Greater Norwich Level 2 Strategic Flood Risk Assessment Detailed Site Summary Tables	

Site details

Site Code	**CC07**
Address/ Grid Ref.	Land at Hobrough Lane, King Street. *Includes 125-129 King Street, 8 dwellings and 131-133 King Street and Hoburgh Lane, 12 dwellings* / 623594,308150
Area	0.35 hectares
Current land use	Brownfield
Proposed land use	Mixed use

Sources of flood risk

Location of site within catchment	The site is in the south east area of the River Wensum catchment. The River Wensum is an Environment Agency designated main river and flows in a southerly direction past the site, gradually bending eastwards and flowing towards its confluence with the River Yare.
Existing drainage features	The site is located on the edge of the River Wensum. The river has been artificially modified through Norwich and the banks of the river have been enforced with steel and concrete. There are no additional watercourses within the site boundary or in close proximity to the site.
Fluvial	**Proportion of site at risk:** **FZ3b –** 1% **FZ3a –** 2% **FZ2 –** 19% **FZ1 –** 81% *The % Flood Zones quoted show the % 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, e.g. FZ2 includes the FZ3 %. FZ1 is the remaining area outside FZ2 (FZ2 + FZ1 = 100%).* **Available data:** Modelling has been completed for the River Wensum using TUFLOW. Both defended and undefended scenarios have been modelled and the defended scenarios have been used to assess the risk of flooding to the site. Limitations of the modelling are summarised in the Mapping Information section at the end of this table. Further modelling was undertaken to apply recent climate change uplifts to the fluvial model of the Wensum. **Flood characteristics:** For the 5% AEP and 1% AEP fluvial flood events, flooding from the River Wensum occurs along the eastern boundary of the site to depths below 0.4m. The modelled flood hazard here is 'Low- Caution' for the 5% AEP event and 'Moderate- Dangerous for some people' for the 1% AEP event. During the 0.1% AEP event, flooding extends further onto the site. Depths remain below 0.4m except along the eastern boundary which experiences depths up to 1m. The flood hazard risk increases to 'Significant- Dangerous for most'.
Coastal and Tidal	The site is not at risk from coastal or tidal flooding.
Surface Water	**Proportion of site at risk (RoFfSW):** **3.3% AEP** – 0% **1% AEP** – 0% **0.1% AEP** – 1% Max depth <0.3m Max velocity >0.25m

	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. 1% AEP includes the 3.3% AEP %) **Description of surface water flow paths:** The site is at Very Low risk of surface water flooding, meaning each year the chance of flooding is less than 0.1%. There is a risk of flooding to depths below 0.3m during the 0.1% AEP event on the Old Barge Yard footpath along the northern boundary of the site and on King Street in front of the site. The modelled hazard rating for these areas is 'Low- Caution'.
Reservoir	The site is not shown to be at risk of reservoir flooding from the available online maps.
Groundwater	The Environment Agency Areas Susceptible to Groundwater Flooding dataset, provided as 1km grid squares, shows the susceptibility of an area to groundwater flood emergence. The following comments can be made about groundwater flood risk: • The entire site has a >= 50% <75% susceptibility to groundwater flood emergence. This assessment does not negate the requirement that an appropriate assessment of the groundwater regime should be carried out at the site-specific FRA stage.
Flood history	The Environment Agency's historic flooding and recorded flood outlines dataset has a record of flooding on the site. The source of flooding was attributed to the River Wensum and flooding occurred in 1912. The site is not located in a postcode that was identified as having previously experienced sewer flooding in the Level 1 SFRA.
Flood risk management infrastructure	
Defences	This site is not protected by any formal flood defences.
Residual risk	There is no residual risk to the site from flood risk management structures.
Emergency planning	
Flood warning	The eastern part of the site is in the 'River Wensum from New Costessey to Thorpe Bridge at Norwich' Flood Alert Area and 'The River Wensum, through Norwich' Flood Warning Area.
Access and egress	The main point of access and egress is on the west of the site from King Street. It may also be possible to access the site from Hobrough Lane which runs along the southern boundary of the site from King Street. Both of these points are unlikely to be impacted during a fluvial flood event as flood risk is modelled to only affect the eastern part of the site. Access is likely to remain unaffected in the future even in the most extreme scenario (0.1% AEP plus the Upper End (+65%). As part of the site is in Future Flood Zone 2 however, a Flood Warning and Evacuation plan should be in place. In terms of surface water flood risk, there is a risk of flooding on King Street in front of the site. However, depths remain below 0.3m for the 0.1% AEP event and the hazard risk is 'Low- Caution' so it is unlikely to significantly impact access and egress.
Dry islands	The site is not located on a dry island.
Climate change	
Implications for the site	• The site is sensitive to increased fluvial flows in the River Wensum resulting from climate change. • The eastern end of the site is in future Functional Flood Zone 3b, which is the 5% AEP plus Upper End (65%) climate change scenario. This results in flooding of depths up to 0.8m and a flood hazard rating of 'Significant- Dangerous for most'. This scenario presents a significant increase in risk to the site as during the present day 5% AEP flood event, the flooding is confined to the boundary with the site itself not at risk of flooding. • The eastern end of the site is in future Flood Zone 3a, which isthe 1% AEP plus the Upper End (65%) scenario. Flood depths in this scenario reach up to 1.2m and have a flood hazard rating of 'Extreme- Dangerous for all'. Even for the less severe climate change scenarios the increased risk is apparent. The 1% AEP plus the Central (25%) climate change scenario results in flooding of the east end of the site with depths mainly between 0.1m and 0.4m, rising to 0.8m along the boundary. During this scenario, the flood hazard rating is mainly low with the 'Caution' rating, however around the eastern boundary of the site it increases to significant meaning 'Dangerous

	for most'. This scenario presents a significant increase in risk to the site as during the present day 1% AEP flood event, flooding only occurs along the boundary of the site. • A significant area of the site is in future Flood Zone 2, which is the 0.1% AEP plus the Upper End (+65%) climate change scenario. This results in flooding across nearly half of the site with depths up to 1.8m and a hazard rating of 'Dangerous for most'. Where the highest depths are along the east boundary of the site, the flood hazard is the most extreme rating of 'Dangerous for all'. • In terms of surface water flood risk, the modelled 1% AEP event plus 40% climate change does not show a significant increase in surface water flooding on the site. **Proportions of the site in Future Flood Zones can be found in Table 6-2 of the Greater Norwich Level 2 SFRA Report**
Requirements for drainage control and impact mitigation	

Broad scale assessment of possible SuDS	**Geology & Soils**
	• Geology at the site consists of:
	  ○ Bedrock – Lewes Nodular Chalk Formation, Seaford Chalk Formation, Newhaven Chalk Formation, Culver Chalk Formation, Portsdown Chalk Formation (undifferentiated) – Chalk.
	  ○ Superficial – Alluvium (Clay, Silt, Sand and Gravel).
	SuDS
	• Most source control techniques are likely to be suitable. Mapping suggests that permeable paving may have to use non-infiltrating systems given the possible risk both to and from groundwater.
	• Infiltration may be suitable. Mapping suggests a medium risk of groundwater flooding and underlying soils may be permeable. Further site investigation should be carried out to assess potential for drainage by infiltration. If infiltration is suitable it should be avoided in areas where the depth to the water table is <1m. As the site is located within a Source Protection Zone, infiltration techniques should only be used where there are suitable levels of treatment although it is possible that infiltration may not be permitted. Additionally, proposed SuDS should be discussed with relevant stakeholders (LPA, LLFA and EA) at an early stage to understand possible constraints.
	• Detention may be feasible provided site slopes are <5% at the location of the detention feature. If the site has contamination or groundwater issues, a liner will be required.
	• Filtration techniques are probably suitable provided site slopes are <5% and the depth to the water table is >1m. If the site has contamination or groundwater issues, a liner will be required.
	• All forms of conveyance are likely to be suitable. Where the slopes are >5% features should follow contours or utilise check dams to slow flows. If the site has contamination or groundwater issues, a liner will be required.
	• Developers should investigate and consider in full all Suds options and demonstrate that SuDS are not appropriate where they are not implemented.
	• The site is not designated by the Environment Agency as previously being a landfill site.
	• Given the highly constrained nature of the site, a carefully considered and integrated flood resilience and sustainable drainage design suitable for the urban setting should be considered. For example, the use of rainwater harvesting and floodable areas at the ground flood level (for example outdoor open storage areas/ rain gardens that are usually dry) should be integrated into the overall design of the development.

Opportunities for wider sustainability benefits and integrated flood risk management	• Due to the size of the site, there is likely to be limited space for green infrastructure. It is recommended that areas of hard paving are designed to ensure that flood water can be stored during a flood event alongside the use of green features such as rain gardens and tree pits. • A resilient approach to urban design should be taken. Habitable floor levels must be above the 1% AEP flood level taking into account climate change upper end scenario with an allowance for freeboard.
NPPF and planning implications	

Exception Test requirements	• The Local Authority will need to confirm that the sequential test has been carried out. The Sequential Test will need to be passed before the Exception Test is applied. • Residential development is classified as 'More Vulnerable' and commercial is classed as 'Less Vulnerable'. As the site is mostly covered by Flood Zone 1 with just a small amount in Flood Zone 2, the Exception Test is not required for the site. • Part of the site however is in Future Flood Zone 3 and it is recommended that a precautionary approach is taken and the Exception Test is applied.
Requirements and guidance for site-specific Flood Risk Assessment	**Flood Risk Assessment:** • At the planning application stage, a site-specific Flood Risk Assessment will be required as part of the development is located in Flood Zone 2. • All sources of flooding, particularly the risk of fluvial and surface water should be considered as part of a site-specific flood risk assessment. • The site-specific FRA should be carried out in line with the National Planning Policy Framework; Flood Risk and Coastal Change Planning Practice Guidance, Norwich City Council's Local Plan policies, and the Norfolk County Council Lead Local Flood Authority's Statutory Consultee for Planning Guidance Document. • Consultation with the Local Authority, Lead Local Flood Authority and the Environment Agency should be undertaken at an early stage. • The development should be designed to ensure that mitigation measures are in place to ensure the development does not flood, or that ground level space is used for less vulnerable parts of the development. **Guidance for site design and making development safe:** • Flood resilient design is essential for this highly constrained urban site: • A resilient approach to urban design should be taken. Habitable floor levels must be above the 1% AEP flood level taking into account climate change (upper end scenario) with an allowance for freeboard- approximately 1.5m above ground level. • 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). • Safe access and egress will need to be demonstrated in the 1 in 0.1% AEP plus climate change fluvial and rainfall events, using the depth, velocity and hazard outputs, supported by a Flood Warning and Evacuation plan. Ideally, the access route should be situated 300mm above the designed flood level and waterproofing techniques should be used where necessary. Raising of access routes must 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. Alternatively, the risk could be managed through the inclusion of higher refuge and a Flood Response Plan that meets the requirements of the Local Council and their Emergency Planner. • Compensatory flood storage is required for any land raising and all proposed buildings (unless they are left open and allowed to accept flows) whenever there is built development on land within the 1% +35% climate change flood extent. This will more challenging given the majority of the site is in Future Flood Zone 3. • Due to the highly constrained nature of the site, resilience measures will be required if buildings are situated in the flood risk area. Due to the significant depths of flooding on the site and its proximity to the River Wensum, it is suggested that a water entry strategy is used for the site (i.e. measures to reduce flood damage once water gets inside rather than trying to keep the water out). • The risk from surface water flow routes should be quantified as part of a site-specific FRA, including a drainage strategy, to ensure that runoff from the development is not increased by development across any ephemeral surface water flow routes. A drainage strategy should help inform site layout and design to ensure there is no increase in runoff beyond current greenfield rates. • Areas at risk from surface water flooding should ideally be integrated into green infrastructure, which presents wider opportunities to improve biodiversity and amenity as well as climate change adaptation. An integrated flood risk management and sustainable drainage scheme for the site is advised. It is essential that a detailed model of surface water flooding, using the existing drainage system, topographical and asset survey is constructed at the FRA stage. This will determine the risk from surface water flooding further and to ensure that overland flows do not overwhelm future sustainable drainage features.

	• Brownfield sites should discharge surface water at the original pre-development (greenfield) runoff rate. If this is not possible, a significant reduction in the current rate of discharge should be achieved and agreed with the relevant drainage body (LLFA). • Developers should refer to Norfolk County Council's 'Norfolk County Council Lead Local Flood Authority Statutory Consultee for Planning Guidance Document' and the Level 1 SFRA for information on SuDS for guidance on the information required by the LLFA from applicants to enable it to provide responses to planning applications.

Key messages

The flood risk element of the Exception Test is likely to be passed if:

- A carefully considered and integrated flood resilient and sustainable drainage design is put forward, with habitable floor levels above the fluvial design flood event (1% AEP) taking into account climate change, approximately 1.5m.
- If flood mitigation measures are implemented then they are tested to ensure 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).
- Space for surface water to be stored on the site is provided and rainwater harvesting should be considered.
- Brownfield sites should discharge surface water at the original pre-development (greenfield) runoff rate. If this is not possible, a significant reduction in the current rate of discharge should be achieved and agreed with the relevant drainage body (LLFA, IDB or Anglian Water).
- Safe access and egress routes must not be in the areas of high surface water risk or the 1% AEP fluvial design flood event (taking into account climate change). The main site access point would be from King Street to the west.
- A Flood Warning and Evacuation Plan should be prepared for the site.

Mapping Information

The key datasets used to make planning recommendations regarding this site were the broadscale 2D modelling outputs from the Environment Agency's Flood Map for Planning, River Wensum Flood Model and the Risk of Flooding from Surface Water map. 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. Flood Zone 3b was produced for the Level 1 SFRA.
Climate change	Climate change allowances (for the 2080s) were modelled as part of Level 2 SFRA. This included Central (+25%), Higher central (+35%) and Upper end (+65%).
Fluvial depth, velocity and hazard mapping	Fluvial depth and hazard mapping has been taken from the River Wensum model for present day, and for future flood zones this was modelling produced for the Level 2 SFRA. This should be explored further at site-specific stage.
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 and hazard mapping for the 1 in 1% AEP event is taken Environment Agency's Risk of Flooding from Surface Water mapping.