South Norfolk Council Level 2 Strategic Flood Risk Assessment Detailed Site Summary Tables

Site details

Site Code	**SN0242 & SN0017SL / VCASH1**
Address	Land west of New Road, Ashwellthorpe TM 13289 97424
Area	0.89 ha
Current land use	Greenfield
Proposed land use	Residential

Sources of flood risk

Location of the site within the catchment	The site is in the catchment of the River Tiffey. The River Tiffey rises at Ashwellthorpe and flows northwest towards Wymondham to its confluence with the Bays River from which point it is designated a Main River. It then flows in a northeast direction towards its tributary with the River Yare to the north of Great Melton. The River Yare then continues eastwards until it reaches the North Sea at Great Yarmouth.
Existing drainage features	The site is located approximately 115 metres east of the River Tiffey (an ordinary watercourse at this location), which flows north, parallel to New Road and then under Wymondham Road. The River Tiffey is designated by the Environment Agency as a heavily modified watercourse. Online imagery suggests there are also a number of drainage ditches in the area, with one along the field boundary to the south.
Fluvial	**The proportion of site at risk:** **FZ3b – 0%** **FZ3a – 0%** **FZ2 – 0%** **FZ1 – 100%** *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:** The Environment Agency's Flood Zone mapping has been used in this assessment. **Flood characteristics:** The site is not currently at risk of flooding from fluvial sources. There is an ordinary watercourse to the west of the site, which is not modelled as part of the Environment Agency's Flood Zone mapping but is discussed below in the surface water flood risk section.
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** – 1% Max depth 0.15 – 0.30m Max velocity 0.25 – 0.50m/s **1% AEP** – 1% Max depth 0.15 – 0.30m Max velocity 0.50 – 1.00m/s

	0.1% AEP – 5% Max depth 0.15 – 0.30m Max velocity 1.00 – 2.00m/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 %)* **Description of surface water flow paths:** The site is predicted to be affected by surface water flooding in all modelled events. In the 3.3% AEP event, predicted surface water flooding is limited to a small area of pooling in the northwest corner of the site. The site slopes downhill from southeast to northwest with this being the lowest corner of the site. Flood depths are shown to be up to 0.30m with a 'Very Low Hazard'. In the 1% AEP event, the predicted surface water ponding in the northwest corner of the site extends slightly east with flood depths still up to 0.30m. There is also a flow path flowing west to the south of the site along a drainage ditch which encroaches slightly onto the southern boundary during the 1% AEP event, with flood depths on the site of up to 0.30m. Both the northwest ponding and southern boundary flow path are classified as 'Very Low Hazard'. In the 0.1% AEP event, the predicted surface water ponding in the northwest of the site becomes part of the large flow path flowing north along the west of the site. The flow path extends east along the northern boundary of the site with flood depths up to 0.30m and is classified predominantly as 'Very Low Hazard' with a small area in the northwest classified as 'Danger for some'. The flow path to the south of the site also extends further north with depths of up to 0.30m. It is predominantly classified as 'Very Low Hazard' on the site with 'Danger for some' in a couple of areas along the southern site boundary.
Reservoir	The site is not shown to be at risk from reservoir flooding from available online maps.
Groundwater	No groundwater flooding information was available at this site. Further investigations should be undertaken as part of a site-specific flood risk assessment to determine whether there is a risk to the site from groundwater.
Sewers	The site is located within a postcode shown to have two recorded instances of sewer flooding in the past.
Flood history	The Environment Agency's historic flooding and recorded flood outlines dataset have no record of flooding on the site.
Flood risk management infrastructure	
Defences	The 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 site is not located within any of the Environment Agency's flood warning areas.
Access and egress	The site is only accessible from the east of the site, from New Road. Access to the site along New Road is affected to both the north and the south of the site during the 0.1% AEP surface water flood event. Depths along New Road are up to 0.60m in the 0.1% AEP flood event with flows classified as a 'Danger for most' in areas to both the north and south of the site. The depths, velocities, hazards, durations and speeds of onset of surface water along access/egress routes should be investigated further in a site-specific assessment, to confirm whether access for emergency vehicles could still be obtained. As surface water events are typically flashy and short-lived, it is likely that access to the site will only be affected for a short period of time. If safe access and egress cannot be demonstrated in the 0.1% AEP event, a Flood Warning and Evacuation Plan should be prepared for the site, with a policy of shelter in situ likely to be appropriate.

Climate change

Implications for the site	• The present day 0.1% AEP surface water flooding extent provides an indication of the likely increase in extent of the more frequent surface water events. There is not a significant increase in the risk from surface water flooding on the site between the 1% and 0.1% AEP surface water events, suggesting that the site is less sensitive to the impacts of climate change. This would require a detailed Flood Risk Assessment to assess the site layout and design. In addition to the SuDs features designed to accommodate runoff from new development infrastructure the proposals should also address the potential loss of natural storage of rainfall and runoff provided by the land in its natural condition. • Developers should consider SuDS strategies to reduce the impacts of climate change from surface water in a detailed site-specific Flood Risk Assessment . • Currently, no model data is available for the ordinary watercourse (River Tiffey) which flows to the west of the site. This should be modelled as part of a site-specific FRA with the most up-do-date climate change allowances to investigate the implications of climate change on the site.

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 and Portsdown Chalk Formation.
	  ○ Superficial- Lowestoft Formation- Diamicton.
	• Soils at the site consist of:
	  ○ Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils.
	SuDS
	• No groundwater data is available for the site. Further groundwater level investigations should be carried out at site-specific FRA level.
	• BGS data indicates that the underlying geology is chalk which is likely to be free draining. This should be confirmed through infiltration testing, with the use of infiltration maximised as much as possible in accordance with the SuDS hierarchy.
	• The site is not located within a historic landfill site.
	• 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 Risk of Flooding from Surface Water (RoFSW) mapping indicates the presence of surface water flow paths during the 3.3%, 1% and 0.1% AEP event. Existing flow paths should be retained and integrated with blue-green infrastructure and public open space.
	• If it is proposed to discharge runoff to a watercourse or sewer system, the condition and capacity of the receiving watercourse or asset should be confirmed through surveys and the discharge rate agreed with the asset owner.

Opportunities for wider sustainability benefits and integrated flood risk management	• Implementation of SuDS at the site could provide opportunities to deliver multiple benefits including volume control, water quality, amenity and biodiversity. This could provide wider sustainability benefits to the site and surrounding area. Proposals to use SuDS techniques should be discussed with relevant stakeholders (LPA, LLFA and EA) at an early stage to understand possible constraints. • Development at this site should not increase flood risk either on or off site. The design of the surface water management proposals should take into account the impacts of future climate change over the projected lifetime of the development. • Opportunities to incorporate 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 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 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. The NPPF classifies residential development as 'More Vulnerable'. The site is in Flood Zone 1 but as it is predicted to be affected by surface water flood risk the Exception Test applies.
Requirements and guidance for site-specific Flood Risk Assessment	**Flood Risk Assessment:** • The site is not at risk of fluvial flooding and is not greater than one hectare but as it is affected by surface water flood risk a site-specific Flood Risk Assessment is required to demonstrate that the Exception Test is satisfied. • Also, given the close proximity of the ordinary watercourse along the west boundary of the site, it is recommended that the performance of this feature is taken into consideration and this watercourse is modelled with the most up-to-date climate change allowances as part of a detailed site-specific Flood Risk Assessment. **Guidance for site design and making development safe:** • The development should be designed using a sequential approach. Development should be steered away from areas of surface water flood risk along the north and south boundary, preserving these spaces as green infrastructure where appropriate. • Safe access and egress will need to be demonstrated in the 0.1% AEP plus climate change rainfall event, using the depth, velocity and hazard outputs. Raising of access routes must not impact on surface water flow routes. Consideration should be given to the siting of access points with respect to areas of surface water flood risk. • Resilience measures will be required if buildings are situated in the flood risk area in the northwest corner of the site. Raising Finished Floor Levels above the design event may remove the need for resilience measures. • The risk from surface water flow routes should be quantified as part of a site-specific Flood Risk Assessment, including a drainage strategy, to ensure that runoff from the development is not increased by placing 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 the current greenfield rates. • On site attenuation schemes would need to be tested to ensure flows are not exacerbated downstream within the catchment. • New or re-development should adopt exemplar source control SuDS techniques to reduce the risk of frequent low impact flooding due to post-development runoff. Assessment for runoff should include allowance for climate change effects. • Surface water runoff should be fully attenuated to the greenfield rate to ensure that there is no increase in surface water flood risk elsewhere. • 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 development is likely to be able to proceed if: • Development is situated away from the areas of surface water risk (the northwest corner).	

- The ordinary watercourse along the western boundary of the site is modelled in a site-specific Flood Risk Assessment to investigate the impacts of climate change on the site.
- Space for surface water to be stored on the site is provided and rainwater harvesting should be considered.
- The proposed site 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 and raising of access routes should not impede surface water flows.
- A Flood Warning and Evacuation Plan should be prepared for the site if safe access and egress cannot be demonstrated during the 0.1% AEP event.

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 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.
Climate change	No modelled climate change data was available for this site. The 0.1% AEP surface water mapping from the Risk of Flooding from Surface Water map has been used as a proxy for the impacts of climate change on surface water.
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, hazard and velocity mapping are taken from the Environment Agency's Risk of Flooding from Surface Water mapping.

South Norfolk Council Level 2 Strategic Flood Risk Assessment Detailed Site Summary Tables

Site details

Site Code	**SN0308 / VCHAL1**
Address	Between Briar Lane and Yarmouth Road, Hales TM 38295 97305
Area	2.42 ha
Current land use	Greenfield
Proposed land use	Residential

Sources of flood risk

Location of the site within the catchment	The site is located within the catchment of an unnamed watercourse, designated a Main River by the Environment Agency, which flows in a northerly direction from Hales towards its confluence with the River Chet. The River Chet then flows eastwards until it joins the River Yare near Reedham. The River Yare then continues eastwards until it reaches the North Sea at Great Yarmouth.
Existing drainage features	The site is located approximately 70m east of an unnamed Main River. Local topography shows the site has its highest elevations in the east and along parts of the southern boundary and slopes downhill towards the west and north, before sloping slightly uphill along the western boundary. There is a change in elevation of approximately 8m across the site. This indicates that drainage from the site would be in a north-westerly direction.
Fluvial	**The proportion of site at risk (Environment Agency's Flood Map for Planning):** **FZ3b – 0%** **FZ3a – 0%** **FZ2 – 0%** **FZ1 – 100%** *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:** The Environment Agency's Flood Zone mapping has been used in this assessment. **Flood characteristics:** The site is not currently at risk of flooding from fluvial sources. The site is not located in Flood Zone 2 or Flood Zone 3 of the Environment Agency's Flood Map for Planning.
Surface Water	**Proportion of site at risk (RoFSW):** **3.3% AEP** – 1.44% Max depth - >1.20m Max velocity – 0.50 – 1.00m/s **1% AEP** – 1.67% Max depth - >1.20m Max velocity – 0.50 – 1.00m/s **0.1% AEP** – 20.2% Max depth - >1.20m Max velocity - 1.00 – 2.00 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. 1% AEP %includes the 3.3% AEP %) **Description of surface water flow paths:** During the 3.3% and 1% AEP events, there is one area of ponding present in the mapping. The ponding is confined to an area of low-lying land in the north of the site and has a maximum depth of >1.20m. During the 3.3% AEP event the diameter of this ponding is approximately 40m. During the 1% AEP event, the diameter increases to approximately 45m.During the 0.1% AEP event, a flow path bisects the site from south to north. The flow path originates to the south of the site and flows in a northerly direction across the site with predicted velocities of up to 1.00 – 2.00m/s and depths up to 0.15 – 0.30m giving it a hazard classification of 'Very Low Hazard' increasing to 'Danger for some' in parts (excluding the smaller area of ponding at the north of the site). The eastern half of the site is located considerably higher than the western half and remains unaffected by surface water for the 0.1% AEP event.
Reservoir	The site is not shown to be at risk from reservoir flooding from available online maps.
Groundwater	No groundwater flooding information was available at this site. Further investigations should be undertaken as part of a site-specific flood risk assessment to determine whether there is a risk to the site from groundwater.
Sewers	The site is located within a postcode shown to have one recorded instance of sewer flooding in the past according to Anglian Water's DG5 Register for Greater Norwich)
Flood history	The Environment Agency's historic flooding and recorded flood outlines dataset have no record of flooding on the site. Norfolk County Council's historic flooding records also do not show any flooding on or surrounding the site.
Flood risk management infrastructure	
Defences	The 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 site is not located within any of the Environment Agency's flood warning areas.
Access and egress	The site can be accessed via Briar Lane which runs from the north of the site down the western side of the site. Briar Lane lies within Flood Zone 2 and Flood Zone 3 of the Environment Agency's Flood Map for Planning. Therefore, access to the site in the 0.1% AEP and 1% AEP fluvial scenarios, could be affected. Access from Briar Lane is affected in all modelled surface water scenarios with a surface water flow path cutting across the road to the northeast of the site. During the 0.1% AEP event, the site is bisected by a surface water flow path and access to the western portion of the site is likely to be significantly impeded. Developers will need to demonstrate safe access and egress in the 0.1% AEP event. Raising of access routes must not impede surface water flows. The depths, velocities, hazards, durations and speeds of onset of fluvial and surface water flooding along access/egress routes should be investigated further in a site-specific assessment, to confirm whether access for emergency vehicles could still be obtained. As surface water events are typically flashy and short-lived, it is likely that if access is affected this would only be for a short period of time. A Flood Warning and Evacuation Plan should be prepared for the site, with a policy of shelter in situ on the western side of the site likely to be appropriate if access cannot be provided.
Climate change	

Implications for the site	• Climate change should also be considered for surface water events; at the site-specific stage, the 1% AEP +40% event is considered as part of surface water drainage strategies, or surface water modelling. The 1% AEP +40% Climate Change Upper Uplift (for the Broadland Rivers Management Catchment) event mapping suggests that the site is likely to be at a significantly increased risk of surface water flooding in future, with the flow path that bisects the site during the 0.1% AEP event, also being present in the 1% AEP +40%. • Developers should consider SuDS strategies to reduce the impacts of climate change from surface water in a detailed site-specific Flood Risk Assessment. • Currently, no model data is available for the unnamed Main River which flows to the west of the site. This should be modelled as part of a site-specific FRA with the most up-do-date climate change allowances to investigate the implications of climate change on the site.
Requirements for drainage control and impact mitigation	

Broad-scale assessment of possible SuDS	**Geology & Soils**
	• Geology at the site consists of:
	  ○ Bedrock- Crag Group- Sand and Gravel.
	  ○ Superficial- Lowestoft Formation- Sand and Gravel; Happisburgh Glacigenic Formation- Diamicton; Happisburgh Glacigenic Formation- Sand.
	• Soils at the site consist of:
	  ○ Slightly acid loamy and clayey soils with impeded drainage.
	SuDS
	• No groundwater data is available for the site. Further groundwater level investigations should be carried out at site-specific FRA level.
	• BGS data indicates that the underlying geology is sand and gravel which is likely to be free draining. This should be confirmed through infiltration testing, with the use of infiltration maximised as much as possible in accordance with the SuDS hierarchy.
	• The site is not located within a historic landfill site.
	• 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 Risk of Flooding from Surface Water (RoFSW) mapping indicates the presence of surface water flow paths during the 0.1% AEP event. Existing flow paths should be retained and integrated with blue-green infrastructure and public open space.
	• If it is proposed to discharge runoff to a watercourse or sewer system, the condition and capacity of the receiving watercourse or asset should be confirmed through surveys and the discharge rate agreed with the asset owner.

Opportunities for wider sustainability benefits and integrated flood risk management	• Implementation of SuDS at the site could provide opportunities to deliver multiple benefits including volume control, water quality, amenity and biodiversity. This could provide wider sustainability benefits to the site and surrounding area. Proposals to use SuDS techniques should be discussed with relevant stakeholders (LPA, LLFA and EA) at an early stage to understand possible constraints. • Development at this site should not increase flood risk either on or off site. The design of the surface water management proposals should take into account the impacts of future climate change over the projected lifetime of the development. • Opportunities to incorporate 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 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, blue/green corridors, 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 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. The NPPF classifies residential development as 'More Vulnerable'. The site is in Flood Zone 1 but as it is predicted to be affected by surface water flood risk and is greater than 1 hectare, and a site-specific Flood Risk Assessment is required.
Requirements and guidance for site-specific Flood Risk Assessment	**Flood Risk Assessment:** • As the site is greater than 1hectare, a site-specific Flood Risk Assessment should be carried out in line with National Planning Policy Framework; Flood Risk and Coastal Change Planning Practice Guidance; the Joint Core Strategy as part of the Greater Norwich Development Partnership for Broadland, Norwich and South Norfolk; and the Norfolk County Council Lead Local Flood Authority's Statutory Consultee for Planning Guidance Document. **Guidance for site design and making development safe:** • The developer will need to demonstrate to the satisfaction of the local planning authority that the development will be safe for its lifetime taking account of the vulnerability of its users, a site-specific flood risk assessment may need to show that appropriate evacuation procedures and flood response infrastructure are in place to manage the residual risk associated with an extreme flood event. (Para 048 Flood Risk and Coastal Change PPG). • The development should be designed using a sequential approach. Development should be steered away from the surface water flow path in the west of the site, preserving this space as green infrastructure where appropriate. • Safe access and egress will need to be demonstrated in the 0.1% AEP plus climate change surface water event, using the depth, velocity and hazard outputs. Raising of access routes must not impact on surface water flow routes. Consideration should be given to the siting of access points with respect to areas of surface water flood risk. • Resilience measures will be required if buildings are situated in the flood risk area along the west of the site. Raising Finished Floor Levels above the design event may remove the need for resilience measures. • The risk from surface water flow routes should be quantified as part of a site-specific Flood Risk Assessment, including a drainage strategy, to ensure that runoff from the development is not increased by placing 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 the current greenfield rates. The flow path which forms during the 0.1% AEP surface water event should be integrated into blue-green infrastructure using SuDS. • On site attenuation schemes would need to be tested to ensure flows are not exacerbated downstream within the catchment. • New or re-development should adopt exemplar source control SuDS techniques to reduce the risk of frequent low impact flooding due to post-development runoff. Assessment for runoff should include allowance for climate change effects. • Surface water runoff should be fully attenuated to the greenfield rate to ensure that there is no increase in surface water flood risk elsewhere. 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 development is likely to be able to proceed if:

- The unnamed Main River which flows to the west of the site is modelled in a site-specific FRA to investigate the impacts of climate change on the site.
- Space for surface water to be stored on the site is provided and rainwater harvesting should be considered.
- The proposed site 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 and raising of access routes should not impede surface water flows. Particular consideration should be given to access and egress to the west of the site.
- 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 Environment Agency's Flood Map for Planning and the Risk of Flooding from Surface Water dataset. 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	In the absence of detailed modelling, the Environment Agency's Flood Map for Planning Flood Zone 2 has been used as an indication of flood extent during a 1% + climate change scenario. For surface water risk, a 1% AEP +40% scenario has been considered, which represents the Broadland Rivers Management Catchment for the 2070s.
Surface Water	The Environment Agency's Risk of Flooding from Surface Water dataset has been used to define areas at risk from surface water flooding.
Surface water depth, velocity and hazard mapping	The surface water depth, hazard and velocity mapping are taken from the Environment Agency's Risk of Flooding from Surface Water mapping.

South Norfolk Council Level 2 Strategic Flood Risk Assessment Detailed Site Summary Tables

Site details

Site Code	**SN0373/VCDIT1**
Address	Land between Thwaite Rd/Tunneys Lane, Ditchingham, South Norfolk, 634229 291610
Area	1.8ha
Current land use	Greenfield
Proposed land use	Residential

Sources of flood risk

Location of the site within the catchment	The site is located in the Broome Beck Catchment, north of Ditchingham. The Broome Beck flows from its source in Bedingham, east, past Ditchingham, and joins the River Waveney at Broome.
Existing drainage features	Local topography shows that the site slopes gently downhill towards the northeast, which suggests existing drainage is towards Broome Beck which is approximately 350m to the northeast of the site.
Fluvial	**The proportion of site at risk (Environment Agency's Flood Map for Planning Flood Zones):** **FZ3b –** 0% **FZ3a –** 0% **FZ2 –**1% **FZ1 –** 99% *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:** The Environment Agency's (EA) Flood Map for Planning has been used within this assessment. **Flood characteristics:** The EA's Flood Map for Planning shows a very small area of the site on the northern boundary is located within Flood Zone 2. The site is not located in Flood Zone 3a or 3b.
Coastal and Tidal	The site is not at risk from tidal or coastal flooding.
Surface Water	**Proportion of site at risk (RoFSW):** **3.3% AEP** – 1% Max depth – 0.15 – 0.30m Max velocity – 0.01 – 0.25m/s **1% AEP** – 2% Max depth – 0.30 – 0.60m Max velocity – 0.25 – 0.50m/s **0.1% AEP** – 10% Max depth – 0.30 – 0.60m Max velocity – 0.50 – 1.00m/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 greater Annual Exceedance Probability (AEP) (e.g. 1% AEP % includes the 3.3% AEP %). **Description of surface water flow paths:** In the 0.1% AEP event, there are small areas of surface water ponding to a maximum depth of 0.6m, and hazard rating of 'danger for some', in a low topographic spot on the northern boundary of the site and on the eastern boundary where the site meets Waveney Road. During the 1% AEP, the extents of these areas decrease, and during the 3.3% AEP, only a marginal part of the site is impacted, with the maximum depth decreasing to 0.3m and the hazard rating decreasing to 'very low hazard'.
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, 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 >=75% susceptibility to groundwater flood emergence. The assessment does not negate the requirement that an appropriate assessment of the groundwater regime should be carried out at the site-specific FRA stage.
Sewers	The site is located in a postcode area with no recorded historic sewer flooding, according to Anglian Water's DG5 Register for Greater Norwich.
Flood history	The Environment Agency's historic flooding and recorded flood outlines datasets do not have a record of any flooding on or surrounding the site. Norfolk County Council's historic flooding records also do not show any flooding on or surrounding the site.
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	A very small area of the site on the northern boundary is within the River Waveney from Diss and the River Dove to Ellingham, including Bungay Flood Alert Area. The site is not located in a Flood Warning area.
Access and egress	The site can currently be accessed by vehicles off Thwaite Road to the west. In all modelled fluvial events, the site and surrounding roads are unaffected by flooding. During the 3.3% and 1% AEP surface water events, flooding is not predicted to impact Thwaite Road. During the 0.1% AEP, an area of surface water ponding may extend from the field to the west of the site onto Thwaite Road. Depths could reach up to 0.6m on the road to a maximum velocity of 1.25m/s and maximum hazard rating of 'danger for some', meaning access and egress for emergency vehicles is unlikely to be affected. Safe access and egress will need to be demonstrated in the 1% AEP plus climate change surface water event. Site drainage proposals should address the requirements for access routes, avoid impeding surface water flows and preserve the storage of surface water to avoid exacerbation of flood risk in the wider catchment.
Dry Islands	The site is not located on a dry island.
Climate change	
Implications for the site	• Increased storm intensities due to climate change may increase the extent, depth, velocity, hazard and frequency of both fluvial and surface water flooding. • In the absence of detailed modelling, Flood Map for Planning Flood Zone 2 can be used as an indicative 1% + climate change flood extent. This suggests the site

	may be at greater fluvial flood risk in the future as Flood Zone 2 extends approximately 100m more towards the site than Flood Zone 3. • Climate change should also be considered for surface water events; at the site-specific stage, the 1% AEP +40% event is considered as part of surface water drainage strategies, or surface water modelling in the Broadland Rivers Management Catchment for the 2070s. The 1% AEP +40% event mapping suggests that the site is not likely to be at significantly increased risk of surface water flooding in future. • Developers should consider SuDS strategies to reduce the impacts of climate change from surface water in a detailed site-specific FRA.
Requirements for drainage control and impact mitigation	

Broad-scale assessment of possible SuDS	**Geology & Soils**
	• Geology at the site consists of:
	  ○ Bedrock- Gravel, sand, silt and clay
	  ○ Superficial- Sand and gravel, river terrace deposits
	• Soils at the site consist of:
	  ○ Freely draining slightly acid sandy soils
	SuDS
	• The site is considered to be highly susceptible to groundwater flooding. Groundwater flooding could occur at the surface which may flow to and pool within topographic low spots during very wet winters. 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 sands, gravels, silts and clays which is likely to be free draining. This should be confirmed through infiltration testing, with the use of infiltration maximised as much as possible in accordance with the SuDS hierarchy. This would suggest a lower groundwater flood risk than is indicated by the EA's Areas Susceptible to Groundwater Flooding (AStGWF) map. The AStGWF is a strategic-scale map and only isolated locations within the overall susceptible area are actually likely to suffer the consequences of groundwater flooding, therefore the map should be treated as indicative.
	• The site is located within a Groundwater Source Protection Zone. Infiltration techniques may not be suitable and should only be used following the granting of any required environmental permits from the Environment Agency for Source Protection Zones 2, 3 and 4 although it is possible that infiltration may not be permitted. Proposed SuDS should be discussed with relevant stakeholders (LPA, LLFA and EA) at an early stage to understand possible opportunities and constraints.
	• The site is not located within a historic landfill site.
	• 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.
	• 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 infiltration 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 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 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. The NPPF classifies residential development as 'More Vulnerable'. • As the site is at risk of groundwater flooding and surface water flooding, as well as fluvial flooding in the future, the Exception Test needs to be applied. The Exception Test will be passed if the area at risk of surface water flooding in the northern part of the site is left undeveloped and instead incorporated as amenity greenspace.
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 the proposed development site contains a small area at fluvial and surface water flood risk, is indicated to be at significant groundwater flood risk and is more than 1 hectare in area. • All sources of flooding 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, Water Company, 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. **Guidance for site design and making development safe:** • Safe access and egress will need to be demonstrated in the 1 % AEP plus climate change rainfall event, using the depth, velocity and hazard outputs. 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 • 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. • The proposed site 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). • 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 development is likely to be able to proceed if:

- Safe access and egress can be demonstrated in the 1% AEP surface water event. The current access point on Thwaite Road is likely to be unaffected by surface water flooding in the 1% AEP event.
- A site-specific FRA demonstrates that the site is not at an increased risk of flooding in the future, that the development of the site does not increase the risk of surface water flooding on the site and to neighbouring properties, and how the natural flood storage provided by the pre-developed site is preserved.
- 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).

Mapping Information

The key datasets used to make planning recommendations regarding this site were the Environment Agency's Flood Map for Planning 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.
Climate change	In the absence of detailed modelling, the Environment Agency's Flood Map for Planning Flood Zone 2 has been used as an indication of flood extent during a 1% + climate change scenario. For surface water risk, a 1% AEP +40% scenario has been considered, which represents the Broadland Rivers Management Catchment for the 2070s.
Fluvial depth, velocity and hazard mapping	This site is not shown to be at significant risk of flooding from fluvial sources.
Surface Water	The Risk of Flooding from Surface Water dataset has been used to define areas at risk from surface water flooding.

South Norfolk Council Level 2 Strategic Flood Risk Assessment Detailed Site Summary Tables

Site details

Site Code	**SN0400 / VCALP1**
Address	Church Meadow, Alpington, TG 29027 01994
Area	1.85ha
Current land use	Greenfield
Proposed land use	Residential

Sources of flood risk

Location of the site within the catchment	The site is located in the catchment of the Well Beck. The Well Beck is an Environment Agency designated main river and flows in a southerly direction from Poringland towards its confluence with the River Chet. The River Chet then flows eastwards until it joins the River Yare near Reedham. The River Yare then continues eastwards until it reaches the North Sea at Great Yarmouth.
Existing drainage features	The site is located 1.2km north of the Well Beck. The Environment Agency states that this river is not heavily modified. Online imagery suggests there are drainage ditches in the surrounding area. Local topography shows the site at a higher relief compared to land located 300m south. This indicates that drainage from the site would be in a southerly direction.
Fluvial	**The proportion of site at risk:** **FZ3b –** 0% **FZ3a –** 0% **FZ2 –** 0% **FZ1 –** 100% *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:** The Environment Agency's Flood Zone mapping has been used in this assessment. **Flood characteristics:** The site is not currently at risk of flooding from fluvial sources. The Environment Agency's Flood Mapping for Rivers and Sea does not show the site to be within flood zone 2 or 3.
Coastal and Tidal	The site is not a risk from coastal or tidal flooding.
Surface Water	**Proportion of site at risk (RoFfSW):** **3.3% AEP** – 0% Max depth – 0m Max velocity – 0m **1% AEP** – 0% Max depth – 0m Max velocity – 0m

	0.1% AEP – 14% Max depth – 0.30m Max velocity – 2m/s *The % SW extents quoted show the % of the site at surface water risk from that particular event, including the percentage of the site at flood risk at a higher risk zone (e.g. 100-year includes the 30-year %)* **Description of surface water flow paths:** During the 3.3% and 1% AEP flood event, there is no predicted risk of surface water flooding within or surrounding the proposed site. In event of a predicted 0.1% AEP flood, a surface water flow path extends from the middle of the site and through the southern boundary. The path is continuous as it flows from high to lower relief (indicated by local LiDAR), then through drainage ditches, before it reaches the Well Beck. The predicted flow depths within the site vary between 0.00m and 0.30m. Flow velocities vary between 0.25m/s and 2m/s. This flooding is classified as 'Very Low Hazard'.
Reservoir	The site is not shown to be at risk of reservoir flooding from the available online maps.
Groundwater	There is no groundwater data available for this site.
Sewers	The site is located within a postcode shown to have 4 recorded instances of sewer flooding in the past.
Flood history	The Environment Agency's historic flooding and recorded flood outlines datasets do not have a record of any flooding on or surrounding the site.
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 site is not located in an Environment Agency Flood Warning Area.
Access and egress	The site is currently accessible from Church Meadow. The site will still be accessible in event of all flooding scenarios as the surface water flood risk is only along the southern boundary of the site. Access to the site is along the north-east boundary. The depths, velocities, hazards, durations and speeds of onset of surface water along access/egress routes should be investigated further in a site-specific assessment, to confirm whether access for emergency vehicles could still be obtained. As surface water events are typically flashy and short-lived, it is likely that access to the site will only be affected for a short period of time.
Dry Islands	The site is not located on a dry island.
Climate change	
Implications for the site	• The present day predicted 0.1% AEP surface water flooding extent provides an indication of the likely increase in extent of the more frequent surface water events. There is a significant increase in the extent of flooding on site between the 1% and 0.1% AEP surface water events, indicating the site is sensitive to the effects of climate change. This would require a detailed Flood Risk Assessment to assess the site layout and design. In addition to the SuDs features designed to accommodate runoff from new development infrastructure the proposals should also address the potential loss of natural storage of rainfall and runoff provided by the land in its natural condition. • Developers should consider SuDS strategies to reduce the impacts of climate change from surface water in a detailed site-specific Flood Risk Assessment.

	• Currently, no model data is available for the ordinary watercourse (Well Beck) which flows south of the site. This should be modelled as part of a site-specific FRA with the most up-do-date climate change allowances to investigate the implications of climate change on the site.
Requirements for drainage control and impact mitigation	

Broad-scale assessment of possible SuDS	**Geology & Soils**
	• Geology at the site consists of:
	  ○ Bedrock- Crag Group - Sand and Gravel.
	  ○ Superficial- Lowestoft Formation - Diamicton.
	• Soils at the site consist of:
	  ○ Loamy and clayey soils- moderate to high fertility, slightly impeded drainage.
	SuDS
	• No groundwater data is available for this site. This should be further investigated at site-specific FRA stage.
	• BGS data indicates that the underlying geology is sand and gravel which are likely to be free draining. This should be confirmed through infiltration testing, with the use of infiltration maximised as much as possible in accordance with the SuDS hierarchy.
	• The site is not located within a historic landfill site.
	• 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 Risk of Flooding from Surface Water (RoFSW) mapping indicates the presence of surface water flow paths during the 0.1% AEP event. Existing flow paths should be retained and integrated with blue-green infrastructure and public open space.
	• If it is proposed to discharge runoff to a watercourse or sewer system, the condition and capacity of the receiving watercourse or asset should be confirmed through surveys and the discharge rate agreed with the asset owner.

Opportunities for wider sustainability benefits and integrated flood risk management	• Implementation of SuDS at the site could provide opportunities to deliver multiple benefits including volume control, water quality, amenity and biodiversity. This could provide wider sustainability benefits to the site and surrounding area. Proposals to use SuDS techniques should be discussed with relevant stakeholders (LPA, LLFA and EA) at an early stage to understand possible constraints. • Development at this site should not increase flood risk either on or off site. The design of the surface water management proposals should take into account the impacts of future climate change over the projected lifetime of the development. • Opportunities to incorporate 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 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 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. The NPPF classifies residential development as 'More Vulnerable'.

	As the site is in Flood Zone 1 but is predicted to be affected by surface water flood risk the Exception Test applies.
Requirements and guidance for site-specific Flood Risk Assessment	**Flood Risk Assessment:** • Although the site is not located in a Flood Zone, a small proportion of the site is subject to surface water flooding in event of a 0.1% AEP flood. Therefore, it is recommended that a site specific Flood Risk Assessment is performed to provide evidence that the proposals satisfy the Exception Test. • 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. **Guidance for site design and making development safe:** • The development should be designed using a sequential approach. • Safe access and egress will need to be demonstrated in the 0.1% AEP plus climate change rainfall event, using the depth, velocity and hazard outputs. Raising of access routes must not impact on surface water flow routes. Consideration should be given to the siting of access points with respect to areas of surface water flood risk. • The risk from surface water flow routes should be quantified as part of a site-specific Flood Risk Assessment, including a drainage strategy, to ensure that runoff from the development is not increased by placing 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 the current greenfield rates. • It is recommended that finished floor levels are raised to 300mm above ground level to prevent surface water flooding within the site. Raising Finished Floor Levels may remove the need for resilience measures. • On site attenuation schemes would need to be tested to ensure flows are not exacerbated downstream within the catchment. • New or re-development should adopt exemplar source control SuDS techniques to reduce the risk of frequent low impact flooding due to post-development runoff. Assessment for runoff should include allowance for climate change effects. • Surface water runoff should be fully attenuated to the greenfield rate to ensure that there is no increase in surface water flood risk elsewhere.

Key messages

The development is likely to be able to proceed if:

- Finished floor levels are raised by 300mm to prevent surface water flooding on site.
- A site-specific Flood Risk Assessment demonstrates that the site is not at an increased risk of flooding in the future as a result of climate change, and that the development of the site does not increase the risk of surface water flooding on the site and to neighbouring properties.
- The proposed site should discharge surface water at the original pre-development (greenfield) runoff rate.
- A drainage strategy should help inform site layout and design to ensure there is no increase in runoff beyond current greenfield rates.
- Safe access and egress routes must not be in the areas of high surface water risk.
- 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 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.
Climate change	No modelled climate change data was available for this site. The 0.1% AEP surface water mapping from the Risk of Flooding from Surface Water map has been used as a proxy for the impacts of climate change on surface water.

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, hazard and velocity mapping are taken from the Environment Agency's Risk of Flooding from Surface Water mapping.

South Norfolk Council Level 2 Strategic Flood Risk Assessment Detailed Site Summary Tables

Site details

Site Code	**SN0432REVB / VCBRO1**
Address	Norwich Road, Brooke, South Norfolk, 628428, 299560
Area	2.47ha
Current land use	Greenfield
Proposed land use	Residential

Sources of flood risk

Location of the site within the catchment	The site lies within the catchment of the River Chet. The Well Beck runs northwest-southeast 1.1km northeast of the site. An unnamed tributary of the Well Beck is located 390m from the northwest corner of the site, meeting the Well Beck 1.2km north of the site. The Well Beck is a tributary of the River Chet, the confluence between which is located 2.2km east of the site.
Existing drainage features	Local topography shows that the site is located at a topographic high point. The site slopes slightly down towards the northeast. This indicates the existing drainage is to the northeast of the site, following the topography towards the unnamed tributary of the Well Brook at the northwest of the site. There are no other drainage features observed within the vicinity of the site.
Fluvial	**The proportion of site at risk (Environment Agency's Flood Map for Planning):** **FZ3b –** 0% **FZ3a –** 0% **FZ2 –** 0% **FZ1 –** 100% *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:** The Environment Agency's (EA) Flood Map for Planning has been used within this assessment.
Surface Water	**Proportion of site at risk (Environment Agency's RoFfSW dataset):** **3.3% AEP** – 1.56% Max depth- 0.30 - 0.60m Max velocity- 0.00 - 0.25m/s **1% AEP** – 3.33% Max depth- 0.30 - 0.60m Max velocity- 0.25- 0.50m/s **0.1% AEP** – 9.56% Max depth- 0.30 - 0.60m Max velocity- 0.50 - 1.00m/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 greater Annual Exceedance Probability (e.g. 1%AEP % includes the 3%AEP %)*

	Description of surface water flow paths: Surface water flooding occurs in the 3.3%, 1% and 0.1% AEP events. This surface water flooding only affects the site to the west of Norwich Road. Two surface water ponds are predicted to form at the east of the site adjacent to Norwich Road in all events. Maximum diameter of the ponding in the 3.3%, 1% and 0.1% event is 26m, 41m and 84m respectively. The remainder of the site is predicted to be free from flooding. During the 3.3% AEP event, maximum flood depths are predicted to be 0.30 – 0.60m and maximum velocities are 0.00 - 0.25m/s. This results in a predicted maximum hazard of 'danger for some' in the centre of each pond. Maximum flood depths are similarly predicted to be 0.30 – 0.60m in the 1% AEP event and maximum flow velocities 0.25 - 0.50m/s, forming a maximum hazard of 'danger for some'. Flood depths are predicted to reach a maximum of 0.30 - 0.60m during the 0.1% AEP event, and maximum velocities predicted to reach a maximum of 0.50 - 1.00m/s. This forms a maximum hazard of 'danger for some' at the centre of each pond.
Reservoir	The site is not shown to be at risk of reservoir flooding from the available online maps.
Groundwater	No groundwater data is available for the site. Further groundwater level investigations should be carried out at site-specific FRA level.
Sewers	The site is located within a postcode where there have been three recorded historic sewer flooding incidences according to Anglian Water's DG5 Register for Greater Norwich
Flood history	The Environment Agency's historic flooding and recorded flood outlines datasets do not have a record of any flooding on or surrounding the site. Norfolk County Council's historic flooding records show two incidents of external and one incident of internal flooding around 0.5km south of the site.
Flood risk management infrastructure	
Defences	The site is not protected by any formal flood defences.
Residual risk	The unnamed watercourse to the west of the site is culverted under Howe Lane. If this culvert were to become blocked water could back up and cause flooding. However, due to the location of the site at a topographic high point the site is unlikely to be affected in a blockage event.
Emergency planning	
Flood warning	The site is not located in an Environment Agency Flood Warning Area.
Access and egress	Currently, access to both sides of the site is only available via Norwich Road and the adjacent layby. There are openings to the land allowing direct access to both sides of the site from both sides of the road when entering Brooke. For the site to the west of Norwich Road, this access point, however, is predicted to be affected by surface water during the 3.3%, 1% and 0.1% AEP events. During the 3.3% and 1% AEP events, surface water flood depths are predicted to reach a maximum of 0.15-0.30m, meaning larger emergency vehicles may still be able to access the site from this route. The site, however, is predicted to remain inaccessible during the 0.1% AEP event. Safe access and egress will need to be demonstrated in the 1% AEP plus climate change surface water event and fluvial events. Ideally, the access route should be situated 300mm above the designed flood level. Raising of access routes must not impact on surface water flow routes. If safe access and egress to the site cannot be safely demonstrated in all flood events, a Flood Warning and Evacuation Plan should be prepared for the site.
Dry Island	The site is not located on a dry island.

Climate change

Implications for the site

- Increased storm intensities due to climate change may increase the extent, depth, velocity, hazard and frequency of both fluvial and surface water flooding.
- Climate change should also be considered for surface water events; at the site-specific stage, the 1% AEP +40% event is considered as part of surface water drainage strategies, or surface water modelling. The 1% AEP +40% Climate Change Upper uplift (for the Broadland Rivers Management Catchment peak flows) event mapping suggests that the site is likely to be at increased risk of surface water flooding in future, with the two existing areas of ponding increasing in size. There is also a new smaller pond shown in the mapping measuring approximately 22m in diameter.
- This would require a detailed Flood Risk Assessment (FRA) to assess the site layout and design. In addition to the SuDs features designed to accommodate runoff from new development infrastructure the proposals should also address the potential loss of natural storage of rainfall and runoff provided by the land in its natural condition.
- Developers should consider SuDS strategies to reduce the impacts of climate change from surface water in a detailed site-specific FRA.
- A site-specific FRA, with the most up-do-date climate change allowances, should be undertaken to investigate the implications of climate change on the site.

Requirements for drainage control and impact mitigation

Broad-scale assessment of possible SuDS

Geology & Soils

- Geology at the site consists of:
  - Bedrock- Crag Group- Sand and Gravel.
  - Superficial- Lowestoft Formation- Diamicton.
- Soils at the site consist of:
  - Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils.

SuDS

- No groundwater data is available for the site. Further groundwater level investigations should be carried out at site-specific FRA level.
- BGS data indicates that the underlying geology is sand and gravel which is likely to be free draining. This should be confirmed through infiltration testing, with the use of infiltration maximised as much as possible in accordance with the SuDS hierarchy.
- The site is not located within a historic landfill site.
- 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 Risk of Flooding from Surface Water (RoFfSW) mapping indicates the presence of surface water flow paths 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.

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 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, green/blue corridors, 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 Local Authority will need to confirm that the sequential test has been carried out in line with national guidelines. • As the site is at risk of surface water flooding the Exception Test needs to be applied. The Exception Test will be passed if the area at risk of surface water flooding to the west of Norwich Road is left undeveloped and instead incorporated as amenity greenspace.
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 the proposed development site contains surface water flood risk and is more than one hectare in area. • All sources of flooding 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; the Joint Core Strategy as part of the Greater Norwich Development Partnership for Broadland, Norwich and South Norwich; and the Norfolk County Council Lead Local Flood Authority's Statutory Consultee for Planning Guidance Document. • Consultation with the Local Authority and the Lead Local Flood Authority 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:** • The developer will need to demonstrate to the satisfaction of the local planning authority that the development will be safe for its lifetime taking account of the vulnerability of its users, a site-specific flood risk assessment may need to show that appropriate evacuation procedures and flood response infrastructure are in place to manage the residual risk associated with an extreme flood event. (Para 048 Flood Risk and Coastal Change PPG). • In accordance with the Sequential Approach development should aim to be steered away from areas of surface water flood risk towards the east of the site, preserving these spaces as green infrastructure. • Safe access and egress will need to be demonstrated in the 1 % AEP plus climate change rainfall event, using the depth, velocity and hazard outputs. 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.

	• 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. • Surface water should be discharged at the pre-development (greenfield) runoff rate 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. • 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 principle of development can be supported if:

- A carefully considered and integrated flood resilient and sustainable drainage design is put forward, with development to be steered away from the eastern edge of the site.
- Space for surface water to be stored on the site is provided and rainwater harvesting should be considered.
- A site-specific Flood Risk Assessment demonstrates that the site is not at an increased risk of flooding in the future, that the development of the site does not increase the risk of surface water flooding on the site and to neighbouring properties and how the natural flood storage provided by the pre-developed site is preserved.
- Safe access and egress can be demonstrated in the 1% AEP surface water and fluvial events, or an appropriate Flood Warning and Evacuation plan based on a policy of shelter-in-situ is agreed with the Local Councils' Emergency Planner.

Mapping Information

The key datasets used to make planning recommendations regarding this site was the Environment Agency's Flood Map for Planning. And their Risk of Flooding from Surface Water (RoFfSW) dataset.

Flood Zones	Flood Zones 2 and 3 have been taken from the Environment Agency's Flood Map for Planning mapping.
Climate change	In the absence of detailed modelling, the Environment Agency's Flood Map for Planning Flood Zone 2 has been used as an indication of flood extent during a 1% + climate change scenario. For surface water risk, a 1% AEP +40% scenario has been considered, which represents the Broadland Rivers Management Catchment for the 2070s.
Fluvial depth, velocity and hazard mapping	This site is not shown to be at significant risk of flooding from fluvial sources.
Surface Water	The Environment Agency's Risk of Flooding from Surface Water dataset has been used to define areas at risk from surface water flooding.

South Norfolk Council Level 2 Strategic Flood Risk Assessment Detailed Site Summary Tables

Site details

Site Code	**SN0552REVB/VCBAR1**
Address	Land at Cock Street and Watton Road, Barford, South Norfolk, 611159 307452
Area	0.8ha
Current land use	Brownfield (east half), Greenfield (west half)
Proposed land use	Residential

Sources of flood risk

Location of the site within the catchment	The site is located in the north of the Tiffey Catchment, to the southwest of Barford. The River Tiffey flows approximately 250m southeast of the site in a northeast direction to its confluence with the River Yare, approximately 700m east of Barford.
Existing drainage features	Local topography shows that the site slopes gently downhill towards the east, which suggests existing drainage is to the east of the site. There are no drainage features within the site boundary or near the site.
Fluvial	**The proportion of site at risk (Environment Agency's Flood Map for Planning Flood Zones):** **FZ3b –** 0% **FZ3a –** 0% **FZ2 –** 0% **FZ1 –** 100% *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:** The Environment Agency's (EA) Flood Map for Planning has been used within this assessment. **Flood characteristics:** The site is not currently at risk of fluvial flooding. The EA's Flood Map for Planning shows the site is not located within Flood Zone 2 and 3.
Coastal and Tidal	The site is not at risk from tidal or coastal flooding.
Surface Water	**Proportion of site at risk (RoFSW):** **3.3% AEP** – 0% **1% AEP** – 0% **0.1% AEP** – 0% *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 greater Annual Exceedance Probability (AEP) (e.g. 1% AEP % includes the 3.3% AEP %).* **Description of surface water flow paths:**

	The site is not shown to be affected by surface water flooding in the 3.3%, 1% and 0.1% AEP event. However, due to the coarse resolution of the RoFSW data, surface water flow paths cannot be entirely ruled out. In the 0.1% AEP event, there is a surface water flow path along Watton Road to the south of the site, which is discussed in 'Access and Egress', below.
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, 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 >=75% susceptibility to groundwater flood emergence. The assessment does not negate the requirement that an appropriate assessment of the groundwater regime should be carried out at the site-specific FRA stage.
Sewers	The site is located in a postcode area with three records of historic sewer flooding, according to Anglian Water's DG5 Register for Greater Norwich.
Flood history	The Environment Agency's historic flooding and recorded flood outlines datasets do not have a record of any flooding on or surrounding the site. Norfolk County Council's historic flooding records show three records of external flooding to properties located approximately 280m east of the site.
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 site is not located in an Environment Agency Flood Alert or Flood Warning area.
Access and egress	The site can currently be accessed by vehicles via Watton Road to the south of the site and Cock Street to the east. In all modelled fluvial events, the site and surrounding roads are unaffected by flooding. During the 1% AEP surface water event, a small area of flooding occurs on Watton Road to the south of the site, however depths remain below 0.15m therefore are unlikely to impact access and egress for emergency vehicles. The area of flooding on Watton Road increases in extent during the 0.1% AEP event and a flow path develops flowing eastwards along Watton Road past the site. Depths are predicted to reach up to 0.3m with a velocity of between 1 and 2m/s, with some small areas reaching >2m/s. The maximum hazard rating here is 'Danger for some' so emergency vehicles should still be able to access the site. However, it is recommended Watton Road is not used as the main access point. Instead, access could be from Cock Street to the east, or a new access point could be added from Back Lane to the west as surface water risk on these roads is negligible. Safe access and egress will need to be demonstrated in the 1% AEP plus climate change surface water event. Site drainage proposals should address the requirements for access routes, avoid impeding surface water flows and preserve the storage of surface water to avoid exacerbation of flood risk in the wider catchment.
Dry Islands	The site is not located on a dry island.
Climate change	
Implications for the site	• Increased storm intensities due to climate change may increase the extent, depth, velocity, hazard and frequency of both fluvial and surface water flooding. • The site is not at risk of fluvial flooding in the present day or future scenario. • Climate change should also be considered for surface water flood events; at the site-specific stage, the 1% AEP +40% event is considered as part of surface water

	drainage strategies, or surface water modelling in the Broadland Rivers Management Catchment for the 2070s. The 1% AEP +40% event mapping suggests that the site itself is not likely to be at risk of surface water flooding in the future. However, Watton Road is predicted to be at increased risk of surface water flooding in the future, as the future 1% AEP event has a greater extent than the present day 1% AEP event, forming a similar flow path to the 0.1% AEP present day surface water event.
Requirements for drainage control and impact mitigation	

Broad-scale assessment of possible SuDS	**Geology & Soils**
	• Geology at the site consists of:
	  ○ Bedrock- White chalk
	  ○ Superficial- Till-Diamicton
	• Soils at the site consist of:
	  ○ Slightly acid loamy and clayey soils with impeded drainage
	SuDS
	• The site is considered to be highly susceptible to groundwater flooding. Groundwater flooding could occur at the surface which may flow to and pool within topographic low spots during very wet winters. 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 white chalk which is likely to be free draining. This should be confirmed through infiltration testing, with the use of infiltration maximised as much as possible in accordance with the SuDS hierarchy. This would suggest a lower groundwater flood risk than is indicated by the EA's Areas Susceptible to Groundwater Flooding (AStGWF) map. The AStGWF is a strategic-scale map and only isolated locations within the overall susceptible area are actually likely to suffer the consequences of groundwater flooding, therefore the map should be treated as indicative.
	• The site is located within a Groundwater Source Protection Zone. Infiltration techniques may not be suitable and should only be used following the granting of any required environmental permits from the Environment Agency for Source Protection Zones 2, 3 and 4, although it is possible that infiltration may not be permitted. Proposed SuDS should be discussed with relevant stakeholders (LPA, LLFA and EA) at an early stage to understand possible opportunities and constraints.
	• The site is not located within a historic landfill site.
	• Surface water discharge rates should not exceed pre-development discharge rates for the site and should be designed to be as close to greenfield runoff rates for the western half and brownfield/existing runoff rates for the eastern half 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.
	• 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.
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 Sequential Test needs to be passed before the Exception Test is applied. The NPPF classifies residential development as 'More Vulnerable'. • As the site lies entirely outside of Flood Zones 2 and 3 and there is no significant surface water flooding on the site, the Exception Test is not required.
Requirements and guidance for site-specific Flood Risk Assessment	**Flood Risk Assessment:** • At the planning application stage, a site-specific Flood Risk Assessment is not required as the proposed development site is located in Flood Zone 1 and at very low risk from surface water flooding. However, given the surface water flows in the vicinity of the site as well as high susceptibility to groundwater flooding, it is recommended that a precautionary approach is taken and a site-specific Flood Risk Assessment (FRA) is undertaken. • All sources of flooding, particularly the risk of groundwater should be considered as part of a site-specific FRA. • 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, Water Company and the Environment Agency should be undertaken at an early stage. **Guidance for site design and making development safe:** • Safe access and egress will need to be demonstrated in the 1% AEP plus climate change rainfall event, using the depth, velocity and hazard outputs. 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. • 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 for the western half of the site and brownfield/existing rates for the eastern half. • The proposed site 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). • 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 development is likely to be able to proceed if:

- Safe access and egress can be demonstrated in the 1% AEP surface water event.
- A site-specific Flood Risk Assessment (FRA) is undertaken. Although there is very low risk of fluvial and surface water flooding on the site meaning development should be accepted, given the surface water flows in the vicinity of the site as well as high susceptibility to groundwater flooding, it is recommended that further investigations are carried out.

Mapping Information

The key datasets used to make planning recommendations regarding this site were the Environment Agency's Flood Map for Planning 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.
Climate change	For fluvial flood risk, climate change data was not available for this site. For surface water risk, a 1% AEP +40% scenario has been considered, which represents the Broadland Rivers Management Catchment for the 2070s.
Fluvial depth, velocity and hazard mapping	This site is not shown to be at risk of flooding from fluvial sources.
Surface Water	The Risk of Flooding from Surface Water dataset has been used to define areas at risk from surface water flooding.

South Norfolk Council Level 2 Strategic Flood Risk Assessment Detailed Site Summary Tables

Site details

Site Code	**SN0567 & SN2082/VCSPO2**
Address	Station Road, Spooner Row, 609136, 297553
Area	1.67ha
Current land use	Greenfield
Proposed land use	Residential

Sources of flood risk

Location of the site within the catchment	The site is located in the west of the Tiffey (u/s Wymondham STW) Catchment, in Spooner Row. The River Tiffey flows from its source near Hethel, through Wymondham, Kimberley, Carelton, Forehoe, Wramplingham and Barford where it joins the River Yare before it reaches the sea at Great Yarmouth.
Existing drainage features	Local topography shows that the site slopes gently downhill towards the Bays River located approximately 0.30km to the east of the site. The Bays River flows north to enter the River Tiffey.
Fluvial	**The proportion of site at risk (Environment Agency's Flood Map for Planning Flood Zones):** **FZ3b –** 0% **FZ3a**- 0% **FZ2 –**0% **FZ1 –** 100% *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:** The Environment Agency's (EA) Flood Map for Planning has been used within this assessment. **Flood characteristics:** The site is not currently at risk of fluvial flooding. The EA's Flood Map for Planning shows the site is not located within Flood Zones 2 or 3.
Surface Water	**Proportion of site at risk (Environment Agency's RoFSW dataset):** **3.3% AEP** – 2% Max depth – >1.20m Max velocity – >2.00m/s **1% AEP** – 2% Max depth – >1.20m Max velocity – >2.00m **0.1% AEP** – 9% Max depth – >1.20m Max velocity – >2.00m

	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 % at risk includes the 3.3% AEP % at risk) **Description of surface water flow paths:** The site is affected by surface water flooding in the 3.3%, 1% and 0.1% AEP event. During these events, water ponds to depths between 0.15 and 0.30m along Station Road and Top Common and encroaches onto the site along the northern and western boundaries, where the topography is lower. In the 0.1% AEP event, a significant surface water flow path is formed along the northern boundary of the site. The hazard rating for the majority of the flooding is 'very low hazard' with some areas of 'danger for some' and 'danger for most' towards the very edge of the northern and western borders of the site. The flood risk is mainly confined to flowing down adjacent roads. In the 0.1% AEP event, several significant areas of surface water ponding are present in the vicinity of the site- these are discussed further in 'Access and Egress', below.
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, 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. The assessment does not negate the requirement that an appropriate assessment of the groundwater regime should be carried out at the site-specific FRA stage.
Sewers	The site is located in a postcode with no recorded historic sewer flooding according to Anglian Water's DG5 Register for Greater Norwich.
Flood history	The Environment Agency's Historic Flood Map and recorded flood outlines datasets do not have a record of any flooding on or surrounding the site. Norfolk County Council's historic flooding records also do not show any flooding to the site itself. There is one record of external flooding approximately 0.1km east of the site. There also one record of internal flooding approximately 0.4km east of the site.
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 site is not located in an Environment Agency Flood Alert or Flood Warning Area.
Access and egress	The site can be accessed via Station Road on the northern border or Top Common on the western border of the site. However, both these roads are at high risk from surface water flooding. Station Road and Top Common are shown to be impacted in the 3.3% 1% and 0.1% AEP modelled surface water events. During the 3.3% AEP and 1% AEP events, this flooding mainly affects the roads, and is mainly channelled along the edge of the road. The maximum depth of this flooding is >1.20m and the maximum velocity is >2.00m/s. During the 0.1% AEP event, the area of Station Road and Top Common impacted by surface water flood extent increases, maximum depth and velocity remain the same. Consultation with the Council's Highways Authority and/or National Highways will be required to inform on current highway drainage conditions. In all modelled fluvial events, the site, and surrounding roads, are unaffected by flooding. Safe access and egress will need to be demonstrated in the 1% AEP plus climate change surface water event and fluvial events. Ideally, the access route should be situated 300mm above the designed flood level. Raising of access routes must not impact on surface water flow routes.

	Consideration should be given to the siting of access points with respect to areas of flood risk. A Flood Warning and Evacuation plan should be in place for the site. Alternatively, risk could be managed by inclusion of a higher refuge and a flood response plan that meets the requirements of the Local Council and their Emergency Planner, considering the likely warning time and duration of flooding.
Dry Islands	The site is not located on a dry island.
Climate change	
Implications for the site	• Increased storm intensities due to climate change may increase the extent, depth, velocity, hazard and frequency of both fluvial, tidal and surface water flooding. • In the absence of detailed modelling, the Flood Map for Planning Flood Zone 2 is used as an indicative 1% + climate change flood extent layer. • Climate change should also be considered for surface water events; at the site-specific stage, the 1% AEP +40% event is considered as part of surface water drainage strategies, or surface water modelling. The 1% AEP +40% Climate Change upper uplift (for the Broadland Rivers Management Catchment) event mapping suggests that the site is likely to be at a slight increased risk of surface water flooding in future, with the area of ponding along the northern boundary of the site increasing in diameter by approximately 5m. Risk to Station Road and Top Common also increases slightly in this climate change scenario. • Developers should consider SuDS strategies to reduce the impacts of climate change from surface water in a detailed site-specific FRA. Given the surface water risk appears to originate from Station Road, the Council's Highways Authority and/or National Highways should be consulted.
Requirements for drainage control and impact mitigation	

Broad-scale assessment of possible SuDS	**Geology & Soils**
	• Geology at the site consists of:
	  ○ Bedrock- Sussex White Chalk Formation
	  ○ Superficial- Till-Diamicton
	• Soils at the site consist of:
	  ○ Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils
	SuDS
	• The site is considered to have a moderate susceptibility to groundwater. 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 chalk which is likely to be free draining. This should be confirmed through infiltration testing, with the use of infiltration maximised as much as possible in accordance with the SuDS hierarchy.
	• The site is not located within a historic landfill site.
	• 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.
	• 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, along the northern site boundary, 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 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, blue/green corridors, 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 Local Authority will need to confirm that the sequential test has been carried out in line with national guidelines. The Sequential Test needs to be passed before the Exception Test is applied. The NPPF classifies residential development as 'More Vulnerable'. • As the site lies within an area at risk of surface water flooding, the Exception Test needs to be applied. This is likely to be passed if the drainage issues on the site boundaries and adjacent roads are addressed.
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 the proposed development site is more than 1 hectare in area and the site and surrounding access routes are at risk of surface water flooding. • All sources of flooding, particularly the risk from 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, South Norfolk 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. **Guidance for site design and making development safe:** • Safe access and egress will need to be demonstrated in the 1 % AEP plus climate change fluvial and rainfall events, using the depth, velocity and hazard outputs. Ideally, the access route should be situated 300mm above the designed flood level. 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. • 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. 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 help to ensure that overland flows do not overwhelm future sustainable drainage features. • The proposed site 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).

Key messages

The development is likely to be able to proceed if:

- Safe access and egress can be demonstrated in the 1% AEP surface water event.
- Consultation with the Council's Highways Authority and/or National Highways shows that the identified drainage issues emanating from Station Road can be resolved or mitigated to an acceptable level.

Mapping Information

The key datasets used to make planning recommendations regarding this site was the Environment Agency's Flood Map for Planning and their Risk of Flooding from Surface Water (RoFSW) dataset.

Flood Zones	Flood Zones 2 and 3 have been taken from the Environment Agency's Flood Map for Planning mapping.
Climate change	1% AEP + 40% Climate Change modelled surface water flood extent was used in this assessment in line with the Broadland Rivers Management Catchment Upper End Peak River Flow uplifts.
Fluvial depth, velocity and hazard mapping	N/A
Surface Water	The Environment Agency's Risk of Flooding from Surface Water dataset has been used to define areas at risk from surface water flooding.

South Norfolk Council Level 2 Strategic Flood Risk Assessment Detailed Site Summary Tables

Site details

Site Code	**SN1052REV / VCPSM1**
Address	Norwich Road, Pulham St. Mary, Pulham St Mary, South Norfolk TM 20630 85491
Area	2.77
Current land use	Greenfield
Proposed land use	Residential

Sources of flood risk

Location of the site within the catchment	The site lies within the River Waveney catchment. The site is located 420m north of the Starston Brook, a tributary of the River Waveney. The tributary between Starston Brook and the River Waveney is 7.6km east of the site. An unnamed watercourse runs 560m from the western edge of the site. The confluence between this unnamed tributary and the Starston Brook is 588m from the southwest of the site.
Existing drainage features	Local topography shows the site is situated at a topographic high and that the site slopes downwards towards its southeast corner. This indicates drainage is likely in a southeast direction, towards the Starston Brook.
Fluvial	**The proportion of site at risk (Environment Agency's Flood Map for Planning):** **FZ3b –** 0% **FZ3a –** 0% **FZ2 –** 0% **FZ1 –** 100% *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:** The Environment Agency's (EA) Flood Map for Planning has been used within this assessment. **Flood characteristics:** The site is not currently at risk of fluvial flooding. The EA's Flood Maps for Planning show the site is not located within Flood Zone 2 and 3.
Surface Water	**Proportion of site at risk (RoFSW):** **3.3% AEP** – 0% Max depth- N/A Max velocity- N/A **1% AEP** – 0% Max depth- N/A Max velocity- N/A **0.1% AEP** – 10.7% Max depth- 0.00 – 0.15m Max velocity- 1.00 – 2.00m/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. 1% AEP % includes the 3.3% AEP %) **Description of surface water flow paths:** The site is not at predicted risk of surface water flooding during the 3.3% or 1% AEP events. In the 0.1% AEP event, a surface water flow path exists along the eastern edge of the site, intruding 100m in from the south of the site. A surface water pond of diameter 25m also is predicted to form in the 0.1% AEP event, just north of the surface water flow path, adjacent to Mill Lane. Predicted flood depths during the 0.1% AEP event reach a maximum of 0.0-0.15m and flow velocities reach a maximum of 1.00 - 2.00m/s. The maximum hazard classification of this flooding is 'Very Low Hazard'.
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 ≥ 25% to <50% 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.
Sewers	The site is not located in a postcode where there is a record of historic sewer flooding according to Anglian Water's DG5 Register for Greater Norwich
Flood history	The Environment Agency's historic flooding and recorded flood outlines datasets do not have a record of any flooding on or surrounding the site. Norfolk County Council's historic flooding records also do not show any flooding on or surrounding the site.
Flood risk management infrastructure	
Defences	The site is not protected by any formal flood defences.
Residual risk	The Starston Brook and its unnamed tributary are both culverted under Station Road and Harleston Road respectively. This could pose a residual risk to the site in the event of a blockage, which could cause water to back up and encroach on the site. However, this is unlikely to occur due to the location of the site at a topographic high.
Emergency planning	
Flood warning	The site is not located in an Environment Agency Flood Warning Area.
Access and egress	Direct access to the southeast of the site is possible via Poppy's Lane. Norwich Road also provides foot access to the southeast of the site. However, this route is not accessible by vehicle due to the presence of a dyke along Norwich Road adjacent to the site. Poppy's Lane is flooded during the 3.3%, 1% and 0.1% AEP events and Norwich Road is flooded during the 1% and 0.1% AEP events. During the 3.3% AEP event maximum flood depths are 0.01-0.15m and during the 1% and 0.1% AEP events, maximums are 0.15-0.30m. Since these flood depths are shallow, the site may remain accessible to larger emergency vehicles in these events.
Dry Island	The site is not located on a dry island.
Climate change	
Implications for the site	• Increased storm intensities due to climate change may increase the extent, depth, velocity, hazard and frequency of fluvial and surface water flooding.

	• Climate change should also be considered for surface water events; at the site-specific stage, the 1% AEP +40% event is considered as part of surface water drainage strategies, or surface water modelling. The 1% AEP +40% Climate Change Upper Uplift (for the Broadland Rivers Management Catchment) event mapping suggests that the site is likely to be at a slight increased risk of surface water flooding in future, with the three new areas of surface water ponding forming within the site. The largest area of ponding measures approximately 30m in diameter. • Developers should consider SuDS strategies to reduce the impacts of climate change from surface water in a detailed site-specific FRA. • A site-specific FRA, with the most up-do-date climate change allowances, should be undertaken to investigate the implications of climate change on the site.
Requirements for drainage control and impact mitigation	

Broad-scale assessment of possible SuDS	**Geology & Soils**
	• Geology at the site consists of:
	  ○ Bedrock- Chalk Formation, Newhaven Chalk Formation, Culver Chalk Formation and Portsmouth Chalk Formation.
	  ○ Superficial- Lowestoft Formation- Diamicton.
	• Soils at the site consist of:
	  ○ Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils.
	SuDS
	• The site is considered to have a low susceptibility to groundwater. Detention and attenuation features should be designed to prevent groundwater ingress from impacting hydraulic capacity and structural integrity. Groundwater monitoring is recommended to determine the seasonal variability of groundwater levels, as this may affect the design of the surface water drainage system. Below ground development such as basements may not be appropriate at this site.
	• BGS data indicates that the underlying geology is chalk which is likely to be free draining. This should be confirmed through infiltration testing, with the use of infiltration maximised as much as possible in accordance with the SuDS hierarchy.
	• The site is not located within a historic landfill site.
	• 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 Risk of Flooding from Surface Water (RoFSW) mapping indicates the presence of surface water flow paths during the 0.1% AEP event. Existing flow paths should be retained and integrated with blue-green infrastructure and public open space.
	• If it is proposed to discharge runoff to a watercourse or sewer system, the condition and capacity of the receiving watercourse or asset should be confirmed through surveys and the discharge rate agreed with the asset owner.

Opportunities for wider sustainability benefits and integrated flood risk management	• Implementation of SuDS at the site could provide opportunities to deliver multiple benefits including volume control, water quality, amenity and biodiversity. This could provide wider sustainability benefits to the site and surrounding area. Proposals to use SuDS techniques should be discussed with relevant stakeholders (LPA, LLFA and EA) at an early stage to understand possible constraints. • Development at this site should not increase flood risk either on or off site. The design of the surface water management proposals should take into account the impacts of future climate change over the projected lifetime of the development. • Opportunities to incorporate 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 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, blue/green corridors, 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 Local Authority will need to confirm that the sequential test has been carried out in line with national guidelines. The Sequential Test will need to be passed before the Exception Test is applied. The entire site lies outside of Flood Zone 2 and 3 but as it is greater than 1 hectare in area and predicted to be affected by surface water flooding, the Exception Test is required.
Requirements and guidance for site-specific Flood Risk Assessment	**Flood Risk Assessment:** • The developer will need to demonstrate to the satisfaction of the local planning authority that the development will be safe for its lifetime taking account of the vulnerability of its users, a site-specific flood risk assessment may need to show that appropriate evacuation procedures and flood response infrastructure are in place to manage the residual risk associated with an extreme flood event. (Para 048 Flood Risk and Coastal Change PPG). • Whilst the site lies entirely outside of Flood Zones 2 and 3, it is recommended that a site-specific Flood Risk Assessment is undertaken to provide evidence that the proposals satisfy the Exception Test due to the surface water flow paths at the southeast of the site. • The site-specific FRA should be carried out in line with the National Planning Policy Framework; Flood Risk and Coastal Change Planning Practice Guidance; the Joint Core Strategy as part of the Greater Norwich Development Partnership for Broadland, Norwich and South Norfolk; and the Norfolk County Council Lead Local Flood Authority's Statutory Consultee for Planning Guidance Document. • Consultation with the Local Authority and the Lead Local Flood Authority should be undertaken at an early stage. **Guidance for site design and making development safe:** • Development should aim to be steered away from areas of surface water flood risk along the southeast of the site, preserving these spaces as green infrastructure. • Safe access and egress will need to be demonstrated in the 0.1% AEP event plus climate change fluvial and rainfall events, using the depth, velocity and hazard outputs. 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. • 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. • Surface water should be discharged at the pre-development (greenfield) runoff rate 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 help to ensure that overland flows do not overwhelm future sustainable drainage features. • 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 development is likely to be able to proceed if:

- A carefully considered and integrated flood resilient and sustainable drainage design is put forward, with development to be steered away from the southern site boundary.
- Space for surface water to be stored on the site is provided and rainwater harvesting should be considered.
- A site-specific Flood Risk Assessment demonstrates that the site is not at an increased risk of flooding in the future, and that the development of the site does not increase the risk of surface water flooding on the site and to neighbouring properties.
- Consideration should be given to the siting of safe access and egress routes, and these must not impede surface water flows risk.

Mapping Information

The key datasets used to make planning recommendations regarding this site were the Environment Agency's Flood Map for Planning and the Risk of Flooding from Surface Water dataset. 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	In the absence of detailed modelling, the Environment Agency's Flood Map for Planning Flood Zone 2 has been used as an indication of flood extent during a 1% + climate change scenario. For surface water risk, a 1% AEP +40% scenario has been considered, which represents the Broadland Rivers Management Catchment for the 2070s.
Surface Water	The Risk of Flooding from Surface Water dataset has been used to define areas at risk from surface water flooding.
Surface water depth, velocity and hazard mapping	The surface water depth, hazard and velocity mapping are taken from the Environment Agency's Risk of Flooding from Surface Water dataset.

South Norfolk Council Level 2 Strategic Flood Risk Assessment Detailed Site Summary Tables

Site details

Site Code	**SN2036**
Address	Low Road, Low Street, Wortwell, Harleston, 627690, 284821
Area	0.52ha
Current land use	Greenfield
Proposed land use	Residential

Sources of flood risk

Location of the site within the catchment	The site is located in the River Waveney Catchment, between the main Waveney River and the Starston Brook tributary. The River Waveney flows from its source in the Regrave and Lopham Fen National Nature Reserve, through the towns of Harleston, Diss, Bungay and Beccles, and joins the River Yare before it reaches the sea at Great Yarmouth. The Starston Brook flows from its source near Sneath Common, through Starston and Redenhall, before joining the River Waveney near Fixton Road.
Existing drainage features	The site is located approximately 0.45km away from the Starston Brook tributary in the north-west. The Environment Agency states that the waterbody is natural, having not been subject to any modifications. Approximately 0.47km south-east from the site is the River Waveney. This section of the river is heavily modified, having been subject to channel straightening and deepening over the years. Online imagery suggests there are also a number of drainage ditches in the area, as well as a cluster of lakes behind the site that surround a Caravan Park. Apart from those specified, there are no additional watercourses within or near the site.
Fluvial	**The proportion of site at risk:** **FZ3b – 0%** **FZ3a – 0%** **FZ2 – 7.7%** **FZ1 – 92.3%** *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:** Hydraulic 2D modelling has been undertaken for the site in 2022 using TUFLOW, based on the existing Environment Agency Lower Waveney model, 2013; as rerun in 2017 by JBA Consulting. **Flood characteristics:** The modelling shows the site is not at risk of flooding in the 5%, 1% or 0.1% AEP events. However, the EA's published Flood Zones show the northeast corner is within Flood Zone 2. Current modelling has been undertaken using LiDAR (without detailed channel survey) therefore it is recommended further investigation is undertaken should development be proposed within the area of the site shown to be within Flood Zone 2.
Coastal and Tidal	The site is not at risk from tidal or coastal flooding.

Surface Water	**Proportion of site at risk (RoFfSW):** **3.3% AEP** – 0% Max depth – 0m Max velocity – 0m/s **1% AEP** – 0% Max depth – 0m Max velocity – 0m/s **0.1% AEP** – 0% Max depth – 0m Max velocity – 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 %)* **Description of surface water flow paths:** There is no risk of surface water flooding within or along the boundary of the site in all AEP events. In the 3.3% AEP event, there is surface water flooding that extends along the open drainage ditch and the cluster of lakes situated 17.3m (at minimum) east of the site. There is minimal flooding on High Road, adjacent to the site, and along Low Road nearby. The estimated depth of this road flooding is <0.30m. Access to and from the site will therefore be maintained. In the 1% AEP event, the surface water flooding extent is slightly greater than in the 1 in 30-year event along High Road and Low Road. The estimated depth of this flooding is <0.30m. Access to and from the site will therefore be maintained. In the 0.1% AEP event, the surface water flooding is seen to slightly encroach on the land behind the proposed site, however this is still 24.2m from the site boundary. Flooding extents are also greater along High and Low Road. This road flooding has an estimated maximum depth of 0.30m and a maximum velocity of 1-2m/s. Emergency vehicles will still be able to access the site. The flooding surrounding the front of the site is classified as 'Very Low Hazard' in all AEP events.
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 <25% 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
Sewers	The site is located in a postcode with no recorded historic sewer flooding.
Flood history	The Environment Agency's historic flooding and recorded flood outlines datasets do not have a record of any flooding on or surrounding the site.
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 north-east and south-east corners of the site are covered in the River Waveney from Diss to Bungay' Flood Alert Area.

Access and egress	The site is currently accessible from High and Low Road. Access and egress to the site is unlikely to be affected by fluvial flooding in the 0.1% AEP event, considering climate change. Access to the site is unlikely to be significantly impacted by surface water during the 0.1% AEP surface water event. There is some minor surface water flooding on the surrounding roads, limited in extent with maximum flood depths on the roads below0.3m. Therefore, emergency vehicles will be able to safely access and exit the site during the event.
Dry Islands	The site is not located on a dry island.
Climate change	
Implications for the site	• Increased storm intensities due to climate change may increase the extent, depth, velocity, hazard and frequency of both fluvial and surface water flooding. • The central and higher climate change scenarios have been modelled as part of this assessment. Modelling suggests that the site will not be at risk in the future even during the 0.1% AEP event in the higher central scenario. • Climate change should also be considered for surface water events; at the site-specific stage, the 1% AEP +40% event is considered as part of surface water drainage strategies, or surface water modelling. The 1% AEP +40% event mapping suggests that the site is unlikely to be at increased risk of surface water flooding in future. In addition to the SuDs features designed to accommodate runoff from new development infrastructure the proposals should also address the potential loss of natural storage of rainfall and runoff provided by the land in its natural condition. • Developers should consider SuDS strategies to reduce the impacts of climate change from surface water in a detailed site-specific FRA.
Requirements for drainage control and impact mitigation	

Broad-scale assessment of possible SuDS	**Geology & Soils**
	• Geology at the site consists of:
	  ○ Bedrock- Neogene and Quaternary (undifferentiated) Formation, made from conglomerates, gravel, silt, sand and muddy aeolian loess-type deposits.
	  ○ Superficial- River Terrace Deposits- Sand and Gravel.
	• Soils at the site consist of:
	  ○ Lime-rich loamy and clayey soils- high fertility, impeded drainage.
	SuDS
	• The site is considered to have very low susceptibility to groundwater flooding, this should be confirmed through additional site investigation work. Below ground development such as basements may still be susceptible to groundwater flooding.
	• BGS data indicates that the underlying geology is a combination of conglomerates, gravel, silt, sand and muds which are 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 site.
	• Any 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 site is within the Waveney, Lower Yare and Lothingland Internal Drainage Board district who may have additional requirements regarding discharge rates (directly or indirectly) into their district. The IDB should be consulted during the detailed design of the site to establish the Board's requirements, and determine whether there will be a need to apply for surface water discharge or ordinary watercourse consents.

	• 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 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 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. The NPPF classifies residential development as 'More Vulnerable'. As part of the site is in Flood Zone 2, the Exception Test is required for the site.
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 the proposed development site is 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:** • 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% AEP plus climate change fluvial and rainfall events, using the depth, velocity and hazard outputs. 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. • Resilience measures will be required if buildings are situated in flood risk areas. • 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. 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. • The proposed site 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).

Key messages

The development is likely to be able to proceed 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.
- 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.
- The proposed site 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).

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…

Flood Zones	Flood Zones 2 and 3 have been taken from the Environment Agency's Flood Map for Planning mapping.
Climate change	Climate change allowances (for the 2080s) were modelled as part of Level 2 SFRA. This included Central (+11%) and Higher Central (+20%). For surface water a +40% scenario has been considered.
Fluvial depth, velocity and hazard mapping	2D hydraulic modelling has been undertaken for the site in 2022 using TUFLOW, based on the existing Environment Agency Lower Waveney model, 2013; as rerun in 2017 by JBA Consulting.
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 is taken Environment Agency's Risk of Flooding from Surface Water mapping.

South Norfolk Council Level 2 Strategic Flood Risk Assessment Detailed Site Summary Tables

Site details

Site Code	**SN2065REV**
Address	High Road, Needham, Harleston, 623261, 282074
Area	0.96ha
Current land use	Greenfield
Proposed land use	Residential

Sources of flood risk

Location of the site within the catchment	The site is located in the River Waveney Catchment, between the River Dove and Starston Brook section of the reach. The River Waveney flows from its source in the Regrave and Lopham Fen National Nature Reserve, through the towns of Harleston, Diss, Bungay and Beccles, and joins the River Yare before it reaches the sea at Great Yarmouth.
Existing drainage features	The site is located approximately 0.3km north-west of the River Waveney. The Environment Agency states that the reach section in which the site is located near is heavily modified, having undergone channel straightening and deepening over the years. Approximately 1.06km south-east from the site, located on the other side of the River Waveney, are 6 large angling lakes. Online imagery suggests that behind the proposed site, there is a drainage ditch that is connected to the River Waveney upstream of the site. Apart from those specified, there are no additional watercourses within the site or near the site.
Fluvial	**The proportion of site at risk:** **FZ3 –** 8% **FZ2 –** 10% **FZ1 –** 90% *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:** Site-specific 2d modelling has been undertaken for the site in 2022 using TUFLOW, based on the existing Environment Agency Lower Waveney model, 2013; as rerun in 2017 by JBA Consulting. **Flood characteristics:** Site specific modelling shows the site is not at risk of flooding in the 5% or 1% AEP events. Whilst the EA's published Flood Zones show the northeast corner and southern edge of the site to be within Flood Zone 2, site-specific modelling suggests the site is unlikely to be at risk in the 0.1% AEP event, and this remains the case even in the upper-end climate change scenario. Site-specific modelling has been undertaken using LIDAR (without detailed channel survey) and it is recommended further investigation is undertaken should development be proposed within the area of the site shown to be within Flood Zone 2.

Coastal and Tidal	The site is not at risk from tidal or coastal flooding.
Surface Water	**Proportion of site at risk (RoFfSW):** **3.3% AEP** – 0% Max depth – 0m Max velocity – 0m/s **1% AEP** – 0% Max depth – 0m Max velocity – 0m/s **0.1% AEP** – 0% Max depth – 0m Max velocity – 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 %)* **Description of surface water flow paths:** There is no risk of surface water flooding within or along the boundary of the site in all AEP events. In the 3.3% AEP event, a surface water flow path is predicted to extend from Upper Harmans Lane and flow behind the proposed site at a minimum distance of 15m away, towards the top of High Road and into the River Waveney. LiDAR data shows that the topography behind the site slopes from 30.05mAOD to 22mAOD, therefore encouraging the surface water flow path to take it's observed route. The estimated depth of the surface water flow path is greatest along Harman's Lane (0.30m-0.60m) and decreases behind the site to a maximum depth of 0.30m. The flooding behind the site is classified as 'Very Low Hazard'. In the 1% AEP event, the extent of the predicted surface water flow path is slightly greater but still follows the same route as in the 3.3% AEP event, into the River Waveney. The estimated depth of the surface water flow path remains the same along Harman's Lane (0.30m-0.60m) and decreases behind the site to a maximum of 0.30m. The flooding behind the site is classified as 'Very Low Hazard'. In the 0.1% AEP event, the predicted surface water flow path is even wider behind the site, but still does not cross the site boundary. The estimated depth of the surface water flow path remains the same along Harman's Lane (0.30m-0.60m) and decreases behind the site to a maximum of 0.30m with a maximum velocity of 1-2m/s. The flooding behind the site is classified as 'Danger for most'. The site will be accessible during all flood AEP events through High Road.
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 < 25% 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.
Sewers	The site is located in a postcode with no recorded historic sewer flooding.
Flood history	The Environment Agency's historic flooding and recorded flood outlines datasets do not have a record of any flooding on or surrounding the site.

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 north-east corner of the site is covered by the 'River Waveney from Diss to Bungay' Flood Alert Area.
Access and egress	The site is currently accessible from High Road. This site will be accessible in event of a 0.1% AEP flood as flooding is unlikely to impact the section of High Road directly south of the site. High Road is seen to experience some flooding near the roundabout to the north of the site and at the junction to the south, however maximum flood depths will be below 0.3m. Access/egress travelling southwards remains unaffected.
Dry Islands	The site is not located on a dry island.
Climate change	
Implications for the site	• Increased storm intensities due to climate change may increase the extent, depth, velocity, hazard and frequency of both fluvial and surface water flooding. • The central and higher climate change scenarios have been modelled as part of this assessment. Modelling suggests that the site will not be at risk in the future even during the 0.1% AEP event in the higher central scenario. • Climate change should also be considered for surface water events; at the site-specific stage, the 1% AEP +40% event is considered as part of surface water drainage strategies, or surface water modelling. The 1% AEP +40% event mapping suggests that the site is unlikely to be at increased risk of surface water flooding in future. In addition to the SuDs features designed to accommodate runoff from new development infrastructure the proposals should also address the potential loss of natural storage of rainfall and runoff provided by the land in its natural condition. • Developers should consider SuDS strategies to reduce the impacts of climate change from surface water in a detailed site-specific FRA.
Requirements for drainage control and impact mitigation	

Broad-scale assessment of possible SuDS	**Geology & Soils**
	• Geology at the site consists of:
	  ○ Bedrock- Neogene and Quaternary (undifferentiated) Formation, made from conglomerates, gravel, silt, sand and muddy aeolian loess-type deposits.
	  ○ Superficial- River Terrace Deposits- Sand and Gravel.
	• Soils at the site consist of:
	  ○ Lime-rich loamy and clayey soils- high fertility, impeded drainage.
	SuDS
	• The site is considered to have very low susceptibility to groundwater flooding, this should be confirmed through additional site investigation work. Below ground development such as basements may still be susceptible to groundwater flooding.
	• BGS data indicates that the underlying geology are conglomerates, gravel, silt, sand and muds which are 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 site.
	• 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. • 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 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 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. The NPPF classifies residential development as 'More Vulnerable'. As the site is partially within Flood Zone 2, the exception test needs to be applied. It is recommended that a precautionary approach is taken and further investigation undertaken if any development is proposed within the area of the site shown to be in Flood Zone 2.
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 the proposed development site is partially 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:** • 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% AEP plus climate change fluvial and rainfall events, using the depth, velocity and hazard outputs. 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. • Resilience measures will be required if buildings are situated in flood risk areas. • 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. 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. • The proposed site 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).

Key messages

The development is likely to be able to proceed if:

- 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.
- The proposed site 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).

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.

Flood Zones	Flood Zones 2 and 3 have been taken from the Environment Agency's Flood Map for Planning mapping.
Climate change	Climate change allowances (for the 2080s) were modelled as part of Level 2 SFRA. This included Central (+11%) and Higher Central (+20%).
Fluvial depth, velocity and hazard mapping	Site-specific 2d modelling has been undertaken for the site in 2022 using TUFLOW, based on the existing Environment Agency Lower Waveney model, 2013; as rerun in 2017 by JBA Consulting.
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.

South Norfolk Council Level 2 Strategic Flood Risk Assessment Detailed Site Summary Tables

Site details

Site Code	**SN4051/VCBB1**
Address	Land Corner of Bell Road and Norwich Road, Barnham Broom, 607993, 307347
Area	1.433
Current land use	Greenfield
Proposed land use	Residential

Sources of flood risk

Location of the site within the catchment	The site is located in the River Yare Catchment, in the village of Barnham Broom. The River Yare flows from its source southwest of Shipdham, past Barnham Broom, through Bawburgh and around Norwich before reaching the North Sea at Great Yarmouth.
Existing drainage features	The site is located approximately 0.41km east of the River Yare. There are no additional watercourses within the site boundary or near the site.
Fluvial	**The proportion of site at risk (Environment Agency's Flood Map for Planning Flood Zones):** **FZ3b –** 0% **FZ3a –** 0% **FZ2 –** 0% **FZ1 –** 100% *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:** The Environment Agency's (EA) Flood Map for Planning has been used within this assessment.
Surface Water	**Proportion of site at risk (RoFSW):** **3.3% AEP** – 1.05% Max depth – 0.30 – 0.60m Max velocity – 0.25 – 0.50m/s **1% AEP** – 3.42% Max depth – 0.30 – 0.60m Max velocity – 0.25 – 0.50m/s **0.1% AEP** – 9.28% Max depth – 0.60 - 0.90m Max velocity – 0.50 – 1.00m/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 greater Annual Exceedance Probability (e.g. 1%AEP % includes the 3.3% AEP %)* **Description of surface water flow paths:**

	There is only one small section on the eastern boundary of the site that is at a low risk of surface water flooding in the 3.3% AEP event. This pool of water is estimated to have a maximum flow depth of 0.60m. The flood hazard classification is predominantly 'Very Low Hazard, although there are areas where flooding is classed as 'Danger for some'. In the 1% AEP event, the extent of surface water flooding increases. However, it is still contained to one section of the eastern boundary of the site. As in the 3.3% AEP event, maximum flow depth is 0.60m and flood hazard classification is a combination of 'Very Low Hazard' and 'Danger for some'. In the 0.1% AEP event, there is further surface water ponding along Bell Road and along a small part of the western boundary of the site. The ponding extent on the eastern boundary of the site is also significantly larger. In this 0.1% AEP surface water event, maximum flood depth increases to 0.90m and a few areas of flooding with a hazard classification of 'Danger for most' can be found. In the 0.1% AEP event, surface water flooding is modelled to pool around Mill Road and parts of Norwich Road and Mill Road, which border the site. The majority of this flooding is modelled with maximum flow depths of 0.60m. There is also a small area of ponding on Bell Road, around 80m south of the site, where flood depths reach >1.20m.
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, 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 western half of the site has a >=50%-<75% susceptibility to groundwater flood emergence. • There is no data shown for the eastern half of the site. The assessment does not negate the requirement that an appropriate assessment of the groundwater regime should be carried out at the site-specific FRA stage.
Sewers	The site is located in a postcode which has been identified as at risk of flooding from sewers in Anglian Water's DG5 Register for Greater Norwich.
Flood history	The Environment Agency's historic flooding and recorded flood outlines datasets do not have a record of any flooding on or surrounding the site. Norfolk County Council's historic flooding records also do not show any flooding to the site. Two incidents of internal flooding have been reported approximately 0.25km from the site.
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 site is not covered by any Environment Agency Flood Alert Areas.
Access and egress	The site is currently accessible via Bell Road or Norwich Road. These roads could be affected by surface water flooding during the 0.1% AEP event as flood depths are shown to reach 0.60m maximum (except for the small area of ponding on Bell Road where depths reach >1.20m). Access and egress, therefore, is unlikely to be affected for emergency vehicles. Safe access and egress will need to be demonstrated in the 1% AEP plus climate change surface water event. Site drainage proposals should address the requirements for access routes, avoid impeding surface water flows and preserve the storage of surface water to avoid exacerbation of flood risk in the wider catchment.
Dry Islands	The site is not located on a dry island.

Climate change

Implications for the site

- Increased storm intensities due to climate change may increase the extent, depth, velocity, hazard and frequency of both fluvial and surface water flooding.
- Climate change should also be considered for surface water events; at the site-specific stage, the 1% AEP +40% climate change event (climate change peak flow upper uplift for the Broadland Rivers Management Catchment) is considered as part of surface water drainage strategies, or surface water modelling. The 1% AEP +40% event mapping suggests that the site is likely to be at a slight increased risk of surface water flooding in future, with the area of ponding at the eastern boundary of the site increasing in diameter by approximately 5m. The mapping also shows a small additional area of ponding on the western side of the site.
- Developers should consider SuDS strategies to reduce the impacts of climate change from surface water in a detailed site-specific FRA.

Requirements for drainage control and impact mitigation

Broad-scale assessment of possible SuDS

Geology & Soils

- Geology at the site consists of:
  - Bedrock- Sussex White Chalk Formation
  - Superficial- Till-Diamicton
- Soils at the site consist of:
  - Slightly acid loamy and clayey soils with impeded drainage.

SuDS

- Half of the site falls in the category of >=50% <75% susceptibility to groundwater flooding. This is a moderate susceptibility to groundwater flooding. 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. For the other half of the site there is no data.
- BGS data indicates that the underlying geology is chalk which is likely to be free draining. This should be confirmed through infiltration testing, with the use of infiltration maximised as much as possible in accordance with the SuDS hierarchy.
- The site is not located within a historic landfill site.
- 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.
- 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 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, blue/green corridors 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 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. The NPPF classifies residential development as 'More Vulnerable'. • As the site is at risk of surface water flooding, the Exception Test needs to be applied. The Exception Test will be passed if the area at risk of surface water flooding in the eastern part of the site is left undeveloped and instead incorporated as amenity greenspace.
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 the proposed development site contains a small area at surface water flood risk and is greater than 1 hectare in Flood Zone 1. • 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, South Norfolk 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:** • The developer will need to demonstrate to the satisfaction of the local planning authority that the development will be safe for its lifetime taking account of the vulnerability of its users, a site-specific flood risk assessment may need to show that appropriate evacuation procedures and flood response infrastructure are in place to manage the residual risk associated with an extreme flood event. (Para 048 Flood Risk and Coastal Change PPG). • Safe access and egress will need to be demonstrated in the 0.1% AEP plus climate change fluvial and rainfall events, using the depth, velocity and hazard outputs. Ideally, the access route should be situated 300mm above the designed flood level. 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. A Flood Warning and Evacuation plan should be in place for the site. Alternatively, risk could be managed by inclusion of a 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 whenever there is built development on land within the 1% +35% climate change flood extent. • Resilience measures will be required if buildings are situated in flood risk areas. • 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. 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. • The proposed site 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). • 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 development is likely to be able to proceed 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.
- The most at-risk area of the site (eastern edge) is designated for less vulnerable development.
- 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.
- The proposed site 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 can be demonstrated in the 1% AEP surface water event.
- 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 Environment Agency's Flood Map for Planning 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.
Climate change	In the absence of detailed modelling, the Environment Agency's Flood Map for Planning Flood Zone 2 has been used as an indication of flood extent during a 1% + climate change scenario. For surface water risk, a 1% AEP +40% scenario has been considered, which represents the Broadland Rivers Management Catchment for the 2070s.
Fluvial depth, velocity and hazard mapping	This site is not shown to be at significant risk of flooding from fluvial sources.
Surface Water	The Environment Agency's Risk of Flooding from Surface Water dataset has been used to define areas at risk from surface water flooding.

South Norfolk Council Level 2 Strategic Flood Risk Assessment Detailed Site Summary Tables

Site details

Site Code	**SN4055 / VCWIN2**
Address	The Street, Winfarthing, TM 10879 85472
Area	0.91ha
Current land use	Greenfield
Proposed land use	Residential

Sources of flood risk

Location of the site within the catchment	The site is located in the River Waveney catchment near the Frenze Beck. The Frenze Beck is a tributary of the Waveney The Frenze Beck emerges in Winfarthing (opposite the proposed site) and flows south around Diss and joins the River Waveney upstream of Scole. The River Waveney then continues travelling through Bungay and Beccles and joins the River Yare, before it reaches the sea at Great Yarmouth.
Existing drainage features	The site is located approximately 0.2km west of the Frenze Beck tributary. The Environment Agency states that the Frenze Beck is not heavily modified. Online imagery shows that there is a drainage ditch located 0.2km north-west of the site. There are no known additional watercourses within or near the site. Local topography shows the site at a higher relief compared to land located 200m east. This indicates that drainage from the site would be in an easterly direction.
Fluvial	**The proportion of site at risk (Environment Agency's Flood Map for Planning):** **FZ3b –** 0% **FZ3a –** 0% **FZ2 –** 0% **FZ1 –** 100% *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:** The Environment Agency's Flood Map for Planning Flood Zone has been used in this assessment. **Flood characteristics:** The site is not shown to be at risk of flooding from fluvial sources by the Environment Agency's Flood Map for Planning. There is an ordinary watercourse 0.2km to the east of the site which is a tributary of the Frenze Beck, although the Environment Agency's Flood Map for Planning shows that the flood zones extend are contained behind a row of properties on the opposite site of the road to the proposed site.
Surface Water	**Proportion of site at risk (Environment Agency's RoFfSW dataset):** **3.3% AEP** – <1% Max depth – 0.15 - 0.30m Max velocity – 0.00 - 0.25m/s **1% AEP** – 1.55% Max depth – 0.15 - 0.30m

	Max velocity – 0.25 - 0.50m/s **0.1% AEP** – 31% Max depth – 0.30 - 0.60m Max velocity – 0.50 - 1m/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 %)* **Description of surface water flow paths:** In general, surface water flooding is limited to the north-east of the site. Surface water mapping suggests that the site may be at risk from surface water flow paths to the north of the site and it is recommended that further investigation is undertaken as part of a site-specific Flood Risk Assessment. During the 3.3% AEP event, predicted surface water flooding on the site is minimal, with only <1% of the site at risk from a surface water flow path crossing into the northern corner of the site. The maximum predicted depth of flooding is 0.15 - 0.30m and maximum velocity is 0.00 - 0.25m/s. This surface water flow path flows along the B1077, down The Street and through the Education Facility (opposite the proposed site) until it joins the Frenze Beck. The flooding at this AEP event is classified as being 'Very Low Hazard'. During the 1% AEP event, the surface water path extent is predicted to be slightly greater than it was in the 3.3% AEP event, flooding slightly more of the northern corner of the site. Predicted flood depths are the same as the 3.3% AEP event. The maximum velocity increases to 0.25 – 0.30m/s. The flooding in the northern corner is classified as being 'Very Low Hazard'. During the 0.1% AEP event, the predicted surface water flow path extends further across the northern corner of the site. Predicted flood depths may affect safe access and egress to the site via the B1077 as the road is shown to be subject to 0.60m flooding in areas. The flooding in this 0.1% AEP event is predominantly classified as 'Very Low Hazard', however there are small areas with 'Danger for some' and 'Danger for most' classifications.
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 >= 25% <50% 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.
Sewers	The site is not located in a postcode with recorded sewer flooding according to Anglian Water's DG5 Register for Greater Norwich.
Flood history	The Environment Agency's historic flooding and recorded flood outlines datasets do not have a record of any flooding on or surrounding the site. Norfolk County Council's historic flooding records also do not show any flooding on or surrounding the site.
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 site is not located in an Environment Agency Flood Warning Area.
Access and egress	There is one main road that could provide access and egress to the site, Mill Road B1077. Access and egress from the site via Mill Road B1077 to the north may be

	affected by surface water flooding in front of the site during the 0.1% AEP event however access southwards is likely to be unaffected. The depths, of this surface water flooding remains below 0.15m so are therefore unlikely to impact access and egress to the site for emergency vehicles. As surface water events are typically flashy and short-lived, it is likely that access to the site will only be affected for a short period of time.
Dry Islands	The site is not located on a dry island.
Climate change	
Implications for the site	• Climate change should also be considered for surface water events; at the site-specific stage, the 1% AEP +40% event is considered as part of surface water drainage strategies, or surface water modelling. The 1% AEP +40% Climate Change upper uplift (for the Broadland Rivers Management Catchment) event mapping suggests that the site is likely to be at increased risk of surface water flooding in future, with the area of surface water flooding to the northern corner of the site increasing by approximately 14m diameter. • Developers should consider SuDS strategies to reduce the impacts of climate change from surface water in a detailed site-specific Flood Risk Assessment. • Currently, no model data is available for the ordinary watercourse (Frenze Beck) which flows to the east of the site. This should be further investigated considering the most up-do-date climate change allowances to investigate the implications of climate change on the site.
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- Lowestoft Formation – Diamicton.
	• Soils at the site consist of:
	  ○ Loamy and clayey soils- moderate fertility, impeded drainage.
	
	SuDS
	
	• The site is considered to have a low susceptibility to groundwater. Detention and attenuation features should be designed to prevent groundwater ingress from impacting hydraulic capacity and structural integrity. Groundwater monitoring is recommended to determine the seasonal variability of groundwater levels, as this may affect the design of the surface water drainage system. Below ground development such as basements may not be appropriate at this site.
	
	• BGS data indicates that the underlying geology is chalk which is likely to be free draining. This should be confirmed through infiltration testing, with the use of infiltration maximised as much as possible in accordance with the SuDS hierarchy.
	
	• The site is not located within a historic landfill site.
	
	• 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 Risk of Flooding from Surface Water (RoFSW) mapping indicates the presence of surface water flow paths 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.

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 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, blue/green corridors, 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 Local Authority will need to confirm that the Sequential Test has been carried out. • The NPPF classifies residential development as 'More Vulnerable'. • The Exception Test is not required for this site due to the site being 100% in Flood Zone 1 and the site is not at significant risk within the 1% AEP surface water scenario.
Requirements and guidance for site-specific Flood Risk Assessment	**Flood Risk Assessment:** • Although 100% of the site is within Flood Zone 1, a small proportion of the site is subject to surface water flooding in all AEP flood events. Therefore, it is recommended that a precautionary approach is taken, and a site-specific flood risk assessment undertaken, including an assessment of future surface water flood risk accounting for climate change. • The site-specific FRA should be carried out in line with the National Planning Policy Framework; Flood Risk and Coastal Change Planning Practice Guidance, South Norfolk 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. **Guidance for site design and making development safe:** • The developer will need to demonstrate to the satisfaction of the local planning authority that the development will be safe for its lifetime taking account of the vulnerability of its users, a site-specific flood risk assessment may need to show that appropriate evacuation procedures and flood response infrastructure are in place to manage the residual risk associated with an extreme flood event. (Para 048 Flood Risk and Coastal Change PPG). • The development should be designed using a sequential approach. Development should be steered away from areas of surface water flood risk along the northern boundary, preserving these spaces as green infrastructure. • Safe access and egress will need to be demonstrated in the 0.1% AEP plus climate change rainfall event, using the depth, velocity and hazard outputs. Raising of access routes must not impact on surface water flow routes. Consideration should be given to the siting of access points with respect to areas of surface water flood risk. • Resilience measures will be required if buildings are situated in the flood risk area along the north of the site. Raising Finished Floor Levels above the design event (+600mm) may remove the need for resilience measures. • The risk from surface water flow routes should be quantified as part of a site-specific Flood Risk Assessment, including a drainage strategy, to ensure that runoff from the

	development is not increased by placing 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 the current greenfield rates. • On site attenuation schemes would need to be tested to ensure flows are not exacerbated downstream within the catchment. • New or re-development should adopt exemplar source control SuDS techniques to reduce the risk of frequent low impact flooding due to post-development runoff. Assessment for runoff should include allowance for climate change effects. • Surface water runoff should be fully attenuated to the greenfield rate to ensure that there is no increase in surface water flood risk elsewhere. • 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 development is likely to be able to proceed if:

- A site-specific Flood Risk Assessment demonstrates that the site is not at an increased risk of flooding in the future as a result of climate change, and that the development of the site does not increase the risk of surface water flooding on the site and to neighbouring properties.
- Space for surface water to be stored on the site is provided and rainwater harvesting should be considered.
- The proposed site should discharge surface water at the original pre-development (greenfield) runoff rate.
- Safe access and egress routes must not be in the areas of high surface water risk.
- 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 was the Environment Agency's Flood Map for Planning and the Risk of Flooding from Surface Water dataset. 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	1% AEP + 40% Climate Change modelled surface water flood extent was used in this assessment in line with the Broadland Rivers Management Catchment Upper End Peak River Flow uplifts
Surface Water	The Risk of Flooding from Surface Water mapping has been used to define areas at risk from surface water flooding.
Surface water depth, velocity and hazard mapping	The surface water depth, hazard and velocity mapping are taken from the Environment Agency's Risk of Flooding from Surface Water dataset.

South Norfolk Council Level 2 Strategic Flood Risk Assessment Detailed Site Summary Tables

Site details

Site Code	**SN4078/VCGIL1**
Address	Land south of GIL1 The Street, Gillingham, 640599 291849
Area	2.2ha
Current land use	Greenfield
Proposed land use	Residential

Sources of flood risk

Location of the site within the catchment	The site is located in the River Waveney Catchment, between Ellingham Mill and Burgh St. Peter. The River Waveney flows from its source in the Regrave and Lopham Fen National Nature Reserve, through the towns of Harleston, Diss, Bungay and Beccles, and joins the River Yare before it reaches the sea at Great Yarmouth.
Existing drainage features	The site is located approximately 0.7km north of the River Waveney. The Environment Agency states that the reach section which the site is located near is heavily modified, having undergone channel straightening and deepening over the years. Online imagery suggests there are drainage ditches to the southeast of the site that direct water to the main river channel. There is an unnamed watercourse flowing north to south through Gillingham which appears to split into two branches to the north of the proposed development site around Old Yarmouth Road. One branch of this watercourse appears to flow broadly southeast on the northern side of Old Yarmouth Road before turning south to flow along the western side of The Street towards the River Waveney. The other branch appears to flow from Old Yarmouth Road, along the western boundary of the site, before turning eastwards along the southern boundary flowing towards a confluence with the other branch to the southwest of The Street and into a network of drainage ditches south of the King's Dam road.
Fluvial	**The proportion of site at risk (Environment Agency's Flood Map for Planning Flood Zones):** **FZ3 –** 11% **FZ2 –**14% **FZ1 –** 86% *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:** Additional modelling was undertaken based on the Environment Agency's Lower Waveney model (2013) to provide depth, velocity and hazard outputs for specific sites. **Flood characteristics:** The modelled 5% AEP flood event covers the western edge and southwest corner of the site. Depths are predicted to reach a maximum of approximately 0.3m here at a velocity of 0.1m/s and hazard rating of 'danger for some'. During the 1% AEP event, the extent increases but depths remain similar. Maximum depths for the 0.1% AEP event reach approximately 0.5m and the extent slightly increases, while the velocities reach 0.6m/s and the hazard rating increases to 'danger for most'.

Coastal and Tidal	**Available data:** Additional modelling was undertaken based on the Environment Agency's Lower Waveney model (2013) to provide depth, velocity and hazard outputs for specific sites. **Flood characteristics:** The modelling shows that during the 0.5% AEP event, the tidal flood extent encroaches onto the southeast corner of the site to depths of approximately 0.6m, velocities of 0.02m/s and hazard rating of 'danger for most'. During the 0.1% AEP, the extent increases in the southeast corner and also enters the site along the western boundary. Depths in the southeast corner reach up to approximately 2.4m, at a velocity of 0.03m/s and hazard rating of 'danger for most'.
Surface Water	**Proportion of site at risk (RoFSW):** **3.3% AEP** – 2% Max depth – 0.60 – 0.90m Max velocity – 0.50 – 1.00m/s **1% AEP** – 4% Max depth – 0.90 – 1.20m Max velocity – 1.00 – 2.00m/s **0.1% AEP** – 13% Max depth – >1.2m Max velocity – 1.00 – 2.00m/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 greater Annual Exceedance Probability (AEP) (e.g. 1% AEP % includes the 3.3% AEP %)* **Description of surface water flow paths:** The site is affected by surface water flooding in the 3.3%, 1% and 0.1% AEP events. In all three surface water events, there is a surface water flow path present to the west of the site, flowing from Geldeston Road, along the western edge of the site, and along the southern edge, similar to the fluvial flow path During the 3.3% event, depths along the western boundary are up to 0.9m at a velocity of between 0.25 and 1m/s and hazard rating of 'danger for some'. For the 0.1% AEP event, the flooding along the western boundary reaches the maximum hazard rating of 'danger for all'. Where flooding extends across the southwest corner, maximum depths are approximately 0.3m at a velocity of 0.25m/s during the 3.3% AEP event. The extent increases and depths increase to 0.6m and hazard rating of 'danger for most' for the 1% AEP event. For the 0.1% AEP event, the depths remain similar but the extent increases further across the corner, and a greater proportion of the flood extent reaches the hazard rating of 'danger for most'.
Reservoir	The site is not shown to be at risk of reservoir flooding from the available online maps. However, the Wet Day reservoir flood extent for Ditchingham Lake inundates a large part of the field to the east of the site, near to the southeast corner of the site. The Wet Day event seeks to estimate the effect of a breach at the same time as a 1 in 1000 river flood is occurring and suggests that the consequences of such a breach are similar to the modelled 1 in 1000 event river flood event, but probably would be associated with a much lower probability.
Groundwater	The Environment Agency Areas Susceptible to Groundwater Flooding, 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 between a >=25% and <50% susceptibility to groundwater flood emergence. The assessment does not negate the requirement that an appropriate assessment of the groundwater regime should be carried out at the site-specific FRA stage.
Sewers	The site is located in a postcode area with no recorded historic sewer flooding, according to Anglian Water's DG5 Register for Greater Norwich.
Flood history	The Environment Agency's historic flooding and recorded flood outlines datasets do not have a record of any flooding on or surrounding the site. Norfolk County Council's historic flooding records also do not show any flooding on or surrounding the site.
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 site is not located in an Environment Agency Flood Alert or Flood Warning area. However, the extents of the tidal River Waveney from Ellingham to Breydon Water Flood Alert Area and the tidal River Waveney from Ellingham Marshes to Belton Flood Warning Area are about 30m southeast of the site.
Access and egress	The site is currently accessible by vehicles from The Street and Daisy Way. The site is surrounded by Flood Zones 2 and 3, which encroach on the western and southern boundaries of the site and cover The Street to the east of the site and Daisy Way and Geldeston Road to the north of the site. This is likely to impact access and egress at the site. Whilst the majority of the site is not at significant risk from surface water, the southern and western boundaries as well as western corner are impacted in the 3.3%, 1% and 0.1% AEP surface water events. This results from a flow path coming across Geldeston Road, flowing along the western boundary of the site then along the southern boundary. Surface water also ponds on The Street at a current access point, to depths up to 0.3m in the 3.3% AEP, and 0.6m in the 0.1% AEP and 1% AEP events with a hazard rating of 'danger for some'. Safe access and egress will need to be demonstrated in the 1% AEP plus climate change surface water, fluvial and tidal events. Site drainage proposals should address the requirements for access routes, avoid impeding surface water flows and preserve the storage of surface water to avoid exacerbation of flood risk in the wider catchment. Consideration should be given to the siting of access points with respect to areas of flood risk. A Flood Warning and Evacuation plan should be in place for the site. Alternatively, risk could be managed by raising vehicle and pedestrian access routes above the design flood level, inclusion of a higher refuge area, and a flood response plan that meets the requirements of the Local Council and their Emergency Planner, considering the likely warning time and duration of flooding.
Dry Islands	The site is surrounded by Flood Zones 2 and 3, forming a dry island bounded by flooding along Geldeston Road to the north, The Street to the northeast and east, and the field boundary to the south and west of the site. An emergency plan should be produced for the site, including raised access/egress routes and a safe refuge area.
Climate change	
Implications for the site	• Increased storm intensities due to climate change may increase the extent, depth, velocity, hazard and frequency of fluvial, coastal and surface water flooding. • The fluvial central and higher central climate change scenarios for peak river flows have been modelled as part of this assessment, based on the Broadland Rivers Management Catchment peak river flow allowances. Modelling suggests that the site will not be at significantly greater risk of fluvial flooding in the future, as during the 1% and 0.1% AEP events in the higher central scenario, there is only a marginal increase in flood extent and depths compared to present day. • The coastal higher central and upper end climate change scenarios have been modelled as part of this assessment, based on sea level allowances for the Anglian river basin district. Modelling suggests the site will be at significantly greater risk of tidal flooding in the future, as during the 0.1% AEP, the higher central extent covers approximately half of the site (whereas for present day just a small part of the southeast corner is affected). Depths are predicted up to 2m in the southeast corner and up to 1m across the rest of the site. The hazard rating is classified as 'danger for all' in the southeast corner and 'danger for most' for a large portion of the rest of the site. • Climate change should also be considered for surface water events; at the site-specific stage, the 1% AEP +40% event is considered as part of surface water drainage strategies, or surface water modelling in the Broadland Rivers Management Catchment for the 2070s. The 1% AEP +40% event mapping shows that the site is

	not likely to be at significantly increased risk of surface water flooding in future, as the extent is only slightly greater in the southwest corner for the future 1% AEP than the present day 1% AEP event.
Requirements for drainage control and impact mitigation	

Broad-scale assessment of possible SuDS	**Geology & Soils**
	• Geology at the site consists of:
	  ○ Bedrock- Neogene to Quaternary Rocks (undifferentiated)- Gravel, Sand, Silt and Clay
	  ○ Superficial- Till-Diamicton
	• Soils at the site consist of:
	  ○ Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils
	SuDS
	• The site is considered to have a low susceptibility to groundwater. Detention and attenuation features should be designed to prevent groundwater ingress from impacting hydraulic capacity and structural integrity. Groundwater monitoring is recommended to determine the seasonal variability of groundwater levels, as this may affect the design of the surface water drainage system. Below ground development such as basements may not be appropriate at this site.
	• BGS data indicates that the underlying geology are conglomerates, gravel, silt, sand and muds which are likely to have highly variable permeability. This should be confirmed through infiltration testing.
	• The site is not located within a historic landfill site.
	• 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 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	• Development at this site should not increase flood risk either on or off site. The design of the surface water management proposals should take into account the impacts of future climate change over the projected lifetime of the development. • Opportunities to incorporate source control techniques such as green roofs, blue/green corridors, permeable surfaces and rainwater harvesting must be considered in the design of the site.
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. • The NPPF classifies residential development as 'More Vulnerable'. • The Exception Test should be applied as the site is located within Flood Zones 2 and 3. It is recommended a precautionary approach is taken and further investigation undertaken if any development is proposed within the area of the site shown to be in Flood Zones 2 and 3 and the area shown to be at risk in the climate change scenario. • The Exception Test should also demonstrate that the site is safe for the lifetime of the development, which is not possible according to tidal climate change modelling, therefore this should be mitigated to avoid risk.
Requirements and guidance for site-	**Flood Risk Assessment:**

specific Flood Risk Assessment	• At the planning application stage, a site-specific Flood Risk Assessment will be required as the proposed development site is located in Flood Zones 2 and 3. • All sources of flooding, particularly the risk of fluvial, tidal 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, Water Company 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. • Mitigation options for areas at tidal risk should be investigated, such as raising land and accommodating future risk through amenity greenspace. Safe access and egress routes should also be demonstrated. **Guidance for site design and making development safe:** • Safe access and egress will need to be demonstrated in the 1% AEP plus climate change fluvial and rainfall events and in the extreme tidal event, using the depth, velocity and hazard outputs. 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 fluvial, tidal and surface water flood risk. • 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. • Compensatory flood storage is required for any land raising and all proposed buildings whenever there is built development on land within the 1% plus climate change flood extent for fluvial and rainfall events, and within the 0.1% plus climate change flood extent for tidal events. • Resilience measures will be required if buildings are situated in flood risk areas. • Areas at risk from surface water, fluvial and tidal flooding should ideally be integrated into green infrastructure, which presents wider opportunities to improve biodiversity and amenity as well as climate change adaptation. 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. • The proposed site 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).

Key messages

The development is likely to be able to proceed if:

- A carefully considered and integrated flood resilient and sustainable drainage design is put forward, with habitable floor levels above the 1% AEP fluvial design flood event and 0.5% AEP tidal design event, taking into account climate change.
- 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).

- The areas identified to be at risk of fluvial and surface water flooding in the western part of the site and tidal flooding in the southeast corner are left undeveloped.
- Safe access and egress can be demonstrated in the 1% AEP surface water and fluvial events and 0.5% AEP tidal event, plus climate change, or raising of access/egress routes for pedestrians and vehicles above the design events and an appropriate Flood Warning and Evacuation plan is agreed with the Local Councils' Emergency Planner.
- 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 Environment Agency's Flood Map for Planning and the Risk of Flooding from Surface Water map. This was supplemented with additional fluvial and tidal modelling. 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	Climate change allowances (for the 2080s) were modelled as part of this Level 2 SFRA. This included Central (+11%) and Higher central (+20%) for fluvial and +1.2m AOD for Higher Central and +1.6m AOD for Upper End for tidal. For surface water a 1% AEP +40% scenario has been considered.
Fluvial and tidal depth, velocity and hazard mapping	Additional modelling was undertaken based on the Environment Agency's Lower Waveney model (2013) to provide depth, velocity and hazard outputs for specific sites.
Surface Water	The Risk of Flooding from Surface Water dataset has been used to define areas at risk from surface water flooding.

South Norfolk Council Level 2 Strategic Flood Risk Assessment Detailed Site Summary Tables

Site details

Site Code	**SN5029 & SN2121REVA/VCWOR2**
Address	Land at Mill High, High Road, Wortwell, 627120 284664
Area	0.9ha (2 separate land parcels)
Current land use	Greenfield
Proposed land use	Residential

Sources of flood risk

Location of the site within the catchment	The site is located in the River Waveney catchment. The River Waveney is an Environment Agency designated main river that rises west of the district at Bressingham, and flows in a north easterly direction through the district and towards Great Yarmouth.
Existing drainage features	Local topography shows the site has lower ground towards the northwest. This indicates that the existing drainage is to the northwest of the site, following topography, to the unnamed tributary in the north. The site is located approximately 250m south of an unnamed tributary of the Waveney that converges at Hixton Road downstream of the site, and 670m north of the main Waveney River. There are no other drainage features observed within the vicinity of the site.
Fluvial	**The proportion of site at risk (Environment Agency's Flood Map for Planning Flood Zones):** **FZ3b – 0%** **FZ3a – 0%** **FZ2 – 0%** **FZ1 – 100%** *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:** The site has been checked against modelling which was undertaken based on the existing Environment Agency Lower Waveney model, 2013; as rerun 2017 by JBA Consulting for the Environment Agency and updated in 2022. The existing model is predominantly a 1D Flood Modeller model utilising extended cross-sections and, in some area's reservoir units, to represent the flood plain. Flood Modeller and TUFLOW software was used for the existing Lower Waveney model and was retained for this study. Two 2D domains covering relevant portions of the flood plain on the left bank of the River Waveney were added to the model. **Flood characteristics:** During the 3.3%, 1% and 0.1% AEP modelled events, the site is not affected by fluvial flooding.
Coastal and Tidal	The site is not at risk from tidal or coastal flooding.

Surface Water	**Proportion of site at risk (RoFSW):** **3.3% AEP** – 34% Max depth – 0.60m Max velocity – 0.25m/s **1% AEP** – 35% Max depth – 0.60m Max velocity – 0.50m/s **0.1% AEP** – 47% Max depth – 0.60m Max velocity – 1.0m/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 greater Annual Exceedance Probability (AEP) (e.g. 1% AEP % includes the 3.3% AEP %).* **Description of surface water flow paths:** Surface water flooding is predicted to affect the site in the 3.3%, 1% and 0.1% AEP events. During the 3.3% AEP event, surface water ponds on the southern land parcel of the site, south of High Road, to depths of between 0.3 and 0.6m. The velocity of flood water reaches up to 0.25m/s, and a resulting flood hazard of 'Very Low' to 'Danger for Some' where flooding is deeper in the middle of the ponding. During the 1% AEP event, the surface water flood extent increases slightly, and depths remain similar to the 3.3% AEP event. The maximum hazard rating remains at 'Danger for Some'. During the 0.1% AEP event, the velocity increases to a maximum of 0.5m/s and the maximum hazard rating increases to 'Danger for Most'. Surface water flooding also extends onto the part of the site that lies north of High Road, as water is channelled through the site in a north westerly direction where the land is lower in topography. The maximum depth of flood water here is 0.15m, with a maximum velocity of 1m/s. The maximum flood hazard on this part of the site is 'Very Low'.
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 is shown to have less than a 25% 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 datasets do not have a record of any flooding on or surrounding the site. Norfolk County Council's historic flooding records also do not show any flooding on or surrounding the site.
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 site is not located within any of the Environment Agency's flood warning or flood alert areas.
Access and egress	There is currently one access point to the site for vehicles, via High Road through the centre of the site. Access and egress are not likely to be impacted during fluvial flooding events. In the 0.1% AEP surface water flooding event to the west of the site along High Road, there is a small area where flood waters are up to 0.3-0.6m deep. This could make it impassable for vehicles. However, access is still possible from the east along this road.
Climate change	

Implications for the site	• Increased storm intensities due to climate change may increase the extent, depth, velocity, hazard and frequency of both fluvial and surface water flooding. • The EA's allowances for central and higher central climate change fluvial scenarios for peak river flows have been modelled as part of this assessment, based on the Broadland Rivers Management Catchment. Modelling suggests that the site will not be at greater risk of fluvial flooding in the future, as during the 0.1% AEP event in the higher central scenario, the site remains outside the area of flooding. • Climate change should also be considered for surface water flood events. The 1% AEP +40% event is therefore considered as part of surface water drainage strategies, or surface water modelling in the Broadland Rivers Management Catchment for the 2070s. This mapping suggests the site is at increased risk from climate change in the southern land parcel and the northwest corner of the site is shown to be at additional risk. • Developers should consider SuDS strategies to reduce the impacts of climate change from surface water in a detailed site-specific FRA.
Requirements for drainage control and impact mitigation	

Broad-scale assessment of possible SuDS	**Geology & Soils**
	• Geology at the site consists of:
	  • Bedrock- Crag Group-Sand.
	  • Superficial- Head formation – Clay, silt, sand and gravel.
	• Soils at the site consist of:
	  • Lime-rich loamy and clayey soils with impeded drainage.
	SuDS
	• The site is considered to have very low susceptibility to groundwater flooding, this should be confirmed through additional site investigation work. Below ground development such as basements may still be susceptible to groundwater flooding.
	• BGS data indicates that the underlying geology is sand which is likely to be free draining. This should be confirmed through infiltration testing, with the use of infiltration maximised as much as possible in accordance with the SuDS hierarchy.
	• The site is not located within a historic landfill site.
	• Surface water outfalls that discharge into the River Waveney may be susceptible to surcharging due to water levels in the River Waveney. The impacts of flood flows will need to be considered in terms of the attenuation storage requirements of the site and placement of the outfalls.
	• 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 Risk of Flooding from Surface Water (RoFSW) mapping indicates the presence of surface water flow paths during the 0.1% AEP event. Existing flow paths should be retained and integrated with blue-green infrastructure and public open space.
	• If it is proposed to discharge runoff to a watercourse or sewer system, the condition and capacity of the receiving watercourse or asset should be confirmed through surveys and the discharge rate agreed with the asset owner.

Opportunities for wider sustainability benefits and integrated flood risk management	• Implementation of SuDS at the site could provide opportunities to deliver multiple benefits including volume control, water quality, amenity and biodiversity. This could provide wider sustainability benefits to the site and surrounding area. Proposals to use SuDS techniques should be discussed with relevant stakeholders (LPA, LLFA and EA) at an early stage to understand possible constraints. • Development at this site should not increase flood risk either on or off site. The design of the surface water management proposals should take into account the impacts of future climate change over the projected lifetime of the development.

	• Opportunities to incorporate infiltration 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 improve water quality of surface water runoff discharged from the site and reduce the impact on receiving waterbodies. • 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 Local Authority will need to confirm that the Sequential Test has been carried out in line with national guidelines. The Sequential Test will need to be passed before the Exception Test is applied. The NPPF classifies residential development as 'More Vulnerable'. The site lies within an area at risk of surface water flooding, therefore the Exception Test is required for the site. The southern parcel of the site is highly unlikely to pass the second part of the Exception Test.
Requirements and guidance for site-specific Flood Risk Assessment	**Flood Risk Assessment:** • Whilst the site lies entirely outside of Flood Zones 2 and 3, it is recommended that a site-specific Flood Risk Assessment is undertaken due to the predicted surface water ponding. • The site-specific FRA should be carried out in line with the National Planning Policy Framework; Flood Risk and Coastal Change Planning Practice Guidance; the Joint Core Strategy as part of the Greater Norwich Development Partnership for Broadland, Norwich and South Norwich; 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, Water Company and the EA should be undertaken at an early stage. **Guidance for site design and making development safe:** • In accordance with the Sequential Approach development should aim to be steered away from areas of surface water flood risk, which for this site includes the southern land parcel, preserving these spaces as green infrastructure. • Safe access and egress will need to be demonstrated in the 0.1% AEP event plus climate change fluvial and rainfall events, using the depth, velocity and hazard outputs. 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. • 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. • Surface water should be discharged at the pre-development (greenfield) runoff rate 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.

	• 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 principle of development can be supported if:

- A carefully considered and integrated flood resilient and sustainable drainage design is put forward, with development steered away from the southern land parcel of the site.
- Space for surface water to be stored on the site is provided and rainwater harvesting should be considered.
- A site-specific Flood Risk Assessment demonstrates that the site is not at an increased risk of flooding in the future, that the development of the site does not increase the risk of surface water flooding on the site and to neighbouring properties and how the natural flood storage provided by the pre-developed site is preserved.

Mapping Information

The key datasets used to make planning recommendations regarding this site were the Environment Agency's Flood Map for Planning 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.
Climate change	Climate change allowances (for the 2080s) for fluvial flood risk were modelled as part of this Level 2 SFRA. This included Central (+11%) and Higher central (+20%). For surface water a 1% AEP +40% scenario has been considered.
Fluvial depth, velocity and hazard mapping	The site is not shown to be at risk from fluvial sources.
Surface Water	The Risk of Flooding from Surface Water map has been used to define areas at risk from surface water flooding.