CC010-A

	Chelmsford City Council Level 2 Strategic Flood Risk Assessment Detailed Site Summary Tables
Site details	
Site Code	**SGS1d**
Address	Riverside Ice and Leisure Land Victoria Road Chelmsford
Area	1.13ha
Current land use	Former swimming baths and Waterloo Lane short stay car park.
Proposed land use	Residential
Flood Risk Vulnerability	More Vulnerable
Sources of flood risk	
Location of the site within the catchment	This site is located in Chelmsford, south east of Waterloo Lane, and immediately adjacent to the River Chelmer. The River flows north to south at this location along the south east border of the site. The site is located within the Chelmer Operational Catchment of the Combined Essex Management Catchment. This management catchment is 3,413km^2 and spans the counties of Essex, Suffolk, and a small part of Cambridgeshire. The site is located at the downstream end of the catchment, near the confluence of the River Can and River Chelmer. Although the catchment is predominately rural, the site is located in a highly urbanised part of the catchment: Chelmsford City.
Topography	Environment Agency 1m resolution LiDAR shows the topography to generally slope downwards towards the south, with the north of the site lying at a maximum of 24.7mAOD and the south of the site lying at a minimum of 23.4mAOD. In addition, LiDAR shows areas of higher topography, up to 25.9mAOD in the centre of the site where there are existing buildings. There is an additional low spot on the northern tip of the site, at 24mAOD. It is important to note that the site is situated within a densely populated and developed urban area, therefore 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 existing drainage features within the borders of the site. The south east border of the site is immediately adjacent (<8m) to the River Chelmer, which flows north east to south west at this location. In addition, much of the site has impermeable surfaces, meaning it is likely drained by the surface water drainage network.
Critical Drainage Area	The site is not located within a Critical Drainage Area.

Fluvial and tidal	**The proportion of site at risk FMFP:** **FZ3 – 58.7%** **FZ2 – 72.6%** **FZ1 – 27.4%** *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 outputs:** **3.3% AEP fluvial event – 0.02%** **1% AEP fluvial event – 53.6%** **0.1% AEP fluvial event – 75.9%** *Modelled results show the percentage of site at risk from a given AEP flood event.* **Available data:** The proportion of the site at flood risk is determined from the Environment Agency's Flood Map for Planning Flood Zones. This represents the undefended scenario. The site is located at the very downstream end of the Environment Agency's 2018 River Chelmer Model, and there are considerable uncertainties in the results in the vicinity of this boundary. The Environment Agency's 1D-2D ISIS-TUFLOW detailed hydraulic model for the River Chelmer (2010) has therefore been used within this assessment of fluvial flooding instead, despite being older. It should be noted that the two models do show broadly similar results, particularly in more extreme events. **Flood characteristics:** In the 3.3% AEP, the defended scenario modelling of the River Chelmer does not inundate the site boundary. In the 1% AEP event, the south of the site, as well as the site boundary, is inundated by flood waters. Much of the north of the site, where the former swimming baths are currently located, is at a higher elevation meaning water does not pond here. Ponding in the south of the site reaches a maximum depth and velocity* of 0.8m and 0.5m/s. The western and northern border are also at a lower elevation and are inundated to a maximum depth and 0.3m and negligible velocity. Similarly, in the 0.1% AEP event, the entire site, aside from two spots of higher elevation around the former swimming baths are inundated by flood waters. Towards the southern border of the site, the maximum depth and velocity is 1.5m and 0.5m/s. In the north of the site, the maximum depth and velocity are 1.0m and 0.2m/s. Whilst hazard results are not available for this model, maximum depths and velocities suggest flooding is likely to pose significant danger to most site users in the 0.1% AEP. **Please note: Hazard ratings for the defended model outputs for the River Chelmer are unavailable.*
Surface Water	**Proportion of site at risk (RoFfSW):** **3.3% AEP** – 23.1% Max depth – 0.6m – 0.9m Max velocity – 0.5m/s – 1m/s **1% AEP** – 41.5% Max depth – 0.6m – 0.9m Max velocity – 1m/s – 2m/s

	0.1% AEP – 59.5% Max depth – >2m Max velocity – 1m/s – 2m/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 %).* The Environment Agency's Risk of Flooding from Surface Water mapping was used in this assessment. **Description of surface water flow paths**: Surface water ponds in areas of lower elevation, this is primarily the south of the site and a smaller spot at the northern corner. In the 3.3% AEP event, there is significant ponding in the south of the site across the majority of the Waterloo Lane 1 Short Stay car park, extending up to 26m from the southern border. The maximum depth and velocity are detailed above, and the maximum hazard is 'Danger for Most' In addition, there is surface water ponding at the northern tip of the site, approximately 35m long, along the unnamed road. The maximum depth, velocity, and hazard of this ponding is 0.3-0.6m, 0.25-0.5m/s, and 'Danger for Some'. In the 1% AEP event, the ponding in the south of the site extends up to 57m from the southern border, across both Waterloo Lane Short Stay car parks. The maximum depth and velocity are quoted above, and the maximum hazard is 'Danger for Most'. Surface water flooding along Waterloo Lane also begins to encroach on the western border of the site. In the northern tip of the site, the ponding extends out from the western border, along the unnamed road, by 45m. The maximum depth, velocity, and hazard here is 0.3-0.6m, 0.5-1.0m/s, and 'Danger for Most'. In the 0.1% AEP event, there is significant risk of flooding across the majority of the site. The ponding in the south of the site again extends up to 57m from the southern border, across both Waterloo Lane Short Stay car parks. The maximum depth and velocity here are quoted above, and the maximum hazard is 'Danger for Most'. In the northern tip of the site, the ponding extends out from the western border, along the unnamed road, by 47m. The maximum depth, velocity, and hazard here is 0.6–0.9m, 0.5-1.0m/s, and 'Danger for Most'.
Reservoir	According to the Environment Agency's (EA) risk of flooding due to reservoirs dataset, this site is not impacted in the 'Dry Day' scenario. According to the Environment Agency's (EA) risk of flooding due to reservoirs dataset, entirety of the site, aside from the location of the former swimming baths that lie at a higher elevation, are at risk of reservoir flooding in the 'Wet Day' scenario. This risk is associated with Chignal Hall Farm Reservoir. The risk designation of Chignal Reservoir has not yet been determined; therefore, in the very unlikely event that the reservoirs fail, there may be a risk to life.
Groundwater	The JBAs Groundwater Emergence Map, is provided as 5m resolution grid squares. The eastern two thirds of the site is shown to have negligible risk of groundwater emergence, and any groundwater emergence incidence has a chance of less than 1% annual probability of occurrence. There will be a remote possibility that incidence of groundwater flooding could lead to damage to property or harm to other sensitive receptors at, or near, this location. To the west of the site, particularly the south west, groundwater levels are either between 0.025m and 0.5m below the surface, or at or very near the surface. Here, there is a risk of groundwater flooding to both surface and

	subsurface assets. Groundwater may emerge at significant rates and has the capacity to flow overland and/or pond within any topographic low spots. This will need to be investigated as part of a site-specific flood risk assessment and is likely to require ground investigations to determine the risk to the site.
Sewers	Sewer flooding records were not available for this assessment. The entirety of Chelmsford is identified as a Flood priority catchment in Anglian Water's Drainage and Wastewater Management Plan (DWMP). Developers should consult Anglian Water as part of any development proposal to ensure development does not exacerbate existing issues and maximise opportunities for development to deliver benefits in line with the long term strategic aims set out in the DWMP.
Flood history	The Environment Agency's Historic Flood Map shows minor flooding, associated with the River Chelmer, along the western and southern borders of the site. The flood outline extends a maximum of 9m into the site. Essex County Council as LLFA has no records of flooding within the site boundary. The closest incidences are 175m to the north east, at north of Victoria Road, and 210m south west near Roseberry Yard. Both incidents are located on the opposite bank of the River Chelmer, the date and cause of these incidents are unknown.
Flood risk management infrastructure	
Defences	The Environment Agency AIMS dataset shows natural high ground lining the eastern border of the site along the River Chelmer, but no formal defences. The site does not lie within the Environment Agency's reduction in risk of flooding from rivers and sea dataset. The Margaretting Flood Alleviation Scheme to safeguard the city centre was cancelled in March 2022. The risk from flooding remains. The City Council continues to work with the Environment Agency to supplement existing flood defences and deliver a new series of catchment-based measures under the Chelmsford Flood Resilience Partnership. Developers should consult the Environment Agency to find out whether this site will be affected by this flood alleviation scheme. Sites affected by flood risk should devise an FRA on the basis that existing city centre flood defences are in place and, if sufficiently advanced, the catchment-based measures identified by the Chelmsford Flood Resilience Partnership project. In either scenario a financial contribution to the Chelmsford Flood Resilience Partnership project would be required.
Residual risk	The site is not at residual risk from an overtopping or breach of defences along the River Chelmer as there are no defences in the vicinity of the site. If flood defences are proposed to defend the site, the residual risk to the site posed by failure of flood defences, including overtopping and breach must be considered in a site-specific Flood Risk Assessment. Maintenance arrangements (including funding mechanisms) for the defences will need to be demonstrated for the lifetime of development, this will need to include how the existing defences can be improved and fixed.
Emergency planning	
Flood warning	The entire site is located in both an Environment Agency Alert Warning Area, and an Environment Agency Flood Warning Area. Flood Alert Area: 051WAFEF6BC (The River Wid from Brentwood, to and including Writtle, and the River Can at Chelmsford) Flood Warning Area: 051FWFEF6C2 (The Rivers Can and Chelmer through Chelmsford, including the High Street and Meadows Shopping Centre).

	051FWFEF6C1 (Riverside properties in Chelmsford, from Rivermead Industrial Estate through Central and Admirals Park including the cricket ground, to Lordship Lane).
Access and egress	Existing access and egress to the site is currently via Waterloo Lane, which runs along the western border of the site. Waterloo Lane is an access road off New Street. In the fluvial 3.3% AEP event, defended model outputs for the River Chelmer show that safe access to the site is possible via Waterloo Lane. In the fluvial 1% AEP event, defended model outputs for the River Chelmer show that most of the site is flooded, however safe access via both Waterloo Lane may be possible, but for emergency vehicles only. The maximum depth is 0.3m and velocity is negligible. In the fluvial 1% AEP plus climate change, and the 0.1% AEP event, defended model outputs for the River Chelmer safe access and egress to the site will be impacted for all vehicles, and most of the site, except a dry island in the centre, is flooded. The maximum depth and velocity of flooding in the 1%+CC and 0.1% AEP events is 0.6m and 0.3m/s, and 0.9m and 0.3m/s respectively. In all modelled surface water events, access and egress to the site is impacted. Waterloo Lane, adjacent to the site, is shown as being inundated in all scenarios. The maximum depth, hazard and velocity in each event is listed below: 3.3% AEP – 0.3-0.6m, 0.25-0.5m/s, and 'Danger for Some'. 1% AEP - 0.3–0.6m, 0.5–1.0m/s, and 'Danger for Most'. 0.1% AEP - 0.6–0.9m, 1.0– 2.0m/s, and 'Danger for Most'. 1% AEP plus 40% Climate Change – 0.7m, 0.9m/s, and 'Danger for Most'. It important to note for the surface water datasets, that the site is situated within a densely populated, developed urban area and LiDAR data is unlikely to be representative of the site topography and structures such as underpasses. As such, surface water flow paths shown at highways or railways where there is an underpass, have been excluded from the calculation of maximum depth, velocity, and hazard. Arrangements for safe access and egress will need to be demonstrated for 1% AEP plus an appropriate allowance for climate change, using the depth, velocity, and hazard outputs. Given the considerable risk to the site during fluvial and surface water scenarios, consultation with RMAs early on should be implemented to ensure an appropriate flood evacuation plan is put in place for the site.
Dry Islands	The centre of the site is shown to form a dry island during the 0.1% AEP event.
Climate change	
Implications for the site	**Management Catchment: Combined Essex 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 River Chelmer has available climate change outputs for the Central (25%) allowance for the 2080s. As the 1% AEP event inundates such a large percentage of the site, the change in extent between the baseline and climate changes events is minor. As such, this assessment will focus on the 3.3% AEP event, as this is likely to provide a more accurate assessment of sensitivity to climate change.

	The 3.3% AEP event does not impact the site in any way. On the other hand, the 3.3% AEP plus climate change event is shown to encroach into the site by approximately 70m from the south eastern corner. The maximum depth and velocity of this ponding is 0.53m and 1.06m/s. This suggests the site is highly sensitive to fluvial climate change. **Surface Water:** The latest climate change allowances have also 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. Unlike its baseline equivalent, 1% AEP plus climate change event impacts the site considerably more, encroaching a further 21m into the south of the site, and also inundating the eastern border of the site along the River Chelmer. The maximum depth, velocity, and hazard in the south of the site border is 1.2m, 1.8m/s, and 'Danger for Most'. As such, it can be inferred that this site is also highly sensitive to surface water 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**
	
	• Geology at the site consists of:
	  ○ Bedrock Geology - London Clay Formation - Clay, silt, and sand.
	  ○ Superficial Geology - Alluvium - Clay, silt, sand, and gravel.
	• Soils at the site consist of:
	  ○ Loamy and clayey floodplain soils with naturally high groundwater
	
	SuDS
	
	• The site is considered to have very low susceptibility to groundwater flooding, this should be confirmed through additional site investigation work. Below ground development such as basements may still be susceptible to groundwater flooding.
	• BGS data indicates that the underlying geology is a mixture of clay, silt, sand, and clay which is likely to be with highly variable permeability. This should be confirmed through infiltration testing. Off-site discharge in accordance with the SuDS hierarchy may be required to discharge surface water runoff from the site.
	• The site is not located within a Groundwater Source Protection Zone
	• The entire site is not located within two Nitrate Vulnerable Zones (2021-2014. These are as follows:
	  ○ Sandings and Chelmsford
	  ○ River Chelmer
	• The entire site is within Drinking Water Safeguard Zone SWSGZ1029
	• The site is not located within a historic landfill site.
	• Surface water discharge rates should not exceed pre-development discharge rates for the site and should be designed to be as close to greenfield runoff rates as reasonably practical in consultation with the LLFA. It may be possible to reduce site runoff by maximising the permeable surfaces on site using a combination of permeable surfacing and soft landscaping techniques.
	• The Risk of Flooding from Surface Water (RoFSW) mapping indicates the presence of surface water flow paths during the 0.1% AEP event. Existing flow paths should be retained and integrated with blue-green infrastructure and public open space.

	• If it is proposed to discharge runoff to a watercourse or sewer system, the condition and capacity of the receiving watercourse or asset should be confirmed through surveys and the discharge rate agreed with the asset owner.
Opportunities for wider sustainability 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. • SuDS are to be designed so that they are easy to maintain, and it should be set out who will maintain the system, how the maintenance will be funded and should be supported by an appropriately detailed maintenance and operation manual. • 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 water quality of surface water runoff discharged from the site and reduce the impact on receiving water bodies. • The potential to utilise conveyance features such as swales to intercept and convey surface water runoff should be considered. Conveyance features should be located on common land or public open space to facilitate ease of access. Where slopes are >5%, features should follow contours or utilise check dams to slow flows.
NPPF and planning implications	
Exception Test requirements	The site is classified as more vulnerable and is almost entirely within Flood Zone 2, therefore the Exception Test is required for this site. Furthermore, the site is at significant risk from surface water flooding. Whilst the Exception Test is only required for sites at risk from fluvial flooding, it is recommended the Chelmsford City Council carefully weigh up the benefits of developing the site against the surface water flood risk. Developers will need to demonstrate through a site-specific flood risk assessment that users of the site will be safe throughout its lifetime.

Requirements and guidance for site-specific Flood Risk Assessment	**Flood Risk Assessment:**
	• At the planning application stage, a site-specific FRA will be required as the proposed development site is:
	  • Almost entirely within fluvial Flood Zones 2 and 3
	  • Greater than one hectare
	  • At risk of other sources of flooding (surface water, groundwater, and reservoir)
	• All sources of flooding should be considered as part of a site-specific FRA.
	• Consultation with Chelmsford City Council, Essex County Council, Anglian 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); and the Council's Local Plan Policy's and SuDS Strategy.

- 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 pre-development greenfield rates.
- Arrangements for safe access and egress will need to be provided for the 1% AEP fluvial and rainfall events with an appropriate allowance for climate change, considering depth, velocity, and hazard. Design and access arrangements will need to incorporate measures, so development and occupants are safe. Given the significant risk to the site and proximity to the River Chelmer, a Flood Warning and Evacuation plan should be prepared for the site.
- Provisions for safe access and egress should not impact on surface water flow routes or contribute to loss of floodplain storage. Consideration should be given to the siting of access points with respect to areas of surface water flood risk.
- Flood resilience and resistance measures should be implemented where appropriate during the construction phase, e.g. raising of floor levels and use of boundary walls. These measures should be assessed to make sure that flooding is not increased elsewhere.

Key messages

The site is at significant risk of fluvial and surface water flooding and is shown to be highly sensitive to increased risk as a result of climate change, therefore the Exception Test will need to be passed before the site can be bought forwards. With regards to the flood risk portion of the Exception Test, development may be able to proceed if:

- Development is steered away from the area of fluvial flood risk in the south of the sit and the small flow paths/areas of surface water ponding, including that along the western and northern borders are incorporated and considered within the development design.
- 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 1% AEP plus climate change events. This includes measures to reduce flood risk along these routes such as raising access, but not displacing floodwater elsewhere. This should also include an adequate flood warning and evacuation.
- 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.

- 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

The key datasets used to make planning recommendations for this site were the Environment Agency's Flood Map for Planning, the Environment Agency's Risk of Flooding from Surface Water map and the Environment Agency's River Chelmer model. 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. The River Chelmer (2010) Environment Agency model has been used in this assessment.
Climate change	The central and upper end allowances were available for the River Chelmer (2010) hydraulic model to indicate the impacts on fluvial flood risk. The latest climate change allowances (updated May 2022) have also been applied to the Risk of Flooding from Surface Water map to indicate the impact on pluvial flood risk.
Fluvial and tidal extents, depth, velocity and hazard mapping	Depth, velocity, and hazard data was derived from the River Chelmer (2010) hydraulic model.
Surface Water	The Risk of Flooding from Surface Water map has been used to define areas at risk from surface water flooding.
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.