flooding, therefore infiltration techniques may not be suitable. This should be confirmed through infiltration testing, with the use of infiltration maximised as much as possible in accordance with the SuDS hierarchy • The whole site is located within Groundwater Source Protection Zones 2 and 3. Proposed SuDS should be discussed with relevant stakeholders (St Albans City and District Council, Hertfordshire County Council and the Environment Agency) at an early stage to understand possible opportunities and constraints. The Groundwater Source Protection Zone guidance is currently undergoing a review. Therefore, developers should ensure they are using the latest guidance. • 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 3.3% AEP, 1% AEP and 0.1% AEP events. 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 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 (St Albans City and District Council, Hertfordshire County Council 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 filter strips, filter drains and bioretention areas 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 the 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 within Flood Zone 1 but at risk from groundwater and surface water flooding. The Sequential Test must be passed, the criteria for which is highlighted within the Level 1 Assessment. 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 can be managed through a sequential approach to design.

Requirements and guidance for site-specific Flood Risk Assessment	• At the planning application stage, a site-specific FRA will be required as the site is:
	  ○ Greater than one hectare
	  ○ At risk of other groundwater and surface water flooding
	• All sources of flooding should be considered as part of a site-specific FRA. Ground investigations are likely to be necessary to confirm the risk from groundwater flooding to the site.
	• Consultation with St Albans City and District Council. Hertfordshire County Council, 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).

- Mitigation for seasonal high groundwater levels must be considered (for example by raising finished floor levels to an appropriate height above ground level).
- Due to the high groundwater flood risk, basements are not permitted.
- The design of SuDS schemes must consider the seasonally high groundwater table. 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.
- 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 surface water plus an allowance for climate change and 0.1% rainfall events with an appropriate allowance for climate change, using the depth, velocity, and hazard outputs.
- Planning permission is required to surface more than 5 square metres of unpaved ground using a material that cannot absorb water.
- Arrangements for safe access and egress will need to be demonstrated for the surface water events with an appropriate allowance for climate change, using the depth, velocity, and hazard outputs.
- 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 however has significant risk of surface water and groundwater flooding.
Development is likely to be able to proceed if:

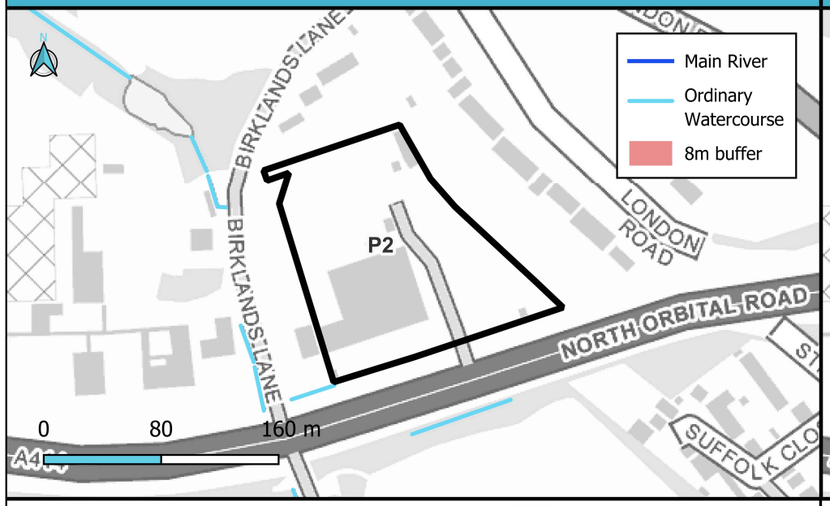
- A site-specific FRA demonstrates that the site is not at an increased risk of flooding in the future and that development of the site does not increase the risk of surface water flooding on the site and to neighbouring areas.
- A carefully considered and integrated flood resilient and sustainable drainage 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 fluvial and 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).
- A site-specific Surface Water Drainage Strategy, and SuDS maintenance and management plan is submitted along with the FRA

Mapping Information	
Flood Zones	Flood Zones 2 and 3a have been taken from the Environment Agency's Flood Map for Planning mapping. There is no detailed hydraulic modelling available at this location.
Climate change	The latest climate change allowances have been applied to the Environment Agency's RoFSW map to indicate the impact on surface water flood risk. In the absence of detailed hydraulic modelling, Flood Zone 2 has been used as an indicative assessment of future fluvial risk at 1% AEP.
Fluvial depth, velocity and hazard mapping	There is no detailed hydraulic modelling available at this location.
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.

Site Reference	P2
Site Name	Land at North Orbital Road

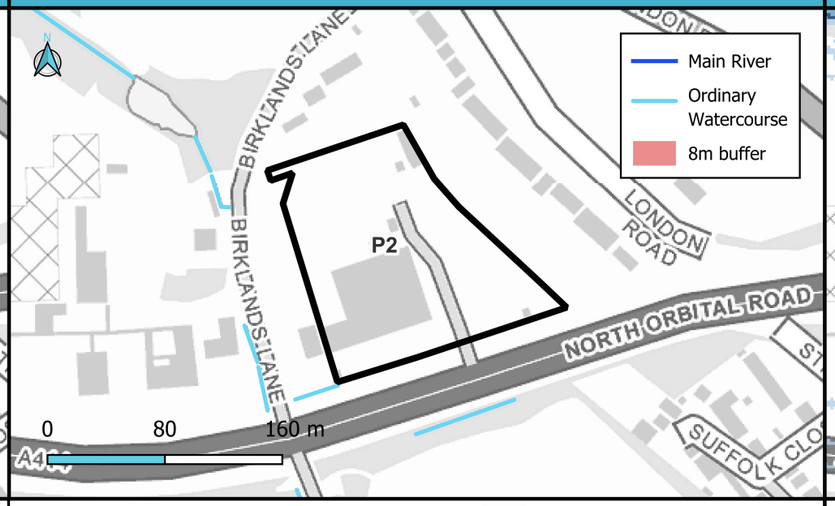
St Albans District Council
Strategic Flood Risk Assessment
Level 2 Detailed Site Summary

Flood Zone Map (present day)



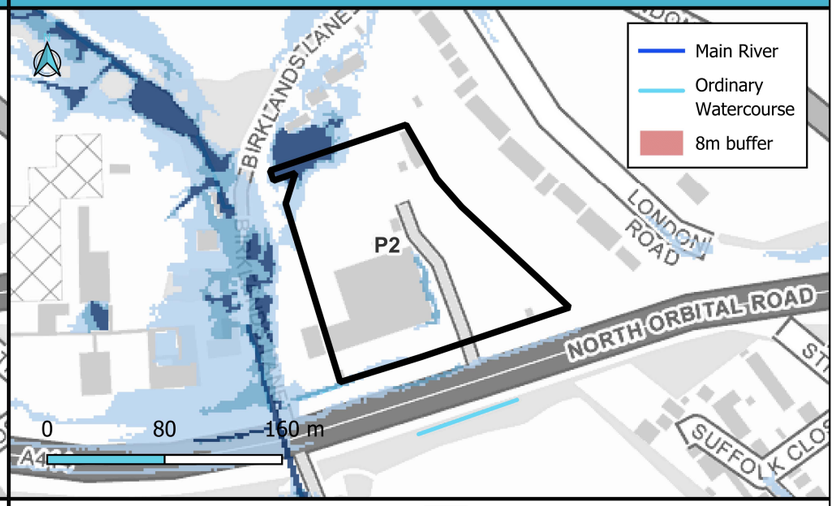
Flood Zone 2 (Between 1% and 0.1% AEP)
Flood Zone 3a (Between 3.33% and 1% AEP)
Flood Zone 3b (Less than 3.33% AEP)
Site boundary
Other site

Flood Zone 3b + Climate Change



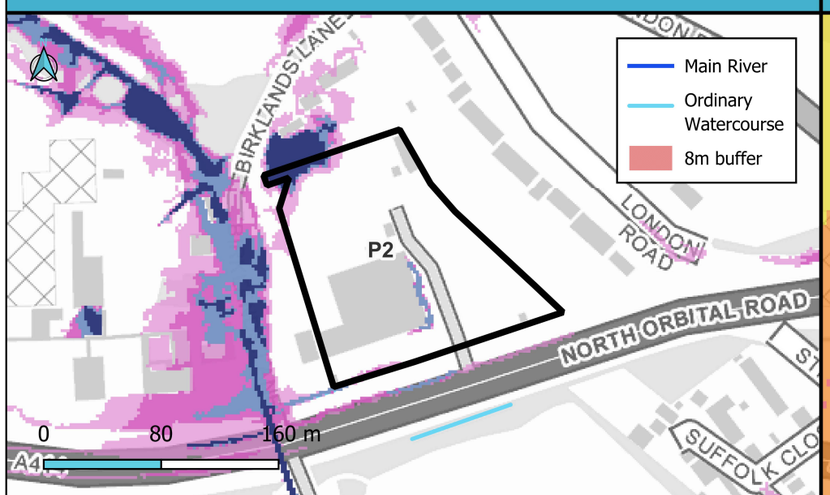
Flood Zone 3b + 21% (Central allowance)
Flood Zone 3b + 35% (Higher allowance)
Flood Zone 3b
Site boundary
Other site

Surface Water Map (RoFSW)



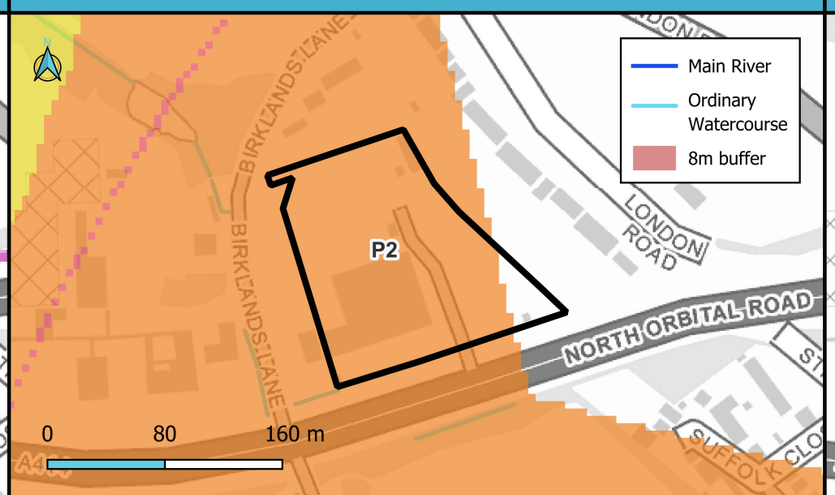
RoFSW 1 in 30-year (3.33% AEP)
RoFSW 1 in 100-year (1% AEP)
RoFSW 1 in 1000-year (0.1% AEP)
Site boundary
Other site

Surface Water Map + Climate Change



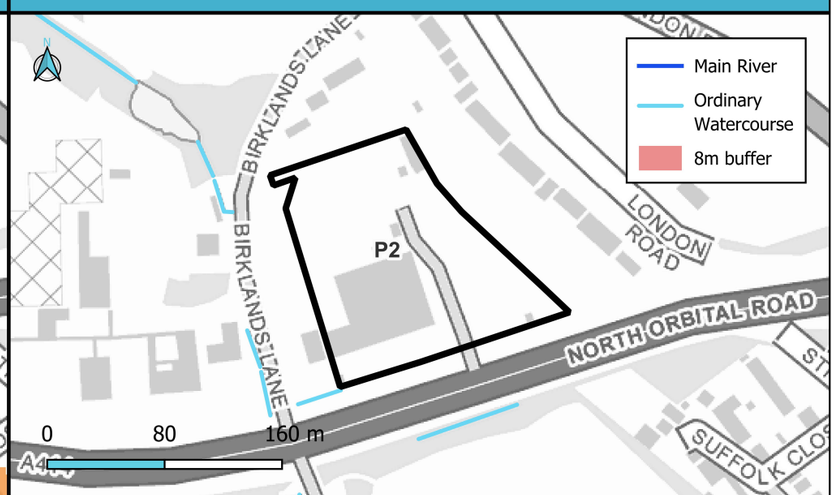
RoFSW 1 in 30-year (3.33% AEP)
RoFSW 1 in 30-year (3.33% AEP) plus 40%
RoFSW 1 in 100-year (1% AEP)
RoFSW 1 in 100-year 1% AEP plus 40%
Site boundary
Other site

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
Other site

Reservoir Flood Risk

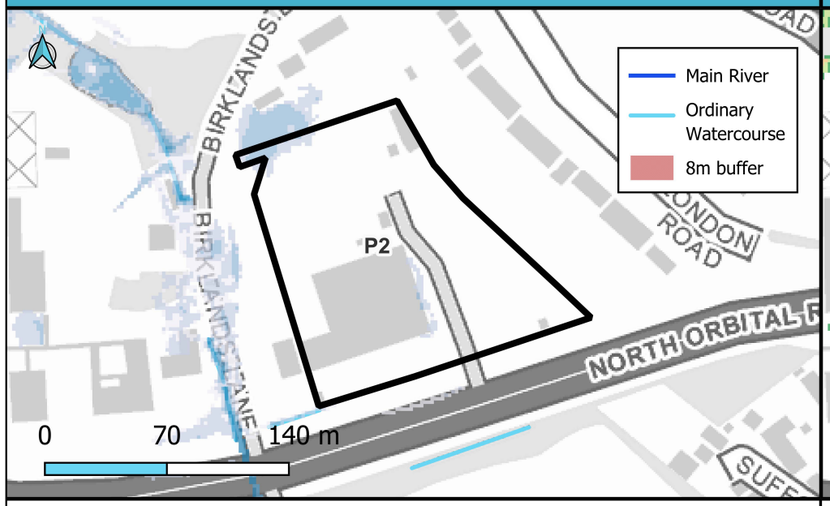


Reservoir 'Dry Day' flood extent
Reservoir 'Wet Day' flood extent
Reservoir - Fluvial contribution to flood extent
Site boundary
Other site

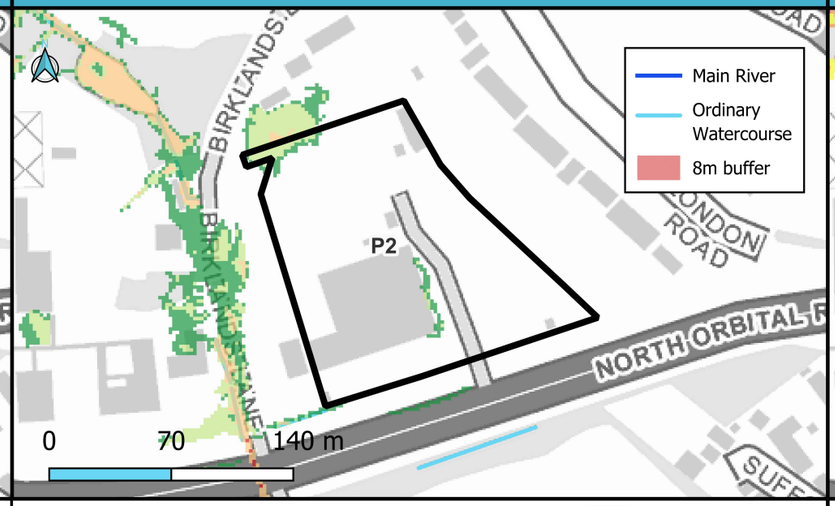
Site Reference	P2
Site Name	Land at North Orbital Road

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

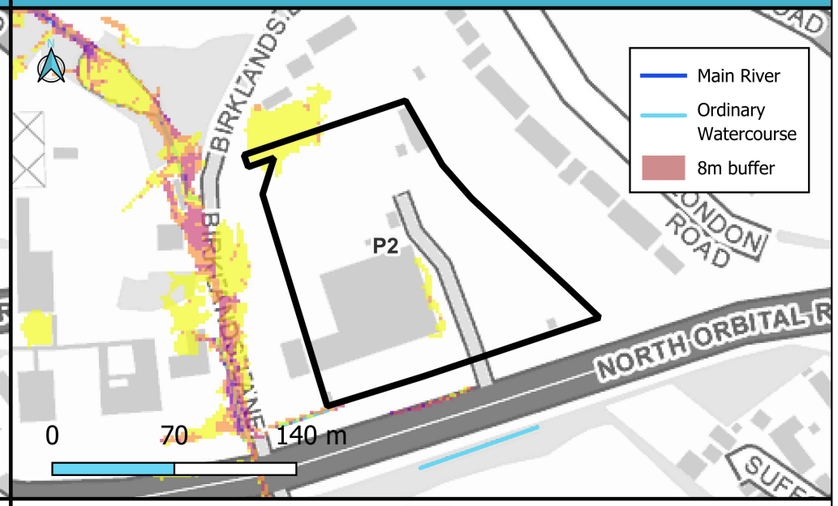
RoFSW Max Depth - 1% AEP



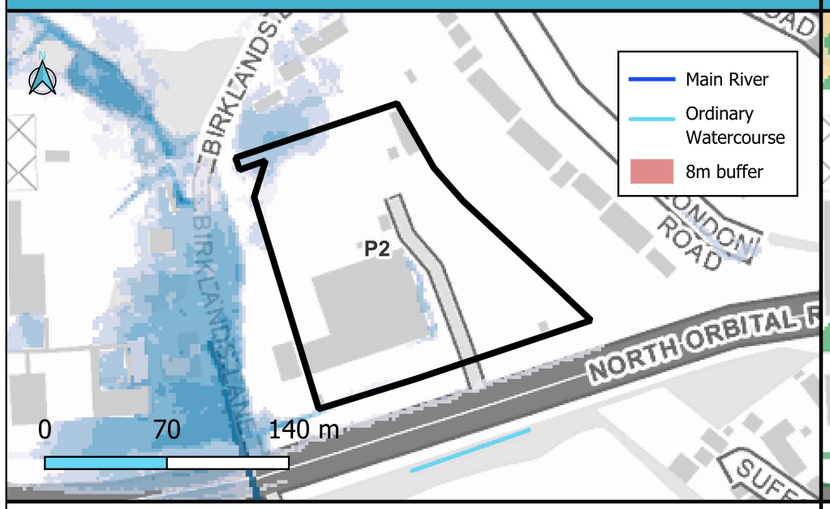
RoFSW Max Hazard - 1% AEP



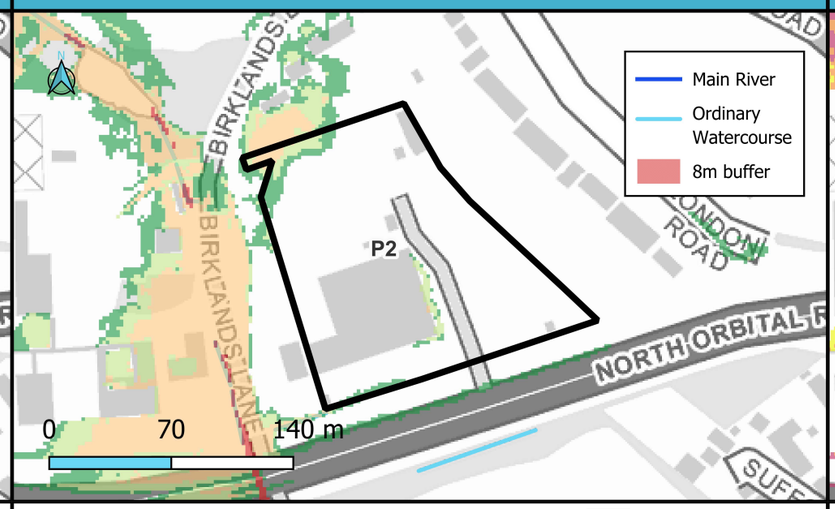
RoFSW Max Velocity - 1% AEP



RoFSW Max Depth - 1% AEP + 40% CC



RoFSW Max Hazard - 1% AEP + 40% CC



RoFSW Max Velocity - 1% AEP + 40% CC