CC010-A

	Chelmsford City Council Level 2 Strategic Flood Risk Assessment Detailed Site Summary Tables
Site details	
Site Code	**GS1v**
Address	Railway sidings
Area	1.01
Current land use	Industrial (Railway sidings)
Proposed land use	Industrial (intensification of existing use)
Flood Risk Vulnerability	Less 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 in the south of the Chelmer (Great Easton - River Can) catchment, which drains 116.2km^2 of land. This catchment is designated as heavily modified.
Topography	LiDAR indicates there is a gentle west to east slope at the site, and so water is likely to flow eastwards across the site. The highest section of the site, located on the northwestern perimeter, is 27.2m AOD, while the lowest area is on the northeast perimeter at 25.9m AOD. A slight depression appears to exist through the middle of the site, along the current access road. There is a railway embankment to the south of the site, with a crest height of 34.5m AOD.
Existing drainage features	There are no visible drainage features on the site, however part of the site is previously developed, and is likely to be drained by the existing surface water drainage network. Surface water drains appear to be present on the site. The River Chelmer flows 10m to the east of the site.
Critical Drainage Area	The site is not located within a critical drainage area.
Fluvial and tidal	**The proportion of site at risk FMFP:** **FZ3 – 0.5%** **FZ2 – 0.5%** **FZ1 – 99.5%** *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 – 0.2%** **1% AEP fluvial event – 0.2%** **0.1% AEP fluvial event – 0.2%**

	Modelled results show the percentage of site at risk from a given AEP flood event. **Available data:** Flood Zones are determined from the Environment Agency's Flood Map for Planning (FMFP). This represents the undefended scenario. The Environment Agency's 1D-2D ISIS-TUFLOW River Chelmer (2018) hydraulic model have been reported as a more accurate representation of the flood risk to this site due to the presence of flood defence structures. **Flood characteristics:** For all modelled scenarios, including climate change simulations, the extent of floodwater remains the same, affecting only 0.2% of the site at the eastern perimeter. The baseline AEP scenarios (3.3%, 1% and 0.1%) estimate maximum flood depths and velocities of 1.6-1.9m and 0.17-0.3m/s, respectively. For all AEPs, this results in a maximum hazard of "Danger for all". The remainder of the site away form the watercourse remains unaffected in all scenarios. The site is not expected to be at risk of tidal flooding.
Surface Water	**Proportion of site at risk (RoFfSW):** **3.3% AEP** – 1.4% Max depth – 0.3-0.6m Max velocity – 0.3-0.5m/s **1% AEP** – 14.1% Max depth – 0.3-0.6m Max velocity – 0.5-1.0m/s **0.1% AEP** – 64.1% Max depth – 0.6-0.9m Max velocity – 1.0-2.0m/s *The % SW extents quoted show the % of the site at surface water risk from that particular event, including the percentage of the site at flood risk at a higher risk zone (e.g. 100-year includes the 30-year %).* The Environment Agency's Risk of Flooding from Surface Water mapping was used in this assessment. **Description of surface water flow paths:** Flooding to the site generally appears to occur in lower lying areas of the site, and flow along the existing cycle path on the northern boundary. In the 3.33% AEP event, flooding is expected to occur along the northern perimeter of the site, along Brook Street Cycle path. In the 1% AEP event flooding on the northern boundary encroaches further on the site, affecting lower lying areas and reaching a maximum depth and velocity of 0.6m and 1.0m/s, respectively. There is also a small section of inundation associated with depression in the south of the site, to a maximum depth and velocity of 0.3m and 0.25 m/s, respectively. The maximum hazard rating of "Danger to most" is found to the northeastern perimeter of the site. In the 0.1% AEP event, extensive flooding is expected on the site. Similar to previous events, this appears to be an expansion

	of flooding along Brook Street and Brook Street Cycle path to the north. In addition, the majority of the eastern half of the site is expected to be flooded, up to the depths and velocities above. A small section of the southwest of the site is also anticipated to experience flooding, with , a maximum hazard rating of "Danger to most" is expected.
Reservoir	The site is not expected to be at risk from reservoir flooding in the dry or wet day scenario.
Groundwater	The JBAs Groundwater Emergence Risk Map, is provided as 5m resolution grid squares. Groundwater levels in the western section of the site are expected to be between 0.025m and 0.5m below the ground surface. Within this zone there is a risk of groundwater flooding to both surface and subsurface assets. There is the possibility of groundwater emerging at the surface locally. The eastern section of the site is shown to have negligible risk of groundwater flooding in this area, and any groundwater flooding incidence has a chance of less than 1% annual probability of occurrence. Within the centre north 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. 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 further through a site-specific flood risk assessment and is likely to require ground investigations to determine the true 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 on the site, associated with the River Chelmer. Essex County Council as LLFA has 1 record of flooding on the site, however the date and source of flooding is unknown.
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 eastern 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	The natural high ground along the River Chelmer is recorded to protect to a 1% AEP flood event, although modelling suggests the standard of protection is higher. The most recent Visual Asset Inspection (05 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 site is not located within a Flood Warning or Flood Alert area. The nearest Flood Warning/Flood Alert area is 5m to the east of the site.
Access and egress	Access and egress to the site by pedestrians and vehicles is via a small road off Brook Street, which can be reached from B1008 to the west. There is also a cycle path to the east. Access to the site is expected to remain possible for all modelled fluvial AEP events and climate change scenarios. For the 3.3% AEP surface water flooding event, the current entrance on Brook Street is expected to be inundated to depths of up to 0.6m and velocities of 0.5m/s, with a hazard of 'Danger to some', and access may be impacted. In the 1% AEP, flood depths of up to 0.6m travelling at up to 2.0m/s at the junction between B1008 and Brook Street are expected, affecting access to the current entrance/exit. For both access points, this corresponds to a "Danger to some", and access may be impacted. In the 0.1% AEP surface water flood event, water depths of up to 0.9m and velocities of over 2.0 m/s are expected at the junction between B1008 and Brook Street, affecting access to the site. This corresponds to a "danger to most". During the design surface water flood event (1% AEP+40% Climate Change - CC), similar depths, velocities and hazards are expected, albeit encroaching further into the central and southern sections of the site. Arrangements for safe access and egress will need to be demonstrated for the design event (1% AEP plus 40% CC), using the depth, velocity, and hazard outputs. Any raising of access routes should not impede surface water flow routes, or increase flood risk elsewhere.
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. In the 1% AEP plus central climate change (+25%) flood, the same extent as all other baseline AEP events is expected. Flood depths of up to 1.8m and velocities of up to 0.2m/s. For the upper scenario (72%), depths of up to 1.9m and velocities of 0.3m/s are possible. Both scenarios generate a to danger to all within their flood extents, including emergency services. Given the minimal increase in depth, velocity and hazard under the above scenarios relative to the original models, the site can be considered insensitive 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. However, due to the proposed development's lower vulnerability than a residential development, it is important to note that this is likely to be a conservative estimate: depending on the design standard of protection of the site, a lower allowance may be suitable. In the design event surface water flood, a large section of the south previously modelled as dry during a 1% AEP is expected to become inundated. Flood depths of up to 0.8m and velocities of up to 1m/s are expected, resulting in a hazard index of danger to most. 57.2% of the site is expected to be affected by flooding, up from 14.1% under the 1% AEP scenario, suggesting the area is highly 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 west of the site is expected to have sedimentary River Terrace Deposits of sand and gravel. The east of the site is likely to consist of alluvial deposits of clay, silt, sand and gravel.
	• Soils at the site consist of:
	  ○ Freely draining slightly acid loamy soils to the west.
	  ○ Loamy and clayey floodplain soils with naturally high groundwater to the east.
	
	SuDS

	• Groundwater levels are indicated to be less than 0.5m below ground level during a 1% AEP event. 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 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 Groundwater Source Protection Zone and there are no restrictions over the use of infiltration techniques with regard to groundwater quality.
	• The site is not located within a historic landfill site.
	• 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 3.33% 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 at significant risk from surface water flooding, although the proposed land use is 'Less Vulnerable'. 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 significant 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	A site-specific Flood Risk Assessment (FRA) is required due to the risk of surface water flooding and the proposed development constituting a change of use to a more vulnerable class (industrial to residential). **Flood Risk Assessment:** • 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. • Climate Change outputs for the 0.1% AEP event for the Chelmer 2018 model could not be produced for this study. At time of writing, the Environment Agency are currently undertaking updates to modelling in this area and developers should consult the Environment Agency to understand the latest available information. If climate change scenarios for the latest allowances for the 0.1% AEP event are not available, developers will need to undertake additional work as part of a site-specific FRA to determine the risk to the site in this scenario. • Ground investigations will be necessary to confirm groundwater risk. This is also likely to impact upon the types of SuDS that are suitable for the site. **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. If safe access/egress cannot be provided in the design event, 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. • 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 majority of the site faces a considerable risk of either surface water, fluvial, groundwater flooding, or all, and is sensitive to climate change impacts in terms of surface water. Therefore, careful consideration will need to be given to these issues if the site is to be brought forward. The Exception Test will need to be passed before the site development 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 are likely to require additional protection measures, beyond relocating them to a specific area of the site, due to the numerous overlapping sources of flood risk to the site.
- Safe access and egress can be demonstrated in the surface water 1% AEP and 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. If safe access and egress cannot be provided, an adequate flood warning and evacuation plan should be prepared.
- 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, such as the centre and southern border.
- Ground investigations will be necessary to confirm groundwater risk. This is also likely to impact upon the types of SuDS that are suitable for the site.
- 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 (2018) 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.
Climate change	The River Chelmer (2018) Environment Agency model has been used in this assessment.
Fluvial and tidal extents, depth, velocity and hazard mapping	The central and upper end allowances were available for the River Chelmer (2018) hydraulic model to indicate the impacts on fluvial flood risk.
Surface Water	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.
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.