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Flood Risk Assessment

Saxon Business Park, Cherry Orchard Way, Southend, Essex

Client Name: Cherry Orchard Homes and Villages Ltd

Project Number: P2665.4B.1

Date: 1 September 2017

ENABLING DEVELOPMENT

Client:	Cherry Orchard Homes and Villages Ltd
Agent / Architect	Third Dimension
Site:	Saxon Business Park, Cherry Orchard Way, Southend, Essex
Report ref.:	P2665.4B.1
Prepared by:	Paul Godbold BSc MSc FGS
Reviewed by:	Rachel Hickey BSc MSc
Approved by:	Alex Brearley BSc
Date:	01 September 2017
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Newmarket Business Centre, 341 Exning Road, Newmarket CB8 0AT
Tel: 01638 663226
www.agbenvironmental.co.uk

agb Environmental Ltd

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1 Introduction

agb Environmental has been commissioned by Third Dimension, on behalf of their Client Cherry Orchard Homes and Villages Ltd, to undertake a Flood Risk Assessment to accompany a development proposal at land to the east of **Saxon Business Park, Cherry Orchard Way (B1013), Southend, Essex (hereafter referred to as 'the site')**. At the time of preparing this Flood Risk Assessment (FRA) it is understood that the proposal comprised clearance of existing hardstanding and construction of Nursing Home; comprising a 105 room Care Home, six Residential Blocks, 8 Bungalows, parking courts, landscaped amenity space, and an internal access road. Further comment regarding the proposed development is presented within Section 3.

1.1 Site-Specific Flood Risk Assessment (FRA)

In accordance with the National Planning Policy Framework (NPPF) and Environment Agency Standing Advice, a Site Specific Flood Risk Assessment (FRA) should be both proportionate to the degree of flood risk and appropriate to the scale, nature and location of the proposed development or land use.

With reference to Environment Agency Flood Zone mapping, the majority of the site lies within Flood Zone 1; with the extreme north-western corner within Flood Zone 3.

Environment Agency Standing Advice requires that a Flood Risk Assessment (FRA) be undertaken for sites within Flood Zone 1 which are >1 hectare (ha).

As the site occupies approximately 4.04ha, and is predominantly within Flood Zone 1; a **Level 1 Flood Risk Assessment (FRA): Screening Study** has been conducted to assess the potential flood impact from all possible sources of flooding.

The aim of the FRA is to provide a qualitative appraisal of the potential flood risk posed to the site, and equally the potential impact that the proposed development may have on flood risk to land or property external to the site. The Screening Study will identify whether or not there are flooding or surface water management issues that require additional consideration and consequently completion of a more detailed FRA.

In completing the FRA, the following data sources were reviewed:

- Environment Agency (EA): Flood Risk Classification; Risk of Flooding from Rivers and the Sea (RoFRaS) database, and EA Standing Advice;
- Rochford District Council: Strategic Flood Risk Assessment (SFRA) Level 1 and 2 Final Report (February 2011);
- Thames Gateway South Essex: Strategic Flood Risk Assessment (SFRA) (2010);
- South Essex Surface Water Management Plan (SWMP) (2011- 2012);
- A 'Floodinsight' Report: Produced by Groundsure (including flood data, flood mapping, historic flooding; and geological data);
- A site specific Topographical Survey;
- British Geological Survey: on-line mapping and geological indicators of flooding; and
- Rochford District Council: Core Strategy Adopted Version (December 2011); (*namely Policy ENV3 – Flood Risk and Policy ENV4 – Sustainable Drainage Systems [SUDS]*).

The Level 1 FRA: Screening Study did not include a Site Reconnaissance.

1.2 Site Setting

The site is situated on the eastern side of the B1013 Cherry Orchard Way, approximately 1.5km south-west of central Rochford, Essex. The site may be located by National Grid Reference TQ 585951, 189967. The planning boundary of the site denotes an approximately square parcel of land covering 4.04 hectares (ha). The northern half of the site comprises predominantly the concrete hardstanding of a demolished commercial works; and includes open expanses of concrete paving and building foundations. The southern half of the site comprises open ground, part treed, part open scrubland. The north-eastern corner of the site is densely wooded. A former access road enters the site at the south-west corner and continues north parallel (and offset) to the western site perimeter.

The site is located within an ostensibly rural location. The western perimeter of the site is bordered by a minor road (Cherry Orchard Lane) and a terrace of eight residential properties. The B1013 Cherry Orchard Way lies <100m west of the site with open agricultural fields beyond.

The southern perimeter is bordered by a grassed recreational field (football pitches); with further agricultural land beyond. The eastern perimeter is bordered by an area of open ground (part treed, part open scrubland); with agricultural fields beyond. The northern perimeter of the site is bordered by the Noblesgreen Ditch watercourse, with grassed recreational fields (football pitches) beyond. A car park (potentially asphalt surfaced) is located to the north-west of the site beyond and adjacent to the Noblesgreen Ditch.

The Site Location and Current Site Layout are provided within Appendix A.

1.3 Site Topography

The Topographic Survey for the site (Appendix B) has been undertaken with reference to an arbitrary on-site survey station, set at datum height 100.00m.

Ground elevation (based on the arbitrary datum) generally exhibits a gradual fall in elevation from south to north across the site; and from west to east. Ground elevation within the southern area approximates 103.0m atop a broad level embankment; falling to 101.0m across a second broad embankment. Ground elevations subsequently decrease to approximately 99.0m across the open ground within the centre of the site. Continuing north; the expanse of concrete across the central site section averages 99.3m, and is fairly level.

The soft landscaped area along the northern aspect of the site beyond the concrete hardstanding is slightly elevated, averaging 99.68m. Ground elevations subsequently fall to approximately 99.1m at the northern perimeter of the site on approach to the Noblesgreen Ditch.

There are no significant surface depressions across the site. Minor; and spatially limited low points are created by narrow linear ditches within the centre of the site.

Ordnance survey mapping indicates that the average elevation of the site to approximate 13mAOD. External to the site, ground elevation dips very gradually from west to east, forming part of the valley section for the Noblesgreen Ditch (a tributary of the River Roach).

1.4 Existing Site Drainage

At the time of preparing the flood risk assessment, a specific Buried Services survey had not been conducted at the site. It is unknown whether the former commercial site was connected to external mains sewerage.

A series of linear 'Drain' sections are indicated on the Topographic Survey; orientated west – east across the hardstanding within the centre of the site. A further drain is indicated on scrubland to the east of the linear sections. It is assumed that the linear drain sections are connected. No direct connection is known to the Noblesgreen Ditch to the north of the site.

External to the western curtilage of the site, a potential surface water swale is located to the west of Cherry Orchard Lane. The swale is elongated north – south and is positioned between Cherry Orchard Lane and Cherry Orchard Way. The swale appears to be connected to a similar sized swale west of Cherry Orchard Way; with the connection being via a culvert beneath Cherry Orchard Way. Both swales appear to be grassed. It is not known whether there is a connection between the swales and the subject site.

The current provision for surface water drainage has not been confirmed.

Surface water drains and swales are indicated on the Surface Water Features Map within Appendix C.

1.5 Surface Water Bodies / Features

There are no surface water features within the curtilage of the site.

The Noblesgreen Ditch, a tributary River Roach, is located along the northern perimeter of the site, flowing west to east. The Noblesgreen Ditch is classified by the Environment Agency as a Main River watercourse and enters the River Roach approximately 1.5km east of the site.

A Surface Water Features map is presented within Appendix C.

1.6 Geology and Ground Permeability

Published British Geological Survey (BGS) records indicate the site to be wholly located on Bedrock of the London Clay Formation (clay, silt and sand); overlain by Superficial River Terrace Deposits 1 to 3, which extend across the whole site. The River Terrace Deposits comprise sand and gravel. Superficial Alluvium Deposits (comprising clay, silt, sand and gravel) are located immediately north-west of the site along the trajectory of the Noblesgreen Ditch, and may transgress slightly across the extreme north-west corner of the site.

The London Clay Bedrock is classified as Unproductive Strata (a non-aquifer); whereas the Superficial River Terrace Deposits are regarded as a Secondary A Aquifer, defined as having permeable layers capable of supporting water supplies at a local rather than a strategic level.

No recent (or historic) intrusive site investigation is known to have been conducted at the site. The closest published BGS borehole is 150m north-west (TQ 8572 9013) which indicates clayey silt (Brick Earth and Buried Channel Deposits) to approximately 7.20m; over sandy gravel (River Terrace Deposits) to 14.40m; over London Clay.

Although it is unlikely that Infiltration Tests (Soakaway Tests) have been conducted within the curtilage of the site, the presence of Superficial River Terrace Deposits comprising sand and gravel indicates potential for the use of Sustainable urban Drainage Systems (SuDS) using Infiltration Techniques. Site specific testing would need to be conducted prior to making recommendations.

The site is not located within an Environment Agency defined Source Protection Zone.

The South Essex Surface Water Management Plan (SWMP) (2011) includes BGS permeability maps; which broadly outlines the site to have a 'Very High' Maximum Permeability. A map extract is included within Appendix D.

The potential use of Infiltration SuDS is discussed further in Section 3 in relation to the proposed development.

2 Flood Hazard and Probability

2.1 Flood Zone Classification

Flood Zone definitions are defined within the National Planning Policy Framework (NPPF) as follows, and relate to the potential risk from flooding by river or sea:

Flood Zone 1 - land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1% Annual Exceedance Probability; AEP).

Flood Zone 2 - land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%AEP), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%AEP) in any year.

Flood Zone 3 - land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%AEP), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%AEP) in any year. Flood Zone 3 is further classified into Flood Zone 3a (high probability) and 3b (the functional floodplain, comprising land where water has to flow or be stored in times of flood).

Environment Agency flood zone mapping indicates that the majority of the site lies predominantly within Flood Zone 1; with the extreme north-western corner of the site within Flood Zone 3. The area defined as Flood Zone 3 is defined within the Rochford Strategic Flood Risk Assessment (SFRA) as being Flood Zone 3a; and not Flood Zone 3b (the functional floodplain). The area defined as Flood Zone 3a is outside of the area proposed for building construction, but marginally overlaps an area proposed for vehicular parking. The flood zone delineation indicates the level of flood risk assuming no flood defences. Flood Zone maps are provided within Appendix E.

The Environment Agency Risk of Flooding from Rivers and the Sea (RoFRaS) database generates an indication of river and coastal flood risk based on a 50m grid. The database considers the probability that any flood defences (if present) will overtop or breach, and the distance from the river or sea. **The RoFRaS Flood Rating for the majority of the site is 'Very Low' (less than 1 in 1,000 [0.1%] in any given year).**

A spatially limited area within the extreme north-western corner of the site is considered to be at 'High' or 'Medium' risk (where High risk denotes a risk considered to be greater than or equal to 1 in 30 [3.3%] in any given year). This area corresponds to the area defined as being within Flood Zone 3a; and partially extends over an area proposed for vehicular parking.

A RoFRaS map of the site and the surrounding area is provided within Appendix E.

2.2 Flood Defences

Information of flood defences from the National Flood and Coastal Defence Database (NFCDD) is presented within the Rochford District Council Strategic Flood Risk Assessment (SFRA, 2011)[1]. A map indicating the expanse of flood defences in proximity to the site is included within Appendix E; and indicates that the flood defence along the section of the

[1] Sourced from the Thames Gateway South Essex Strategic Flood Risk Assessment (SFRA, 2010).

Noblesgreen Ditch that spans the northern boundary of the site is a 'Maintained Channel' designed to protect against a 1 in 100 to a 1 in 200 year event.

There are no areas of Flood Storage within a 250m radius of the site.

2.3 Historic Flooding

The Environment Agency (EA) database of historic flooding events dating back to 1947 confirms that no flood events have impacted the subject site. An Environment Agency map indicating the extent of Historical Flooding is presented within Appendix F.

The Rochford SFRA (2011) references historical flooding and confirms no recorded flood events in close proximity to the subject site. A map indicating recorded surface water (pluvial) and sewer flood events is included within Appendix F.

2.4 Hydraulic Modelling of Fluvial and Tidal Flood Levels

2.4.1 Fluvial Flood Levels

The Rochford SFRA (2011) does not detail fluvial hydraulic modelling for the Noblesgreen Ditch. Surface water (pluvial) modelling is however presented within the SFRA and SWMP, and is discussed within Section 2.5.

2.4.2 Tidal Flood Levels

The Noblesgreen Ditch watercourse is a tributary of the River Roach, and is not influenced by tidal fluctuation. The River Roach is tidally influenced downstream of the Rochford Railway Station; which is downstream of the subject site.

Tidal flood levels are not relevant to the subject site.

2.5 Surface Water (Pluvial) Flooding

Surface Water (Pluvial) Flooding is rainfall generated overland flow prior to runoff entering a watercourse or sewer. Actual flooding may be a result of either overwhelming of sewerage and drainage systems during extreme events; or less extreme rainfall events over lower permeability ground. In such circumstances overland flow and ponding may occur in topographic depressions.

JBA Risk Management Limited provide flood maps based on modelling of extreme rainfall events (1 in 75 year, 1 in 200 year, and 1 in 1,000 year rainfall events) to indicate areas which may be vulnerable from surface water or 'pluvial' flooding. The model used generates a maximum depth of flooding within '5m cells' of topographical map coverage.

The JBA modelling indicates the risk of pluvial flooding across the majority of the site to be 'Negligible' (unclassified). Spatially limited areas of 'Low' risk are also indicated across the central section of the site; and within the extreme north-west corner, which are areas of concrete hardstanding. A 'Low' classification represents the maximum depth of flooding to be greater than 0.1m in a 1 in 1,000 year rainfall event.

Two areas determined as part 'High' and part 'Significant' risk are identified bordering the curtilage of the site (a 'Significant' risk being between 0.3m to 1m in a 1 in 75 year rainfall event). The first is located external to the north-western site corner, and extends west across the B1013 Cherry Orchard Way. The second is located adjacent to the mid-point of the eastern site perimeter, on an area of open ground. Both areas are outside of the

available Topographic Survey for the site, so it is currently uncertain (yet likely) that both locations are slight topographic lows. 'Low' to 'Significant' risk is also indicated within the swales to the west of the site.

The potential surface water (pluvial) flood risk within the curtilage of the site and surrounding area is depicted on the plan within Appendix G.

The Environment Agency (EA) Flood Maps for Surface Water (FMfSW) for the Rochford area indicate the majority of the site to be at no risk of surface water (pluvial) flooding; but with a spatially limited area of the central hardstanding to be at 'Low' risk, which is equivalent to between a 1 in 1,000 (0.1%) and 1 in 100 (1%) annual exceedance probability. The extreme north-west of the site is indicated to be at 'High' risk, equivalent to a 1 in 30 (3.3%). The FMfSW mapping concurs with the JBA flood map risk evaluation, and is incorporated within the Rochford SFRA as a map depicting Areas Susceptible to Surface Water Flooding. The majority of the site is shown to be 'Less Susceptible'. An extract from the SFRA map is included within Appendix G.

The South Essex SWMP includes details of Pluvial Hydraulic Modelling using a TUFLOW software model[2] for a range of rainfall event probabilities for the urban areas within the South Essex area; including the urbanised area of Rochford. The subject site was included within the model as a marginal buffer zone for the Rochford (ROC1) sub-group model. Resultant predicted flood depth and hazard rating maps for the 1 in 100 (1%) Annual Exceedance Probability (including a 20% allowance for Climate Change) for the area surrounding the site are provided within Appendix G. Although the scale of the maps is large, the subject site can be identified as being predominantly within the <0.1m flood depth category; with spatially limited areas of the central and north-western site section being indicated within the 0.1m to 0.25m flood depth category. The Flood Hazard category for the site is 'Caution: Very Low Hazard'; which is the lowest risk category[3].

Overall, the site is considered to be at 'Low' risk from Surface Water (Pluvial) Flooding.

2.6 Groundwater Flooding

The British Geological Survey (BGS) Susceptibility to Groundwater Flooding hazard database identifies areas where geological conditions *could* facilitate flooding, and where groundwater may be present close to surface.

The database indentifies the majority of the site as having **'Potential for groundwater flooding to occur at surface'**. The classification reflects the geological conditions beneath the site; namely, the presence of high permeability Superficial River Terrace Deposits (comprising sand and gravel), over low permeability London Clay. A BGS Groundwater Flooding Map is provided within Appendix H.

The classification relates to the potential flooding of the Superficial Deposits. The BGS state 'Moderate' confidence in the classification; which may reflect the paucity of groundwater

[2] TUFLOW is a 2D hydrodynamic modelling tool that simulates water level variations and flows for averaged unsteady 2D free-surface flows.

[3] Flood Hazard has been defined based on the joint Environment Agency and Defra Research and Development Technical Report FD2320 (January 2006); and uses surface water flood depths and velocities to categorise the flood hazard.

level data within the area. It would therefore be recommended that a site investigation is undertaken to determine actual groundwater levels in order to inform the site specific groundwater risk.

Where groundwater flooding at surface is indicated, a groundwater flooding hazard should be considered in all land-use planning decisions; and it is recommended that other relevant sources of groundwater flooding are referenced to establish a relative risk of groundwater flooding. For this reason, reference has been made to the relevant SFRA and SWMP, as detailed below.

The South Essex SWMP (2011) states, that no records of groundwater flooding have been reported to the Environment Agency within the jurisdiction of Rochford District Council. The SWMP does however indicate that higher risk would be present where Superficial River Terrace Deposits are located; which is the case at the subject site. The SWMP includes a Groundwater Susceptibility Map that indicates the site to be within an area of 'Very High' susceptibility. An extract from the map is included within Appendix H.

The SFRA concurs with the SWMP in stating that no records of groundwater flooding have been reported within the Rochford District study area (based on consultation with the Environment Agency).

On account of the lack of actual groundwater flooding events, and the absence of recent groundwater level data, the site is considered to be at 'Moderate' risk from Groundwater Flooding.

2.7 Critical Drainage Areas

The South Essex SWMP identifies nine (9No.) Critical Drainage Areas (CDAs) within the area of Rochford District Council; which are defined as "discrete geographic areas (usually a hydrological catchment) where multiple or interlinked sources of flood risk cause flooding during a severe rainfall event; thereby affecting people, property or local infrastructure".

The subject site is not located within a CDA.

The SWMP includes a Surface Water Management Plan for Rochford. The plan comprises actions within each CDA. There are no actions which relate to the subject site.

2.8 Climate Change

Climate Change will potentially increase both the frequency and intensity of localised storms, which could heighten localised drainage problems. In general, the impacts of climate change should be assessed over the lifetime of a proposed development, and calculated in accordance with the National Planning Policy Framework (NPPF). The Technical Guidance to the NPPF previously recommended national precautionary sensitivity ranges for peak rainfall intensities and peak river flows for use in the assessment of the impacts of climate change on flooding[4]. The previous national sensitivity allowances were updated in February 2016 with new guidance from the Environment Agency. The new guidance replaced the former single national allowance with a range of allowances to assess fluvial flooding. The new allowances for use in flood risk assessment are varied based on individual river basin

[4] Table 5 of the Technical Guidance to the NPPF national precautionary sensitivity ranges for peak rainfall intensities: +5% (1990 – 2025); +10% (2025 – 2055); +20% (2055 – 2085) and +30% (2085 – 2115)

districts; and subsequently refined based on the vulnerability classification of the development; the flood zone classification; and the lifetime of the development.

As the subject site is located almost entirely within Flood Zone 1, allowances for climate change in relation to fluvial flood risk have not been discussed further.

The source information used to inform the interpretation of hydraulic surface water (pluvial) modelling within Section 2.5 of this report included an allowance for climate change (based on the NPPF national allowance level).

3 Development Proposal

At the time of preparing this FRA, the proposed development comprised break-up and removal of the existing hardstanding, building foundations and internal access road; and the subsequent construction of a Nursing Home comprising the following principal elements:

- A Care Home providing 105 rooms;
- Six (6No.) Residential Blocks (Blocks A to F) providing a total of 316 apartments;
- Eight (8No.) Bungalows;
- Formal Amenity Space (gardens) between Residential Blocks;
- Parking Courts linked by internal access roads;
- A security office, cafe, and electricity sub-station; and
- Soft landscaping.

The spatial design of the development is included within Appendix I.

The development would constitute a change of land use from Commercial to Residential.

The development would constitute an increase in impermeable surfacing across the site (percentage increase to be confirmed).

It is noted that the whole development would be within Flood Zone 1; with the exception of a proportion of the parking court located within the north-western corner of the site, which would be within Flood Zone 3a.

3.1 Vulnerability Classification of the development

As the development is to provide residential dwellings, the Flood Risk Vulnerability Classification for the development has been determined as "More Vulnerable" (as defined by the NPPF); which would be considered appropriate for Flood Zone 1 (subject to an FRA).

In lieu of published Environment Agency Standing Advice for More Vulnerable development >1ha within Flood Zone 1; this FRA has adopted a precautionary approach, and included the information required for vulnerable developments within Flood Risk Zones (Flood Zones 2 and 3). Comment regarding Finished Floor Levels; Surface Water Management; and Access and Evacuation are outlined below; with additional information and recommendations in Section 4.2 Mitigation Measures.

3.2 Proposed Finished Floor Levels

At the time of preparing the FRA, specific Finished Floor Levels (FFL) had not been stated. It is known that the development would not include basement or sub-basement levels; and that all permanent residential construction would be wholly within Flood Zone 1. A FFL recommendation is provided within Section 4.2 Mitigation Measures.

3.3 Proposed Site Drainage

Drainage proposals for both Foul Water and Surface Water had not been determined at the time of preparing this FRA.

It is considered likely that The Applicant would seek to route Foul Water Discharge to an existing off-site network in the vicinity of Cherry Orchard Way. The Applicant would therefore be recommended to submit a Pre-development Enquiry (Capacity Check) to Anglian Water to verify that the proposed discharge volume and flow would be acceptable.

Disposal of Surface Water would need to accord with the recognised hierarchy of Sustainable urban Drainage Systems (SuDS); and be in accordance with the Rochford District Council: Core Strategy Adopted Version (December 2011).

A Surface Water Drainage Strategy is reported under separate cover.

Comment on potential Surface Water Management is provided within Section 4.2 Mitigation Measures.

3.4 Flood Risk Activity Permit

This development may require a 'Flood Risk Activity Permit' under the Environmental Permitting (England and Wales) Regulations 2010 for any proposed works or structures within eight metres of the top of the bank of the Noblesgreen Ditch; which is designated a 'Main River' watercourse. The permit is issued by the Environment Agency, and was formerly called a Flood Defence Consent.

In respect of the subject site, it is therefore recommended that the development design is positioned so as to incorporate a naturalised buffer zone of at least 8m along the southern bank of the Noblesgreen Ditch, in which no permanent construction is planned. This would ensure requisite vehicular access for flood defence maintenance along the Noblesgreen Ditch. An access gate could be incorporated either directly from an access road, or from a parking court area.

4 Summary

4.1 FRA Summary Points

- Environment Agency flood zone mapping indicates Saxon Business Park, Cherry Orchard Way, Southend, Essex ('the site') to be predominantly located within **Flood Zone 1**; defined as a zone having less than 1 in 1,000 annual probability of river flooding (<0.1%). The extreme north-western corner of the site is indicated to be within Flood Zone 3a; defined as having a 1 in 100 or greater annual probability of flooding.

- In recognition of the flood risk setting for the site, a **Level 1 Flood Risk Assessment (FRA): Screening Study** was conducted.

- **The Environment Agency Risk of Flooding from Rivers and the Sea (RoFRaS) Flood Rating for the majority of the site is 'Very Low' (less than 1 in 1,000 [0.1%] in any given year). The only exception is the north-western corner of the site; which is defined to be at 'Medium' or 'High' risk, which corresponds with the delineation of Flood Zone 3a. It is noted that the residential buildings proposed within the development are all within the 'Low Risk' areas of the site.**

- The Noblesgreen Ditch watercourse; a tributary of the River Roach; is located along the northern perimeter of the site, and is classified by the Environment Agency as a Main River.

- The site does not benefit directly from Flood Defences; although a 'Maintained Channel' flood defence spans the length of the Noblesgreen Ditch along the northern boundary of the site. The flood defence is designed to protect against a 1 in 100 to a 1 in 200 year event.

- The topography of the site exhibits a slight dip both south to north and west to east. The average elevation of the site is 13mAOD.

- To date, Foul Drainage and Surface Water Drainage have not been surveyed within the site; but historic use of the site suggests it is likely that foul water would have been connected to off-site Anglian Water infrastructure. Small scale linear surface water ditches are located within the centre of the site; with two larger swale features located beyond the western curtilage of the site. No connections to site are known.

- The SFRA does not include Hydraulic Modelling of Fluvial Flood Levels for the Noblesgreen Ditch. The Noblesgreen Ditch is not influenced by tidal fluctuation.

- The site has not been impacted by historic flooding from any identified source.

- The potential risk from **Surface Water (Pluvial) Flooding across the majority of the site is considered to be 'Negligible' (unclassified).** A 'Low' classification is determined for spatially limited areas of the existing centrally located hardstanding, and the north-west corner of the site. A 'Low' classification represents the maximum depth of flooding to be greater than 0.1m in a 1 in 1,000 year rainfall event. Environment Agency Flood Maps for Surface Water (FMfSW) indicate a similar risk

classification. Pluvial Hydraulic Modelling presented within the South Essex SWMP indicates the Flood Hazard category for the site to be 'Caution: Very Low Hazard'. **The overall risk of surface water (pluvial) flooding is considered 'Low'.**

- The British Geological Survey (BGS) Susceptibility to Groundwater Flooding indicates **'Potential for groundwater flooding at surface'** across the site. The classification reflects the potential flooding of high permeability Superficial River Terrace Deposits (sand and gravel) over low permeability London Clay. **The overall risk of groundwater flooding is considered 'Moderate' based on there being no evidence of historic flooding records and no recent site specific data.** (It is recommended that any future scheduled site investigation works include a remit to determine groundwater levels so as to further clarify groundwater risk).
- The site is not within a Critical Drainage Area (CDA).
- The site is not within an Environment Agency Source Protection Zone (SPZ).
- The proposed residential development is classified within the NPPF as a 'More Vulnerable' development. Such developments are considered appropriate within Flood Zone 1 (subject to an FRA).
- The development proposes break-up and removal of the existing hardstanding, building foundations and internal access road; and the subsequent construction of a Nursing Home.
- The proposed development is estimated to increase the impermeable surfacing across the site; the precise area is yet to be determined.
- Finished Floor Levels (FFLs) are yet to be confirmed.
- Proposed Foul Water Drainage would be to off-site Anglian Water infrastructure.
- It is recommended that all permanent construction should be offset 8m south of the Noblesgreen Ditch watercourse in order to enable flood defence maintenance.
- Proposed Surface Water Drainage is yet to be determined, but needs to consider the use of SuDS. The SFRA (and published geological conditions) suggests the site is within an area of 'High' Maximum Permeability'; which could permit the use of Infiltration SuDS. Confirmation would be subject to appropriate Soakaway (Infiltration) testing.

4.2 Mitigation Measures

In considering flood Mitigation Measures appropriate to the site and the proposed development; the following key flood risk factors have been taken into consideration:

- The Environment Agency Risk of Flooding from Rivers and the Sea (RoFRaS) database indicates the site to be predominantly within Flood Zone 1; and at 'Low' potential risk of flooding. All permanent buildings would be within Flood Zone 1.

- The maximum risk of Surface Water (Pluvial) Flooding across the site is classified as 'Low' for all areas where permanent buildings are proposed. The EA FMfSW indicates the pluvial flood risk to be 'Low'.
- The British Geological Survey (BGS) Susceptibility to Groundwater Flooding indicates 'Potential for groundwater flooding at surface'. The overall risk is considered 'Moderate'.
- No recorded historical flooding has impacted the site.

4.2.1 Finished Floor Levels

Finished Floor Levels (FFLs) had not been determined at the time of preparing the FRA. The proposed design does not include basement or sub-basement levels.

The SFRA requires that "where development in flood risk areas is unavoidable, the most common method of mitigating flood risk is to ensure habitable floor levels are set 300mm above the maximum flood water level with an allowance for climate change". However, as the location of all proposed permanent residential buildings would be wholly within Flood Zone 1; all construction would be by definition, within an area of very low flood risk potential.

Across the area of the site where permanent residential buildings are proposed, the maximum risk of flooding is from surface water (pluvial) flooding, which is classified as 'Low' (greater than 0.1m in a 1 in 1,000 year event); and groundwater flooding, which is considered 'Moderate' (although no records of flooding are known).

In view of the relatively low risk from all sources of potential flooding; a nominal minimum Finished Floor Level (FFL) is therefore recommended, up to a maximum of 300mm above ground level.

4.2.2 Surface Water Management

Full detail of the proposed Surface Water Management design for the site had yet to be determined at the time of preparing the FRA; but would need to be compliant with the 'Building Regulations (2010), Drainage and Waste Disposal, Approved Document H, Section H3: Rainwater Drainage'.

The SFRA encourages the use of Sustainable urban Drainage Systems (SuDS) where appropriate; including Infiltration Techniques where permeable geology permits. The selection and use of SuDS using Infiltration Techniques would be likely on account of the presence of the potentially high permeability River Terrace Deposits beneath the site (comprising sand and gravel). Site specific Soakaway (Infiltration) Tests would need to be conducted prior to making recommendations; but as the site is external to Environment Agency Source Protection Zones, the use of infiltration SuDS could be considered.

Should The Applicant wish to use external Anglian Water infrastructure for surface water disposal; it is recommended that a Pre-development Enquiry (Capacity Check) be submitted to Anglian Water to verify that discharge volumes and flow would be acceptable.[5]

As the proportion of impermeable surfacing across the site would be increased, it is considered likely that the post construction surface water run-off volume and flow patterns

[5] A single pre-development enquiry could be submitted for both Foul and Surface Water Drainage.

would be altered. As surface water (pluvial) flooding has been identified as a low to negligible risk, it could be assumed that the likely change in impermeable surfacing may not be a significant issue in terms of flood risk.

The Rochford District Council Core Strategy Adopted Version (December 2011) Policy ENV4 – Sustainable Drainage Systems (SuDS), requires the incorporation of runoff control via SuDS to ensure runoff and infiltration rates do not increase the likelihood of flooding. As Policy ENV4 is a requirement for residential development of over 10 units, the policy will be a requirement for the proposed development.

Overall, surface water drainage is not considered likely to significantly increase flood risk across the site; or to adjoining off-site properties.

A Surface Water Drainage Strategy is reported under separate cover.

4.2.3 Access and Evacuation

As the site is located within Flood Zone 1, Access and Evacuation in the event of flooding is not applicable.

4.3 Concluding Comments

- The proposed development is considered appropriate for a site within Flood Zone 1; subject to a Flood Risk Assessment.
- The Environment Agency Risk of Flooding from Rivers and the Sea (RoFRaS) database indicates a 'Low' risk of flooding; with the exception of a spatially limited area within the north-west corner which is considered 'High' risk. All proposed buildings are within the 'Low' risk area.
- Historic flooding is not recorded at the subject site.
- Potential risk from Surface Water (pluvial) Flooding is considered 'Low'.
- Potential risk from Groundwater Flooding is considered 'Moderate' (but with no historical records).
- A Surface Water Drainage Strategy is reported under separate cover. It is likely that SuDS using Infiltration Techniques would be considered.
- Anglian Water should be consulted regarding potential connections to off-site drainage infrastructure.
- It is considered unlikely that the proposed development would pose a flood risk on-site, or to land or property external to the site.
- A nominal minimum Finished Floor Level (FFL) of up to 300mm above ground elevation is considered appropriate given the low flood risk setting for the site.
- Additional Flood Risk Assessment is not considered necessary.
- In the event that the development proposal is changed, the FRA should be reviewed; and where necessary updated.

5 Closure

The conclusions and recommendations made in this report are limited to those that can be made on the basis of the research carried out. The results of the research should be viewed in the context of the work that has been carried out and no liability can be accepted for matters outside the stated scope of the research. Any comments made on the basis of information obtained from third parties are given in good faith on the assumption that the information is accurate. No independent validation of third party information has been made by agb Environmental Ltd.

The 'vicinity' of the site for the purposes of the report, is defined as locations situated within an approximate 250m radius of the site, although certain sources of contamination and/or sensitive targets further than 250m of site have also been included. Advice provided within this report is based on current guidelines available at the time of writing. This report is subject to amendment in light of additional information becoming available or statutory consultee review, including the Environment Agency and Local Council.

This report is written in the context of an agreed scope of work between agb Environmental Ltd and the Client and should only be used in this specific context. Re-interpretation of this report in whole or part may become necessary if additional information becomes available or practices or legislation changes.

agb Environmental Ltd does not provide legal advice; the advice of the Client's legal advisors may also be required. agb Environmental Ltd Terms and Conditions apply.

6 References

Department for Communities and Local Government (2012) National Planning Policy Framework.

Department for Communities and Local Government (2012) Technical Guidance to the National Planning Policy Framework.

Rochford District Council: Local Development Framework Core Strategy Adopted Version (December 2011).

Environment Agency (2012): 'Standing Advice' for Flooding.

Groundsure (2016) Floodinsight Report, B1013 Cherry Orchard Way, nr Rochford, Southend-on-Sea, Essex. Ref: CMAPS-CM-546900-31083-200716.

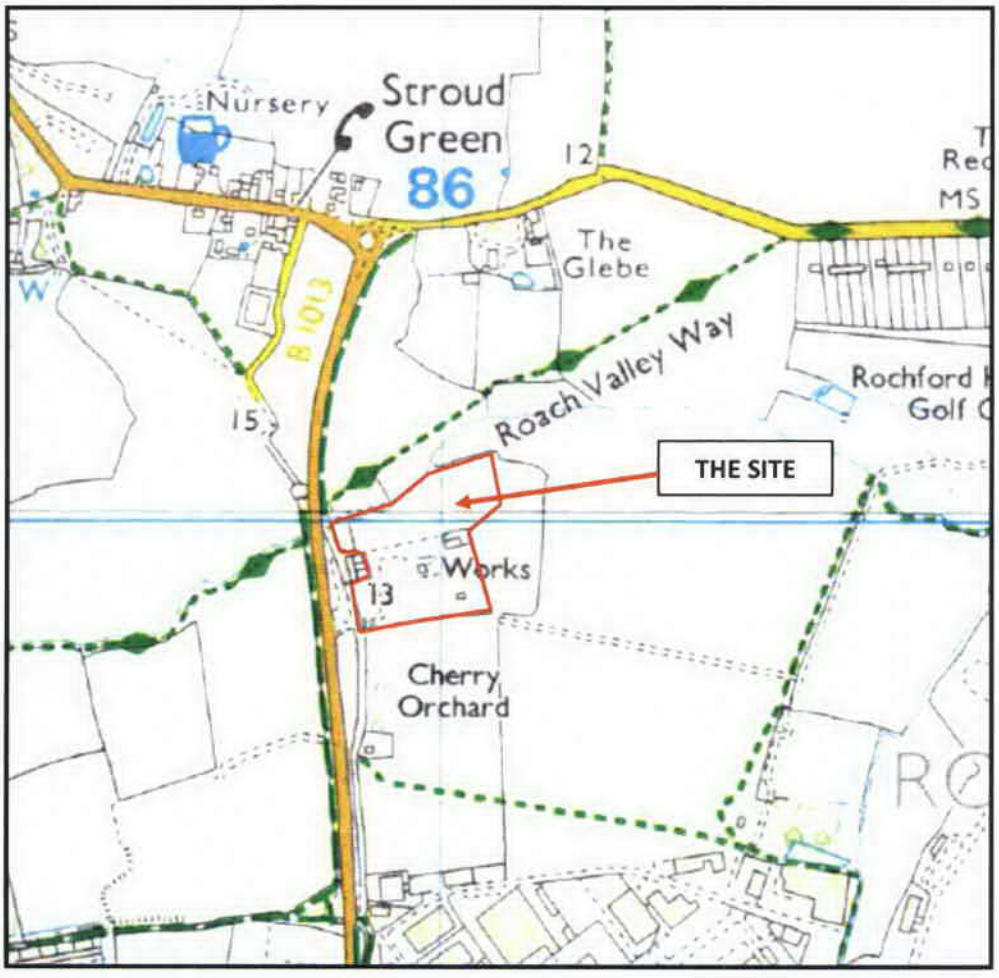
HM Government (2015) The Building Regulations (2010), Drainage and waste disposal, Approved Document H.

Scott Wilson (2011) Rochford District Council: Strategic Flood Risk Assessment (SFRA) Level 1 & 2 Final Report (February 2011).

URS / Scott Wilson (2011) South Essex Surface Water Management Plan Phase 1 Report (April 2011); and Phase II, III and IV (April 2012).

APPENDIX A Site Location Map and Current Site Layout

SITE LOCATION MAP **SAXON BUSINESS PARK, CHERRY ORCHARD WAY, SOUTHEND, ESSEX**

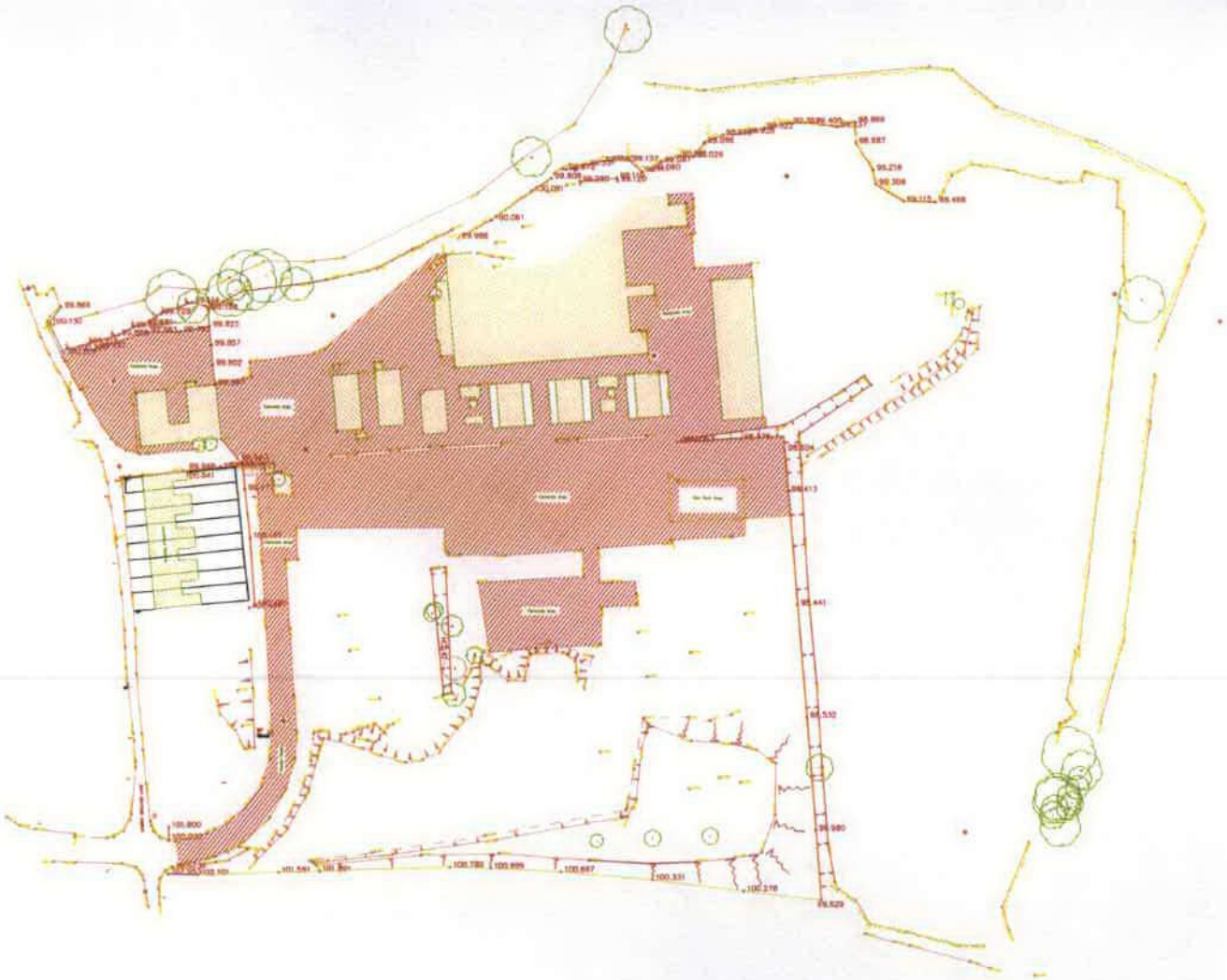


Key:

THE SITE = Saxon Business Park, Cherry Orchard Way, Southend, Essex

Aerial Photograph Capture date:	24-Aug-2014
Grid Reference:	585951,189967
Site Size:	4.04ha

APPENDIX B Topographic Survey



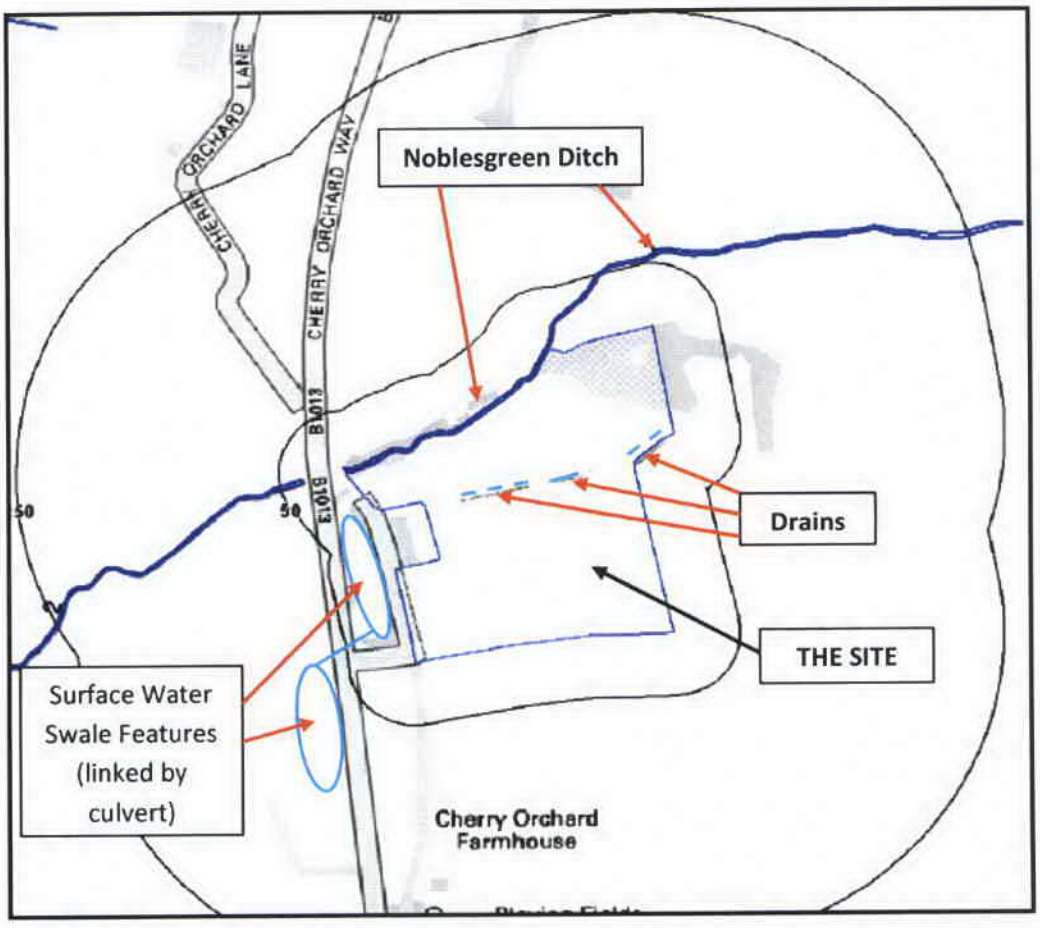
Brickworks,
Cherry Orchard Way,
Eastwood,
Essex

Peter Chambers
Engineering Services

CO/01 01

APPENDIX C Surface Water Features Map

SURFACE WATER FEATURES MAP



Key:

THE SITE = Saxon Business Park, Cherry Orchard Way, Southend, Essex

Site Outline

Surface Water Feature (wider than 5m)

50 / 250 Search Buffers (m)

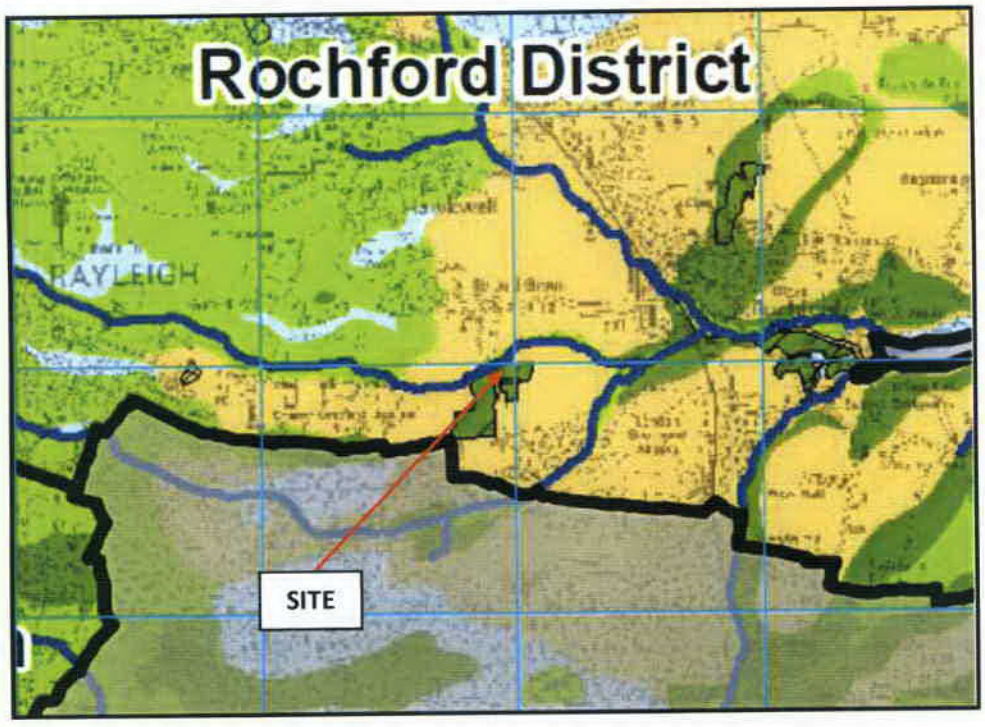
Surface Water Feature (narrower than 5m)

Note: The Swale Features are interpreted based on aerial photographs of the site. A connection between the swales is assumed based on evidence of a culvert beneath the road.

APPENDIX D British Geological Survey: Permeability Map (SWMP extract)

PERMEABILITY MAP:

Map depicting the maximum ground permeability across Rochford District; based on British Geological Survey information.



Key: **THE SITE = Saxon Business Park, Cherry Orchard Way, Southend, Essex**

Extract from South Essex Surface Water Management Plan (SWMP) (2011).

Legend

- Council Administrative Boundary
- Main River
- Artificial (Undivided)
- Landslide Deposits (Undifferentiated)

BGS Minimum Permability

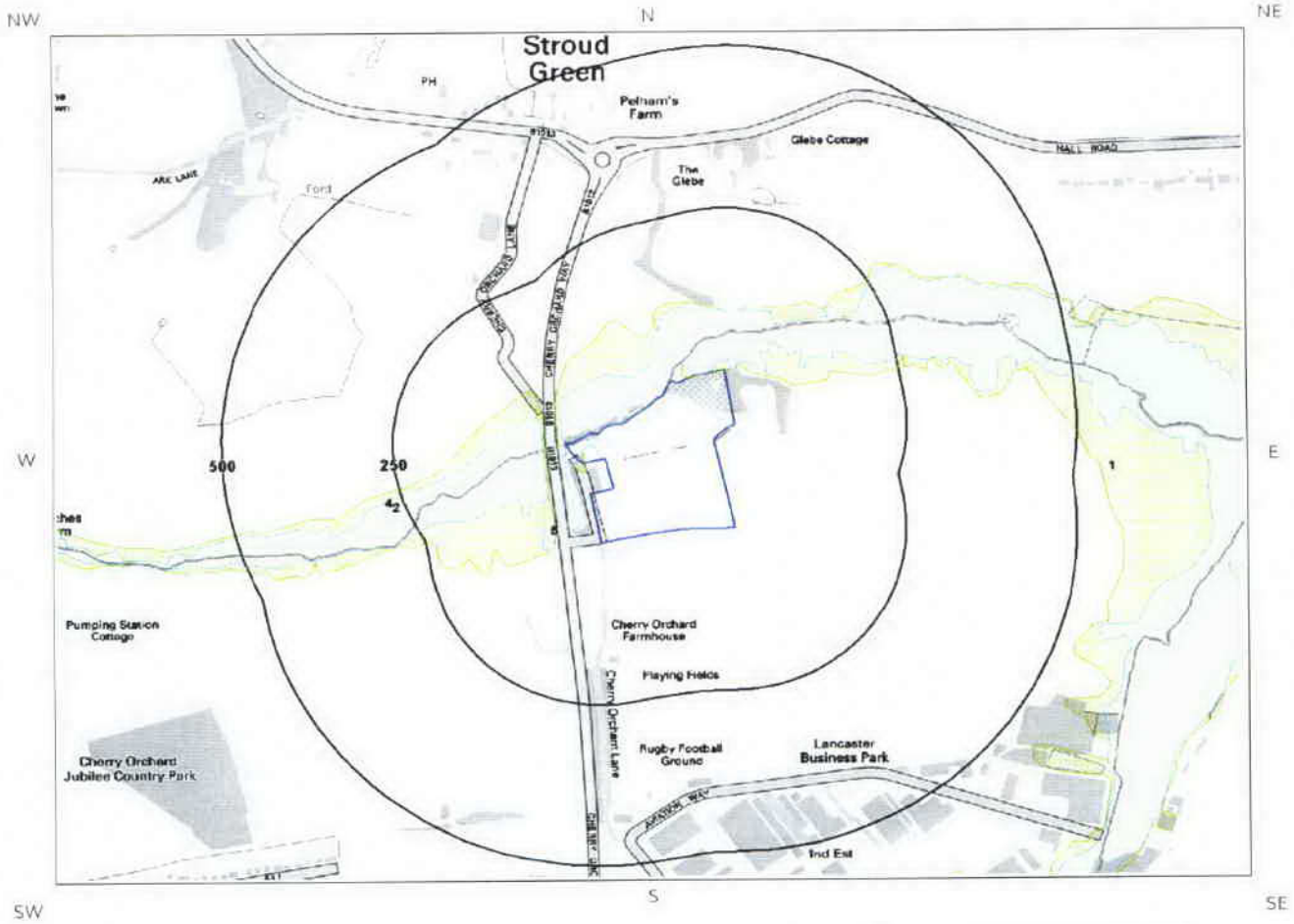
- Very High
- High
- Moderate
- Low
- Very Low

APPENDIX E Flood Zone Map and Flood Defences ('Floodinsight' Report and SFRA extract)

Groundsure
LOCATION INTELLIGENCE

CENTRE MAPS LIVE.

1. Environment Agency Flood Map for Planning (from rivers and the sea)



Environment Agency Flood Map for Planning Legend

- Search Centre
- Search Buffers (m)
- Zone 2 Floodplain
- Zone 3 Floodplain
- Flood Defences
- Area used for Flood Storage
- Proposed Flood Defence Scheme
- Area Benefiting from Flood Defences

Report Reference: CMAPS-CM-546900-31083-200716
Client Reference: 31083

Groundsure
LOCATION INTELLIGENCE

CENTRE MAPS LIVE.

1. Environment Agency Flood Zones

1.1 River and Coastal Zone 2 Flooding

Is the site within 250m of an Environment Agency Zone 2 floodplain? Yes

Environment Agency Zone 2 floodplains estimate the annual probability of flooding as between 1 in 1000 (0.1%) and 1 in 100 (1%) from rivers and between 1 in 1000 (0.1%) and 1 in 200 (0.5%) from the sea. Any relevant data is represented on Map 1 - Flood Map for Planning:

ID	Distance (m)	Direction	Update	Type
1	0.0	On Site	01-Jul-2016	Zone 2 - (Fluvial /Tidal Models)
2	29.0	W	01-Jul-2016	Zone 2 - (Fluvial /Tidal Models)

1.2 River and Coastal Zone 3 Flooding

Is the site within 250m of an Environment Agency Zone 3 floodplain? Yes

Zone 3 shows the extent of a river flood with a 1 in 100 (1%) or greater chance of occurring in any year or a sea flood with a 1 in 200 (0.5%) or greater chance of occurring in any year. Any relevant data is represented on Map 1 - Flood Map for Planning.

The following floodplain records are represented as green shading on the Flood Map (1):

ID	Distance (m)	Direction	Update	Type
3	0.0	On Site	01-Jul-2016	Zone 3 - (Fluvial Models)
4	32.0	W	01-Jul-2016	Zone 3 - (Fluvial Models)
5	62.0	W	01-Jul-2016	Zone 3 - (Fluvial Models)

1.3 River and Coastal Flood Defences

Are there any Flood Defences within 250m of the study site ? No

This search consists only of flood defences present in the dataset provided by the Environment Agency. Any relevant data is represented on Map 1 - Flood Map for Planning.

Database searched and no data found.

1.4 Areas benefiting from Flood Defences

Are there any areas benefiting from Flood Defences within 250m of the study site? No

Any relevant data is represented on Map 1 - Flood Map for Planning.

1.5 Areas of Proposed Flood Defences

Are there any Proposed Flood Defences within 250m of the study site? No

* This illustrates the number of households that move from 'very significant' or 'significant' to 'moderate' or 'low' probability of flood risk bands if the proposed flood scheme is to be implemented.

Any relevant data is represented on Map 1 - Flood Map for Planning.

Guidance: This search consists only of proposed flood defences present in the dataset provided by the Environment Agency. Please note that proposed flood defence schemes will not influence the current RoFRaS ratings for the site.

1.6 Areas used for Flood Storage

Are there any areas used for Flood Storage within 250m of the study site? No

Flood Storage Areas are considered part of the functional floodplain, and are areas where water has to flow or be stored in times of flood. Technical Guidance to the National Planning Policy Framework states that only water-compatible development and essential infrastructure should be permitted within flood storage areas, and existing development within this area should be relocated to an area with a lower risk of flooding. Any relevant data is represented on Map 1 - Flood Map for Planning.

Notes on Flood Zone Data:

This data relates solely to flooding from rivers or the sea. The Environment Agency estimate that over 2.5 million properties are at risk of flooding within England and Wales. River flooding occurs when a watercourse cannot cope with the water draining into it from the surrounding land. This can happen, for example, when heavy rain falls on an already waterlogged catchment. Coastal flooding results from a combination of high tides and stormy conditions. If low atmospheric pressure coincides with a high tide, a tidal surge may happen which can cause serious flooding.

The Groundsure Flood Insight Report comments upon whether a property lies in proximity to Environment Agency Zone 2 and Zone 3 floodplains. The Government's Technical Guidance to the National Planning Policy Framework explains how flood risk should be considered at all stages of the planning and development process in order to reduce future damage to property and potential loss of life. The Government looks to planning authorities to ensure that flood risk is properly taken into account in the planning of developments to reduce the risk of flooding and the damage which floods cause.

Flood Zones enable planning authorities to apply the sequential test (see Technical Guidance to the National Planning Policy Framework) for development proposals and prevent inappropriate development.

Technical Guidance to the National Planning Policy Framework defines the flood zones as: -

Zone 1 – little or no risk with an annual probability of flooding from rivers and the sea of less than 0.1%

Zone 2 – low to medium risk with an annual probability of flooding of 0.1-1.0% from rivers and 0.1-0.5% from the sea.

Zone 3 – high risk with an annual probability of flooding of 1.0% or greater from rivers, and 0.5% or greater from the sea.

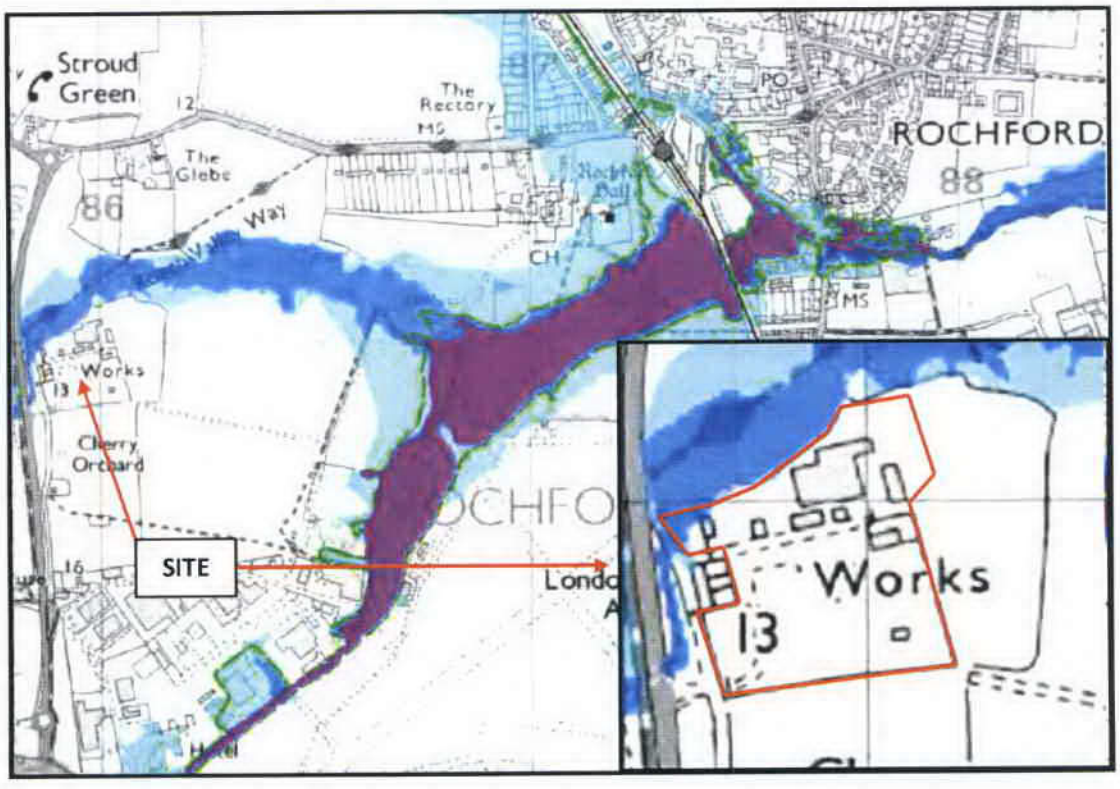
Flood Zone 3b/Flood Storage Areas - very high risk with the site being used as part of the functional flood plain or as a Flood Storage Area.

The flood zones are the main constraint map underpinning decisions on development and flood risk.

Existing Flood Defences

Flood defences seek to reduce the risk of flooding and to safeguard life, protect property, sustain economic activity and the natural environment. Flood defences are designed to protect against flood events of a particular magnitude, expressed as risk in any one year. For example, defences in urban areas may be built to provide protection against flood events of a size which might occur on average once in one hundred years or less.

FLOOD ZONE 3a / 3b DELINEATION:



Key: **THE SITE = Saxon Business Park, Cherry Orchard Way, Southend, Essex**

Extract from the Rochford District Council Strategic Flood Risk Assessment (SFRA) (2011).

Flood Zones

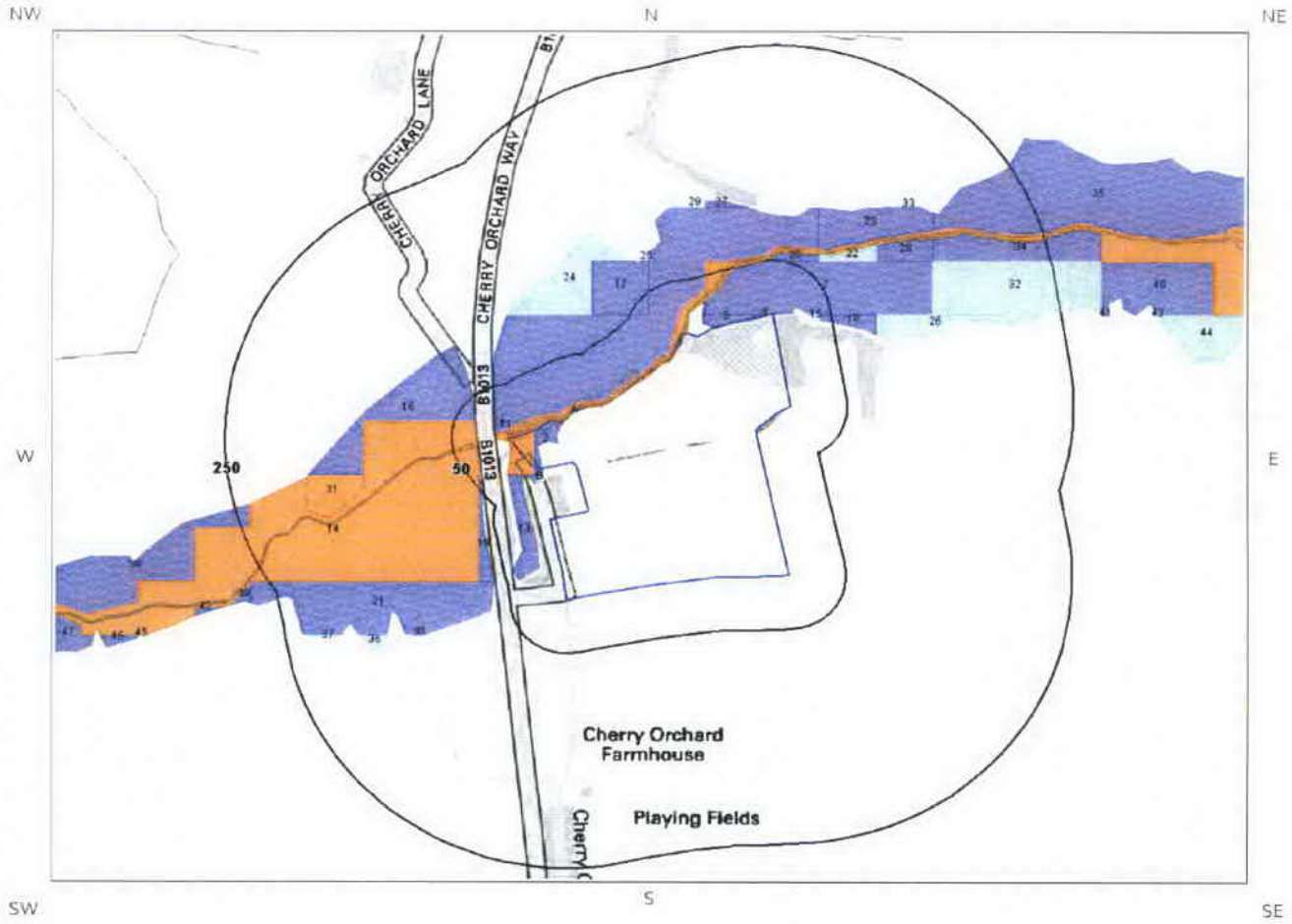
FZ 2 - Low Probability

FZ 3a - High Probability

FZ 3a including Climate Change

FZ 3b - Functional Floodplain

2. Environment Agency RoFRaS Flooding Map



Environment Agency RoFRaS Flooding legend

Site Outline

100 250 Search Buffers (m)

RoFRaS Rating

- Very Low
- Low
- Medium
- High

2. Environment Agency Risk of Flooding from Rivers and the Sea (RoFRaS)

2.1 Environment Agency Risk of Flooding from Rivers and the Sea (RoFRaS) Flood Rating (River and Coastal)

What is the highest risk of flooding onsite? High

The Environment Agency RoFRaS database provides an indication of river and coastal flood risk at a national level on a 50m grid with the flood rating at the centre of the grid calculated and given above. The data considers the probability that the flood defences will overtop or breach by considering their location, type, condition and standard of protection.

RoFRaS data for the study site indicates the property is in an area with a High (1 in 30 or greater) chance of flooding in any given year.

Any relevant data within 250m is represented on the RoFRaS Flood map. Data to 50m is reported in the table below.

ID	Distance (m)	Direction	RoFRaS Flood Risk
1	0.0	On Site	Medium
2	0.0	On Site	Medium
3A	0.0	On Site	Medium
4A	0.0	On Site	Medium
5	0.0	On Site	Medium
6	0.0	On Site	High
7	0.0	On Site	Medium
8	0.0	On Site	Low
9	4.0	NW	Medium
10B	5.0	S	Low
11	7.0	N	Medium
12B	7.0	SW	Medium
13	13.0	SW	Medium
14	29.0	W	High
15	32.0	E	Low
16	33.0	NW	Medium
17	36.0	NW	Medium
18	38.0	E	Medium
19	42.0	SW	Medium
20	49.0	N	Medium

Notes on RoFRaS data:

This information is based on the very latest Environment Agency Risk of Flooding from Rivers and the Sea (RoFRaS) data. This data has been created by dividing the flood plain into 50m squares, or smaller areas where a square if intersected by a river or coastline. These are called impact cells. The method then calculates the likelihood that the centre of each impact cell will start to flood using a number of different flood scenarios.

A number of insurance companies providing cover for flood risk use this data as the basis of their risk model, although they may also utilise additional information such as claims histories, which may further influence their decision. Where a high risk of flooding is identified flood risk insurance may be difficult to obtain without further work being undertaken. Property owners of sites within Low and Medium risk areas are still considered to be at risk of flooding and insurance premiums may be increased as a result. Owners of properties within Low, Medium and High risk areas are advised to sign up to the Environment Agency's Flood Warning scheme. The probability estimates for RoFRaS risk bands are as follows:

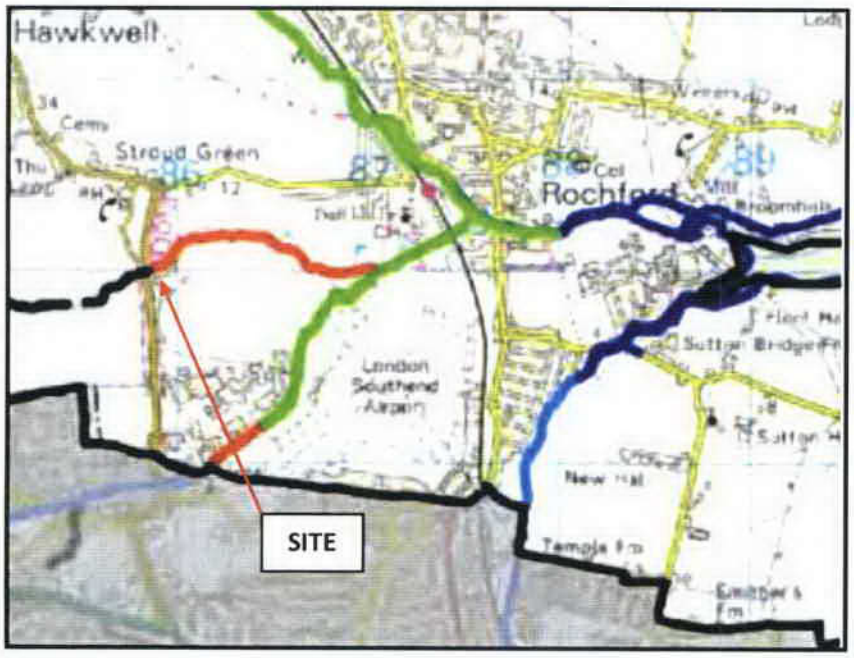
Very Low – the chance of flooding from rivers or the sea is considered to be less than 1 in 1000 (0.1%) in any given year.

Low – the chance of flooding from rivers or the sea is considered to be less than 1 in 100 (1%) but greater than or equal to 1 in 1000 (0.1%) in any given year.

Medium – the chance of flooding from rivers or the sea is considered to be less than 1 in 30 (3.3%) but greater than 1 in 100 (1%) in any given year.

High – the chance of flooding from rivers or the sea is considered to be greater than or equal to 1 in 30 (3.3%) in any given year.

FLOOD DEFENCES:



Key: **THE SITE = Saxon Business Park, Cherry Orchard Way, Southend, Essex**

Extract from the Rochford District Council Strategic Flood Risk Assessment (SFRA) (2011).

Rochford District Boundary

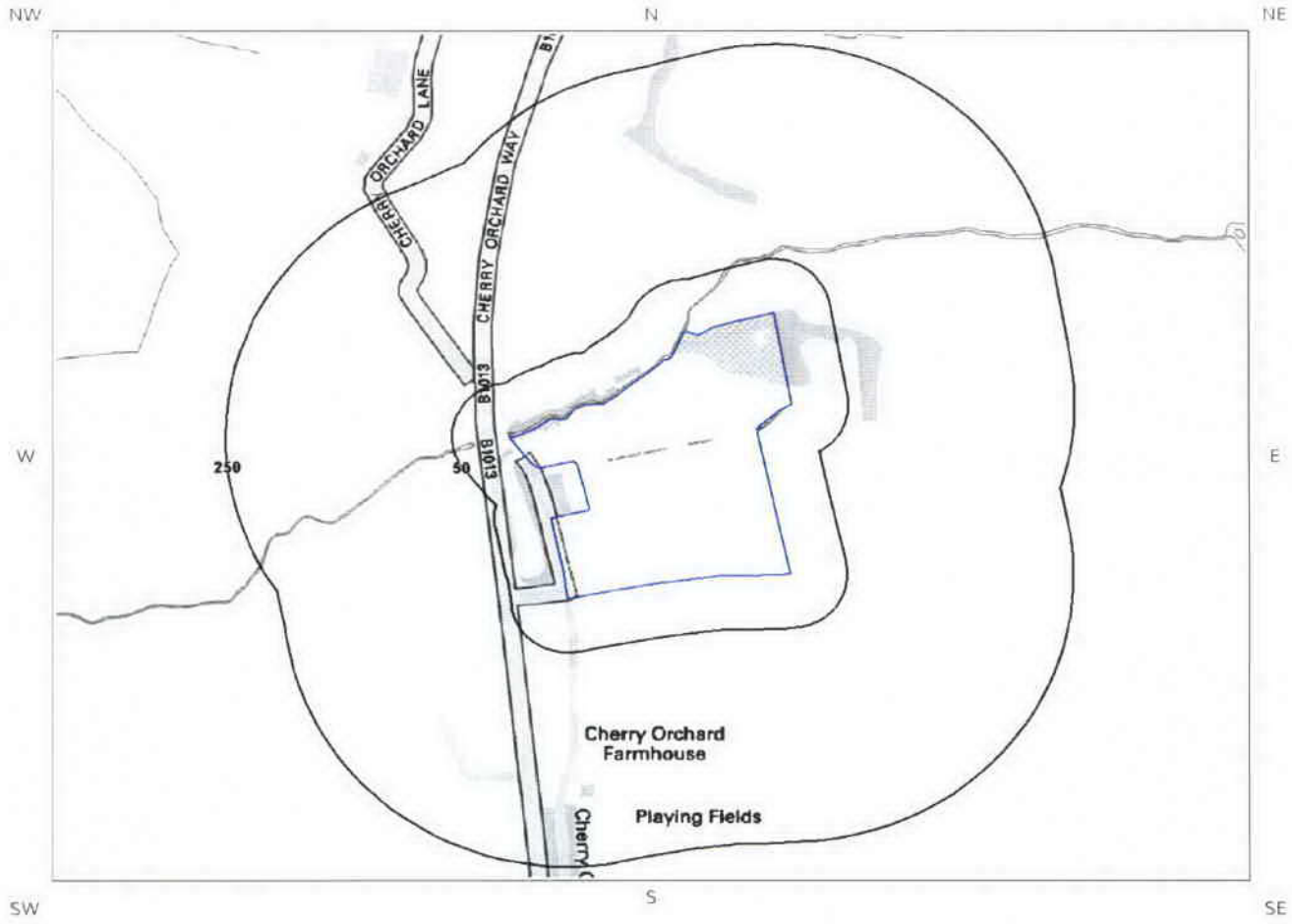
Defence Design Standard (NFCDD Dataset)

- 1000yr
- 200 - 1000yr
- 100 - 200yr
- 50 - 100yr
- 40 - 50yr
- 30 - 40yr
- 20 - 30yr
- 10 - 20yr
- 0 - 10yr
- Unknown

The Flood Defence along the northern perimeter of the site is identified as a 'Maintained Channel' of design standard 100 – 200 year.

APPENDIX F Historic Flooding ('Floodinsight' Report and SFRA extract)

3. Environment Agency Historic Flooding Events Map



Environment Agency Historic Flooding Events legend

Site Outline

125
250
Search Buffers (m)

Historic Flood Events

3. Environment Agency Historic Flooding Events

3.1 Historic Flood Outlines

Has the site or any area within 250m been subject to historic flooding as recorded by the Environment Agency? No

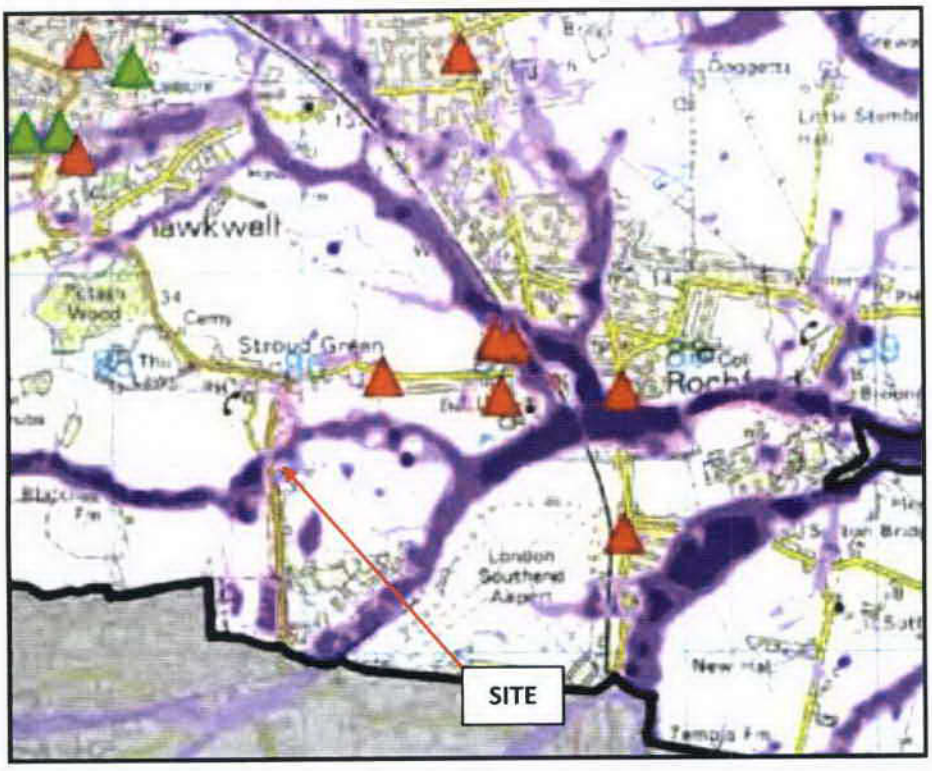
This database shows the individual footprint of every flood event recorded by the Environment Agency and previous bodies.

Any records found within the search radius are displayed on Map 3 – Historic Flooding Events.

Notes on Historic Flooding data:

Over 21,000 separate events are recorded within this database, dating back to 1947. This data is used to understand where flooding has occurred in the past and provides details as available. Absence of a historic flood event for an area does not mean that the area has never flooded, but only that the Environment Agency do not currently have records of flooding within the area. Equally, a record of a flood footprint in previous years does not mean that an area will flood again, and this information does not take account of flood management schemes and improved flood defences.

HISTORIC FLOODING:



Key: **THE SITE = Saxon Business Park, Cherry Orchard Way, Southend, Essex**

Extract from the Rochford District Council Strategic Flood Risk Assessment (SFRA) (2011).

▲ Records of Flooding within Rochford DC

▲ Sewer Flooding Records (Anglian Water DG5 Records)

Rochford District Boundary

Areas Susceptible to Surface Water Flooding (Environment Agency Dataset)

Less

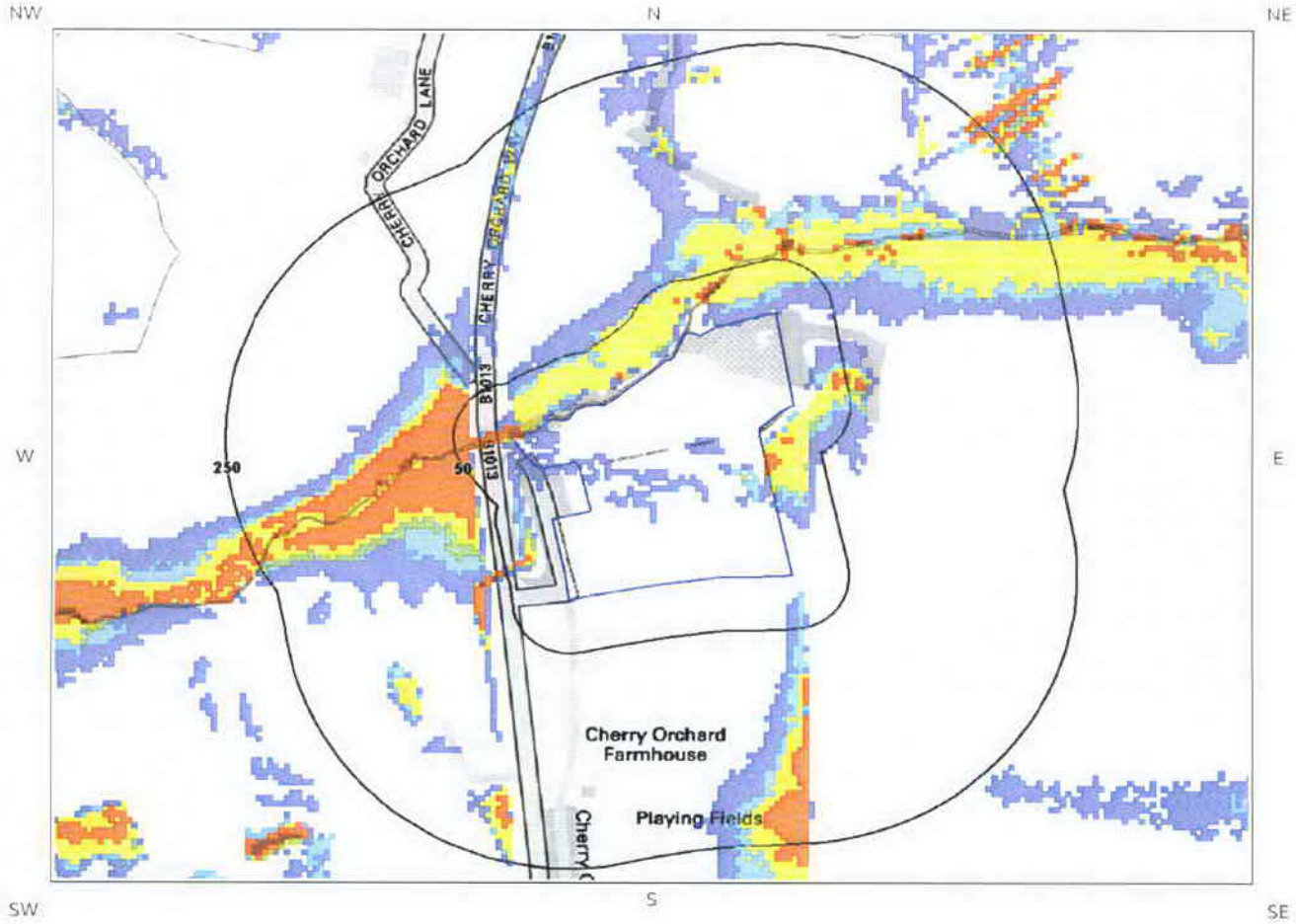
Intermediate

More

The map extract also presents 'Areas Susceptible to Surface Water Flooding'. This is detailed further within Appendix G using the same map.

APPENDIX G Surface Water (Pluvial) Flooding ('Floodinsight' Report and SWMP extract)

4. JBA Surface Water (Pluvial) Flood Map



JBA Surface Water (Pluvial) Flood Legend

Site Outline

125
250
Search Buffers (m)

Highly Significant
Significant
High
Moderate to High
Moderate
Low to Moderate
Low

4. JBA Surface Water (Pluvial) Flooding

Surface Water (pluvial) flooding is defined as flooding caused by rainfall-generated overland flow before the runoff enters a watercourse or sewer. In such events, sewerage and drainage systems and surface watercourses may be entirely overwhelmed.

Surface Water (pluvial) flooding will usually be a result of extreme rainfall events, though may also occur when lesser amounts of rain falls on land which has low permeability and/or is already saturated, frozen or developed. In such cases overland flow and 'ponding' in topographical depressions may occur.

What is the risk of pluvial flooding at the study site? Significant

Guidance: The site or an area in close proximity has been assessed to be at Significant Risk of surface water (pluvial) flooding. This indicates that this area would be expected to be affected by surface water flooding in a 1 in 75 year rainfall event to a depth of between 0.3m to 1m.

The following pluvial (surface water) flood risk records within 50m of the study site are shown on the JBA Surface Water Flooding Map:

Distance	Direction	Risk
0.0	On Site	High
0.0	On Site	High
0.0	On Site	Low
0.0	On Site	Low
0.0	On Site	Low
0.0	On Site	Low
0.0	On Site	Low
0.0	On Site	Low
0.0	On Site	Low
0.0	On Site	Low
0.0	On Site	Low
0.0	On Site	Low
0.0	On Site	Low
0.0	On Site	Low
0.0	On Site	Low
0.0	On Site	Low
0.0	On Site	Low
0.0	On Site	Low
0.0	On Site	Low
0.0	On Site	Low to Moderate

Distance	Direction	Risk
0.0	On Site	Low to Moderate
0.0	On Site	Low to Moderate
0.0	On Site	Low to Moderate
0.0	On Site	Low to Moderate
0.0	On Site	Moderate
0.0	On Site	Moderate
0.0	On Site	Significant
0.0	On Site	Significant
1.0	E	Low
1.0	NW	Low
2.0	W	High
2.0	NW	Low
3.0	N	Low
3.0	N	Low
3.0	NW	Low
3.0	E	Low to Moderate
3.0	E	Moderate
4.0	SE	Low to Moderate
5.0	NW	Low to Moderate
6.0	NW	Low
6.0	NW	Low
6.0	E	Low to Moderate
6.0	SE	Low to Moderate
7.0	N	Low
8.0	NW	Low to Moderate
8.0	N	Low to Moderate
8.0	N	Low to Moderate
9.0	E	Low
9.0	NW	Low
9.0	NW	Low to Moderate
9.0	N	Low to Moderate
9.0	N	Low to Moderate
9.0	N	Moderate
10.0	N	Low to Moderate
11.0	N	Low
11.0	SE	Low to Moderate
11.0	NW	Significant
12.0	E	Low
13.0	N	Low

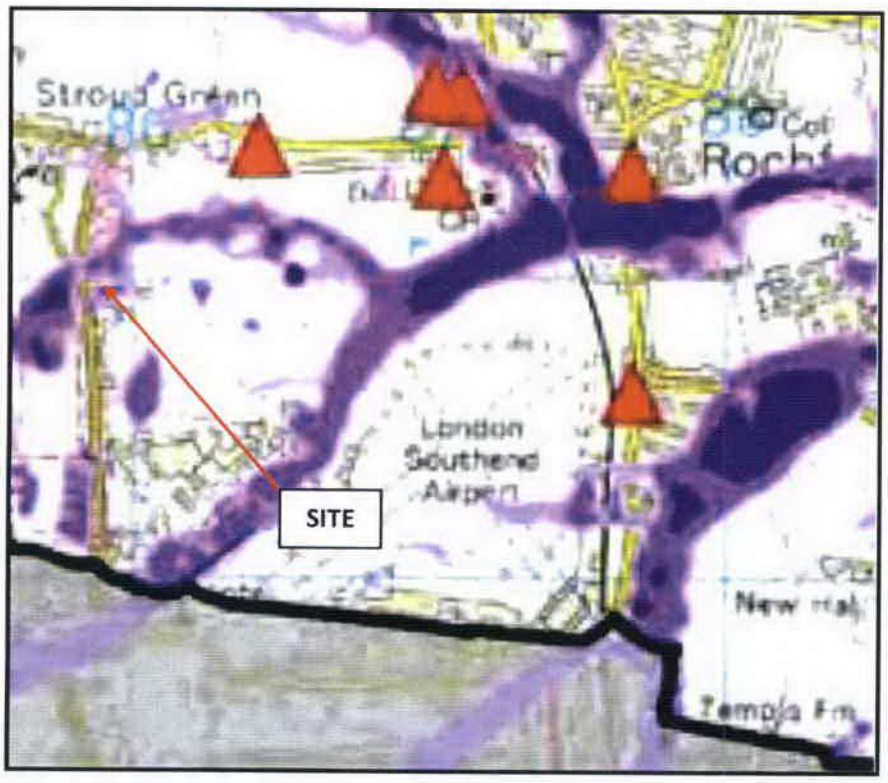
Notes on Surface water (Pluvial) Flooding data:

JBA Consulting surface water flood map identifies areas likely to flood following extreme rainfall events, i.e. land naturally vulnerable to surface water or "pluvial" flooding. This data set was produced by simulating 1 in 75 year, 1 in 200 year and 1 in 1000 year rainfall events. Modern urban drainage systems are typically built to cope with rainfall events between 1 in 20 and 1 in 30 years, though older ones may even flood in a 1 in 5 year rainstorm event.

The model provides the maximum depth of flooding in each 5m "cell" of topographical mapping coverage. The maps include 7 bands indicating areas of increasing natural vulnerability to surface water flooding. These are:-

- **Less than 0.1m in a 1 in 1000 year rainfall event** - Negligible
- **Greater than 0.1m in a 1 in 1000 year rainfall event** - Low
- **Between 0.1m and 0.3m in a 1 in 200 year rainfall event** – Low to Moderate
- **Between 0.3m and 1m in a 1 in 200 year rainfall event –** Moderate
- **Greater than 1m in a 1 in 200 year rainfall event** – Moderate to High
- **Between 0.1m and 0.3m in a 1 in 75 year rainfall event** – High
- **Between 0.3m to 1m in a 1 in 75 year rainfall event** - Significant
- **Greater than 1m in a 1 in 75 year rainfall event** – Highly Significant

SUSCEPTIBILITY TO SURFACE WATER FLOODING:



Key: **THE SITE = Saxon Business Park, Cherry Orchard Way, Southend, Essex**

Extract from the Rochford District Council Strategic Flood Risk Assessment (SFRA) (2011).

Rochford District Boundary

Areas Susceptible to Surface Water Flooding (Environment Agency Dataset)

Less

Intermediate

More

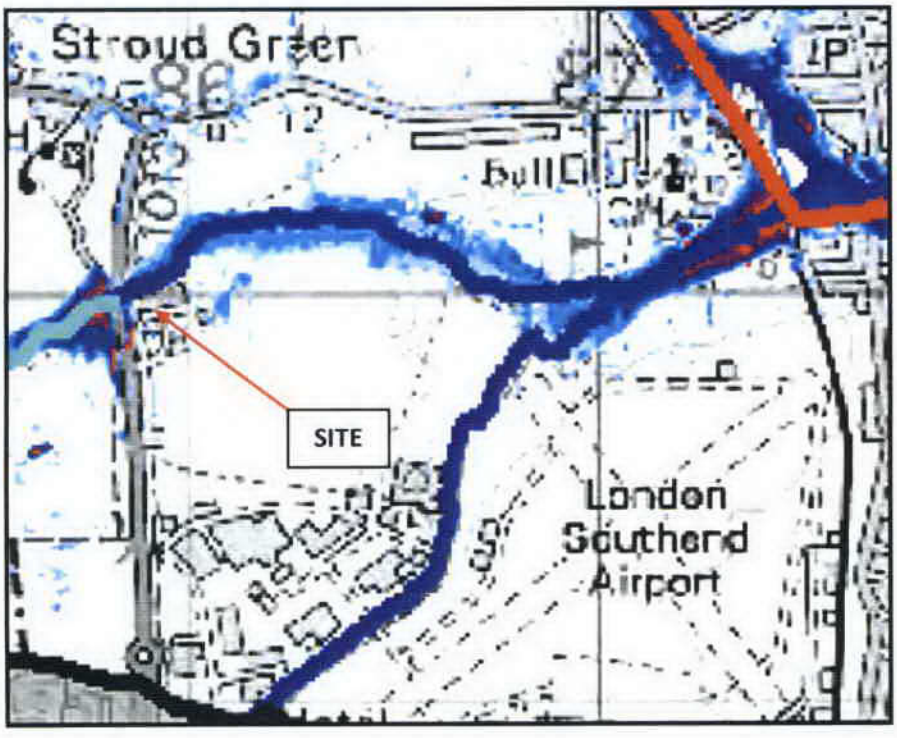
Records of Flooding within Rochford DC

Sewer Flooding Records (Anglian Water DG5 Records)

PLUVIAL HYDRAULIC MODELLING:

Surface Water Flood Depth

The map extract illustrates Surface Water Flood Depths (in metres) resulting from hydraulic pluvial modelling (using TUFLOW); as presented within the South Essex SWMP. The map shown is for the 1 in 100 chance of a rainfall event occurring in a given year plus Climate Change (1% AEP + 20%).



Key: **THE SITE = Saxon Business Park, Cherry Orchard Way, Southend, Essex**

Extract from the South Essex Surface Water Management Plan (SWMP) (2011).

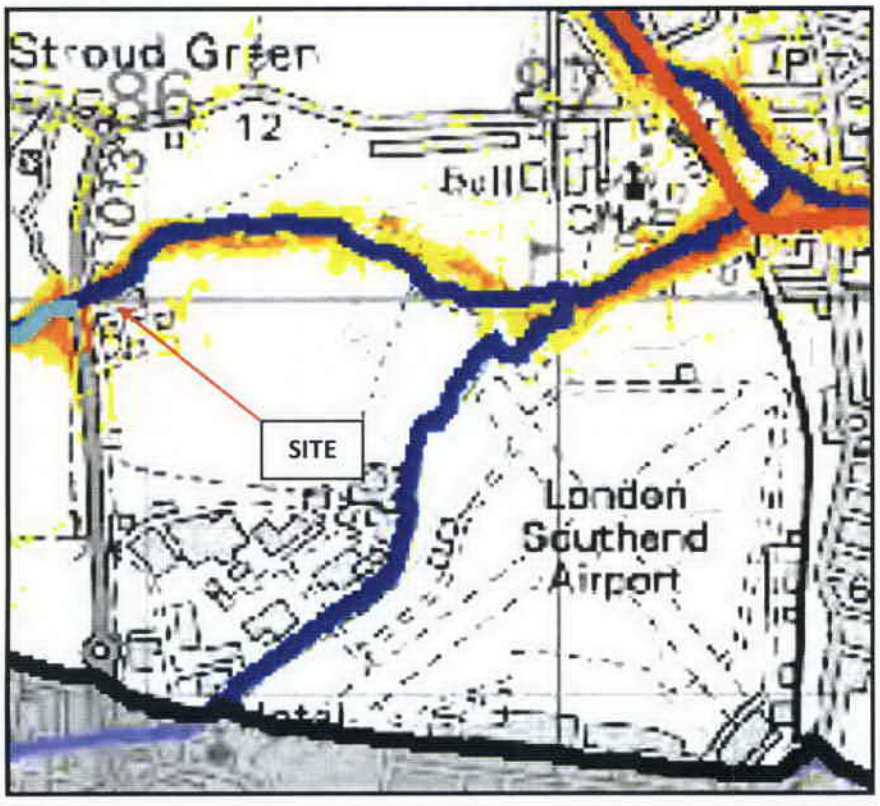
Flood Depth

- <0.1m
- 0.10m - 0.25m
- 0.25m - 0.50m
- 0.50m - 1.00m
- 1.00m - 1.5m
- >1.50m

- Council Extent
- Critical Drainage Area
- Main River
- Critical Ordinary Watercourses

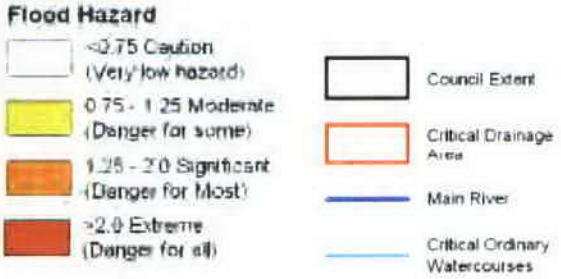
Surface Water Flood Depth

The map extract illustrates Surface Water Flood Hazard resulting from hydraulic pluvial modelling (using TUFLOW); as presented within the South Essex SWMP. The map shown is for the 1 in 100 chance of a rainfall event occurring in a given year plus Climate Change (1% AEP + 20%).



Key: **THE SITE = Saxon Business Park, Cherry Orchard Way, Southend, Essex**

Extract from the South Essex Surface Water Management Plan (SWMP) (2011).

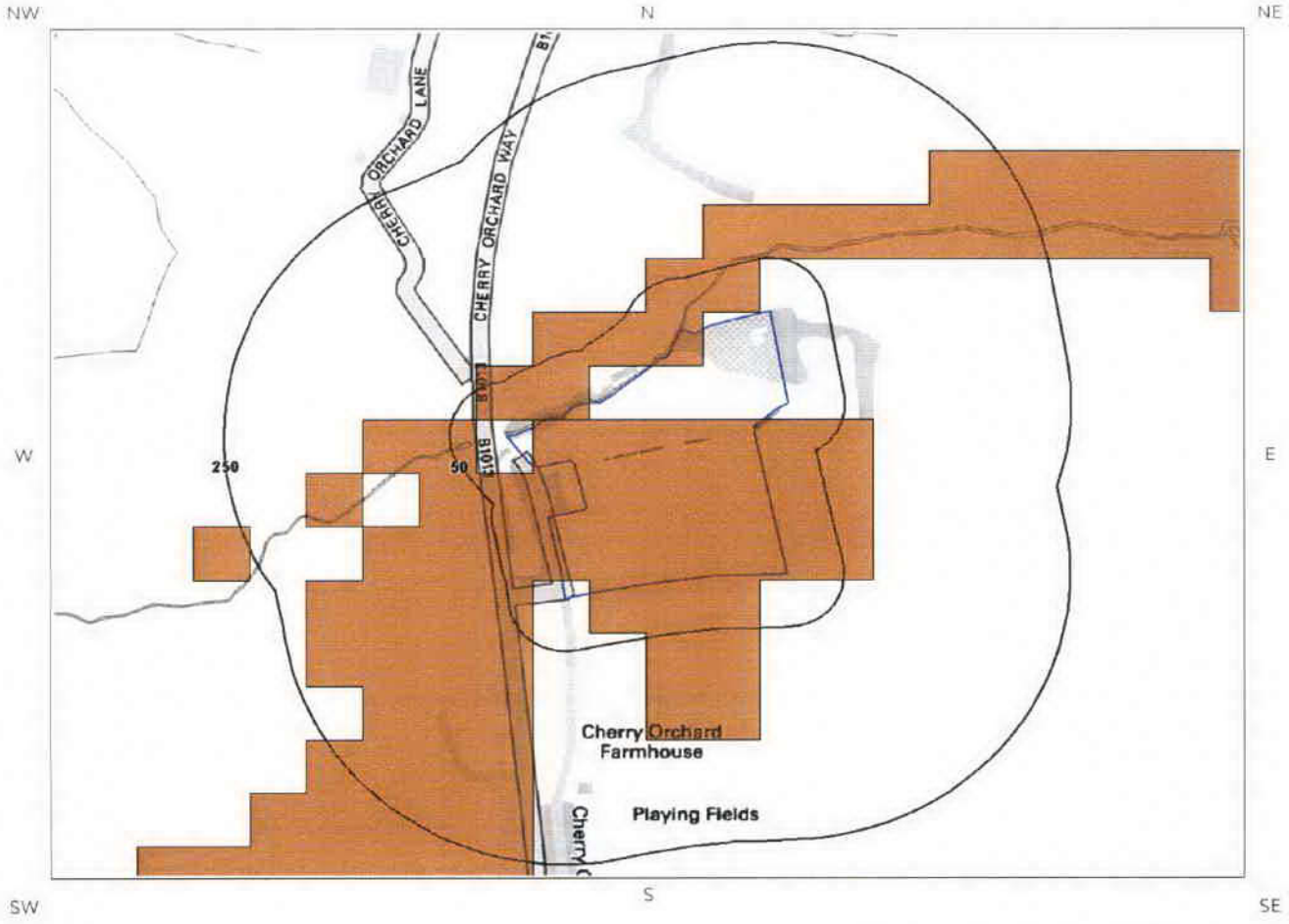


APPENDIX H Groundwater Flooding ('Floodinsight' Report and SWMP extract)

Groundsure
LOCATION INTELLIGENCE

CENTRE MAPS LIVE.

6. BGS Groundwater Flooding Map



BGS Groundwater Flooding legend

Site Outline

50
250
Search Buffers (m)

Limited potential for groundwater flooding to occur

Potential for groundwater flooding of property below ground level

Potential for groundwater flooding to occur at surface

6. Groundwater Flooding

6.1 Groundwater Flooding Susceptibility Areas

Are there any British Geological Survey groundwater flooding susceptibility flood areas within 50m of the boundary of the study site? Yes

What is the highest susceptibility to groundwater flooding in the search area based on the underlying geological conditions? Potential for groundwater flooding at surface

Does this relate to Clearwater Flooding or Superficial Deposits Flooding? Superficial Deposits Flooding

Where potential for groundwater flooding to occur at surface is indicated, this means that given the geological conditions in the area groundwater flooding hazard should be considered in all land-use planning decisions. It is recommended that other relevant information e.g. records of previous incidence of groundwater flooding, rainfall, property type, and land drainage information be investigated in order to establish relative, but not absolute, risk of groundwater flooding.

6.2 Groundwater Flooding Confidence Areas

What is the British Geological Survey confidence rating in this result? Moderate

Groundwater flooding is defined as the emergence of groundwater at the ground surface or the rising of groundwater into man-made ground under conditions where the normal range of groundwater levels is exceeded.

The confidence rating is on a threefold scale - Low, Moderate and High. This provides a relative indication of the BGS confidence in the accuracy of the susceptibility result for groundwater flooding. This is based on the amount and precision of the information used in the assessment. In areas with a relatively lower level of confidence the susceptibility result should be treated with more caution. In other areas with higher levels of confidence the susceptibility result can be used with more confidence.

Notes on Groundwater Flooding data:

The BGS Susceptibility to Groundwater Flooding hazard dataset identifies areas where geological conditions could enable groundwater flooding to occur and where groundwater may come close to the ground surface.

Groundwater flooding may either be associated with shallow unconsolidated sedimentary aquifers which overlie unproductive aquifers (Superficial Deposits Flooding), or with unconfined aquifers (Clearwater Flooding).

The susceptibility data is suitable for use for regional or national planning purposes where the groundwater flooding information will be used along with a range of other relevant information to inform land-use planning decisions. It might also be used in conjunction with a large number of other factors, e.g. records of previous incidence of groundwater flooding, rainfall, property type, and land drainage information, to establish relative, but not absolute, risk of groundwater flooding at a resolution of greater than a few hundred metres. The susceptibility data should not be used on its own to make planning decisions at any scale, and, in particular, should not be used to inform planning decisions at the site scale. The susceptibility data cannot be used on its own to indicate risk of groundwater flooding.

Groundsure
LOCATION INTELLIGENCE

CENTRE MAPS LIVE.

7. BGS Geological Indicators of Flooding

Are there any geological indicators of flooding within 250m of the study site? Yes

This dataset identifies the presence of superficial geological deposits which indicate that the site may be, or have been in the past, vulnerable to inland and/or coastal flooding. This assessment does not take account of any man-made factors such as flood protection schemes, and the data behind the report are purely geological.

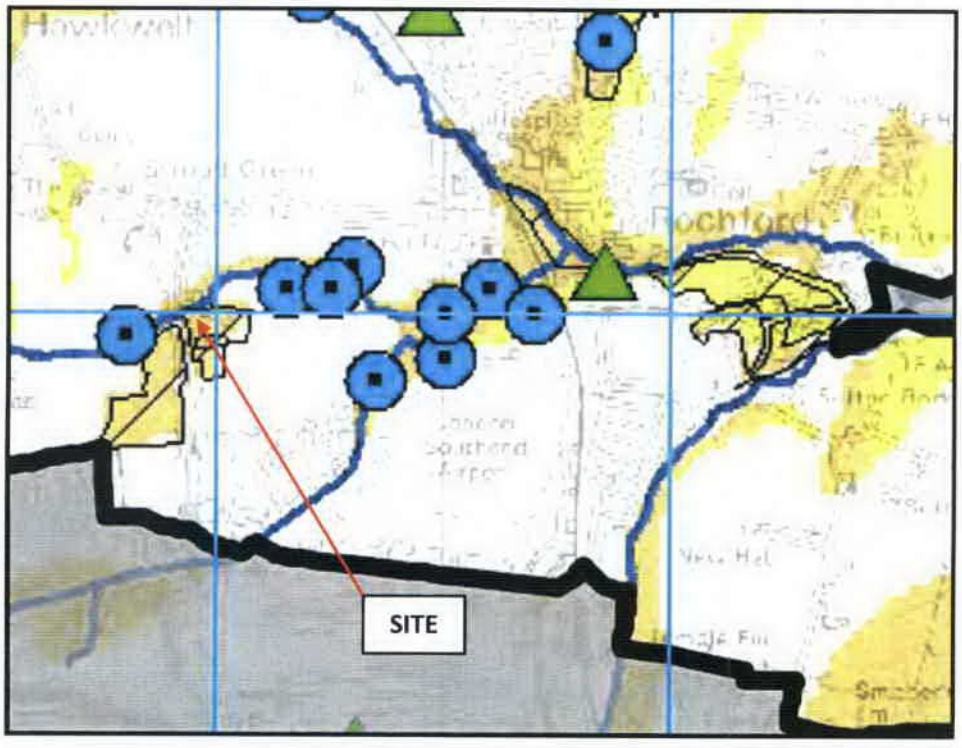
Distance	Direction	Description
0.0	On Site	Higher flood potential from rivers: the first areas to experience the effects of inland flooding in a river catchment.
0.0	On Site	Higher flood potential from rivers: the first areas to experience the effects of inland flooding in a river catchment.
196.0	E	Lower flood potential from rivers: areas affected by secondary flooding in extreme cases as a result of a prolonged flood event.
233.0	NE	Lower flood potential from rivers: areas affected by secondary flooding in extreme cases as a result of a prolonged flood event.
236.0	E	Lower flood potential from rivers: areas affected by secondary flooding in extreme cases as a result of a prolonged flood event.

Notes on BGS Geological Indicators of Flooding data:

The BGS Geological Indicators of Flooding (GIF) data set is a digital map based on the BGS Digital Geological Map of Great Britain at the 1:50,000 scale (DiGMapGB-50). It was produced by characterising Superficial (Drift) Deposits on DiGMapGB-50 in terms of their likely vulnerability to flooding, either from coastal or inland water flow. These Superficial Deposits are considered 'recent' in geological terms, most having been formed in the later parts of the Quaternary geological period (i.e. within the last few tens of thousands of years). Observations made during recent major inland and coastal flooding events have demonstrated that the erosion and deposition of these recent geological sediments have produced subtle topographical variations, resulting in landforms such as fluvial and coastal floodplains. The mapping of these landforms, in conjunction with the fluvial and/or coastal deposits that underlie them, has in turn determined the extent of previous coastal and inland flooding.

On this basis, the floodplains which are at greatest risk from flooding can be both visualised and defined by Superficial Deposits as depicted on geological maps. These include deposits such as river alluvium and lacustrine (lake) alluvium, as well as the First River Terrace or 'Floodplain terrace' (raised flat areas adjacent to or within floodplains, which represent the level of the floodplain prior to the most recent episode of down-cutting). Older and higher river terraces have been excluded as they lie outside the geologically defined floodplain. Areas at risk from coastal inundation are similarly characterised by a range of estuarine or marine deposits that include, for example, tidal flats.

SUSCEPTIBILITY TO GROUNDWATER FLOODING:



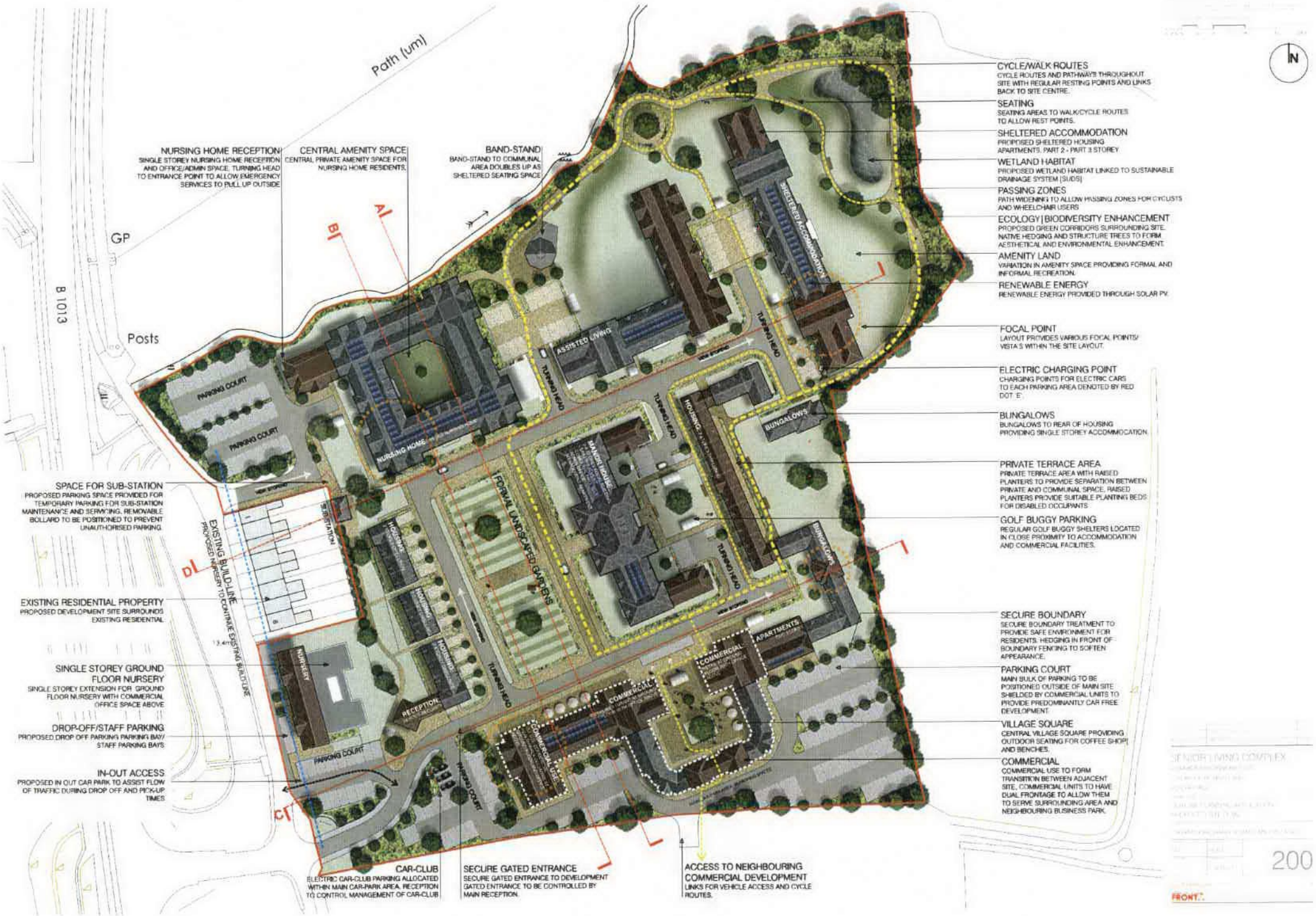
Key: **THE SITE = Saxon Business Park, Cherry Orchard Way, Southend, Essex**

Extract from The South Essex Surface Water Management Plan (SWMP) (2011).

BGS Groundwater Flooding Susceptibility

- Very High
- High
- Rochford Council Administrative Boundary
- Main River
- Current Abstraction Licences
- Flooding Events Since April 2007

APPENDIX I Proposed Development Plans



SENIOR LIVING COMPLEX

200

FRONT.