Oaklands Meadows

Flood Risk Assessment

Countryside Properties and Essex County Council
Property Services

Project number: L00005
L00005-AEC-NA-NA-RP-C-0001

22 September 2021

Quality information

Prepared by	Checked by	Verified by	Approved by
			
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Revision History

Revision	Revision date	Details	Authorized	Name	Position
P1	18/12/19	Preliminary Issue		Anne Farmer	Associate Director
P2	23/03/20	Issued to LLFA for comments		Anne Farmer	Associate Director
P3	28/05/21	Issued for comments		Anne Farmer	Associate Director
P4	16/06/21	Issued to support planning application		Anne Farmer	Associate Director
P5	22/09/21	Issued to support planning application		Anne Farmer	Associate Director

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1. Executive Summary

AECOM has prepared, on behalf of Countryside Properties and Essex Council Property Services ('the Applicants'), a Flood Risk Assessment (FRA) to accompany a planning application submitted to Chelmsford City Council, as Local Planning Authority, for the Proposed Development. The purpose of this report is to present the findings of the assessments, which includes flood risk from all sources. Where flood risks are present or where they cannot be clearly established, further actions or mitigations are outlined.

SITE DETAILS	
Grid Reference & Postcode	E 580582, N 198497 approximate, site centred, closest postcode is CM3 5QN.
Approximate Site Area	The existing site covers an area of approximately 112 ha. Of this 112 ha, approximately 41 ha will be developable area including areas of residential, education, mixed use and local centre uses. A further minimum area of 8.59Ha will be formal recreation land.
Current Use	Predominantly agricultural land use.
Proposed Use	Residential

FLOOD RISK ASSESSMENT	
Fluvial Flood Zone	Flood Zone (FZ) 1.
Vulnerability	More Vulnerable.
Compatibility	Compatible – More Vulnerable uses are considered appropriate in Flood Zone 1 and 2.
Sequential Test	Sequential Test is considered to have been applied and passed.
Exception Test	Exception Test is therefore not required.
Floods Risks to the site	Surface Water Flooding - Medium Groundwater Flooding - Medium Sewer Flooding – Very Low Reservoir Breach Flooding – Very Low
Flood Risks from the site	Surface Water Flooding - Low Groundwater Flooding - Low Sewer Flooding – Very Low Reservoir Breach Flooding – Very Low

ACTIONS AND MITIGATIONS	
Water Management Infrastructure	The drainage strategy of the whole site will manage rainfall by providing attenuation features and limiting the discharge to the Fenn Brook branch from the developed areas to the equivalent 1 in 1 year greenfield runoff rate. This reduction in incoming flows from the existing site to the river will lead to a reduction in the flow on the Fenn Brook branch and the rest of the watercourses within the site. Furthermore, the drainage strategy will provide a betterment to the surface water flood extents for the 1 in 30, 1 in 100 and the 1 in 1000 year events. Swales will provide additional storage and delay the concentration of surface runoff at the low points close to the confluence of the ordinary watercourse and the main river, at the west of the site by the B1418, due to the longer drainage paths.
Further actions & mitigations	• Ground investigation and groundwater monitoring

2. Introduction

This Flood Risk Assessment (FRA) has been prepared to support the outline Planning Permission, with all matters reserved (but with full details provided for the principal means of vehicular access to the site, the initial phase of on-site highway works, strategic ground reprofiling, strategic surface water attenuation, and strategic foul drainage) for the Oaklands Meadows site. This flood risk assessment assesses the proposed development in accordance with the relevant guidelines. This report should be read in conjunction with the Drainage Strategy[1] report of the site.

The overall development consists of 112 ha. and is located to the north of the town of South Woodham Ferrers. The existing site is categorised as "greenfield".

2.1 Background

This FRA has been prepared in accordance with the National Planning Policy Framework (NPPF) and the Planning Practice Guidance set out on GOV.UK[2] in order to assess the flood risks associated with this development and set out the necessary strategies for mitigating these risks.

This FRA is based upon available and up to date flood risk information, available online from the Environment Agency (EA)[3], British Geological Survey (BGS), MAGIC website, Chelmsford City Council (CCC) and Essex County Council. This includes:

- EA Flood Risk Maps.
- Geology Maps from BGS.
- Aquifer designations, groundwater vulnerability and Soilscape Maps from MAGIC.
- Chelmsford Strategic Flood Risk Assessment (SFRA).
- Essex County Council Preliminary Flood Risk Assessment (PFRA).
- Essex County Council & Chelmsford City Council Surface Water Management Plan (SMWP).
- Essex Sustainable Drainage Systems Design Guide.
- CIRIA C753 SuDS Manual 2015.

2.2 Scope of assessment

The NPPF Planning Practice Guidance states that a FRA should be undertaken on a new development when the site is:

- in flood zone 2 or 3 including minor development and change of use;
- more than 1 hectare (ha) in flood zone 1;
- less than 1 ha in flood zone 1, including a change of use in development type to a more vulnerable class (for example from commercial to residential), where they could be affected by sources of flooding other than rivers and the sea (for example surface water drains, reservoirs);
- in an area within flood zone 1 which has critical drainage problems as notified by the Environment Agency.

Given the size of the proposed development, a FRA should be undertaken for this site.

In accordance with the NPPF Planning Practice Guidance, a site-specific flood risk assessment is carried out by (or on behalf of) a developer to assess the flood risk on a development site. Where necessary the assessment should accompany a planning application submitted to the Local Planning Authority. The assessment should

[1] AECOM (September 2021) Oaklands Meadows – Drainage Strategy, Ref: L00005-AEC-NA-NA-RP-C-0002
[2] National Planning Policy Framework Planning Practice Guidance available at www.gov.uk/government/collections/planning-practice-guidance
[3] EA Guidance 'Flood Risk and Coastal Change' available at www.gov.uk/guidance/flood-risk-and-coastal-change

demonstrate to the decision-maker how flood risk will be managed now and over the development's lifetime, taking climate change into account, and with regard to the vulnerability of its users.

The objectives of a site-specific flood risk assessment are to establish:

- whether a proposed development is likely to be affected by current or future flooding from any source;
- whether it will increase flood risk elsewhere;
- whether the measures proposed to deal with these effects and risks are appropriate;
- the evidence for the local planning authority to apply (if necessary) the Sequential Test, and;
- whether the development will be safe and pass the Exception Test, if applicable.

The assessment also needs to consider surface water and provide:

- An estimate of how much surface water run-off the development will generate.
- Details of existing methods for managing surface water runoff, e.g. drainage to a sewer.
- Plans for managing surface water and for making sure there's no increase in the volume of surface water and rate of surface water runoff.

2.3 Aims and Objectives

This FRA assesses the flood risk to and from the proposals at the land at Oaklands Meadows.

In preparing this FRA, the following objectives have been completed:

- Consideration of the risk of flooding arising from the proposed development in addition to the risk of flooding to the existing development;
- Identification and quantification of the vulnerability of the development to flooding from fluvial, pluvial and other sources and, where appropriate, identification of potential flood risk reduction measures, and;
- Where appropriate assessment of the remaining 'residual' risk after risk reduction measures have been considered and demonstrate that this is acceptable for the particular development.

3. Site Description

3.1 Existing Site

The site is located immediately to the north of the town of South Woodham Ferrers. It is located to the north of Burnham Road (B1012) and to the east of Willow Grove. The B1418 runs up through the site and northwards towards the settlement of Woodham Ferrers. Ordnance Survey National Grid reference to the centre of the site is E 580582, N 198497 and the closest postcode is CM3 5QN.

The existing site covers an area of approximately 112 ha. Of this 112 ha, approximately 41 ha. will be developable area including areas of residential, education, mixed use and local centre uses. A further minimum area of 8.59 ha. will be formal recreation land. The majority of the site is currently undeveloped and is predominantly agricultural land.

A parcel of land (approximately 4.22 ha.) owned by Sainsbury's is situated on the boundary with the proposed development land, facing the B1012. This includes a new Sainsbury's store, external car park and a health facility centre.

A site location plan is included in Appendix A (Drawing L0005-AEC-NA-NA-DR-C-1001). The plan shows the overall site boundary and individual boundaries for Countryside and ECC land.

3.2 Topography

The topographical survey carried out in March 2021 shows that the western part of the site fall from the northeast to the southwest with steep falls from approximately 30.0 mAOD on the north eastern boundary to 8mAOD at the roundabout between B1012 and B1418. The parcel on the west of B1418 fall from 20.0 mAOD to 8.5 mAOD.

The eastern part of the proposed development falls from north to south with levels dropping from 40.0mAOD to 9.5mAOD. The parcel in the centre of the site is not proposed for development due to the steep nature of the existing topography. A small parcel in the south of B1012 at the east of the whole site is included in this submission, with existing levels falling from 9.5 mAOD to 6.0 mAOD. The topographical survey is included in Appendix A.

3.3 Hydrology

The Fenn Brook flows north to south through the western portion of the site. It was classed as Main River by the Chelmsford City Council Strategic Flood Risk Assessment (SFRA)[4]. The Environment Agency carries out maintenance, improvement or construction work on main rivers to manage flood risk.

A branch of the Fenn Brook flows north east to south west through the site. This branch crosses the B1418 to the north of its roundabout junction with the B1012 in a culvert; to the west of the B1418. It was classed as Ordinary Watercourse by the SFRA along much of its length, becoming a Main River downstream of the B1418. Lead local flood authorities, district councils and internal drainage boards carry out flood risk management work on ordinary watercourses.

The contours on the western part of the site fall directly towards the Fenn Brook branch and to existing ditches that convey the runoff into the Fenn Brook branch. Therefore, the runoff from the existing site discharges into the Fenn Brook.

The Fenn Brook Branch crossing the site joins the Fenn Brook to the north of the B1012 between its roundabout junction with the B1418 and the roundabout junction with the A132. The Fenn Brook flows south under the B1012 on the north-western edge of South Woodham Ferrers and under an unclassified road and then under a railway line, where it connects to Fenn Creek. The Fenn Brook connects to the Fenn Creek at a point approximately 650m south of the Site. The Fenn Creek flows in a southerly direction towards the River Crouch, which is located approximately 2.5km south.

[4] JBA Consulting (October 2017), Chelmsford City Council – Level 1 and Level 2 Strategic Flood Risk Assessment

The topographical survey shows no watercourses in the eastern land. The contours in the centre and east of the site are falling towards the B1012. There is a small pond close to the Fenn Brook branch, although it is not clear whether the pond is associated with the Fenn Brook Branch.

There is an existing ditch in the south of B1012, between the Memorial Gardens and the southern parcel. This ditch flows in a north to south direction, crossing below the railway lines.

An existing hydrology plan is included in Appendix A (Drawing L00005-AEC-NA-NA-DR-C-0002).

3.4 Site Geology & Hydrogeology

The geological mapping for the site from British Geological Survey (BGS)[5] shows the drift geology is absent in much of the site, predominantly in the north, south and east, meaning that the solid bedrock geology will likely be present immediately beneath topsoil and subsoil in those areas. Head Deposits, comprising Clay, Silt, Sand and Gravel are present on the west of the site.

The superficial deposits overlying the bedrock geology are the London Clay Formation in the majority of the site and Claygate Member on the east. Both comprise Clay, Silt and Sand. The site geology has been assessed in more detail in the Geotechnical and Geoenvironmental Desktop Study[6].

The superficial deposits underlying the site (Head Deposits) are classified as a Secondary Undifferentiated aquifer. This designation is assigned in cases where it has not been possible to attribute either aquifer category A or B due to the variable characteristics of the rock type.

The Claygate Member is classified as a Secondary A Aquifer. Secondary A aquifers are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. The London Clay Formation is classified as Unproductive Strata. This designation applies to materials with low permeability that have negligible significance for water supply or river base flow.

The Head Deposits and the Claygate Beds both imply a low permeability stratum which may locally be suitable for soakaway drainage subject to detailed assessment. Further investigation should be undertaken to determine the depth of the Head Deposits and the feasibility of soakaway or other infiltration system. It is recommended to undertake percolation tests in the strategic locations to determine the infiltration rate of the Head Deposits. The percolation tests should be undertaken in accordance with BRE Digest 365 Soakaway Design.

MAGIC groundwater vulnerability map classifies the site as minor aquifer intermediate vulnerability in the western area and minor aquifer low vulnerability in the eastern area. The soil class for the site is 6 – Freely draining lime-rich loamy soils and 17 – Slowly permeable seasonally wet acid loamy and clayey soils.

A review of available BGS borehole records within the vicinity of the site was undertaken in the Geotechnical and Geoenvironmental Desktop Study. It identified groundwater strikes and seepages within the Claygate Member at depths of between 2.0m and 2.5m. No groundwater strikes were recorded in the Head deposits or the London Clay Formation in the boreholes reviewed. Groundwater flow, where present, is likely to be in a southerly direction towards the Fenn Creek (c. 270m south-east) which converges with the River Crouch approximately 2.5km south.

The low permeability of the London Clay Formation is likely to prove unsuitable for infiltration and may act as a barrier to infiltration if required.

In conclusion, depending on the proposed depth of water attenuation features, trial pit investigation comprising between one and three holes including permeability testing, at each of the preliminary attenuation feature locations should be undertaken to understand the nature of the strata for each attenuation feature.

According to drainage hierarchy contained in the Essex Sustainable Drainage Systems Design Guide, the viability of an adequate soakaway or other infiltration system or a hybrid solution of infiltration and discharging

[5] British Geology Maps from British Geology Survey available at www.bgs.ac.uk
[6] AECOM (February 2019), South Woodham Ferrers – Geotechnical and Geoenvironmental Desktop Study

into a surface water body should always be considered before discharging all run off into a surface water body only. A copy of the British Geological Survey maps for this area are included in Appendix B, Figures 5-10.

3.5 Historical Land Use

Historical mapping shows that land use on-Site has comprised predominantly agricultural fields since the earliest mapping edition of the 1880s with no significant changes evident. Hamberts Farm is shown adjacent to the Site, facing B1012, on the earliest mapping, with additions to the buildings in the farmyard over subsequent years.

The construction of the railway to South Woodham Ferrers is mapped for the first time in 1898 and this initially included a branch line that passed in a cutting through the western part of the site (c. 400m long). This branch was dismantled by the 1920s and the cutting is gradually abandoned and ultimately backfilled over the subsequent years, no longer shown on mapping from 1979.

Since the site has historically remained as greenfield, it is likely no contamination is present on the site.

3.6 Public Sewers

The available sewer records dating from February 2017 have been reviewed.

3.6.1 Surface Water Sewers

There is only one surface water sewer present on the site and it does not fall within any proposed development area. There is an outfall which drains existing residential properties on Kingsway, Edwin Hall View and The Tabrums to the south of the Site and the B1012. The surface water sewer flows north into the B1418, where the B1418 is crossed by the ordinary watercourse, the surface water sewer discharges into the watercourse. There is no diameter stated for this sewer.

There is a surface water sewer present in the B1012 Burnham Road, flowing east to west, shown as a 375 mm, then a 525 mm diameter pipe. Where Hullbridge Road has its junction with Burnham Road the surface water sewer turns south and becomes a 675 mm diameter pipe. Thereafter, at the junction of Hullbridge Road and King Edwards Road, it is joined by a 300 mm diameter surface water sewer; the main surface water sewer turns east and flows beneath King Edwards Road in 900 mm diameter pipework. Towards the end of King Edwards Road, the surface water sewer turns south down East Bridge Road. It is likely, although not confirmed, that the surface water sewer eventually flows into Clementsgreen Creek.

There is another surface water sewer present in the B1012 Burnham Road, commencing at a 'high point' near where the other sewer commences but flowing west to east, shown as a 450 mm and then a 600 mm diameter pipe. The surface water sewer turns south down Ferrers Road; again, it is likely, although not confirmed, that the surface water sewer eventually flows into Clementsgreen Creek.

3.6.2 Foul Water Sewers

There are no foul water sewers present on the site. AW asset records show a foul water sewer which serves Woodham Ferrers to the west of the site, this flows south as a 175 mm diameter pipe and flows south-south-east parallel to Fenn Brook, before turning south-south-west and then south again to run at the rear of existing residential properties on Willow Grove road from which it receives flows from a 150 mm foul sewer serving those properties. The main 175 mm diameter foul sewer continues south-south-east beneath the roundabout junction with the A132, B1012 and Willow Grove road.

There is a foul water sewer present in the B1012 Burnham Road, running parallel to the surface water sewer. Diameter of the pipe is not present on Anglian Water records. The sewer comes from the south in front of Hamberts Farm and runs through B1012, flowing east to west, until the roundabout between B1012 and B1418. Towards the roundabout the foul water sewer turns down through Wickford Road.

3.7 Consultation responses

3.7.1 Environment Agency

The Environment Agency was consulted regarding the site via an email pre-planning enquiry dated 22 March 2019 and responded on 16 April 2019. The response from the Environment Agency is included in Appendix C and summarized below:

- The site lies partially within Flood Zone 2 and 3a, the medium and high probability zone. It is therefore necessary for the application to pass the Sequential and Exception Tests and to be supported by a site-specific Flood Risk Assessment (FRA). However, no development areas will be located within any of these Flood Zones.
- The FRA should demonstrate that the 'development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall'.
- The applicant may need an environmental permit for flood risk activities if they want to do work in, under, over or within 16m of the river and of any flood defence structure or culvert of the Fenn Brook, designated a 'main river'.

3.7.2 Lead Local Flood Authority

The Lead Local Flood Authority (LLFA) for the area, Essex County Council was consulted by an email dated 2nd October 2019, in order to provide a copy of the Surface Water Management Plan and the Preliminary Flood Risk Assessment Report of the area.

The FRA and Drainage Strategy were submitted to the LLFA in April 2020 through the SuDS Planning Advice Written Response Service in order to obtain preliminary comments from the LLFA. A response from the LLFA to the pre-application advice was received on the 14th May 2020. The LLFA confirmed they were happy with the drainage strategy in principle. The flood mitigation proposal sufficiently addresses the SUDS principles to manage surface water flows from the site and also mitigates the overland flows by incorporating open SUDS features. A copy of the ECC pre-application response is included in Appendix C.

A Development Flood Risk Management Pre-Application Advice Meeting with representatives from the LLFA and Local Planning Authority was held on the 25th February 2021. The surface water drainage strategy was discussed in the meeting and the current strategy agreed in principle.

3.8 Proposed development

The proposed development area Oaklands Meadows is within Chelmsford City Council's Local Plan and classified as Strategic Growth Site 10.

The proposed development comprises:

1. Residential development of up to 1020 homes (Class C3);
2. Up to 88 bedroom units of residential care use (Class C2 use);
3. Up to 1,100 sq m GEA Neighbourhood centre (including retail uses) within class E and including a multi-purpose community centre;
4. Up to 1,200 sqm GEA of other commercial uses falling within Class E (of which not less than 1000 sq m to be business floorspace within Use Class Eg);
5. 2fe Primary School and 2 no. 56 place Early Years facilities
6. 5 serviced plots for Travelling Showpeople (GEA 10,000sqm);
7. Open spaces and other landscaped areas, including parks, play areas, wildlife habitat areas, allotments, community orchards, formal/informal open space, playing fields and associated ancillary maintenance buildings, structures and pavilion;

8. All associated highway infrastructure, including means of vehicular access to the site and all internal roads and service areas;
9. Pedestrian, cycle and bridleway routes (including partial extinguishment of Bridleway 25);
10. Vehicular and cycle parking to serve the proposed development;
11. All drainage works including foul drainage infrastructure, Sustainable Urban Drainage Systems including ground and surface water attenuation features;
12. Ground Reprofiling Works;
13. Demolition of existing buildings;
14. All associated ancillary works including services and utilities.

The drainage strategy has informed the masterplan to ensure that adequate planning for attenuation and surface water drainage features is taken into consideration within the proposed layout. The masterplan is included within Appendix D and shown in Figure 1 below.

Figure 1 Proposed site layout

4. National Planning Policy

4.1 National Planning Policy

Section 14 of the National Planning Policy Framework 2019 (NPPF) and the associated Planning Practice Guidance (PPG) details current policy with respect to flood risk. Paragraph 163 (footnote 50) of the NPPF outlines that development proposals located within Flood Zones 2 and 3 and those of greater than a hectare will require a site-specific FRA. The existing site covers an area of approximately 96.55 ha, therefore a site-specific FRA is required.

As stated in the PPG these flood zones refer to the probability of river and sea flooding, ignoring the presence of defences. The flood zones are shown on the EA's Flood Map for Planning (Rivers and Sea), available on the EA's website. The flood zones are defined in Table 1 of the PPG which has been reproduced as Table 4-1 below;

Table 4-1 PPG Table 1 Flood zones [abbreviated] (2014)

Flood Zone	Definition
Zone 1 - Low Probability	Land having a less than 1 in 1,000 annual probability of river or sea flooding
Zone 2 – Medium Probability	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or Land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding.
Zone 3a - High Probability	Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding.
Zone 3b - The Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency.

According to the EA's Flood Maps for planning, the site is situated within Flood Zone 1. The EA's Flood Zone Map is included in Appendix B (Figure 4).

The NPPF considers the vulnerability of different types of development to flooding. The vulnerability classifications are detailed in Table 2 of the PPG, which accompanies the NPPF, and has been reproduced as Table 4-2.

Table 4-2 PPG Table 2 Flood risk vulnerability classification [abbreviated] (2014)

Vulnerability Classification	Development Uses
Essential Infrastructure	• Essential transport infrastructure which has to cross the area at risk. • Essential utility infrastructure which has to be located in a flood risk area for critical operational reasons. Wind turbines.
Highly Vulnerable	• Police stations, Ambulance stations and Fire stations and command centres and telecommunications installations required to be operational during flooding; Emergency dispersal points; Basement dwellings. • Caravans, mobile homes and park homes intended for permanent residential use. • Installations requiring hazardous substances consent.
More Vulnerable	• Hospitals; Residential institutions including care homes, children's homes, social homes, prisons and hostels. • Buildings used for: dwelling houses; student residences; drinking establishments; nightclubs; and hotels. • Non–residential uses for health services, nurseries and educational establishments. • Landfill and sites used for waste management facilities for hazardous waste. • Sites used for holiday or short-let caravans/camping, subject to a specific warning and evacuation plan.

Less Vulnerable	• Police, ambulance and fire stations which are not required to be operational during flooding • Buildings used for: shops; financial, professional and other services; restaurants and cafes; hot food takeaways; offices; general industry; storage and distribution; non–residential institutions not included in 'more vulnerable'; and assembly and leisure; Land and buildings used for agriculture and forestry. • Waste treatment (except landfill and hazardous waste facilities). • Minerals working and processing (except for sand and gravel working). • Water treatment plants. • Sewage treatment plants.
Water Compatible Development	• Flood control infrastructure; water/sewage transmission infrastructure and pumping stations; • Sand and gravel workings; docks, marinas and wharves; navigation facilities; MOD defence installations. • Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location; Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms. • Water-based recreation (excluding sleeping accommodation); Lifeguard and coastguard stations. • Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.

The proposed development is residential-led in nature with flexible amenity and retail/leisure uses proposal and non-residential buildings for health services, nurseries and educational uses. Hence, the proposed development has a vulnerability classification of *'more vulnerable'.*

Table 3 of the PPG illustrates a matrix which identifies the vulnerability classifications which are appropriate within each flood zone (reproduced in Table 4-3). The table states that Flood Zone 1 is adequate for all development uses.

Table 4-3 PPG Table 1 Flood risk vulnerability classification [abbreviated] (2014)

Flood Risk Vulnerability Classification (Table 2 NPFF)		Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone	1	✓	✓	✓	✓	✓
	2	✓	✓	Exception Test required	✓	✓
	3A	Exception Test required	✓	✗	Exception Test required	✓
	3B	Exception Test required	✓	✗	✗	✗

4.2 Climate Change Impact

Based on the PPG it is recommended that potential effects of Climate Change should be considered realistically for the lifetime of a proposed development and that *"…developers, the local planning authority and Environment Agency should discuss and agree what allowances are acceptable".*

The EA updated the guidance covering allowances for climate change to be taken into account. The site in question is on the River Anglian Basin and according to the latest guidance, based on the 2080s figure; the central allowance (25%) should be used as a river flow allowance. However, according to the updated EA guidance, the upper end allowance (65%) should be applied in the area in proximity of Flood Zone 2 and 3a.

Table 2 on the PPG (reproduced in Table 4-4). specifies anticipated changes in extreme rainfall intensity in small and urban catchments. For flood risk assessments and strategic flood risk assessments, both the central and upper end allowances should be assessed to understand the range of impact. Furthermore, as stated in the Essex SUDS Design Guide, Essex County Council LLFA take a conservative, risk adverse approach to flood and water management and therefore expect the Upper End figures to be used. Therefore, a value of 40% will be used for climate change in the drainage strategy for the development.

Table 4-4 PGG Table 2 peak rainfall intensity allowance in small and urban catchments

Applies across all of England	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper end	10%	20%	**40%**
Central	5%	10%	20%

4.3 Local Planning Policy

The latest Planning Policy adopted by the Chelmsford City Council and Essex County Council is taken into consideration pertaining surface water drainage and flood prevention.

4.3.1 Chelmsford Strategic Flood Risk Assessment

In 2017, the Strategic Flood Risk Assessment (SFRA) Levels[7] 1 & 2 were completed in accordance with the NPPF, to inform Chelmsford City Council (CCC) of the nature and extent of flood risk in the area. The Level 1 SFRA (October 2017) for Chelmsford assesses and maps known sources of flood risk, including fluvial, surface water, sewer, groundwater and impounded water bodies, taking into account future climate change predictions, and to allow CCC to locate future development primarily in low flood risk areas. The Level 2 SFRA (October 2017) facilitates application of the Sequential and Exception Tests to specific sites.

The SFRA included the land on the North of South Woodham Ferrers as a potential development site. It considers that the vast majority of the area falls in Flood Zone 1, with less than 1% of the land falling within Flood Zone 2 and Flood Zone 3. Approximately 35%, 16% and 9% of the site falls within 1 in 1000 yr, 1 in 100yr and 1 in 30yr surface water flood map respectively.

The report states that South Woodham Ferrers flooded in 1953, however, the site is outside of the historic flood map extent. Therefore, there are no historic events affecting the site.

4.3.2 Essex County Council Preliminary FRA

The Preliminary Flood Risk Assessment (PFRA)[8] was produced by URS (Scott Wilson) on behalf of Essex County Council. The PFRA is a high-level screening exercise to locate areas in which the risk of surface water and groundwater flooding is significant and warrants further examination through the production of maps and management plans.

In relation to South Woodham Ferrers and the surrounding area, the PFRA notes the following:

i. DEFRA's 'National Rank Order of Settlements Susceptible to Surface Water Flooding' document ranks settlements across England according to the number of properties that are susceptible to future surface water flooding from severe rainfall events, i.e., the number of properties predicted to be at risk, along with the national ranking. South Woodham Ferrers has 430 properties predicted to be at risk and is ranked 612th out of the 4,215 settlements that were assessed in England).

There were no other specific references to South Woodham Ferrers and the surrounding area in the PFRA. Mapping, where provided in appendices and as separate figures are at too low a resolution to interpret either in relation to South Woodham Ferrers or the site. The PFRA is therefore not considered further as part of this review.

[7] JBA Consulting (October 2017), Chelmsford City Council – Level 1 and Level 2 Strategic Flood Risk Assessment
[8] URS Scott Wilson (January 2011), Essex County Council – Preliminary Flood Risk Assessment Final Report

4.3.3 Surface Water Management Plan

A Surface Water Management Plan (SWMP) is defined by DEFRA in its SWMP technical guidance[9] as a plan which outlines the preferred surface water management strategy in a given location.

The DEFRA technical guidance emphasises that SWMPs may not be required in all locations and that studies should be prioritised in areas considered to be at greatest risk of surface water flooding or where partnership working is essential to both understand and subsequently address surface water flooding issues.

A SWMP[10], dated March 2014, was produced on behalf of Essex County Council and Chelmsford City Council. The SWMP study area is limited to the City of Chelmsford and an area immediately to the north and does not extend to South Woodham Ferrers, notwithstanding that the town lies within the Chelmsford City Council jurisdiction. Other SWMPs are listed on the Essex County Council website, however, none would appear to cover the South Woodham Ferrers area. It is concluded that it was determined that a SWMP was not required for South Woodham Ferrers but we would seek to validate this understanding with the Local Planning Authority. However, the Drainage Strategy for the site has been undertaken in line with the principles and recommendations for integrated management of surface water stated in the Chelmsford City Council SWMP, the ECC SUDS design guide and the national and local design principles.

Essex County Council (ECC) was consulted regarding the Surface Management Plan via an email dating on 2nd October 2019 and responded on 16th October 2019. ECC confirmed the proposed development was not located within any SWMP and the closest one is the South Essex SWMP, which covers Rockford, Castle Point and Basildon but not the proposed site. Furthermore, Critical Drainage Area maps from ECC consulted online indicates that the site does not fall within any Critical Drainage Area. Critical Drainage Areas are defined as small catchments where there is an increased risk of surface water flooding. Figure 14, within Appendix B, shows the Critical Drainage Area Map.

4.3.4 Essex County Council SUDS Design Guide

Essex County Council LLFA produced the Sustainable Drainage Systems Design Guide in April 2019 that summarizes the local standards for Essex and, together with the National Standards, promotes the use of SuDS which help to reduce surface water runoff and mitigate flood risk.

The guide provides information on the planning, design and delivery of attractive and high-quality SuDS schemes which should offer benefits to the environment and community alike. The guide should be seen as complementing The C753 SuDS Manual (CIRIA, 2015) and local principles are intended to supplement the National Standards and aid in the evaluation of SuDS proposals.

The drainage strategy and SuDS design on the proposed development has been undertaken according to both national and local principles and processes of designing SuDS. Furthermore, a meeting with Essex County Council Lead Local Flood Authority (LLFA) was carried out to discuss the drainage strategy of the site and the main sustainable design principles that should be considered at this stage.

[9] DEFRA (March 2010), Surface Water Management Plan Technical Guidance.
[10] Capita Symonds (March 2014) Chelmsford Surface Water Management Plan, Version 0.3.

5. Flood Risk to the Site

5.1 Overview

BS 8533: 2017[11] details recommendation and guidance on the appropriate assessment and management of flood risk where development is proposed in the UK. It is intended to provide developers with practical assistance for dealing with flood risk in and around their development.

It outlines that an assessment should be made of flood risk both to the development site and as a result of the development site in relation to the following sources of flooding:

1. Tidal and fluvial flooding – flooding from main rivers, ordinary watercourses and the sea.
2. Surface water flooding – flooding from overland flow due to rainfall.
3. Groundwater flooding – flooding related to the water table, where ground water levels rise above surface levels.
4. Flooding from sewers and drains – flooding from surcharging of below ground drainage systems.
5. Flooding caused by the failure of infrastructure – flooding from reservoir, canal or land drainage infrastructure, usually as a result of catastrophic failure.

The categories of the risk in this FRA have been qualitatively defined as:

- 'High' Risk: flooding is likely to result in significant damage to property and pose a significant risk to life;
- 'Medium' Risk: flooding may result in possible minor damage to property, but flood progress would allow adequate time for residents to be warned and safely evacuated to higher ground or appropriate places of safety;
- 'Low' Risk: flooding is unlikely to result in any damage to property damage and pose little or no risk to life.
- 'Very Low' Risk: flooding is very unlikely to occur.

The following sections summarise the significant potential sources of flooding identified from a desk-based appraisal and inform of further actions or mitigations to be undertaken.

5.2 Flood Risk – Current Flood Maps/Information

5.2.1 Fluvial Flooding

The NPPF and EA online flood risk guidance defines different flood zones depending on the probability of river and sea flooding, ignoring the presence of defences. Table 4-1 on this report summarizes the flood zones and flooding probability on each of them. As stated in Section 4.1, the EA flood risk mapping indicates that the site falls within Flood Zone 1. Flood Zone 1 comprises land assessed as having a less than 0.1% (1 in 1000) annual probability of river or sea flooding.

The Fenn Brook, which runs north to south on the west boundary of the site, is the primary source of fluvial flood risk to the site. A branch of the Fenn Brook flows north east to south west through the site with minor streams & ditches along the site discharging into it.

The EA map shows Flood Zones 2 and 3 sitting on the southwest boundary of the site. Therefore, the Masterplan has been designed to ensure that all development is situated outside of Flood Zone 2 and 3, falling within Flood Zone 1 only.

[11] BSI (2017), BS 8533:2017 – Assessing and managing flood risk in development – Code of practice

In conclusion the risk of fluvial flooding can be considered as low. Figure 2 below, shows the EA Fluvial Flood Risk Map.

Figure 2 EA Flood Risk from rivers or the sea Map

As described in Section 4.1, the proposed development has a vulnerability classification of 'more vulnerable'. Flood Zone 1 is adequate for all development uses. Therefore, the risk to the undeveloped site from flooding from rivers is considered to be low.

According to the CCC Strategic Flood Risk Assessment (SFRA) Level 2, which covers adjacent areas, the only recorded fluvial flooding incident in South Woodham Ferrers, dated on 1953, and did not affect the site. However, from discussions with the EA and local residents, we understand that the area in proximity to Burnham Road floods approximately every two years due to a combination of fluvial and tidal flooding.

The CCC SFRA states that flood risk from the Fenn Brook is relatively small and water only gets out of bank in the 1 in 100 year event (Flood Zone 3a) but the extent only increases slightly in the 1 in 1,000 year event (Flood Zone 2). The Fenn Brook flows under Burnham Road (B1012) at the southern site boundary; hence blockage of this culvert could increase levels upstream potentially resulting in overtopping of the banks and flooding of the site. However, it is unlikely that this would ever occur if the culvert is appropriately maintained.

The drainage strategy of the whole site will manage rainfall by providing attenuation features and limiting the discharge to the Fenn Brook branch from the developed areas to the equivalent 1 in 1 year greenfield runoff rate. This reduction in incoming flows, for higher rainfall events, to the river will lead to a reduction in the flow on the Fenn Brook branch and the rest of the watercourses within the site. As a result of this, the flood risk from rivers is expected to be reduced due to the proposed development, hence the risk of fluvial flooding as a result of the development is low and further action or mitigation is not considered to be required.

5.2.2 Tidal Flooding

South Woodham Ferrers itself has areas designated for tidal flooding in extreme events. This affects the area to the south east of the site. From discussions with the EA, we understand that this can lead to flows in the Fenn Brook. backing up and causing localised flooding in the vicinity of Burnham Road.

5.2.3 Surface Water Flooding / Overland Flow

The CCC SFRA states that the surface water flood risk largely corresponds to the river corridor with a few small areas of ponding. Approximately 35%, 16% and 9% of the site area falls within the 1 in 1000 yr., 1 in 100yr. and 1 in 30yr. surface water flood map respectively. The topography at the site means that surface water and overland flows will tend to flow towards the south-west and south-east in valleys, channels and watercourses.

A drawing showing the extent of surface water flood zones, overland flood paths and contributing catchments is included in Appendix D (Drawing L00005-AEC-NA-NA-DR-C-5004).

The review of the EA 'Flood Map for Surface Water' (Figure 3 below) indicates that the majority of the site is at 'Very Low' risk, however, the ordinary watercourses have 'Low', 'Medium' and 'High' risk areas associated with them.

Figure 3 EA Flood Risk from surface water map

In addition to this, there is ponding in the corridor running parallel to the branch of Fenn Brook. Ponding in this area is generated due to the presence of a valley in the existing ground profile. This valley extends from the north east of the south west of the site at approximately 30m southern of the branch. This affects the proposed development areas located in the left bank of Fenn Brook branch (DA002, DA104 & DA008),

Therefore, the introduction of swales and attenuation basins will be required to convey surface water runoff to the watercourse, provide managed storage and mitigate the risk of flooding on the residential dwellings. The drainage strategy will manage rainfall at source by providing attenuation ponds, mimicking the natural drainage regime and limiting the discharge from the developed areas to the equivalent 1 in 1 year greenfield runoff rate. This will significantly reduce the pluvial flows for the catchments and reduce the pluvial risk. More detail on the drainage strategy can be found on the drainage strategy report[12].

The largest ponding area of the site is located upstream of the Fenn Brook culvert that crosses underneath the B1012, on the south west of the site. However, it has been agreed to leave this area as open space and localised grading of the surface could be required to convey the runoff to the Fenn Brook.

The SFRA states there are no known past flooding events affecting this site from any flooding source.

The majority of the site is at very low risk from surface water flooding, with the valley corridor being at medium and high risk. A robust SuDS strategy has utilised good management practices and design principles to control

[12] AECOM (June 2021), South Woodham Ferrers – Drainage Strategy

and manage surface water run-off to reduce the existing risk of flooding from surface water and not pose an additional flood risk to the site.

In order to provide a sustainable drainage strategy and not alter the current drainage regime, a network of swales around the boundary of the site is provided to not only protect the site from overland flow but also to preserve the existing drainage regime. The swales will be of adequate capacity to convey the 1 in 100 year event greenfield runoff including a 40% allowance for climate change.

The proposed development consists of 37% of the total catchment. This developable land will be attenuated down to 1 in 1 greenfield runoff rate, and therefore the drainage strategy will provide a betterment to the surface water flooding extends for the 1 in 100 and the 1 in 1000 and the provision of swales will provide additional storage and delay the concentration of surface runoff to the ordinary watercourse and the main river, at the west of the site by the B1418, due to the longer drainage paths.

The site is divided into several development parcels, with the provision of several detention basins, to limit the discharge to the equivalent 1 in 1 year Greenfield Runoff Rate for storms up to the 1 in 100 years including 40% for climate change.

In accordance with the SuDs hierarchy, the drainage strategy for the individual development parcels will include, where feasible source control attenuation such as rainwater harvesting, permeable paving, swales etc. to promote attenuation and treatment. This will be considered during the detailed design of individual development areas.

Given the foregoing, it is expected that the proposed drainage strategy will reduce the existing runoff on the site and the impact of the proposed development to the surface water on the area is expected to be low. Therefore, further action or mitigation is not considered to be required.

5.2.4 Groundwater Flooding

The site geology and hydrogeology are described in section 3.4 of this report. The drawings from MAGIC and British Geological Survey Mapping indicate that the west of the site is susceptible to flooding from groundwater whereas the vulnerability of the east side from groundwater flooding is considered as low. This could only relate to the areas where the drift/superficial geology is present, which is generally coincident with the areas occupied by ordinary watercourses and main rivers, into which any groundwater issues would tend to flow.

There are no known instances of groundwater flooding on or in the vicinity of the site. This may be due to events not having occurred or may be due to instances not having any significant consequences based on the current land use. Hence, further ground investigation and ground water monitoring should allow groundwater levels to be assessed and monitored to establish the level of risk, especially in the west of the site. Therefore, the risk to the undeveloped site from groundwater flooding is considered to be medium and mitigation measures should be undertaken. MAGIC aquifer and groundwater drawings are shown in Figures 5 to 10, within Appendix B.

An increase in the likelihood of groundwater flooding as a result of development is generally related to changes in sub-surface flow paths as a result of underground structures, such as basements or sheet piling. Such structures are not expected to be proposed as part of the development. Therefore, the impact of the proposed development to groundwater flooding on adjacent areas is expected to be low and further action or mitigation is not considered to be required.

5.2.5 Sewer Flooding

As discussed in Section 3.6, there is a single surface water sewer present on the site. This sewer is of short length and discharges into the watercourse beneath the B1418 in culvert. The two surface water sewers present in the B1012 Burnham Road are at a lower elevation to the majority of the Site, as is the foul sewer adjacent to Burnham Road and the short section between Hill View Nurseries and the roundabout junction with the B1012 and B1418, which is likely to be just within the site boundary.

The foul water sewer which serves Woodham Ferrers and passes through the western portion of the site is small (175 mm diameter) and for a significant part of its length flows is located in an area of the site at lowest elevation, (between 5 m and 10 m AOD).

Given the foregoing, it is unlikely that any failure of the sewers would result in significant flooding of the site and where any sewer flooding was to occur on site this would very likely follow overland flow routes and flow into the watercourses and main rivers.

There are no known instances of foul or surface water sewer flooding in the vicinity of the site. The SFRA, PFRA, SWMP do not highlight a risk of sewer flooding in relation to the subject site or South Woodham Ferrers. Therefore, the risk to the undeveloped site from flooding from existing sewers and drains is considered to be low and mitigation is not considered to be required.

As discussed in the Drainage Strategy, no direct connection will be made to the existing surface water sewers. Therefore, it is considered that there will be no impact on the existing surface water sewer system. New surface water sewers are proposed as part of the proposed development, which could introduce a source of flood risk to the site and surrounding areas via surcharging.

The capacity of the foul sewers is under discussion with Anglian Water to ensure that any discharge from the site is managed and does not impact on the downstream network. This is likely to involve infrastructure improvements and upgrades to the existing network. Please refer to the drainage strategy for more detail. Anglian Water are working with the design team to ensure that the foul drainage can be accommodated. Please refer to the letter from Anglian Water in Appendix C.

5.2.6 Reservoir Breach Flooding

The site does not fall within the risk of flooding area from any reservoir according to the Environment Agency Mapping and the information is included in Appendix B as Figure 12. Furthermore, flooding from reservoirs is extremely unlikely and there has been no loss of life in the UK from reservoir flooding since 1925.

5.2.7 Summary of Flood Risk to/from the development

Flood risk to and from the site has been summarised in Table 5-1 and Table 5-2 respectively. The flood risk column includes a consideration of the impacts of climate change, where information is available. These table includes a consideration of the impacts. Where mitigation measures are required, these are described in Section 6.

Table 5-1 Summary of flood risks to the development

Flood Mechanism	Source	Flood risk to the development	Mitigation required?	Residual risk
Tidal	None	None	None	N/A
Fluvial	Fenn Brook	Low*	No	Low
Surface Water Flooding / Overland Flow	Runoff from adjacent areas	Medium*	Flood Attenuation Measures. For areas adjacent to Flood Zone 2 and 3, Flood Warning System and Flood Evacuation Plan Flood Resilience / Resistance Measures may be required.	Low
Groundwater	Underlying geology and groundwater levels	Medium*	Ground investigation and ground water monitoring	Low
Sewers	Surrounding public/private drainage systems	Very Low	No	Very low
Artificial Sources	Nearby artificial waterbodies	Very Low	No	Very low

*Considering the impacts of climate change

Table 5-2 Summary of flood risks from the development

Flood Mechanism	Source	Flood risk from the development	Mitigation required?	Residual risk
Tidal	None	None	None	N/A
Fluvial	Fenn Brook	Low*	No	Low
Surface Water Flooding / Overland Flow	Runoff from adjacent areas	Low*	No	Low
Groundwater	Underlying geology and groundwater levels	Low*	No	Low
Sewers	Surrounding public/private drainage systems	Very low	No	Low
Artificial Sources	Nearby artificial waterbodies	Very Low	No	Very low

*Considering the impacts of climate change

5.3 Sequential and Exception Test

The Sequential Test is intended to direct new development to areas of lowest probability of flood risk, and ensure developments are in the most appropriate flood zone. The Sequential Test was carried out as part of the Local Plan. As the developable areas are within Flood Zone 1 and the proposed uses are in the More Vulnerable category, the development can be considered appropriate for the proposed use, and therefore passes the Sequential Test. The Exception Test is not required as the developable areas are located within Flood Zone 1, as stated in Table 4-3.

6. Development Proposals-Mitigation Measures

6.1 Proposed Levels

As stated in Section 2, it is proposed to develop the whole site with a mainly residential development, with supporting infrastructure such as access roads, a primary school, a local centre, a mixed use area for employment and large landscaped and open spaces.

According to the NPPF Planning Practice Guidance and EA guidance no habitable spaces should be located on the flood plain extent, so all residential finished floor levels should be a minimum of whichever is higher of:

- 300 millimetres (mm) above the general ground level of the site
- 600mm above the estimated river or sea flood level.

According to Section 4.2 the Upper allowance (65%) should be added to estimate the river flood level in proximity to flood zone 2 and 3. The level of the ground showed to flood in the EA Flood Maps sits at approximately 5.50 m AOD. The lowest level of developable land is at 8.10m AOD., which is significantly above the flood level so the criteria from the NPPF Planning Practice Guidance and EA are fulfilled.

6.2 Ground Investigation and Groundwater monitoring

The Head Deposits and the Claygate Beds, both present on the site, imply a low permeability stratum which may locally be suitable for soakaway drainage subject to detailed assessment. Furthermore, the west of the site is susceptible to flooding from groundwater whereas the vulnerability of the east side from groundwater flooding is considered as low.

AECOMs was commissioned by Countryside to undertake a ground investigation at the site to acquire ground and groundwater data. AECOM issued a technical note in the 12th April 2021 to summarise the findings and provide an interim geotechnical assessment of the data acquired from that ground investigation.

The ground investigation was completed between 12th and 21st October 2020 and comprised the installation of three 50mm diameter groundwater monitoring standpipes in the three boreholes, two falling head tests in two boreholes and one infiltration test in a trial pit. In both of the falling head tests completed, the drop in water level over the elapsed time was insufficient to meet the criteria for calculation of a permeability value. The infiltration test in the trial pit recorded a minor reduction and so the required reduction to between 75% and 25% of the trial pit capacity over which the infiltration rate is calculated was not achieved. Taking this into consideration, the options of an infiltration system or a hybrid solution of infiltration and discharging into a surface body have been discarded.

Regarding groundwater monitoring, no groundwater strikes were recorded during the formation of the exploratory holes. The water levels in the standpipes installed during the fieldwork were subject to an ongoing programme of monitoring, intended to comprise six visits at approximately monthly intervals from the end of fieldwork. At the time of this report, four rounds of monitoring have been completed. The results of the first four rounds of monitoring are showing presence of shallow groundwater.

7. Drainage Strategy

The surface water drainage strategy for the proposed development is set out in the separate Drainage Strategy. The report sets out the strategic drainage strategy including attenuation to be provided to ensure that the development manages surface water discharge from the site, manages overland flows and does not increase flood risk elsewhere. The flow from the site is restricted to the existing 1 in 1 year greenfield run -off rate. Refer to AECOM report L00005-AEC-NA-RP-C-0002.

The drainage strategy is based on unlined attenuation features based assuming no contamination being present at the site and groundwater being sufficiently low to not affect water levels in the detention basins. This will be reviewed following further geotechnical investigation and if infiltration can be utilised the design will be refined.

8. Conclusions

The flood risk assessment highlights that there are some potential flood risks related to the site. There is no development close to the limited areas of Flood Zones 2 & 3 in the vicinity of the site therefore no special mitigation measures are necessary. However, a drainage strategy has been produced taking into consideration all risks to and from the proposed development to ensure these are managed and no flood risk proposed to the development or increase of flood risk off site. Hence, it is considered likely that risks and impacts can be managed to an appropriate level with the adoption of mitigation measures employed as part of the proposed development.

Given the above, the development proposal of the site is in accordance with both National and Local Planning Policies and based on the information provided within this FRA is considered sustainable and acceptable in terms of flood risk, and therefore Planning Consent should not be withheld on flood risk grounds.