GeoSmart Information

FloodSmart

Flood Risk Assessment

Site Address

Ardleigh Oaks
Old Ipswich Road
Ardleigh
Essex
CO7 7QR

Grid Reference

602458, 229520

Report Prepared for

Lewis Halliday, Phase 2 Planning

On behalf of HT Industrial Ltd

Date

2023-10-17

Report Status

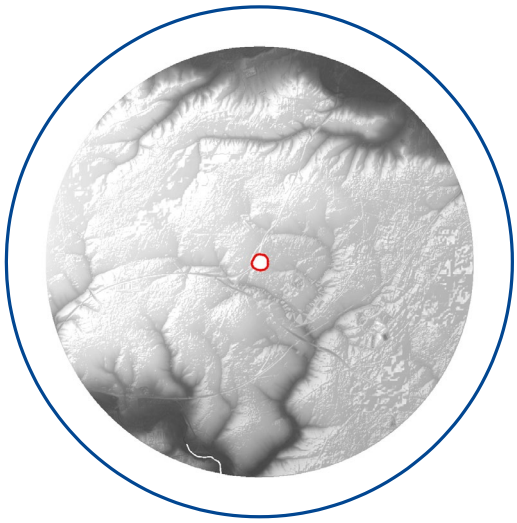
DRAFT

Site Area

0.96 ha

Report Reference

80610R2



RISK – Very Low

The Site is located in Flood Zone 1, this equates to a Very Low risk of flooding from rivers. Surface water (pluvial) flood risks are Very Low. Groundwater flood risks are Negligible and flooding risks from artificial sources (i.e. canals, reservoirs and sewers) are Negligible. Mitigation measures are recommended in this report to reduce the risks to an acceptable level over the lifetime of the development. A SuDS strategy has been prepared separately (ref: 80610.01).

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1. Executive summary

A review has been undertaken of national environmental data sets to assess the flood risk to the Site from all sources of flooding in accordance with the National Planning Policy Framework (NPPF) (2023) and National Planning Practice Guidance (NPPG) (Published in 2014 and updated in August 2022). A site-specific flood risk assessment, to assess the flood risk to and from the development Site, is provided within this concise interpretative report written by an experienced GeoSmart consultant. Baseline flood risk and residual risks that remain after the flood risk management and mitigation measures are implemented are summarised in the table below.

Site analysis

Source of Flood Risk	Baseline*	Final **
River (fluvial) flooding	Very Low	N/A
Surface water (pluvial) flooding	Very Low to Low	Very Low
Groundwater flooding	Negligible	N/A
Other flood risk factors present	No	N/A
Is any other further work recommended?	No	No (see below)

*BASELINE risks have been calculated for the whole Site, using national risk maps, including the benefit of EA flood defences.**FINAL RISK RATING Includes a detailed analyses of flooding risks over the lifetime of the proposed development, including allowances for climate change AND assumes recommended mitigation measures are implemented. N/A indicates where mitigation is not required.

Summary of existing and proposed development

The Site is located in Ardleigh, Essex in a setting of commercial and residential land use at National Grid Reference TM 02455 29526. Currently, the Site comprises four warehouses, varying in size and predominantly of industrial use, used as a highway maintenance and storage depot (Use Class Sui Generis) operated by Amey Highways Limited, acting as a contractor for the Highways Authority.

Development proposals comprise the demolition of existing industrial buildings and the construction of new B8 commercial property circa 22,000SQFT with associated yard space, parking and ancillary refuse and cycle storage.

Summary of flood risks

The flood risks from all sources have been assessed as part of this report and are as follows:

River (fluvial)

According to the Environment Agency's (EA) Flood Map for Planning Purposes, the Site is located within a fluvial Flood Zone 1 (Low Probability); and

According to the EA's Risk of Flooding from Rivers and Sea (RoFRS) map, which considers the type, condition and crest height of flood defences, the Site has a Low risk of flooding.

Surface water (pluvial) flooding

According to the EA's Risk of Flooding from Surface Water (pluvial) flood mapping, the Site has a Very Low to Low risk of pluvial flooding. The Low risk scenario is mapped as impacting the east of the Site; however this would not affect the area proposed for development and as such the risks to the development are deemed to be very low.

Present day

Flooding would not affect the area proposed for development in the 1 in 100 year present day scenario event.

Climate change

Flooding would not affect the area proposed for development in the 1 in 100 year plus climate change event.

A SuDS strategy has been prepared separately (ref: 80610.01) to ensure surface water runoff from the Site is managed over the lifetime of the proposed development.

Baseline mapping indicates a Very Low to Low. risk, however a review of the flood model data/local topography/ borehole data/ additional information indicates the risk is likely to be lower.

Groundwater flooding

Groundwater Flood Risk screening data indicates there is a Negligible potential risk of groundwater flooding at the surface in the vicinity of the Site during a 1 in 100 year event.

Artificial sources of flooding

The risk of flooding from artificial (man-made) sources such as reservoirs, sewers and canals has been assessed:

- The EA's Risk of Flooding from Reservoir map confirms the Site is not at risk of reservoir flooding. The potential for a breach of a reservoir to occur and flooding affecting the Site is low, although disused quarry pits adjacent to the south of the Site may pose a Very Low to Low reservoir risk not identified within the baseline mapping or EA data. These water-

filled pits are at a lower elevation than the Site and flooding should be mitigated by the owners.

- Ordnance Survey (OS) data confirms there are no canals near to the Site.
- The Strategic Flood Risk Assessment (SFRA) (Tendring SFRA, JBA, 2015), have not recorded historic incidences of flooding as a result of surcharging sewers within the CO7 7 postcode.

The risk of flooding from artificial sources is considered to be Negligible.

In accordance with paragraphs 161, 168 and footnote 56 of the NPPF (2023), as the development proposals are comprised of the demolition of existing buildings and construction of a similar building in its place within Flood Zone 1, the Sequential Test is not required.

Recommendations

Recommendations for flood mitigation are provided below, based upon the proposed development and the flood risk identified at the Site.

- There is a Very Low risk of flooding from all sources at the Site and as such, flood mitigation measures such as raising FFL's and installing barrier systems are not required.
- Flood resilient measures should be considered in order to reduce the risk and severity of any potential flooding.
- The ongoing management and maintenance of existing and any proposed drainage networks, under the responsibility for the future commercial operator of the Site, should be undertaken in perpetuity with the development.

GeoSmart recommend the mitigation measures discussed within this report are considered as part of the proposed development where possible and evidence of this is provided to the Local Planning Authority as part of the planning application.

2. Introduction

Background and purpose

A site-specific flood risk assessment has been undertaken, to assess the flood risk to and from the development Site. This assessment has been undertaken by firstly compiling information concerning the Site and the surrounding area. The information gathered was then used to construct a 'conceptual site model', including an understanding of the appropriateness of the development as defined in the NPPF (2023) and the source(s) of any flood risk present, guided by the NPPG (Published in 2014 and updated in August 2022). Finally, a preliminary assessment of the steps that can be taken to manage flood risk to the development was undertaken.

This report has been prepared with reference to the NPPF (2023) and NPPG (2022).

"*The National Planning Policy Framework set out the Government's planning policies for England and how these are expected to be applied*" (NPPF, 2023).

The NPPF (2023) and NPPG (2022) promote a sequential, risk based approach to the location of development. This also applies to locating a development within a Site which has a variable risk of flooding.

"*The approach is designed to ensure that areas at little or no risk of flooding from any source are developed in preference to areas at higher risk. This means avoiding, so far as possible, development in current and future medium and high flood risk areas considering all sources of flooding including areas at risk of surface water flooding*" (Paragraph: 023. NPPG, 2022).

The purpose of this report is to provide clear and pragmatic advice regarding the nature and potential significance of flood hazards which may be present at the Site.

Report scope

In accordance with the requirements set out within NPPG 2022 (Paragraph: 021 Reference ID: 7-021-20220825), a thorough review of publicly and commercially available flood risk data and EA supplied data indicating potential sources of flood risk to the Site from rivers and coastal sources, surface run-off (pluvial), groundwater and reservoirs, including historical flood information and modelled flood extent. Appropriate measures are recommended to manage and mitigate the flood risk to the property.

Information obtained from the EA and a review of the Colchester (AECOM, 2016) and Tendring (JBA, 2015) Strategic Flood Risk Assessments (SFRA) are used to ascertain local flooding issues and, where appropriate, identify information to support a Sequential and/or Exception test required as part of the NPPF (2023).

The existing and future flood risk to and from the Site from all flood sources is assessed in line with current best practice using the best available data. The risk to the development has been assessed over its expected lifetime, including appropriate allowances for the impacts of climate change. Residual risks that remain after the flood risk management and mitigation

measures are implemented, are considered with an explanation of how these risks can be managed to keep the users of the development safe over its lifetime.

An indication of whether the Site will potentially increase flood risk elsewhere is provided, including where the proposed development increases the building footprint at the Site. A drainage strategy to control runoff can be commissioned separately if identified as a requirement within this report.

Report limitations

It is noted that the findings presented in this report are based on a desk study of information supplied by third parties. Whilst we assume that all information is representative of past and present conditions, we can offer no guarantee as to its validity and a proportionate programme of site investigations would be required to fully verify these findings.

The basemap used is the OS Street View 1:10,000 scale, however the Site boundary has been drawn using BlueSky aerial imagery to ensure the correct extent and proportion of the Site is analysed.

This report excludes consideration of potential hazards arising from any activities at the Site other than normal use and occupancy for the intended land uses. Hazards associated with any other activities have not been assessed and must be subject to a specific risk assessment by the parties responsible for those activities.

Datasets

The following table shows the sources of information that have been consulted as part of this report:

Table 1. Datasets consulted to obtain confirmation of sources of flooding and risk

Source of flooding	Datasets consulted			
	Commercial Flood Maps	Local Policy & Guidance Documents*	Environment Agency	OS Data
Historical	X	X	X	
River (fluvial)	X	X	X	
Surface water (pluvial)	X	X	X	

Source of flooding	Datasets consulted			
	Commercial Flood Maps	Local Policy & Guidance Documents*	Environment Agency	OS Data
Groundwater	X	X		
Sewer		X		
Culvert/bridges		X		X
Reservoir		X	X	

*Local guidance and policy, referenced in Section 6, has been consulted to determine local flood conditions and requirements for flood mitigation measures.

Local policy and guidance

For this report, several documents have been consulted for local policy and guidance and relevant information is outlined below:

Tendring District Local Plan (2013 - 2033, 2021)

Policies

1.4 Essex County Council (ECC) is a key partner in its strategic role for infrastructure and service provision and as the Highway Authority, Lead Local Flood Authority, Local Education Authority and Minerals and Waste Planning Authority.

Policy SP 7

Include measures to promote environmental sustainability including addressing energy and water efficiency, and provision of appropriate water and wastewater and flood mitigation measures including the use of open space to provide flora and fauna rich sustainable drainage solutions.

Policy SP 9

F. Other Requirements

17. The delivery of smart, innovative and sustainable water efficiency/re-use solutions that fosters climate resilience and a 21st century approach towards water supply, water and waste water treatment and flood risk management. Taking a strategic approach to flood risk through the use of Strategic Flood Risk Assessments and the updated Climate Projections 2019 and identifying opportunities for Natural Flood Risk Management. Provision of

improvements to waste water treatment plant including an upgrade to the Colchester Waste Water Treatment Plan and off-site drainage improvements aligned with the phasing of the development within the plan period and that proposed post 2033. To ensure new development does not have an adverse effect on any European Protected or nationally important site and complies with environmental legislation (notably the Water Framework Directive and the Habitats Directive), the required waste water treatment capacity must be available ahead of the occupation of dwellings.

Colchester Strategic Flood Risk Assessment (AECOM, 2016):

Policies

6.5 Finished Floor Levels

Areas at risk of fluvial flooding

In areas at risk of fluvial flooding from main rivers and smaller watercourses, finished floor levels (FFL) should be set at least 300mm above the 1% AEP event flood level including a suitable allowance for climate change, or above ground level, whichever is more precautionary. It should be noted that land raising to achieve raised FFL should only be permitted if it can be provided in such a way that does not increase flood risk to surrounding areas.

Areas at risk of tidal flooding

In the southern part of the Borough, land adjacent to the Blackwater and Colne estuary is identified to be at risk of tidal flooding. In these areas, FFLs should be set at least 300mm above the flood level for the 0.5% AEP event including an allowance for climate change over the lifetime of the development.

Areas at residual risk of tidal flooding

Much of Colchester town centre is protected from tidal flooding by the presence of the Colne Barrier and is therefore at residual risk of tidal flooding in the event of a failure of the barrier or overtopping of defences. In these areas, FFL should be set at least 300mm above the flood level for the 0.5% AEP event including an allowance for climate change over the lifetime of the development.

Areas at risk of surface water flooding

In these areas, FFLs should be set above at least 300mm above the ground level or the modelled flood level where surface water modelling has been undertaken.

Guidance

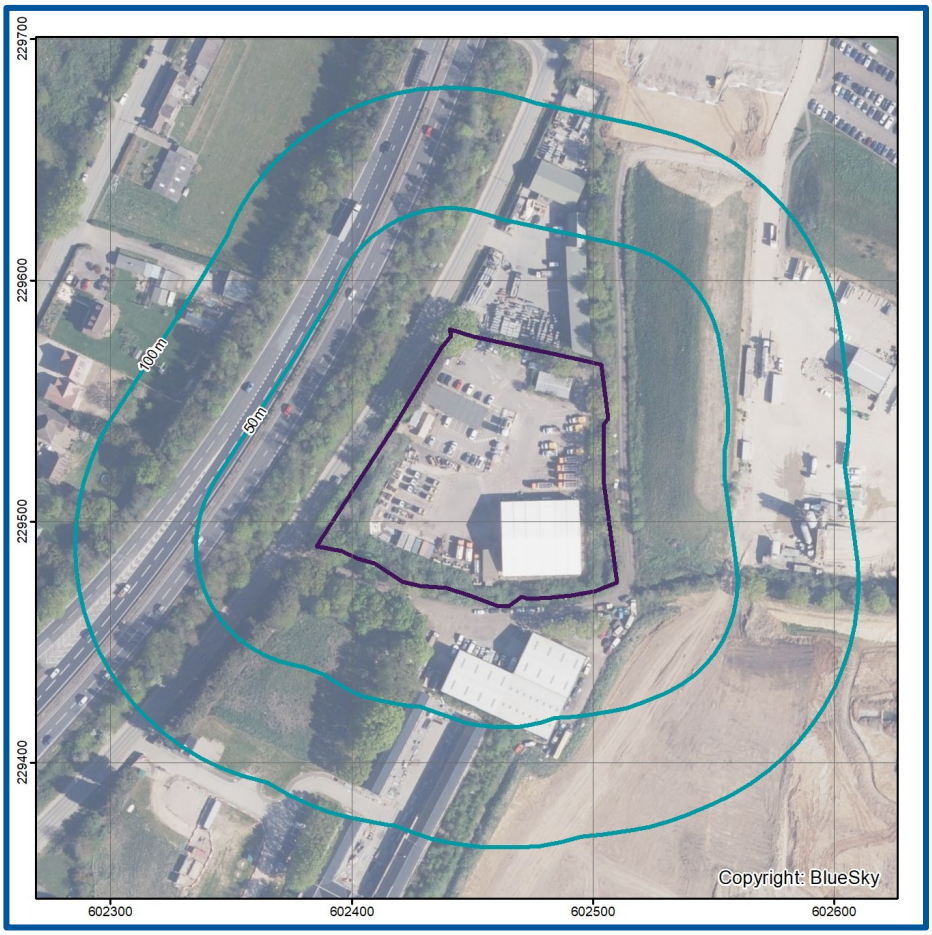
Strategic Flood Risk Assessments are carried out by local authorities, in consultation with the Environment Agency, to assess the flood risk to the area from all sources both now and in the future due to climate change. They are used to inform planning decisions to ensure inappropriate development is avoided (NPPF, 2023).

3. Site analysis

Site information

The Site is located in Ardleigh, Essex in a setting of commercial and residential land use at National Grid Reference TM 02455 29526.

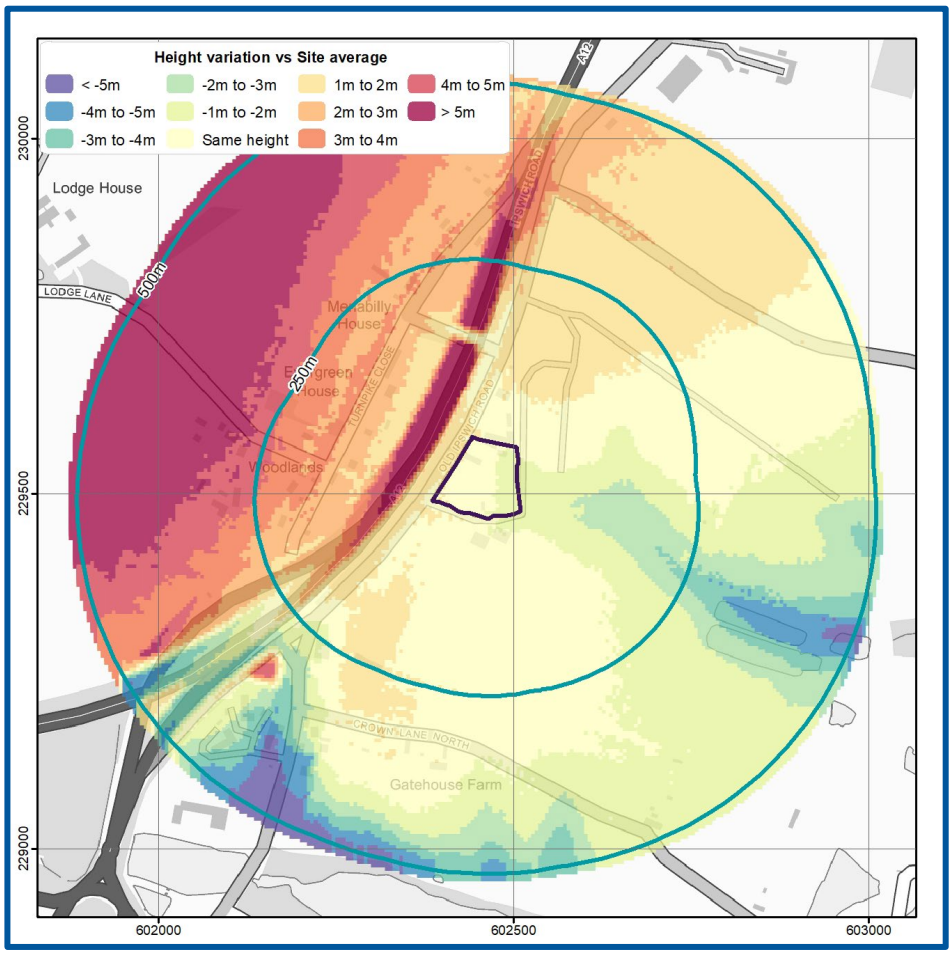
Figure 1. Aerial imagery of the Site (Bluesky, 2023)



The Figure below indicates ground levels within 500m of the Site fall in a south easterly direction

The general ground levels on the Site are between 38.46 and 43.95 mAOD with the Site falling gradually in an easterly direction. This is based on EA elevation data obtained for the Site to a 1 m resolution with a vertical accuracy of ±0.15 m (Appendix B).

Figure 2. Site Location and Relative Elevations (GeoSmart, 2023)



Development

The Site is currently used within a commercial and industrial capacity, used as a highway maintenance and storage depot (Use Class Sui Generis) operated by Amey Highways Limited, acting as a contractor for the Highways Authority.

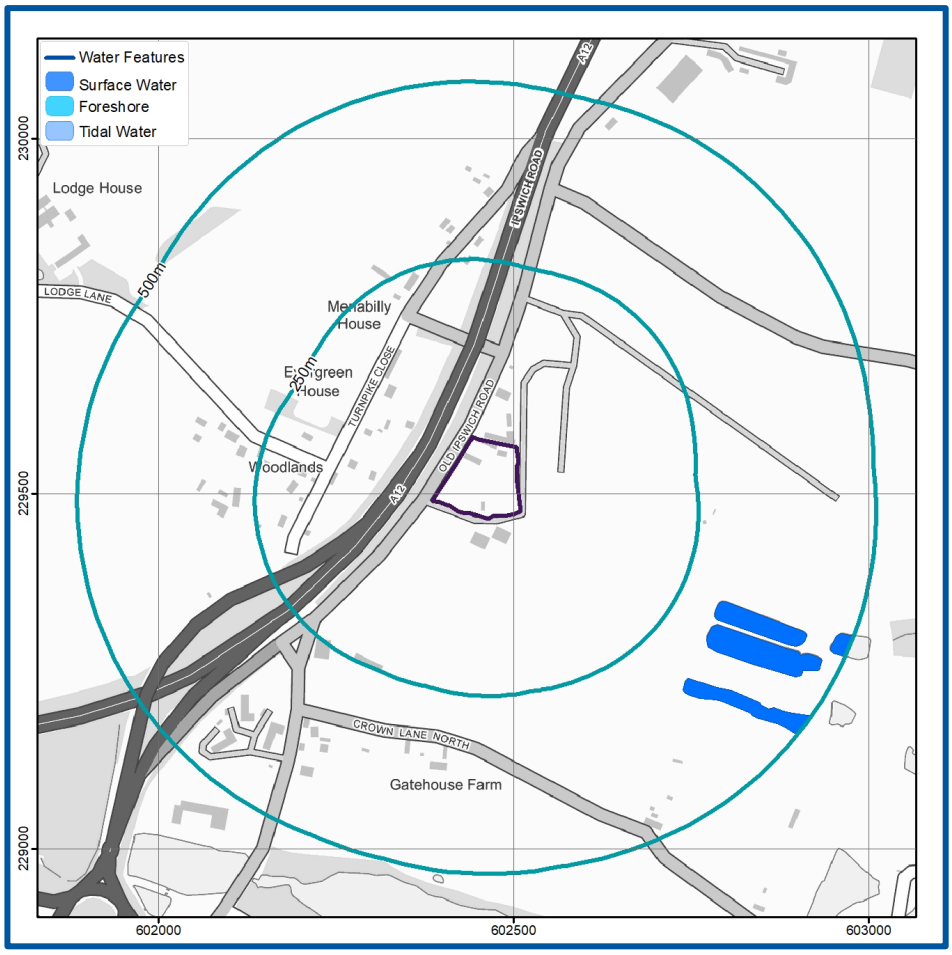
Development proposals comprise the demolition of existing industrial buildings and the construction of new B8 commercial property circa 22,000SQFT with associated yard space, parking and ancillary refuse and cycle storage.

The effect of the overall development will not result in an increase in number of occupants and/or users of the Site and will not result in the change of use, nature or times of occupation. According to Annex 3 of the NPPG (2022), the vulnerability classification of the existing development is Less Vulnerable and proposed development is Less Vulnerable. The estimated lifespan of the development is 75 years.

Hydrological features

According to Ordnance Survey (OS) mapping included in the following figure, there are numerous surface water features within 500 m of the Site.

Figure 3. Surface water features (EA, 2023)



The Ardleigh Reservoir is located approximately 590m south and 1.04km east of the Site at a lower elevation.

There are numerous artificial water features/reservoirs between 92m east and 1.2km south east of the Site relating to the surrounding quarry (Purell Construction).

Salary Brook is located approximately 820m south east of the Site at a higher elevation.

There are two irrigation reservoirs 870m north east of the Site at lower elevations.

An unnamed tributary extending from Salary Brook is located approximately 896m west of the Site at a higher elevation.

Simons Lake is located approximately 897m south east of the Site at a lower elevation.

Proximity to relevant infrastructure

A culvert on Salary Brook is located 838m south west of the Site on the A12.

There is a culvert on the Ardleigh Reservoir located approximately 1.7km to the east on Wick Lane.

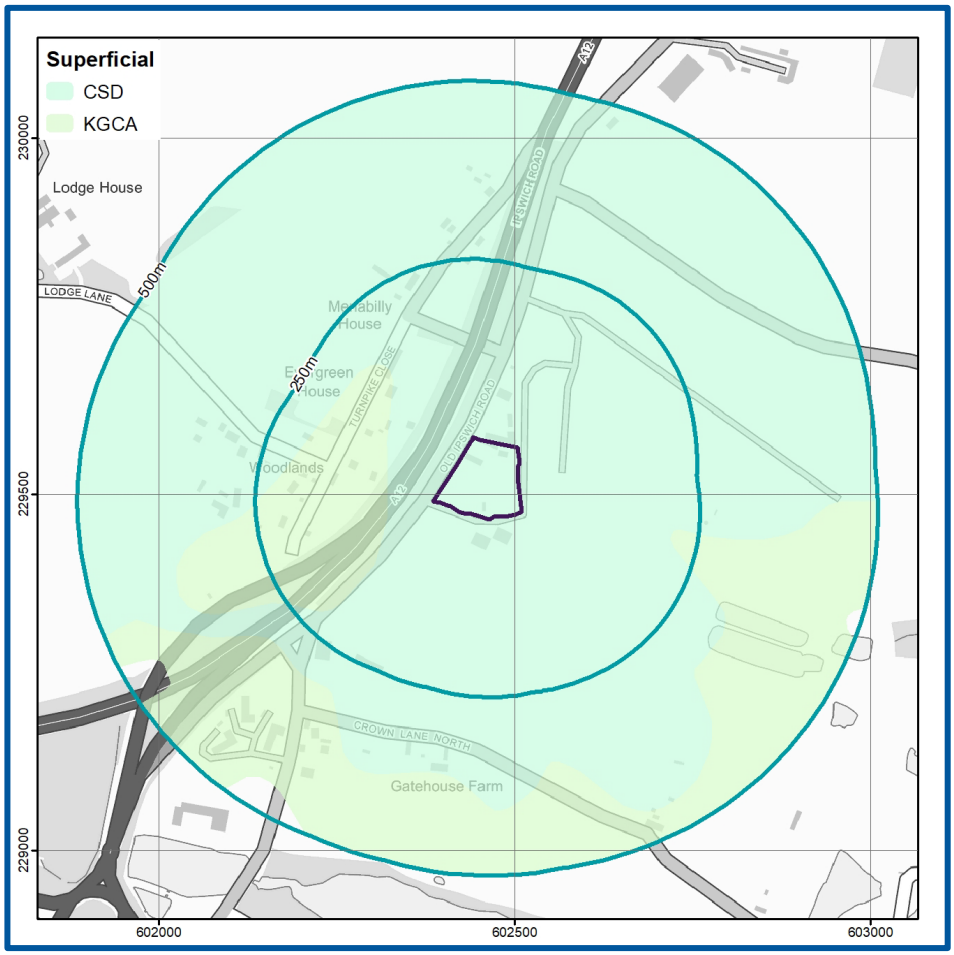
There is a culvert on the Ardleigh Reservoir located approximately 643m to the south west on Old Ipswich Road.

The River Stour is located 4.4km north east of the Site.

Hydrogeological features

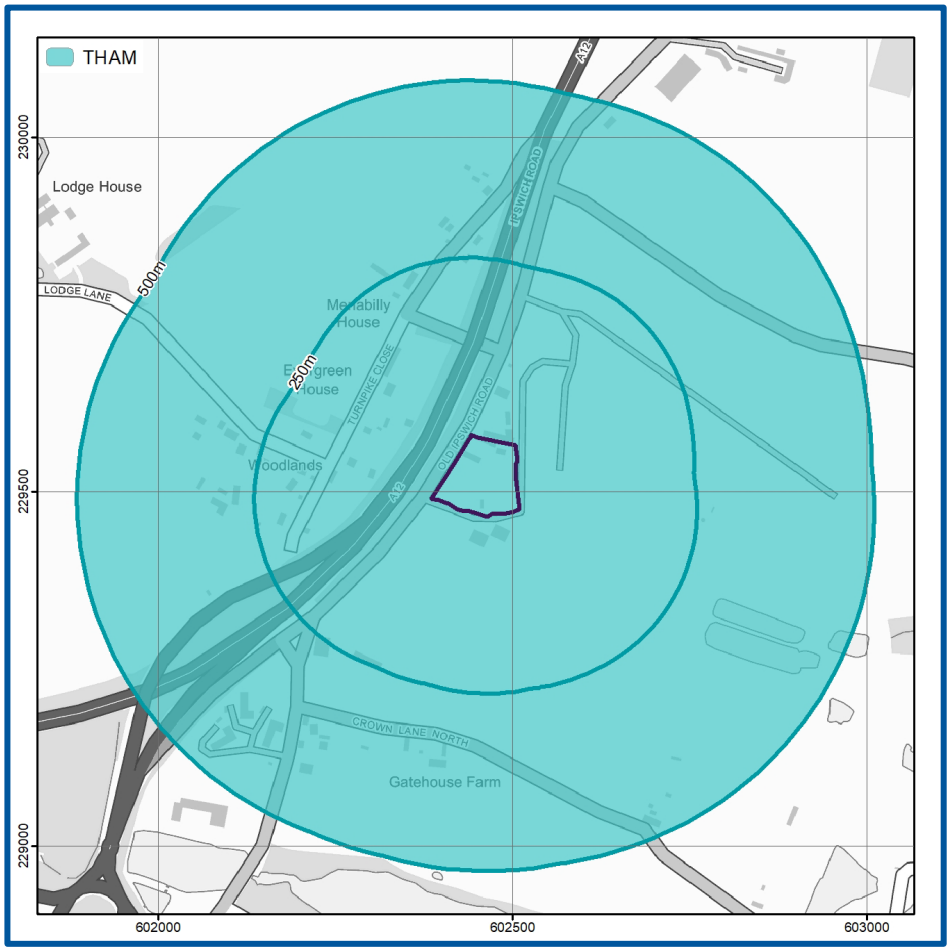
British Geological Survey (BGS) mapping indicates the underlying superficial geology (Figure below) consists of the Cover Sand (clay, silt and sand) (CSD), with surrounding superficial deposits of Kesgrave Catchment Subgroup sand and gravel within 250m of the Site boundary (KGCA) (BGS, 2023). Both superficial deposits are classified as a Secondary (B) Aquifer (EA, 2023).

Figure 4. Superficial Geology (BGS, 2023)



BGS mapping indicates the underlying bedrock geology (Figure below) consists of Thames Group clay, silt and sand (THAM) (BGS, 2023) and is classified as a Unproductive Strata (EA, 2023).

Figure 5. Bedrock Geology (BGS, 2023)



Geological conditions

A review of the BGS borehole database (BGS, 2023) indicates the nearest and most relevant borehole to the Site (ref: TM02NW27) is located 89m to the west of the Site boundary at an elevation of 41.58 mAOD, and indicates the underlying geology to consist of 0.3m of topsoil overlying of glacial loam and clayey sand to a depth of 2.4m below ground level. The base of the borehole is located at a depth of 3m bgl comprising glacial sand, gravel and clayey sand where no groundwater is observed (Appendix C).

Groundwater

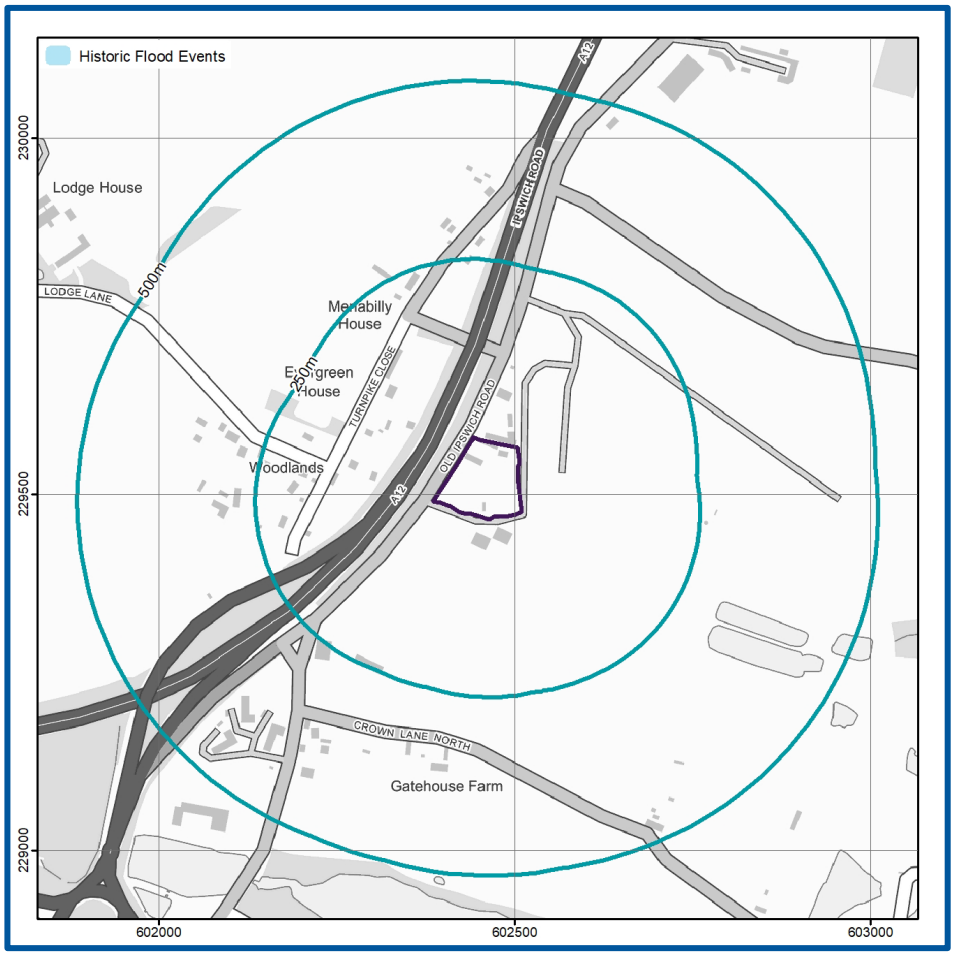
Groundwater levels are not recorded to the depth of the borehole 3.0 m below ground level on 06/11/68, subject to seasonal variations.

4. Flood risk to the development

Historical flood events

According to the EA's Historical Flood Map (Figure below) and Appendix A of the Tendring SFRA (JBA, 2009), there has been no flooding events affecting the Site

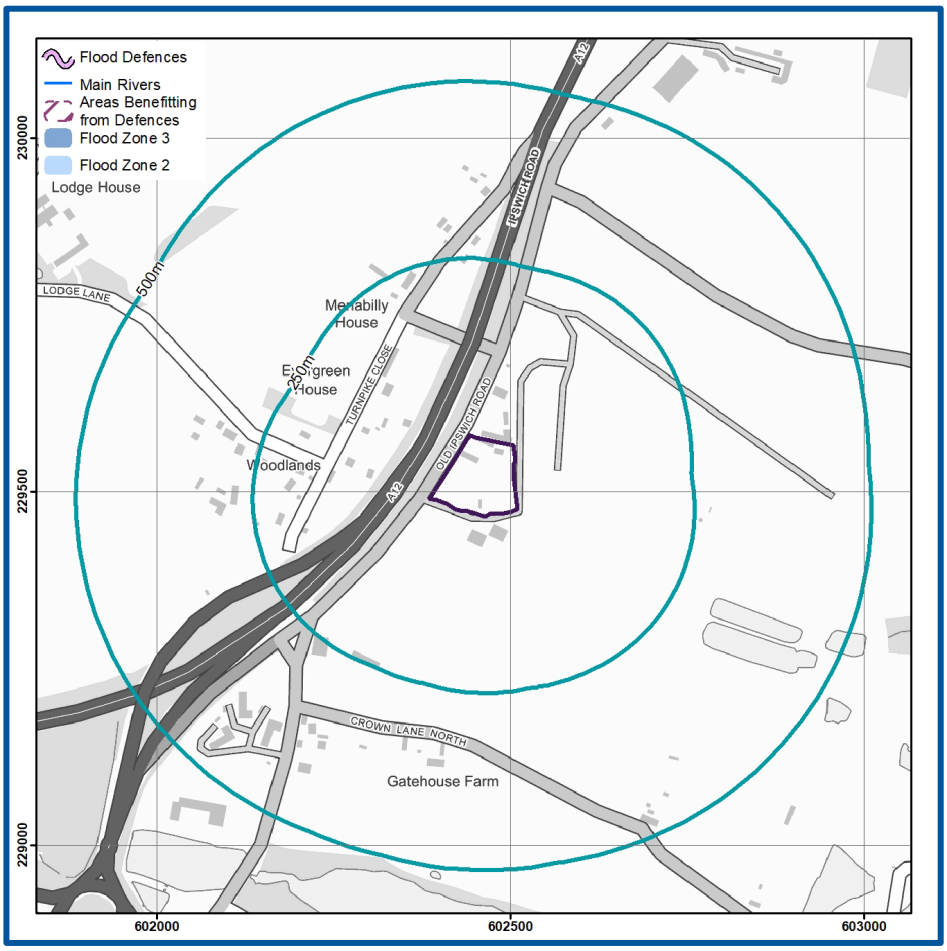
Figure 6. Historic Flood Events (BGS, 2023)



Rivers (fluvial)

According to the EA's Flood Map for Planning Purposes (Figure below), the Site is located within fluvial Flood Zone 1 and is therefore classified as having a Low probability of fluvial flooding from the Ardleigh Reservoir and Sally Brook.

Figure 7. EA Flood Map for Planning Purposes (EA, 2023)



Guidance

As defined in the NPPF (2023):

Ignoring the presence of any defences, land located in a Flood Zone 1 is considered to have a Low probability of flooding, with less than a 1 in 1000 annual probability of fluvial or coastal flooding in any one year.

Development of all uses of land is appropriate in this zone (see glossary for terminology).

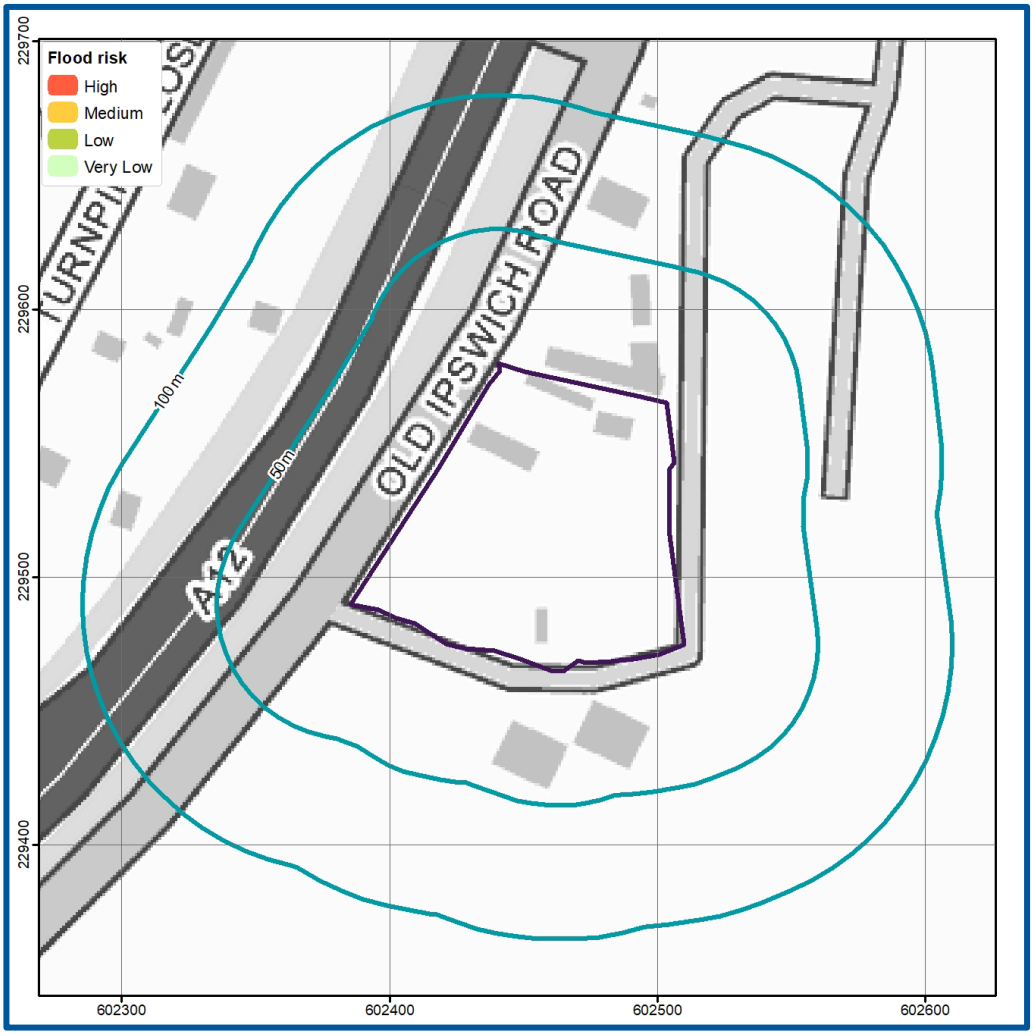
- The Site is not located in an area benefiting from flood defences.
- There are no formal flood defences within 250 m of the Site.
- There are no proposed flood defences within 250 m of the Site.

Flood risk including the benefit of defences

The type and condition of existing flood defences influence the 'actual' risk of fluvial flooding to the Site, albeit the long-term residual risk of flooding (ignoring the defences) should be considered when proposing new development.

According to the EA's Risk of Flooding from Rivers and Sea (RoFRS) map (Figure below), which considers the type, condition and crest height of flood defences, the Site has a Very Low risk of flooding from the nearby watercourse, the Ardleigh Reservoir and Sally Brook.

Figure 8. Risk of Flooding from Rivers and Sea map (EA, 2023)

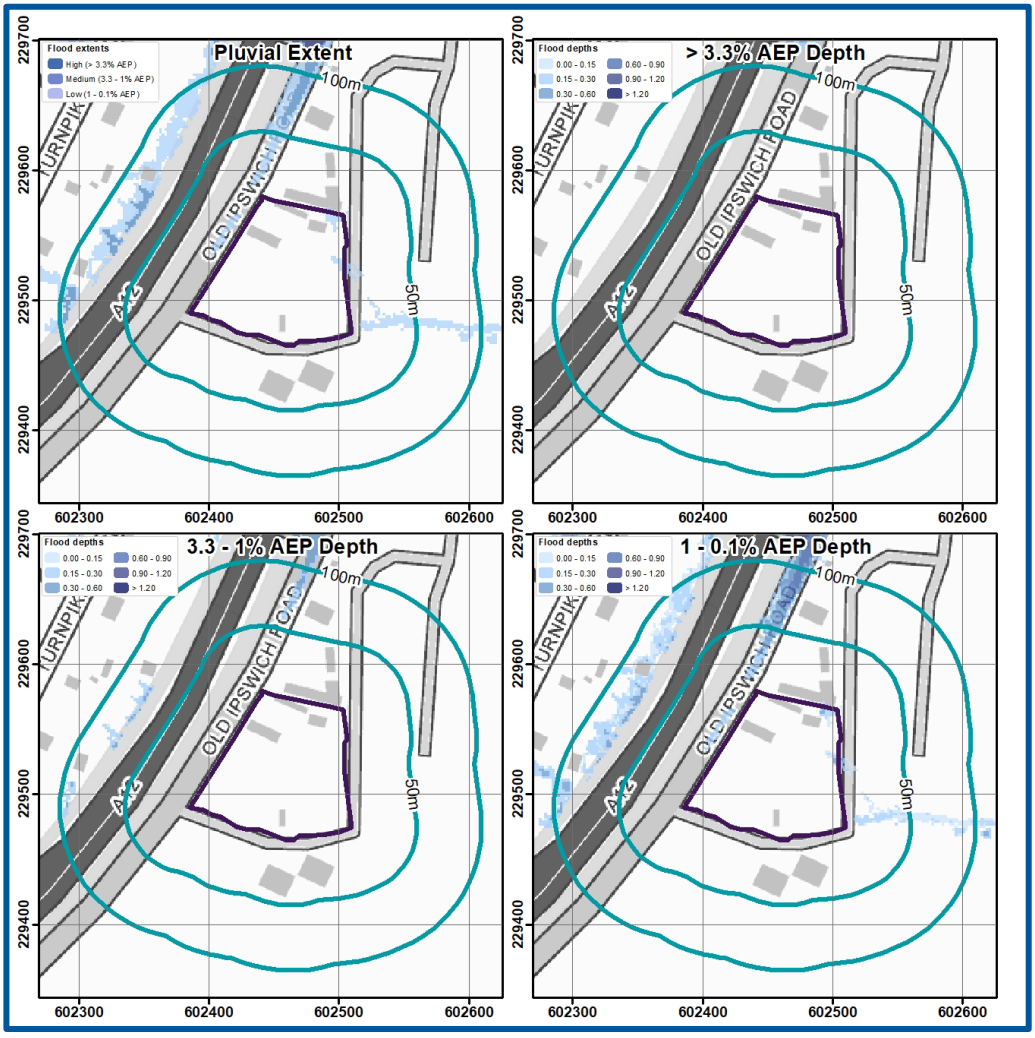


Surface water (pluvial) flooding

Surface water flooding occurs when intense rainfall exceeds the infiltration capacity of the ground and overwhelms the drainage systems. It can occur in most locations even at higher elevations and at significant distances from river and coastal floodplains.

According to the EA's Risk of Flooding from Surface Water (pluvial) flood mapping (Figure below), the Site has a Very Low risk of pluvial flooding[1]. Isolated regions of Low risk pluvial flooding are also identified along the eastern boundary of the Site.

Figure 9. EA surface water flood extent and depth map (EA, 2023)



[1] Environment Agency. April 2019. What is the Risk of Flooding from Surface Water map? Version 2.0. Accessed from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/842485/What-is-the-Risk-of-Flooding-from-Surface-Water-Map.pdf

Guidance

According to EA's surface water flood risk map the Site is at:

- Very Low risk - chance of flooding of less than 1 in 1000 (0.1%).
- Low risk - chance of flooding of between a 1 in 1000 & 1 in 100 (0.1% and 1%).

The SFRA does not indicate reported incidents of historical surface water flooding within 100 m of the Site and does not confirm the Site is located within a Critical Drainage Area (CDA)[2] (AECOM, 2016).

The Figure above confirms the extent and depth of flooding in multiple modelled flood scenarios. Flooding depths of up to 300 mm would impact small, isolated areas in the northeast corner of the Site in the 1 - 0.1% AEP (Low) risk event but does not affect the area for proposed development.

Similarly, flooding depths of up to 300 mm would impact the access routes to and from the Site in the 1 - 0.1% AEP (Low) risk event heading northwards on Old Ipswich Road.

Guidance

According to EA's surface water flood risk map the following advisory guidance applies to the Site:

Flood Depth

- 0.15 to 0.3 m - Flooding would: typically exceed kerb height, likely exceed the level of a damp-proof course, cause property flooding in some areas.

Climate change factors

Paragraph 002 of the National Planning Practice Guidance (August, 2022) requires consideration of the 1% AP (1 in 100 year) event, including an appropriate allowance for climate change.

As the Site is located within the Combined Essex Management Catchment and the proposed development is classed as Less Vulnerable, where the proposed lifespan is approximately 75 years. the Upper (40%) allowance is required to determine a suitable climate change factor to apply to rainfall data.

[2] A Critical Drainage Area (CDA) is an area that has critical drainage problems and which has been notified to the local planning authority as such by the Environment Agency in line with the National Planning Policy Framework (NPPF, 2023). CDA's are specific to Flood Zone 1, defined as areas where runoff can and may have historically contributed to flooding downstream, although they are not necessarily areas where flooding problems may occur. Where a Site is located in Flood Zone 1 and within a CDA, a Flood Risk Assessment (FRA) is required and the Council may also request Sustainable Drainage Scheme (SuDS) features to be included within the proposed development.

The 0.1% AP (1 in 1000 year) surface water flooding event has been used as a proxy in this instance for the 1% AP (1 in 100 year) plus climate change event.

Surface water flooding flow routes

Analysis of OS mapping, ground elevation data and the EA's pluvial flow route mapping in the 1 in 1000 year (Low probability) event confirms the Site is not located on a potential overland flow route.

Groundwater flooding

Groundwater flooding occurs when sub-surface water emerges from the ground at the surface or into Made Ground and structures. This may be as a result of persistent rainfall that recharges aquifers until they are full; or may be as a result of high river levels, or tides, driving water through near-surface deposits. Flooding may last a long time compared to surface water flooding, from weeks to months. Hence the amount of damage that is caused to property may be substantially higher.

Groundwater Flood Risk screening data (Figure below) indicates there is a Negligible risk of groundwater flooding at surface in the vicinity from permeable superficial deposits during a 1 in 100 year event.

Figure 10. GeoSmart GW5 Groundwater Flood Risk Map (GeoSmart, 2023)

Mapped classes within the screening map combine likelihood, possible severity and the uncertainty associated with predicting the subsurface system. The map is a national scale screening tool to prompt site-specific assessment where the impact of groundwater flooding would have significant adverse consequences. Mapping limitations and a number of local factors may reduce groundwater flood risk to land and property even where it lies within mapped groundwater flood risk zones, which do not mean that groundwater floods will occur across the whole of the risk area.

A site-specific assessment has been undertaken to refine the groundwater risk screening information on the basis of site-specific datasets (see Section 3) including BGS borehole data, and the EA's fluvial floodplain data (where available) to develop a conceptual groundwater model. The risk rating is refined further using the vulnerability of receptors including occupants and the existing and proposed Site layout, including the presence of basements and buried infrastructure. The presence of any nearby or on-Site surface water features such as drainage ditches, which could intercept groundwater have also been considered.

It is understood there are no existing basements, and a basement is not proposed as part of the development.

According to a review of the hydrogeology (Section 3), the Site is underlain by variably permeable superficial deposits above an unproductive/low permeability bedrock. A shallow groundwater table could potentially exist above the contact between the superficial and bedrock layers, resulting in a 'perched' groundwater table.

Groundwater levels may rise in the superficial aquifer in a seasonal response to prolonged rainfall recharge, which may cause an unusually high peak in groundwater levels during some years. The topography of the surrounding land being generally flat and higher than some nearby areas therefore reduces the possible groundwater risk to Very Low as water flow is channeled to lower elevations. According to a review of the hydrogeology (Section 3), the nearby boreholes (ref: TM02NW27) did not encounter groundwater during their 3m depth (Appendix C). This is the most relevant borehole to the Site, located less than 90m from the development within the same superficial and bedrock geology.

SFRA

Section 4.5.2 of the Colchester SFRA does not indicate reported incidents of historical ground water flooding within 50 m of the Site (AECOM, 2016).

Spring lines have not been identified in close proximity to the Site.

Topographic Lows

The local topography and drainage are such that the development threshold is likely to be higher than the area where groundwater emerges in adjacent low points.

The baseline groundwater flood risk rating is Negligible.

Guidance
Negligible Risk - There will be a remote possibility that incidence of groundwater flooding could lead to damage to property or harm to other sensitive receptors at, or near, this location.

Climate change predictions suggest an increase in the frequency and intensity of extremes in groundwater levels. Rainfall recharge patterns will vary regionally resulting in changes to average groundwater levels. A rise in peak river levels will lead to a response of increased groundwater levels in adjacent aquifers subject to the predicted climate change increases in peak river level for the local catchment.

The impact of climate change on groundwater levels beneath the Site is linked to the variation in rainfall recharge which is uncertain.

Flooding from artificial sources

Artificial sources of flood risk include waterbodies or watercourses that have been amended by means of human intervention rather than natural processes. Examples include reservoirs (and associated water supply infrastructure), docks, sewers and canals. The flooding mechanism associated with flood risk from artificial sources is primarily related to breach or failure of structures (reservoir, lake, sewer, canal, flood storage areas, etc.)

Sewer flooding

The SFRA does not include any information regarding flooding events from sewers (Tendring SFRA, JBA, 2015), (Colchester SFRA, AECOM, 2016) of the Site.

Guidance

Properties classified as "at risk" are those that have suffered, or are likely to suffer, internal flooding from public foul, combined or surface water sewers due to overloading of the sewerage system either once or twice in the ten year reference period. Records held by the sewage utility company provide information relating to reported incidents, the absence of any records does not mean that the Site is not at risk of flooding.

Canal failure

According to Ordnance Survey (OS) mapping, there are no canals within 500 m of the Site.

Water supply infrastructure

Water supply infrastructure is comprised of a piped network to distribute water to private houses or industrial, commercial or institution establishments and other usage points. In urban areas, this represents a particular risk of flooding due to the large amount of water supply infrastructure, its condition and the density of buildings. The risks of flooding to properties from burst water mains cannot be readily assessed.

If more information regarding the condition and history of the water supply infrastructure within the vicinity of the Site is required, then it is advisable to contact the local water supplier Anglian and Affinity Water.

Culverts and bridges

The blockage of watercourses or structures by debris (that is, any material moved by a flowing stream including vegetation, sediment and man-made materials or refuse) reduces flow capacity and raises water levels, potentially increasing the risk of flooding. High water levels can cause saturation, seepage and percolation leading to failure of earth embankments or other structures. Debris accumulations can change flow patterns, leading to scour, sedimentation or structural failure.

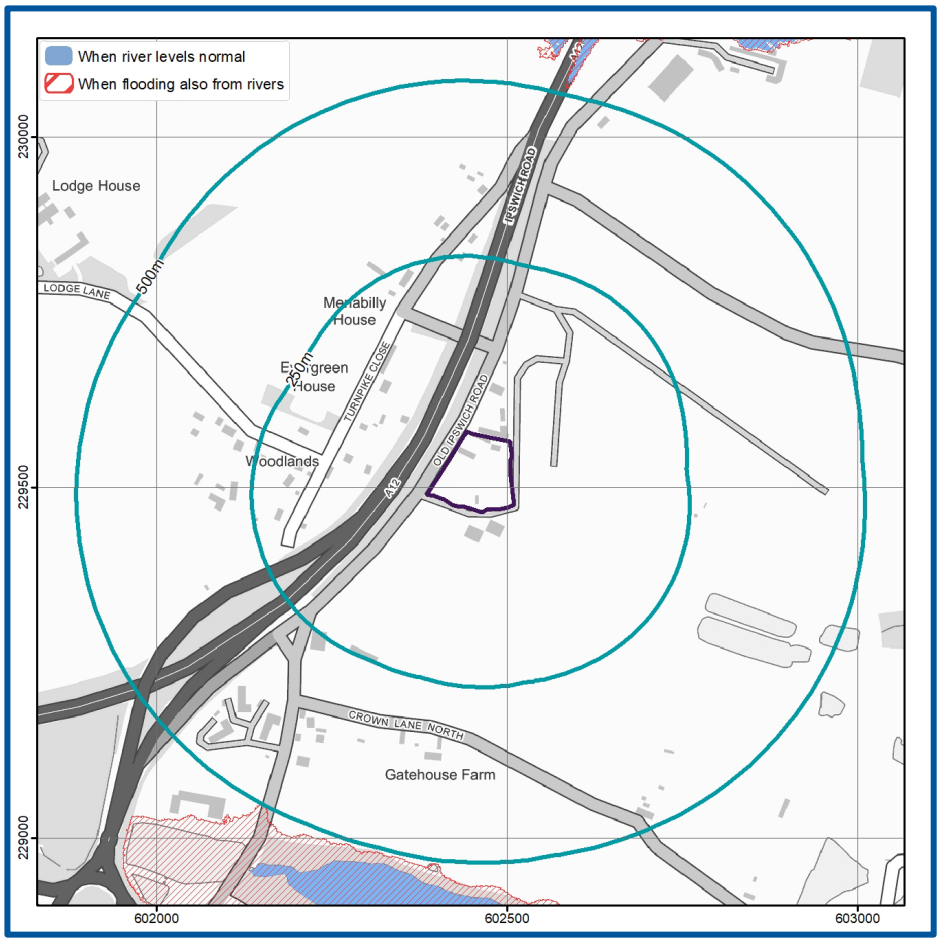
Culverts and bridges have been identified within close proximity to the Site (see Section 3). These structures may pose a flood risk to the Site should they become blocked or damaged.

The SFRA has not identified any historic drainage issues within the Site area (AECOM, 2016).

Reservoir flooding

According to the EA's Risk of Flooding from Reservoir mapping the Site is not at risk of flooding from reservoirs (Figure below) (EA, 2023). This is also confirmed by Appendix E of the Tendring SFRA (JBA, 2009) Flood Risk from Ardleigh Reservoir Flood map (Appendix D), which maps flooding in the area over a period up to 2009.

Figure 11. EA Risk of Reservoir Flooding (EA, 2023)



Guidance

The risk of reservoir flooding is related to the failure of a large reservoir (holding over 25,000 m^3 of water) and is based on the worst-case scenario. Reservoir flooding is extremely unlikely to occur (EA, 2023).

5. Flood risk from the development

Floodplain storage

Where flood storage from any source of flooding is to be lost as a result of development, on-site level-for-level compensatory storage, accounting for the predicted impacts of climate change over the lifetime of the development, should be provided. Where it is not possible to provide compensatory storage on site, it may be acceptable to provide it off-site if it is hydraulically and hydrologically linked.

The loss of floodplain storage is less likely to be a concern in areas benefitting from appropriate flood risk management infrastructure.

Flooding would not affect the area proposed for development in the 1 in 100 year plus climate change event. There are two isolated, low flood risk areas in the northeast of the Site boundary at a lower elevation than the area of proposed development, but these would not impact the area proposed for development.

Drainage and run-off

The proposed development involves an increase of impermeable surfaces at the Site. An estimation of run-off is therefore required to permit effective Site water management and prevent any increase in flood risk to off-Site receptors from the Site.

A Sustainable Drainage Strategy has been prepared separately by GeoSmart (ref: 80610.01) to manage runoff from the proposed development.

The NPPF (2023) recommends the effects of climate change are incorporated into FRA's. As per the most recent update to the NPPG (May 2022) the applicable climate change factor for the 1 in 30 (≥ 3.3% AEP) and 1 in 100 (< 3.3 to 1% AEP) year event to apply to surface water flooding is dependent upon the management catchment.

As the proposed development is being changed to residential, the lifespan of the development and requirements for climate change should allow up to the 1% AEP upper end allowance. As the Site is located within the Combined Essex Management Catchment the following peak rainfall allowances are to be applied.

Table 2. Climate change rainfall allowances

Combined Essex Management Catchment	3.3% Annual exceedance rainfall event		1% Annual exceedance rainfall event	
	2050s	2070s	2050s	2070s
Upper end	35%	35%	45%	40%
Central	20%	20%	20%	25%

6. Suitability of the proposed development

The information below outlines the suitability of proposed development in relation to national and local planning policy.

National policy and guidance

The aims of the national planning policies are achieved through application of the Sequential Test and in some cases the Exception Test.

Guidance

Sequential test: The aim of this test is to steer new development towards areas with the lowest risk of flooding (NPPF, 2023). Reasonably available sites located in Flood Zone 1 should be considered before those in Flood Zone 2 and only when there are no reasonably available sites in Flood Zones 1 and 2 should development in Flood Zone 3 be considered.

Exception test: In some cases, this may need to be applied once the Sequential Test has been considered. For the exception test to be passed it must be demonstrated that the development would provide wider sustainability benefits to the community that outweigh flood risk and a site-specific FRA must 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.

Suitability of the proposed development, and whether the Sequential and Exception Tests are required, is based on the Flood Zone the Site is located within and the flood risk vulnerability classification of the existing and proposed development. Some developments may contain different elements of vulnerability and the highest vulnerability category should be used, unless the development is considered in its component parts.

This report has been produced to assess all development types, prior to any development. The vulnerability classification and Flood Zones are compared within the table overleaf (Table 2 of the NPPG (2022)).

As the Site is located within Flood Zone 1, all types of development listed within the Table overleaf are acceptable according to National Policy.

Table 3. Flood risk vulnerability and flood zone 'incompatibility' (taken from NPPG, 2022)

Flood risk vulnerability classification		Essential infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less vulnerable
Flood Zone	Zone 1 – low probability	✓	✓	✓	✓	✓
	Zone 2 – medium probability	✓	✓	Exception test required	✓	✓
	Zone 3a - high probability	Exception test required	✓	X	Exception test required	✓
	Zone 3b – functional flood plain	Exception test required	✓	X	X	X

EA Flood Risk Standing Advice for vulnerable developments located in Flood Zones 2 or 3 (February, 2022)

For all relevant vulnerable developments (i.e. more vulnerable, less vulnerable and water compatible), advice on the points should be followed:

- Surface water management;
- Access and evacuation; and
- Floor levels.

Surface water management

Plans for the management of surface water need to meet the requirements set out in either the local authority's:

- Surface water management plan where available; OR
- Strategic flood risk assessment.

They also need to meet the requirements of the approved building regulations Part H: drainage and water disposal. Read section H3 rainwater drainage.

Planning permission is required to use a material that can't absorb water (e.g. impermeable concrete) in a front garden larger than $5m^2$.

Access and evacuation

Details of emergency escape plans should be provided for any parts of a building that are below the estimated flood level:

Plans should show:

- Single storey buildings or ground floors that don't have access to higher floors can access a space above the estimated flood level, e.g. higher ground nearby;
- Basement rooms have clear internal access to an upper level, e.g. a staircase;
- Occupants can leave the building if there's a flood and there's enough time for them to leave after flood warnings.

Floor levels

The following should be provided:

- average ground level of your site
- ground level of the access road(s) next to your building
- finished floor level of the lowest room in your building

Finished floor levels should be a minimum of whichever is higher of 300mm above the:

- average ground level of the site
- adjacent road level to the building
- estimated river or sea flood level

You should also use construction materials that have low permeability up to at least the same height as finished floor levels.

If you cannot raise floor levels to meet the minimum requirement, you will need to:

- raise them as much as possible
- consider moving vulnerable uses to upper floors
- include extra flood resistance and resilience measures

When considering the height of floor levels, you should also consider any additional requirements set out in the SFRA. Flood water can put pressure on buildings causing structural issues. If your design aims to keep out a depth of more than 600mm of water, you should get advice from a structural engineer. They will need to check the design is safe.

Extra flood resistance and resilience measures

Follow the guidance in this section for developments in flood risk areas where you cannot raise the finished floor levels to the required height. You should design buildings to exclude flood water where possible and to speed recovery in case water gets in.

Make sure your flood resilience plans for the development follow the guidance in the CIRIA Property Flood Resilience Code of Practice. Please note that the code of practice uses the term 'recovery measures'. In this guide we use 'resilience measures'.

Flooding can affect the structural stability of buildings. If your building design would exclude more than 600mm of flood water, you should get advice from a structural engineer. They will need to check the design is safe. Only use resistance measures that will not cause structural stability issues during flooding. If it is not possible to safely exclude the estimated flood level, exclude it to the structural limit then allow additional water to flow through the property.

The design should be appropriately flood resistant and resilient by:

- using flood resistant materials that have low permeability to at least 600mm above the estimated flood level
- making sure any doors, windows or other openings are flood resistant to at least 600mm above the estimated flood level
- using flood resilient materials (for example lime plaster) to at least 600mm above the estimated flood level
- by raising all sensitive electrical equipment, wiring and sockets to at least 600mm above the estimated flood level
- making it easy for water to drain away after flooding such as installing a sump and a pump
- making sure there is access to all spaces to enable drying and cleaning
- ensuring that soil pipes are protected from back-flow such as by using non-return valves

Temporary or demountable flood barriers are not appropriate for new buildings. Only consider them for existing buildings when:

- there is clear evidence that it would be inappropriate to raise floor levels and include passive resistance measures
- an appropriate flood warning or other appropriate trigger is available

7. Resilience and mitigation

Based on the flood risk identified at the Site, the national and local policies and guidance and proposed development, the mitigation measures outlined within this section of the report are likely to help protect the development from flooding.

Sea (coastal/tidal) flood mitigation measures

As the Site is not identified as being at risk of flooding from sea (coastal/tidal) sources, mitigation measures are not required.

Rivers (fluvial) flood mitigation measures

As the Site is not identified as being at risk of flooding from fluvial sources, mitigation measures are not required.

Surface water (pluvial) flood mitigation measures

As the Site is not identified as being at risk of pluvial flooding, mitigation measures are not required.

A surface water drainage (SuDS) strategy has been prepared separately (ref: 80610.01) to ensure surface water runoff can be managed effectively over the lifetime of the proposed development.

Groundwater flood mitigation measures

As the Site is not identified as being at risk of groundwater flooding, mitigation measures are not required.

Reservoir flood mitigation measures

According to EA data, the nearest reservoir (Ardleigh Reservoir) is situated approximately 1.4 km to the south to southeast of the Site but does not pose a risk of flooding from reservoirs; therefore, mitigation measures are not required. Other flood risk mitigation measures

As the Site is not identified as at risk from other sources, mitigation measures are not required.

Residual flood risk mitigation measures

The risk to the Site has been assessed from all sources of flooding and appropriate mitigation and management measures proposed to keep the users of the development safe over its lifetime. There is however a residual risk of flooding associated with the potential for failure of mitigation measures if regular maintenance and upkeep isn't undertaken. If mitigation measures are not implemented or maintained, the risk to the development will remain as the baseline risk.

Further flood mitigation information

More information on flood resistance, resilience and water entry can be found here: http://www.planningportal.gov.uk/uploads/br/flood_performance.pdf

www.knowyourfloodrisk.co.uk

Emergency evacuation - safe access / egress and safe refuge

An area of safe refuge should be sufficient in size for all potential users and be reasonably accessible to the emergency services.

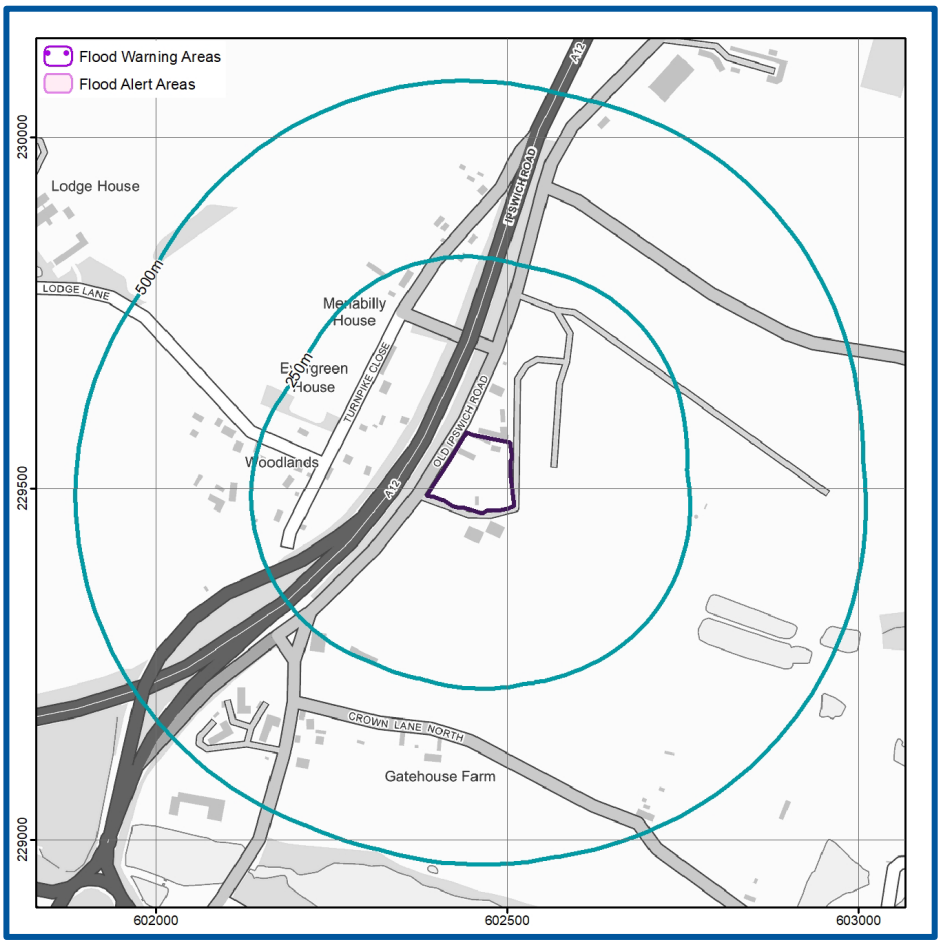
Emergency evacuation from the development and the Site should only be undertaken in strict accordance with any evacuation plans produced for the Site, with an understanding of the flood risks at the Site including available mitigation, the vulnerability of occupants and preferred evacuation routes.

Flood warnings

The EA operates a flood warning service in all areas at risk of flooding; this is available on their website: https://www.gov.uk/check-flood-risk. The Site is not located within an EA Flood Alerts/Warning coverage area so is not able to receive alerts and/or warnings (Figure below). All warnings are also available through the EA's 24 hour Floodline Service 0345 988 1188.

The EA aims to issue Flood Warnings 2 hours in advance of a flood event. Flood Warnings can provide adequate time to enable protection of property and evacuation from a Site, reducing risk to life and property.

Figure 12. EA Flood Warning Coverage for the local area (EA, 2023).



Emergency evacuation

Where possible, a safe access and egress route with a 'very low' hazard rating from areas within the floodplain to an area wholly outside the 1 in 100 year flood event including an allowance for climate change should be demonstrated.

Based on the EA's Flood Zone Map the closest dry evacuation area within Flood Zone 1 is along Old Ipswich Road (c.10 m west – direct measurement). It is advised that evacuation from the premises would be the preferred option in a flood event if safe to do so. It is recommended that residents prepare to evacuate as soon as an EA Flood Warning is issued in order to completely avoid flood waters.

8. Conclusions and recommendations

Table 4. Risk ratings following Site analysis

Source of Flood Risk	Baseline[1]	After analysis[2]	After Mitigation[3]
River (fluvial) flooding	Very Low	Very Low	N/A
Surface water (pluvial) flooding	Very Low to Low	Very Low to Low	Very Low
Groundwater flooding	Negligible	Negligible	N/A
Other flood risk factors present	No	No	N/A
Is any other further work recommended?	No	No	No (see below)

1 BASELINE risks assigned for the whole Site, using national risk maps, including the benefit of EA flood defences.

2 AFTER ANALYSIS modification of risk assessment based on detailed site specific analysis including some or all of the following: flood model data, high resolution mapping, building location, access routes, topographic and CCTV surveys. Reasons for the change in classification are provided in the text.

3 AFTER MITIGATION risks include risks to proposed development / asset and occupants if mitigation measures recommended in this report are implemented, including the impacts of climate change.

*N/A indicates where mitigation is not required.

The table below provides a summary of where the responses to key questions are discussed in this report. Providing the recommended mitigation measures are put in place it is likely that flood risk to this Site will be reduced to an acceptable level.

Less vulnerable developments in a Flood Zone 1 are acceptable according to the NPPF and providing the recommended mitigation measures are put in place (see previous sections) it is likely that flood risk to this Site will be reduced to an acceptable level.

Table 5. Summary of responses to key questions in the report

Key sources of flood risks identified	None (see Section 4).
Are standard mitigation measures likely to provide protection from flooding to/from the Site?	N/A (see Section 7).
Is any further work recommended?	No (See exec summary and section 7)

9. Further information

The following table includes a list of additional products by GeoSmart:

Additional GeoSmart Products			
✓	Additional assessment: SuDSmart Report		The SuDSmart Report range assesses which drainage options are available for a Site. They build on technical detail starting from simple infiltration screening and work up to more complex SuDS Assessments detailing alternative options and designs. Please contact info@geosmartinfo.co.uk for further information.
✓	Additional assessment: EnviroSmart Report		Provides a robust desk-based assessment of potential contaminated land issues, taking into account the regulatory perspective. Our EnviroSmart reports are designed to be the most cost effective solution for planning conditions. Each report is individually prepared by a highly experienced consultant conversant with Local Authority requirements. Ideal for pre-planning or for addressing planning conditions for small developments. Can also be used for land transactions. Please contact info@geosmartinfo.co.uk for further information.

10. References and glossary

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GeoSmart Information

Glossary

General terms

BGS	British Geological Survey
EA	Environment Agency
GeoSmart groundwater flood risk model	GeoSmart's national groundwater flood risk model takes advantage of all the available data and provides a preliminary indication of groundwater flood risk on a 50m grid covering England and Wales. The model indicates the risk of the water table coming within 1 m of the ground surface for an indicative 1 in 100 year return period scenario.
Dry-Island	An area considered at low risk of flooding (e.g. In a Flood Zone 1) that is entirely surrounded by areas at higher risk of flooding (e.g. Flood Zone 2 and 3)
Flood resilience	Flood resilience or wet-proofing accepts that water will enter the building, but through careful design will minimise damage and allow the re-occupancy of the building quickly. Mitigation measures that reduce the damage to a property caused by flooding can include water entry strategies, raising electrical sockets off the floor, hard flooring.
Flood resistance	Flood resistance, or dry-proofing, stops water entering a building. Mitigation measures that prevent or reduce the likelihood of water entering a property can include raising flood levels or installation of sandbags.
Flood Zone 1	This zone has less than a 0.1% annual probability of river flooding
Flood Zone 2	This zone has between 0.1 and 1% annual probability of river flooding and between 0.1% and 0.5 % annual probability sea flooding
Flood Zone 3	This zone has more than a 1% annual probability of river flooding and 0.5% annual probability of sea flooding
Functional Flood Plain	An area of land where water has to flow or be stored in times of flood.
Hydrologic model	A computer model that simulates surface run-off or fluvial flow. The typical accuracy of hydrologic models such as this is ±0.25m for estimating flood levels at particular locations.
OS	Ordnance Survey
Residual Flood Risk	The flood risk remaining after taking mitigating actions.
SFRA	Strategic Flood Risk Assessment. This is a brief flood risk assessment provided by the local council

SuDS	A Sustainable drainage system (SuDS) is designed to replicate, as closely as possible, the natural drainage from the Site (before development) to ensure that the flood risk downstream of the Site does not increase as a result of the land being developed. SuDS also significantly improve the quality of water leaving the Site and can also improve the amenity and biodiversity that a Site has to offer. There are a range of SuDS options available to provide effective surface water management that intercept and store excess run-off. Sites over 1 Ha will usually require a sustainable drainage assessment if planning permission is required. The current proposal is that from April 2014 for more than a single dwelling the drainage system will require approval from the SuDS Approval Board (SABs).

Aquifer Types

Principal aquifer	These are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale.
Secondary A aquifer	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.
Secondary B aquifer	Predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering.
Secondary undifferentiated	Has been assigned in cases where it has not been possible to attribute either category A or B to a rock type due to the variable characteristics of the rock type.
Unproductive Strata	These are rock layers or drift deposits with low permeability that has negligible significance for water supply or river base flow.

NPPF (2023) terms

Exception test	Applied once the sequential test has been passed. For the exception test to be passed it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk and a site-specific FRA must 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.
Sequential test	Aims to steer new development to areas with the lowest probability of flooding.
Essential infrastructure	Essential infrastructure includes essential transport infrastructure, essential utility infrastructure and wind turbines.

Water compatible	Water compatible land uses include flood control infrastructure, water-based recreation and lifeguard/coastal stations.
Less vulnerable	Less vulnerable land uses include police/ambulance/fire stations which are not required to be operational during flooding and buildings used for shops/financial/professional/other services.
More vulnerable	More vulnerable land uses include hospitals, residential institutions, buildings used for dwelling houses/student halls/drinking establishments/hotels and sites used for holiday or short-let caravans and camping.
Highly vulnerable	Highly vulnerable land uses include police/ambulance/fire stations which are required to be operational during flooding, basement dwellings and caravans/mobile homes/park homes intended for permanent residential use.

Data Sources

Aerial Photography	Contains Ordnance Survey data © Crown copyright and database right 2023 BlueSky copyright and database rights 2023
Bedrock & Superficial Geology	Contains British Geological Survey materials © NERC 2023 Ordnance Survey data © Crown copyright and database right 2023
Flood Risk (Flood Zone/RoFRS/Historic Flooding/Pluvial/Surface Water Features/Reservoir/ Flood Alert & Warning)	Environment Agency copyright and database rights 2023 Ordnance Survey data © Crown copyright and database right 2023
Flood Risk (Groundwater)	GeoSmart, BGS & OS GW5 (v2.4) Map (GeoSmart, 2023) Contains British Geological Survey materials © NERC 2023 Ordnance Survey data © Crown copyright and database right 2023
Location Plan	Contains Ordnance Survey data © Crown copyright and database right 2023
Topographic Data	OS LiDAR/EA Contains Ordnance Survey data © Crown copyright and database right 2023 Environment Agency copyright and database rights 2023

11. Appendices

GeoSmart Information

Appendix A

Site plans

GeoSmart Information

Appendix B

Environment Agency LiDAR ground elevation data

GeoSmart Information

Appendix C

BGS Borehole Data

GeoSmart Information

Appendix D

Flood Risk from Ardleigh Reservoir Floodmap SFRA (JBA, 2009)

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Commercial Director

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