CC010-A

	Chelmsford City Council Level 2 Strategic Flood Risk Assessment Detailed Site Summary Tables
Site details	
Site Code	**CW1e/CW1c**
Address	Lockside & Travis Perkins Navigation Road Chelmsford
Area	3.12 ha
Current land use	Industrial Estate
Proposed land use	Residential
Flood Risk Vulnerability	More Vulnerable
Sources of flood risk	
Location of the site within the catchment	The site is located within the Chelmer Operational Catchment, which is 657.4km^2. Within the operational catchment, the site is located on the Western boundary of the drainage area for the River Chelmer, downstream of its confluence with the River Can. This section of the Chelmer drains 54.48km^2 of land. Due to urbanisation within the catchment, the channel through Chelmsford has been heavily modified with reinforcements and defences.
Topography	The site is relatively level throughout, with the highest point located in the northwest of the site (24.6mAOD) and the lowest area toward the eastern perimeter (22.0 mAOD). The site is generally level, with a topographic depression in the central portion of the site extending to the east, toward the Hill Road Community Allotments. The accuracy of the EA LiDAR is limited by the urban nature of the site, which may have created distortions to the Digital Terrain Model (DTM). This uncertainty also applies to any flood risk datasets using the EA LiDAR as a DTM.
Existing drainage features	There are no drainage features within the site boundaries. The site's southern border is immediately adjacent to the Chelmer and Blackwater Navigation Channel, which features a landing and wharf. This channel flows from the northwest to the southeast. Access to the channel, and additionally water levels, are controlled by Springfield Lock. The River Chelmer flows westward approximately 150m south of the site. Part of the site is previously developed, and is likely to be drained by the existing 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 – 46.8%** **FZ2 – 81.4%** **FZ1 – 18.6%** *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 – 1.5%** Max depth: 0.14m Max velocity: 0.00m/s (negligible flow) **1% AEP fluvial event – 46.0%** Max depth: 0.67m Max velocity: 0.82m/s **0.1% AEP fluvial event – 82.0%** Max depth: 1.0m Max velocity: 2.2m/s *Modelled results show the percentage of site at risk from a given AEP flood event.* **Available data:** Proportion of the sites at flood risk are determined from the Environment Agency's Flood Map for Planning Flood Zones. This represents the undefended scenario. Therefore, the defended scenario outputs have been reported as a more accurate representation of the flood risk in Chelmsford due to the presence of flood defence structures. Flood defence structures along the River Chelmer are designed to protect to a 1% AEP flood event. The EA's Reduction in Risk of Flooding from Rivers and Sea due to Defences dataset extent has been used to assess the area of the site located within this extent, see the 'Defences' section below for more details. The Environment Agency's 1D-2D ISIS-TUFLOW detailed hydraulic model for the River Chelmer (2010) has been used within this assessment of fluvial flooding. **Flood characteristics:** In the 3.3% AEP event, flood water encroaches approximately 20m into the site from its eastern border. LiDAR shows that this part of the site lies lower than surrounding areas. The maximum depth of this standing water is 0.14m. In the 1% AEP event, nearly half of the site is inundated. As the central portion of the site lies at a lower elevation, and the southern section is located next to the channel itself the flooding is more extreme in these sections. The maximum flood depth and velocity are 0.67m and 0.82m/s, respectively. Higher lying land to the north remains dry under this scenario. In the 0.1% AEP event, the majority of the site is inundated. Again, the highest depths and velocities are found in the lower-lying central section. Here, depths of up to 1.0m flowing at velocities of up to 2.1m/s are possible. Only a small area of land to the northeast is expected to remain dry under this scenario. Whilst hazard scores 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 event. The site is not considered to be at risk from tidal flooding.
Surface Water	**Proportion of site at risk (RoFfSW):** **3.3% AEP** – 7.2% Max depth – 0.6-0.9 m Max velocity – 1-2 m/s **1% AEP** – 15.4% Max depth – 0.6-0.9 m Max velocity – 1-2 m/s **0.1% AEP** – 40.2%

	Max depth – 0.6-0.9 m Max velocity - 1-2 m/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:** In the 3.3% AEP surface water flood event, ponding is expected to occur along Hill Road South, the lower lying section in the centre of the site, and the southern section of the pedestrian access track on the border between CW1e and CW1c. The maximum depth and velocity of this ponding is quoted above, the maximum hazard rating is 'Danger for Most'. In the 1% AEP event, flood extents remain along roads and lower lying areas, albeit to a greater extent. Maximum depth and velocity are quoted above, and the maximum hazard rating remains at 'Danger for Most'. In the 0.1% AEP event, over 40% of the site is inundated. The only areas generally not at risk of surface water flooding are the building footprints themselves. These results should be treated with caution however, as the high level of urbanisation to sections of this site introduces uncertainties and inaccuracies to the DTM used for flood modelling. The flow paths described for the 1% AEP event are exacerbated in this event and are the worst affected areas of the site. The maximum depth and velocity of the site is quoted above, and the maximum hazard rating is 'Danger for Most'.
Reservoir	According to the Environment Agency's (EA), in the Wet Day scenario, Handley Barns Farm (Private individual) flood extents cover the majority of the site with the exception of the northern area of the site. Chignal Hall Farm and Mashbury Hall Farm (CJH Farming Ltd) cover the majority of the site with the exception of the central area of the northern boundary. In the Dry Day scenario, a section of the lowest lying land on the eastern perimeter of the site is expected to be inundated. The risk designation of Chignal Reservoir has not yet been determined while the others have been determined to be high risk, therefore, in the very unlikely event that the reservoirs fail, there is be a risk to life.
Groundwater	The JBAs Groundwater Emergence Map, is provided as 5m resolution grid squares. The southern section 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. However, within the northeast section of the site, groundwater levels are either at or very near (within 0.025m of) the ground surface. Within this zone there is a risk of groundwater flooding to both surface and subsurface assets. This means that groundwater may emerge at significant rates and has the capacity to flow overland and/or pond within any topographic low spots. Within the northwest section of the site, some sections are expected to have slightly deeper groundwater levels of between 0.025m and 0.5m below the ground surface. While these areas are expected to represent slightly lower vulnerability to groundwater flooding,

	groundwater emergence is still possible, particularly in topographic lows. The risk to the site from groundwater will need to be considered through a site-specific flood risk assessment and is likely to require ground investigations to confirm 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 records of flooding to the southern and eastern perimeters of the site, associated with the Chelmer and Blackwater Navigation Channel. Essex County Council as LLFA has no records of flooding within the site boundary. The closest Flood Incidences are within 350m of the site. No information is included on the cause and date of these incidents. The closest recorded South Essex Historic Flood information is located within 500m of the site. These reports document internal flooding to business premises in 2007 and 2008, causing damage to electrics. The source of flooding is not disclosed.
Flood risk management infrastructure	
Defences	The Environment Agency (EA) AIMS dataset shows that the site is not protected by formal flood defences along the River Chelmer. The southern perimeter of the site is classed by the EA as a natural high ground, with a recorded standard of protection of 100 years.
Residual risk	There are no formal defences in the immediate vicinity of the site. The natural high ground along the Chelmer and Blackwater Navigation Channel is recorded to protect to a 1% AEP flood event, although modelling suggests the standard of protection is lower. The most recent Visual Asset Inspection (16 April 2023) found that the natural high ground protecting the site was in good condition. 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. 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. Whilst there are currently no formal defences within the vicinity of the site, developers should consult with Chelmsford City Council and the Environment Agency to identify whether land within the site boundary may need to be safeguarded for flood defences in future. If defences are proposed as part of the development, maintenance arrangements (including funding mechanisms) for the defences will need to be demonstrated for the lifetime of development.
Emergency planning	
Flood warning	The majority of the site falls under the Flood Alert for The River Wid from Brentwood, to and including Writtle, and the River Can at

	Chelmsford (051WAFEF6BC), with only the northern perimeter remaining outside the alert area. The site is also within the flood warning areas for ' The Rivers Can and Chelmer through Chelmsford, including the High Street and Meadows Shopping Centre (051FWFEF6C2)', and also as 'Riverside properties on the Rivers Chelmer and Can in Chelmsford (051FWFEF6C2)'.
Access and egress	Vehicular access and egress to the site is currently possible via Hill Road South, Brockley Road, the entrance and exit to Travis Perkins. All of these roads connect to Navigation Road. There is currently pedestrian only access and egress through an unnamed access route between Brockley Road and the exit to Travis Perkins, on the boundary between CW1e and CW1c. There appears to be pedestrian access and egress via the towpath to the south of the site. During a 3.33% AEP surface water event, vehicular access and egress is expected to be unaffected on Brockley Road and Travis Perkins' access points. Similarly, pedestrian access is also expected to be possible via the unnamed path on the border between CW1e and CW1e and the towpath. However, Hill Road South is expected to be flooded with up to 0.6m depth, with velocity up to 2m/s, at its junction with Navigation Road, which may affect access/egress. Navigation Road is expected to be inundated at its junction with Byron Road to the east and Cressy Quay to the west of the site. Access to the sections of Navigation Road adjacent to the site, with the exception of Hill Road South, should remain possible via Queen's Road. During a 1% AEP surface water flood, flooding is expected at the current entrance to the Travis Perkins site (but not its exit). As with the 3.33% AEP event, Hill Road South is expected to become inaccessible by road or foot, especially close to its junction with Navigation Road. Under this scenario, Queen's Road is also liable to become inundated, so the only dry access road to the section of Navigation Road may be via the unpaved service track at the back of the houses on Hill Road and Queen's Road. The previously dry pedestrian access via the towpath and unnamed path under the 3.33% AEP scenario are no longer expected to be possible. During the design surface water flood event (1% AEP+40%CC), all existing access and egress points are expected to be inundated with up to 0.9m of water, with velocity in excess of 1.7m/s. Dry access to the site is not expected to be possible during this event. Similarly, dry access to the site is likely not possible during a 0.1% AEP event. During a fluvial flood, all potential access and egress routes to the are expected to remain accessible during a 3.33% AEP fluvial flood. During a 1% AEP fluvial flood, all egress connections to Navigation Road are expected to remain dry, although the southern portions of the roads may experience flooding. Access to the southern access and egress points is expected to be impacted under this scenario. The fluvial design event (1%AEP+Climate Change) predicts a similar situation to the 1% AEP. Under a 0.1% AEP, most of the site is expected to become inundated, affecting the current egress and access routes to the Travis Perkins site via Navigation Road. Access to Navigation Road is expected to remain possible for all other northern access points, via roads from the north and east. Developers will need to demonstrate safe access and egress during the 1% AEP plus climate change fluvial and surface water events. Given that much of the site is shown to be at risk in the design event, a flood warning and evacuation plan should be prepared for the site. Refer to Section 8.6 of the Level 1 SFRA for details on what emergency plans should include.

	It is important to note that the accuracy of the EA LiDAR is limited by the urban nature of the site, which has created distortions to the Digital Terrain Model (DTM). As flood modelling was based on this DTM, this uncertainty also transfers to the modelled flood extents produced in this study.
Dry Islands	The site is not located on a dry island.
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%) and Upper End (72%) allowances for the 2080s. Under a 3.33% AEP plus central climate change (+25%) flood, the previously unaffected southern and low-lying central areas of the site are expected to experience inundation. This is expected to result in flood depths of up to 0.49m, and velocities of up to 1.42m/s. For the upper scenario (72%), depths of up to 0.74m and velocities of 1.49m/s are possible. Under the fluvial design event (1% AEP plus climate change), depths of 0.77m and velocities of 1.51m/s are possible. Areas in the south of the site previously unflooded under a 1% AEP event are inundated under this scenario. Given the significant increase in flood extents, depths and velocities in future, the site can be said to be highly sensitive to increased risk as a result of 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. Under the design event surface water flood, Brockley Road is expected to become inundated, having previously been modelled as dry during a 1% AEP. Flood depths of up to 0.85m and velocities of up to 1.73m/s are expected, resulting in a hazard index of up to 1.58. Under this scenario, 36.1% of the site is expected to be affected by flooding, up from 15.4% under the 1% AEP scenario, suggesting the area is relatively sensitive to climate change. Development proposals at the site must address the potential changes associated with climate change and be designed to be safe for the intended lifetime. The provisions for safe access and egress must also address the potential increase in severity and frequency of flooding.
Requirements for drainage control and impact mitigation	

Broad-scale assessment of possible SuDS	**Geology & Soils**
	
	• Geology at the site consists of:
	  ○ Bedrock Geology - London Clay Formation consisting of clay, silt and sand.
	  ○ Superficial Geology – The site is expected to have glaciofluvial deposits of sand and gravel to the north, and

	alluvial deposits of sand, clay, silt and gravel to the south.
	• Soils at the site consist of:
	  ○ Freely draining slightly acid loamy soils to the north, and loamy and clayey floodplain soils with naturally high groundwater to the south.
	SuDS
	• The site is not considered to be susceptible to groundwater flooding, due to the nature of the local geological conditions. This should be confirmed through additional site investigation work.
	• BGS data indicates that the underlying geology is clay, silt and sand 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 historic landfill, a source protection zone or an Internal Drainage Board (IDB) area.
	• The site is designated in two Nitrate Vulnerable Zones (NVZs)
	  ○ Surface Water - "Surface Water S428 - River Chelmer NVZ"
	  ○ Groundwater - "Groundwater G78 - Sandlings and Chelmsford"
	• The site is also within a Drinking Water Safeguard Zone (SWSGZ1029), meaning it is at risk from nutrients and certain pesticides.
	• 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 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 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.

	• 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 partially within Flood Zones 2 and 3 and is shown to be at significant risk of fluvial flooding in the 3.3% and greater events, therefore the Exception Test is required. The site is also at significant risk from surface water flooding. 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:
	  ○ Mostly within Fluvial Flood Zones 2 and 3
	  ○ Larger than one hectare
	  ○ At risk of flooding from numerous sources (fluvial, 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 in relatively low

	return period events, a Flood Warning and evacuation Plan should be prepared if the site is bought forwards. • 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. • Developers should consult with Chelmsford City Council and the Environment Agency to determine whether any land within the site needs to be safeguarded for improvements to flood defences either as part of the development, or in the future. • 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 brought forwards. With regards to the flood risk portion of the Exception Test, development may be able to proceed if:

- Flood vulnerable uses should be steered away from the southern and lower lying central portion of the site, due to risks from fluvial and surface water flooding.
- 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 include an adequate flood warning and evacuation plan.
- A site-specific FRA demonstrates site users will be safe throughout the lifetime of the development 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 2010 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.