Uttlesford District Council
Level 2 Strategic Flood Risk Assessment
Detailed Site Summary Table

Site details	
Site Code	**Takeley C**
Address	North Takeley Street
Area	27.34ha
Current land use	Agricultural Land
Proposed land use	Employment
Flood Risk Vulnerability	Less Vulnerable
Sources of flood risk	
Location of the site within the catchment	The site is located to the west of the Pincey Brook, in the very north of its catchment, to the west of Takeley. It is bounded by the A120 (also known as Thremhall Avenue) to the north, agricultural land to the east, the B1256 (also known as Dunmow Road) to the south and Priory Wood to the west. The eastern boundary is located approximately 550m away from the Main River, Pincey Brook.
Topography	The ground has a maximum elevation of 180m AOD. The boundary of each field has an elevation of a minimum of 75m AOD, mostly on the site boundary. Running from north to south, in the centre of the site there are two depressed channels which are Ordinary Watercourses.
Existing drainage features	There is an Ordinary Watercourse, called the Shermore Brook, which flows north to south bisecting the site, from the northern site boundary, under Dunmow Road and continues south through Hatfield Forest and into the Pincey Brook approximately 2.8km downstream. Another parallel depression is present in the ground terrain data slightly to the east, from the northern boundary to Taylor's Farm, which in some OS mapping (OpenMap Local Raster) is shown to be an Ordinary Watercourse (but not present in other mapping sources e.g. Open Street Map), with a footpath in the same alignment, around the perimeter of Taylor's Farm.
Fluvial and tidal	**The proportion of site at risk FMFP:** FZ3 – 0% FZ2 – 0% FZ1 – 100% **Fluvial model outputs:** 3.3% AEP fluvial event – N/A 1% AEP fluvial event – N/A 0.1% AEP fluvial event – N/A **Available data:**

	The EA Flood Map for Planning Rivers and Sea Flood Zone shows available data for tidal flood risk and fluvial flood risk of Main Rivers. However, there is no available data for Ordinary watercourses with catchments smaller than 3km2, therefore the Risk of Flooding from Surface Water dataset has been used as a proxy to infer risk. It is recommended that developers investigate the risk from the Ordinary Watercourses as part of a site-specific FRA, which may require a new localised hydraulic model to confirm the risk to the site. **Flood characteristics:** The EA's Flood Map for Flood Zones indicates that the site is not at risk from fluvial flooding. However, this is only the case because it does not model or map catchments smaller than 3km2, and the sources of the Ordinary Watercourses start at the site's northern boundary. Two Ordinary Watercourses flow through the centre of the site from north to south. As a result, the surface water flood risk 1-in30, 1-in-100 and 1-in-1,000 return period events have been used as a proxy for fluvial flooding to infer risk. Both of the Ordinary Watercourses have a steep elevation of up to 227mAOD to the east of the watercourse and so if fluvial flooding were to occur, it is likely this would be pushed to the west of the watercourses. As the sources start along the site's northern boundary, it is likely risk will be fairly confined along the watercourse. Depths of surface water flooding (and hence potential out of bank fluvial floodplain depths) are outlined in the surface water section below. Additionally, the Ordinary Watercourse that runs along part of the southern boundary has a steep elevation of up to 240mAOD to the south of the watercourse. Therefore, if fluvial flooding occurred then this would likely spill into the site. It is recommended that developers investigate the risk from the Ordinary Watercourses, and indeed their exact alignment where it is unclear in OS mapping, as part of a site-specific FRA, which may require a new localised hydraulic model to confirm the risk to the site.
Surface Water	**Proportion of site at risk (RoFfSW):** **3.3% AEP** – 2.9% Max depth – 0.60-0.90 Max velocity – 0.25-0.50m/s **1% AEP** – 4.6% Max depth – 0.90-1.20m Max velocity – 0.50-1.00m/s **0.1% AEP** – 11.7% Max depth – >1.20m Max velocity – 1.00-2.00m/s **Available data:** The Environment Agency's Risk of Flooding from Surface Water (ROFfSW) map has been used within this assessment. **Description of surface water flow paths:**

	ROFfSW mapping shows flow paths generated on the site within the 3.3%, 1% and 0.1% AEP events. For all AEPs, the majority of mapped surface water flood risk aligns with the courses of the Ordinary Watercourses in the southern central portion of the site. The maximum flood depth is predicted to reach >1.20m where the Ordinary Watercourse meets the B1256, reducing to between 0.00 – 0.15m towards the centre of the site. This flow path is flowing in a southerly direction into Pincey Brook. The extents appear conservatively wide in this area considering the narrow floodplain of the Ordinary Watercourse, suggesting a large topographic depression for the water to pond in, and that a refinement may be possible with more detailed modelling. The west, north and east of the site are largely free from surface water risk. For the 3.3% AEP, a circular area of ponding forms in the centre of the southern boundary, just west of Taylor's Farm where the Ordinary Watercourse meets the B1256. Flood depths in the flow paths remain deep (up to 0.90m) with medium a velocity (0.25 – 0.50 m/s). For the 1% AEP event, the extent of surface water flooding increases slightly in the south of the site, with a few additional spots of ponding in the centre of the site. Flood depths reach up to 1.20m, and velocities reach up to 1.00 – 2.00m/s. For the 0.1% AEP event, the extent of the flow path has significantly increased, incorporating the ponding in previous AEP events and spreading further into the central portion of the site and along the south-western boundary. The flow path is deep at the confluence of the ordinary watercourse and the B1256, with approximate depths of >1.20m and velocities reach between 0.00 – 2.00m/s.
Reservoir	This site is not shown to be at risk of reservoir flooding from either the dry or wet day extents.
Groundwater	The site is not considered to be susceptible to groundwater emergence flooding, due to the nature of the local geological conditions. This should be confirmed through additional site investigation work.
Sewers	According to the Thames Water Flood Data, there are no incidents of sewer flooding in the CM24 1 postcode area. The site is located within the Thames sewer catchment. While Uttlesford is not identified as a flood priority catchment in Thames Water's Drainage and Wastewater Management Plan (DWMP), developers should consult Thames Water as part of any development proposal to ensure development does not exacerbate existing issues and maximise opportunities for development to deliver benefits to Thames Water's strategic aims.
Flood history	The EA Historic Flooding Map shows that the site has not previously been affected by fluvial flooding from Main Rivers. The nearest EA historic flood extent is located approximately 2.3km south of the site, and relates to flooding from the Pincey Brook in 1947, due to the channel capacity being exceeded. Historic flooding data provided by Essex County Council also showed no historic flood incidents for this site. There are no published Section 19 Flood Investigations for Takeley and no Parish Flood Risk Survey information.
Flood risk management infrastructure	

Defences	The site is not currently protected by any formal flood defences.
Residual risk	There are approximately five culverts present on the site, with more downstream of the Ordinary Watercourses. The Ordinary Watercourses across the site are flowing in a southerly direction and so if downstream culverts were to become blocked then water could back up and flood the southern part of the site. It is recommended that the residual risk to the site of a blockage to this culvert is assessed within a detailed hydraulic model, as part of a site-specific FRA.
Emergency planning	
Flood warning	The site is not covered by the Environment Agency's Flood Warning Service, nor the Flood Alert Service.
Access and egress	Currently, vehicular access and egress to and from the site is from the B1256 Dunmow Road, halfway along the southern boundary by Taylor's Farm (it may be that other access points are proposed in future Master planning). In the 0.1% surface water AEP event, there is a risk of surface water flooding in this area to a maximum depth of 0.15m. The maximum velocity is 0.50-1.00m/s which could impede access and egress. In the 3.3% and 1% AEP events, there are isolated pockets or stretches of flooding along the B1256 east and west of the site, with the main risk between the Shermore Brook and Taylor's Farm. This has a maximum depth and velocity of 1.20m and 1.00m/s respectively. This has a hazard score of 'Danger to All'. The 3.3% and 1% SW+CC model shows the same isolated pockets along the B1256 with a maximum depth and velocity of 1.24m and 1.38m/s. This has a hazard score of 'Danger to All' and not conducive to safe access and egress. Consideration will be needed for where the site is bisected by the Ordinary Watercourses, in terms of how people may access different parts of the site should flood waters create isolated 'parcels', but it is recommended that all access is directed south the B1256.
Dry Islands	The site is not located on a dry island.
Climate change	
Implications for the site	**Management Catchment:** Roding, Beam and Ingleburn **Fluvial:** The site is located in Flood Zone 1 and there is no detailed model coverage to assess the impacts of climate change on fluvial risk. However, there are Ordinary Watercourses on the site, and the ROFfSW mapping can provide an indication on fluvial flooding with climate change. However, it is recommended that a detailed hydraulic model of the Ordinary Watercourses on the site is developed as part of a site-specific FRA, with climate change allowances modelled to confirm risk. The 1% AEP ROFfSW extent has been used as a proxy for the 3.3% AEP + climate change fluvial event. The ROFfSW mapping shows a slight difference in flood extent between the 3.3% and 1% AEP events, which

	suggests that climate change is not expected to have a significant impact on the extent of flooding from the Ordinary Watercourse during a 3.3% AEP event. The 0.1% ROFfSW AEP extent has been used as a proxy for the 1% AEP + climate change fluvial event. The increase in flood extent in the ROFfSW mapping indicates that climate change may increase the extent of fluvial flooding in the south of the site. **Surface Water:** The 3.3% SW+CC AEP model is similar in extent to the 1% surface water with no climate change AEP event. However, depths and velocities are more similar to the 3.3% AEP event, at 1.00m and 0.67m/s respectively. The 1% SW+CC AEP model is similar in depth and velocity to the 3.3% surface water and no climate change AEP event. The maximum depth and velocity of this flooding is 1.18m and 0.78m/s respectively, meaning it is a 'hazard for some'. This shows that the site is not very vulnerable to the impacts of climate change. Development proposals at the site must address the potential changes associated with climate change and be designed to be safe for the intended lifetime. The provisions for safe access and egress must also address the potential increase in severity and frequency of flooding.
Requirements for surface water drainage and integrated flood risk management	

Broad-scale assessment of potential SuDS	**Geology & Soils**
	• The bedrock geology is 'London Clay Formation – clay, silt and sand'.
	  ○ Relatively impermeable, improved slightly by the presence of sand and flint gravel.
	
	• The superficial deposit is 'Lowestoft Formation – Diamicton' which is composed of sheets of chalky till, with outwash sands and gravels, silts and clays.
	  ○ This mixture of characteristics means that the drainage of the area will vary. Sands, gravel and chalk facilitate water permeation; however, silts and clays make the ground impermeable.
	  ○ The composition of these soils will influence the drainage of the site.
	
	Sustainable Drainage Systems (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 London Clay Formation, overlain with superficial deposits of Lowestoft Formation Diamicton and is likely to have varying drainage. Any proposed use of infiltration should be supported by infiltration testing. Off-site discharge in accordance with the SuDS hierarchy is required to discharge surface water runoff.
	• The site is not located within a historic landfill site.
	• Use of infiltration SuDS not appropriate if the site is located on contaminated ground.
	• Surface water discharge rates should not exceed the existing greenfield runoff rates for the site. Opportunities to further reduce

	discharge rates should be considered and agreed with the LLFA. It may be possible to reduce site runoff by maximising the permeable surfaces on site using a combination of permeable surfacing and soft landscaping techniques. • The ROFfSW mapping indicates the presence of surface water flow paths on the site during the 3.3%, 1% 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. • 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.
Opportunities for wider sustainability benefits and integrated flood risk management	• The use of Natural Flood Resilience (NFM) measures on the Ordinary Watercourses which affect the site should be investigated, where suitable, to manage runoff and help mitigate flood events downstream in Takeley and the wider Pincey Brook catchment. • Opportunities should be taken to open (or 'daylight') the culverted ordinary watercourse beyond the south west boundary of the site, to enhance biodiversity and reduce the risk of blockage to the structure. • Opportunities for using source control SuDS to manage runoff rates and volumes, contributing to the reduction of flood peaks on the Ordinary Watercourses on the site and the Pincey Brook downstream, as well as existing surface water flow paths leaving the site. • Waterside areas, or areas along known flow routes, can act as blue green infrastructure, being used for recreation, amenity, and environmental purposes, allowing the preservation of flow routes and flood storage, and at the same time providing valuable social and environmental benefits contributing to other sustainability objectives.

NPPF and planning implications	
Exception Test requirements	The Local Authority will need to confirm that the Sequential Test has been carried out in line with national guidelines. The Exception Test is not required for this development as the site is classified as 'Less Vulnerable' (Employment and not present in the Flood Zones). However, there is still fluvial flood risk from the Ordinary Watercourses which needs to be investigated in more detail and confirmed in a FRA.

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:
	  ○ Greater than one hectare
	  ○ At risk from Ordinary Watercourses through the site
	  ○ At risk of other sources of flooding (surface water)
	• All sources of flooding should be considered as part of a site-specific FRA.
	• Consultation with the Local Authority, Lead Local Flood Authority, Water Company, 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); Uttlesford District Council's Local Plan Policies and Essex County Council's SuDS Guidance.
	• The development should be designed with mitigation measures in place where required.
	• Detailed modelling will be required to confirm Flood Zone and climate change extents for the Ordinary Watercourses at the site as part of a site-specific FRA, to determine the flood extents, climate change and flood 1 in 1000-year flood level (0.1% AEP) The Environment Agency and LLFA should be consulted at the time of the flood risk assessment. They will advise as to whether existing detailed models are available, and if so, whether they need to be updated.Climate change should be assessed using recommended climate change allowances at the time of the assessment (Flood risk assessments: climate change allowances - GOV.UK (www.gov.uk)) for the type of development and level of risk. The current allowances were published in May 2022 but may be subject to change in the future.
	• Blockage scenario modelling should be conducted to assess the residual risk associated with potential blockage of the small culverts on the unnamed Ordinary Watercourses.
	• Trash screens on culverts downstream of sites can build up with debris and increase flood risk. Additionally, Parish Councils can seek access improvements for trash screens and the ownership of the screen may be unknown.
	• If any culverts or flood risk infrastructure are found to be under the required conditions, then the new development must not compromise assets downstream, and if there is scope, then improvements should be sought to bring the assets up to condition.
	
	Compensatory flood storage should be provided where development is proposed within the 1 in 100-year (1% AEP) flood extent, including an appropriate allowance for climate change. Ideally, proposed developments

should have a net gain of floodplain storage to reduce the risk of flooding, on site and elsewhere.

Guidance for site design and making development safe:

- The developer will need to show, through an FRA, that future users of the development will not be placed in danger from flood hazards throughout its lifetime. It is for the applicant to show that the development meets the objectives of the NPPF's policy on flood risk. For example, how the operation of any mitigation measures can be safeguarded and maintained effectively through the lifetime of the development. (Para 048 Flood Risk and Coastal Change PPG).
- The risk from surface water flow routes should be quantified as part of a site-specific FRA, including a drainage strategy, so runoff magnitudes from the development are not increased by development across any ephemeral surface water flow routes. A drainage strategy should help inform site layout and design to ensure runoff rates are as close as possible to greenfield rates.
- Planning permission is required to surface more than 5 square metres of unpaved ground using a material that cannot absorb water.
- Arrangements for safe access and egress will need to be demonstrated for the 1% AEP surface water event with an appropriate allowance for climate change, using the depth, velocity, and hazard outputs. As safe access and egress may not be possible to the south of the site during a 1% surface water event, if this is the preferred access route for the site, a Flood Warning and Evacuation Plan will be required.
- 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.
    - set finished floor levels to 300mm above the 1% AEP flood level, including an appropriate allowance for climate change.
    - include property 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 300mm above the estimated flood level.
    - making sure any doors, windows or other openings are flood resistant to at least 300mm above the estimated flood level.
    - raising all sensitive electrical equipment, wiring and sockets to at least 300mm above the estimated flood level.
    - The EA advises that minimum flood floor level for 'More Vulnerable' development such as residential properties should be set 600mm above the 1% AEP fluvial plus climate change peak flood level, where the appropriate new climate change allowances have been used. Therefore, if the vulnerability of the site increases then the minimum flood floor level would have to increase.

Key messages

Development is likely to be able to proceed if:

- Fluvial flood risk is confirmed through hydraulic modelling in a site-specific FRA, and development is steered away from the areas of fluvial and surface water flooding in the site.
- Surface water flow paths and areas of surface water ponding should be 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 plus climate change events. This includes measures to reduce flood risk along these routes such as raising access, but not displacing floodwater elsewhere. Consideration needs to be given to the site being bisected by Ordinary Watercourses, which may impede safe access/ egress from certain parts of the site.
- 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	
Flood Zones	Flood Zones 2 and 3 have been taken from the EA Flood Map for Planning mapping. As the risk of fluvial flooding from Ordinary Watercourses on the site is not represented in the Flood Map for Planning, the ROFfSW mapping has been used as a proxy dataset and identifies fluvial flood risk at the southeastern and southern boundaries of the site.
Climate change	A detailed fluvial hydraulic model is not available for this site, and therefore the impacts of climate change cannot be assessed in detail. Instead, the ROFfSW mapping has been used as a proxy for fluvial and surface water flooding in the 3.3% AEP + climate change and the 1% AEP + climate change events.
Fluvial depth, velocity and hazard mapping	Depth, velocity, and hazard data was derived from the EA ROFfSW mapping, in the absence of a detailed fluvial hydraulic model.
Surface Water	The EA ROFfSW dataset has been used for this assessment. 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 EA ROFfSW mapping.
Groundwater	Groundwater data was derived from JBA's Groundwater Emergence maps.
Sewer	Uttlesford's sewers are managed by both Thames Water (for catchments flowing south) and Anglian Water (for catchments flowing north). Data for sewer flooding was provided by Thames Water. Sewer flooding data was requested from Anglian Water but not received within the study timeframe.
Reservoir	The EA 'Dry Day' and 'Wet Day' Reservoir flood maps have been used in this assessment.