FLOOD RISK ASSESSMENT

Site Address

Summercroft Primary School
Plaw Hatch Cl
Bishop's Stortford
CM23 5BJ

Client

Alex Turton
SES Mechanical Services Limited

Date

11/04/2024

1 Document Control

FLOOD RISK ASSESSMENT

Site Address:	Summercroft Primary School Plaw Hatch Cl Bishop's Stortford CM23 5BJ
National Grid Reference:	550179, 221671
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Prepared for:	Alex Turton SES Mechanical Services Limited
Date:	11/04/2024
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Contents

2 Abbreviations

Abbreviation	Description
STM	STM Environmental Consultants Limited
BGS	British Geological Survey
EA	Environment Agency
OS	Ordnance Survey of Great Britain
FRA	Flood Risk Assessment
NPPF	National Planning Policy Framework
FWD	Floodline Warning Direct
FRMS	Flood Risk Management Strategy
LPA	East Hertfordshire District Council
SWMP	Surface Water Management Plan
SFRA	Strategic Flood Risk Assessment
CDA	Critical Drainage Area
AEP	Annual Exceedance Probability
CC	Climate Change
SuDS	Sustainable Urban Drainage Systems
GWSPZ	Groundwater Source Protection Zone
LLFA	Lead Local Flood Authority
mbgl	metres below ground level
DCLG	Department for Communities and Local Government
PPGPS	Planning practice guidance and Planning system
ASHP	Air Source Heat Pump

3 Disclaimer

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4 Executive Summary

SECTION	SUMMARY
Location	Summercroft Primary School, Plaw Hatch Close, Bishop's Stortford, CM23 5BJ - Grid Reference: 550179, 221671
Area	Total Site Area: 2.8ha Development Area: 271m^2
Proposed Development	A heating distribution replacement project which incorporates Air Source Heat Pump installation.
Flood Zone	The site is located in Flood Zone 3a.
Topography	The elevation ranges from 85.47mAOD (E, Service Road) to 85.00mAOD (W, Site Entrance). The proposed development has an approximate ground level of 85.2mAOD.
Sequential and Exception Tests	Development is minor and less vulnerable so Sequential and Exception Tests should not be required. LLFA to decide.
Main Sources of Flooding	Two unnamed culverted water courses located 430m (SW) of the site and 378m (NE). The River Stort is located 1.2km (W).
Flood Defences	High ground, located 430m (SW) of the site and 378m (NE).
Records of Historic Flooding	The SFRA historic mapping contains one flood incident 360m (SW) of the site, the source is not identified. There have also been 8 sewer flooding incidents which have occurred within the (CM23 5) postcode.
Fluvial (River) and Tidal (Sea) Flood Risk	Medium – The site is impacted during both the 1% AEP + CC and 0.1% AEP fluvial events. During the 1%AEP + 20% event the site is impacted to a maximum flood depth of 0.10m to a flood level of 85.12mAOD.
Pluvial (Surface Water) Flood Risk	Low – The site remains dry during the 1 in 30-year and 1 in 100-year pluvial events. The site floods to a maximum of 0.3m during the modelled 1 in 1000-year event.
Flood Risk from Artificial (Canals and Reservoirs) Sources	Low – The River Stort Navigation Canal is located 1.2km West of the proposed site.
Groundwater Flood Risk	Low – According to the BGS, the site is not potentially susceptible to groundwater flooding and no recorded incidents have been identified.

SECTION	SUMMARY
Development Impacts on Local Flood Risk	The development will increase the site impermeable and built-up area by 1m^2. As such, given the scale of the development, the impact to local flood risk can be considered to be negligible.
Proposed Flood Risk Mitigation Measures	• The finished floor level will be set at 350mm above the ground level at approximately 85.55mAOD; • This is inclusive of both rubber footings (200mm increase) and the use of a concrete plinth (150mm increase); • The rubber footings allow for void area below the ASHP to ensure minimal displacement of flood water if they were to occur.
Surface Water Management (SuDS)	Given the small size of the proposed development (1m^2), the impacts of which will be negligible, as such SuDS have not been included.
Conclusions	Based on the information reviewed and taking into account the proposed mitigation measures, it is considered that overall flood risk to the proposed development is acceptable and that it will not increase local flood risk. As such, the development is considered to be in compliance with local planning policy and the NPPF.

5 Introduction

STM Environmental Consultants Limited (STM) were appointed by Alex Turton of SES Mechanical Services Limited (Client) to provide a Flood Risk Assessment (FRA) at a site located at Summercroft Primary School, Plaw Hatch Close, Bishop's Stortford, CM23 5BJ.

6 Development Proposal

The FRA is required to support a planning application for a heating distribution replacement project which incorporates Air Source Heat Pump installation.

Further details including drawings of the development plans are available in Appendix 2.

7 Report Aims and Objectives

The purpose of this report is to establish the flood risk to the site from all potential sources and, where possible, to propose suitable mitigation methods to reduce any risks to an acceptable level. It aims to make an assessment of whether the development will be safe for its lifetime, taking into account climate change and the vulnerability of its users, without increasing flood risk elsewhere.

The FRA assesses flood risk to the site from tidal, fluvial, surface water, groundwater, sewers and artificial sources. The FRA has been produced in accordance with the National Planning Policy Framework (NPPF) and its supporting guidance.

8 Summary of Data Review Undertaken

The following research has been undertaken as part of the FRA:

- Desktop assessment of topographical, hydrological and hydrogeological settings through review of the information sourced from the British Geological Survey (BGS), the Environment Agency (EA) and the Ordnance Survey (OS);
- Review of publicly available flood risk mapping provided by the EA;
- Review of the Preliminary Flood Risk Assessment (PFRA) and Level 1 Strategic Flood Risk Assessment (SFRA) produced by the LLFA outlining flood risk from various sources within the borough.

9 Legislative and Policy Context

9.1 Legislative Context

The Flood and Water Management Act was introduced in 2010. The Act defines the role of lead local flood authority (LLFA) for an area. All LLFA are required to develop, maintain, apply and monitor a strategy for local flood risk management in its area, called “local flood risk management strategy”.

Alongside the Act, Flood Risk Regulations (2009) outline the roles and responsibilities of the various authorities, which include preparing Flood Risk Management Plans and identifying how significant flood risks are to be mitigated.

9.2 Policy Context

9.2.1 National Planning Policy Framework (NPPF)

The NPPF (updated July 2021) sets out the government’s planning policies for England and how these are expected to be applied. It also provides a set of guidelines and philosophy with which local planning authorities (LPAs) can build their own unique policies to appropriately regulate development within their jurisdictions.

Section 14 entitled “Meeting the challenge of climate change, flooding and coastal change” deals specifically with flood risk.

Paragraph 159 states that “Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere”.

In addition, Paragraph 161 outlines that “All plans should apply a sequential, risk-based approach to the location of development – taking into account all sources of flood risk and the current and future impacts of climate change – so as to avoid, where possible, flood risk to people and property. They should do this, and manage any residual risk, by:

- applying the sequential test and then, if necessary, the exception test as set out below;
- safeguarding land from development that is required, or likely to be required, for current or future flood management;
- using opportunities provided by new development and improvements in green and other infrastructure to reduce the causes and impacts of flooding, (making as much use as possible of natural flood management techniques as part of an integrated approach to flood risk management);
- where climate change is expected to increase flood risk so that some existing development may not be sustainable in the long-term, seeking opportunities to relocate development, including housing, to more sustainable locations”.

The NPPF then states in Paragraph 163 that “if it is not possible for development to be located in areas with a lower risk of flooding (taking into account wider sustainable development objectives), the exception test may have to be applied. The need for the exception test will depend on the potential vulnerability of the site and of the development proposed, in line with the Flood Risk Vulnerability Classification”.

It further states that when determining any planning application, LPAs should “ensure that flood risk is not increased elsewhere. Where appropriate, applications

should be supported by a site-specific flood-risk assessment[55]. Development should only be allowed in areas at risk of flooding where, in the light of this assessment (and the sequential and exception tests, as applicable) it can be demonstrated that:

- within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location;
- development is appropriately flood resilient and resistant;
- it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;
- any residual risk can be safely managed; and
- safe access and escape routes are included where appropriate, as part of an agreed emergency plan.

Applications for minor development and changes of use should not be subject to the Sequential or Exception Tests but should still meet the requirements for site-specific flood risk assessments set out in footnote 55.

Footnote 55 states: “A site-specific flood risk assessment should be provided for all development in Flood Zones 2 and 3. In Flood Zone 1, an assessment should accompany all proposals involving: sites of 1 hectare or more; land which has been identified by the Environment Agency as having critical drainage problems; land identified in a strategic flood risk assessment as being at increased flood risk in future; or land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use.”

The NPPF also lays out requirements for how LPAs should deal with planning applications in coastal areas. They should ensure that should they “reduce risk from coastal change by avoiding inappropriate development in vulnerable areas or adding to the impacts of physical changes to the coast.”

Developments in Coastal Change Management Areas should only be considered appropriate where it is demonstrated that:

- it will be safe over its planned lifetime and will not have an unacceptable impact on coastal change;
- the character of the coast including designations is not compromised;
- the development provides wider sustainability benefits;
- the development does not hinder the creation and maintenance of a continuous signed and managed route around the coast.

9.2.2 Local Planning Policy – East Hertfordshire District Council

Policy WAT1: Flood Risk Management

- The functional floodplain will be protected from inappropriate development and where possible developed flood plain should be returned to Greenfield status with an enhanced level of biodiversity.

- Development proposals should neither increase the likelihood or intensity of any form of flooding, nor increase the risk to people, property, crops or livestock from such events, both on site and to neighbouring land or further downstream.

- Development should take into account the impacts of climate change and should build in long term resilience against increased water levels. Therefore, appropriate distances and buffers between water courses and built development should be maintained in accordance with Environment Agency guidelines.

- In order to steer new development to areas with the lowest probability of flooding, the Sequential Test will be used. In exceptional circumstances, if developments are proposed which are required to pass the NPPF Exceptions Test, they will need to address flood resilient design and emergency planning by demonstrating that:

(a) The development will remain safe and operational under flood conditions;

(b) a strategy of either safe evacuation and/or safely remaining in the building is followed under flood conditions;

(b) Key services will continue to be provided under flood conditions; and

(d) Buildings are designed for quick recovery following a flood.

9.3 EA Standing Advice on Flood Risk

The Environment Agency's standing advice lays out the process that must be followed when carrying out flood risk assessments for developments.

Flood Risk Assessments are required for developments within one of the Flood Zones. This includes developments:

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

10 Site Description and Environmental Characteristics

10.1 Site Location and Area

The site is located at Summercroft Primary School, Plaw Hatch Close, Bishop's Stortford, CM23 5BJ and is centred at national grid reference 550179, 221671. The site has a total area of 2.8ha and the proposed development (red line boundary) area is 271m^2.

A site location map and aerial photo are shown below. Photographs of the site are available in Appendix 1.

10.2 Site Access

The site is accessed via Plaw Hatch Close.

10.3 Local Planning Authority

The site falls within the jurisdiction of East Hertfordshire District Council in terms of the planning process.

10.4 Lead Local Flood Authority

Hertfordshire County Council is the Lead Local Flood Authority (LLFA).

10.5 Flood Zone

For planning purposes, the site is located in Flood Zone 3a as defined by the EA and LLFA.

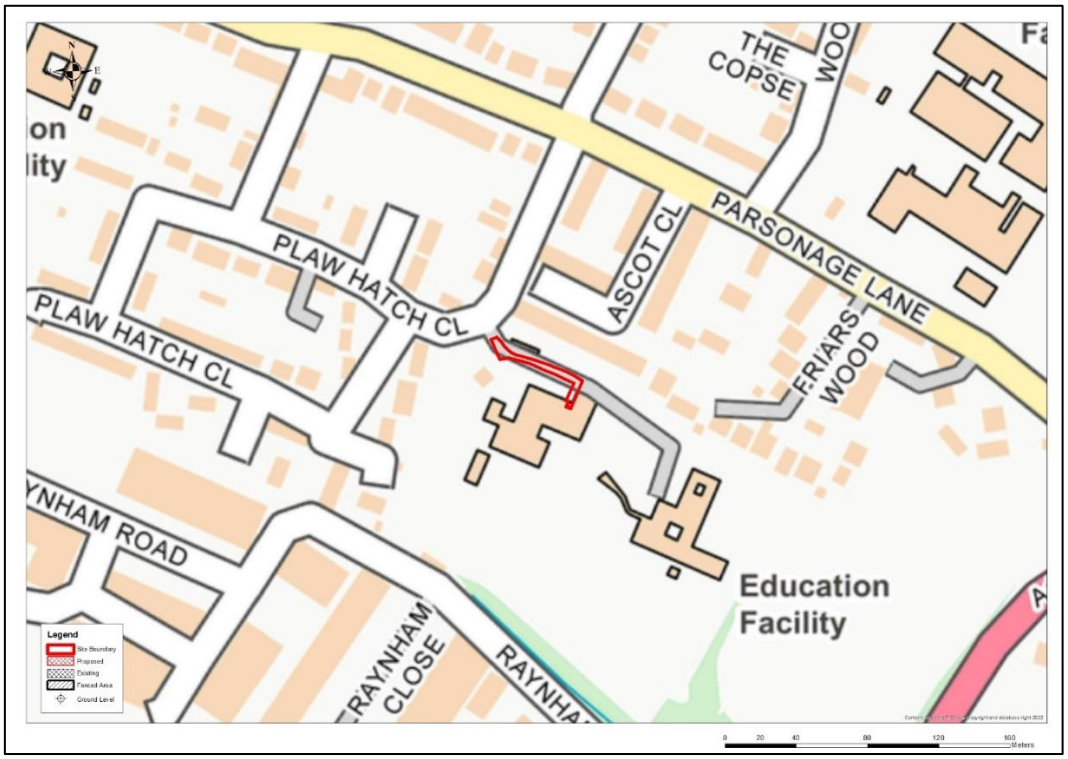


Figure 1: Site Location Map

Figure 2: Site Aerial Map

10.6 Site and Surrounding Land Uses

10.6.1 Site Current Land Use

The site is currently a Primary School with associated playing grounds and car parking.

10.6.2 Surrounding Land Uses

A description of the current and surrounding land uses of the site is given in Table 1.

Table 1: Summary of surrounding land uses

Boundary	Land Use Description	
	Immediately Adjacent (Within 0 – 25m)	**General Local Area (Within 25 – 250m)**
Northern	Primary School Grounds	Primary School, Public Road and Residential Dwellings
Eastern	Primary School Grounds	Primary School, Public Road and Residential Dwellings
Southern	Primary School Grounds	Primary School, Public Road and Industrial Site
Western	Primary School Grounds	Primary School, Public Road and Residential Dwellings

10.7 Hydrology

The nearest watercourse to the site are both unnamed culverted water courses located 430m South West of the site and 378m North East of the site. The nearest main watercourse is the River Stort, which is located 1.2km West from the proposed site.

A hydrology map can be found in Appendix 5.

10.8 Geology

Data from the British Geological Survey indicates that the underlying superficial geology is characterised as Lowestoft Formation (Diamicton). The underlying bedrock geology is characterized as London Clay Formation (Clay, Silt and sand).

10.9 Hydrogeology

The site lies upon both an unproductive superficial aquifer and bedrock aquifer.

Appendix 3 provides BGS mapping showing the hydrogeology at the site location.

10.10 Topography

A LIDAR DTM map showing the topography of the site and surrounding area is available in Appendix 3. As a topographic survey was not available, site levels were estimated using this.

The development area is relatively flat. The elevation ranges from 85.47mAOD (East), located on the service road adjacent to where the ASHP is situated, to 85.00mAOD adjacent to the entrance to the site (West).

The proposed fencing and ASHP, are at an approximate average ground level of 85.06mAOD.

11 The Sequential and Exception Tests

11.1 The Sequential Test

The Sequential Test aims to steer developments and redevelopments to areas of lower flood risk. The test compares the proposed development site with other available sites, in terms of flood risk, to aid the steering process. The Sequential Test is not required if the proposed development is a minor development or if it involves a change of use unless the development is a caravan, camping chalet, mobile home or park home site.

Based on Government Guidance, Minor Development means:

- minor non-residential extensions: industrial/commercial/leisure etc extensions with a footprint less than 250 square metre.
- alterations: development that does not increase the size of buildings eg alterations to external appearance.

- householder development: For example; sheds, garages, games rooms etc within the curtilage of the existing dwelling, in addition to physical extensions to the existing dwelling itself. This definition excludes any proposed development that would create a separate dwelling within the curtilage of the existing dwelling eg subdivision of houses into flats.

With regard to residential and commercial developments, major development, as defined by the Town and Country Planning (Development Management Procedure) means one or more of the following:

- c(i) - the number of dwelling houses to be provided is 10 or more; or
- c(ii) - the development is to be carried out on a site having an area of 0.5 hectares or more and it is not known whether the development falls within sub-paragraph (c)(i);
- the provision of a building or buildings where the floor space to be created by the development is 1,000 square metres or more;
- or development carried out on a site having an area of 1 hectare or more.

Development is minor and less vulnerable so Sequential and Exception Tests should not be required. LLFA to decide.

11.2 The Exception Test

Where the Sequential Test is undertaken and alternative sites of lower flood risk are not available, then the proposed development may require an Exception Test in order to be granted planning permission. Where the exception test is required, it should be applied as soon as possible to all local development document allocations for developments and all planning applications other than for minor developments. All three elements of the exception test have to be passed before development is allocated or permitted. For the exception test to be passed:

- It must demonstrate that the development provides wider sustainability benefits to the community that outweigh the flood risk, informed by an SFRA, where one has been prepared;
- The development should be on developed land or on previously developed land;
- A flood risk assessment must demonstrate that the development will be safe without increasing flood risk elsewhere, and where possible will reduce the overall flood risk.

The requirements for an Exception Test are given in Table 2 and are defined in terms of Flood Zone and development vulnerability classification.

Table 2: NPPF Flood Zone vulnerability compatibility (source: NPPF).

Flood Zones	**Flood Risk Vulnerability Classification**				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a	Exception Test required	✗	Exception Test required	✓	✓
Zone 3b	Exception Test required	✗	✗	✗	✓

Key:

✓ Development is appropriate

✗ Development should not be permitted.

The Exception Test is should not be required by the LLFA.

12 Site Specific Flood Risk Analysis

The PFRA and Level 1 SFRA produced by the LLFA and maps from the EA provide information regarding historic flooding events and incidents as well as predictions of flood extents and depths during extreme rainfall events.

12.1 Fluvial (River) and Tidal (Sea) Flood Risk

12.1.1 Mechanisms for Fluvial Flooding

Fluvial, or river flooding, occurs when excessive rainfall over an extended period of time or heavy snow melt causes a river to exceed its capacity. The damage from a fluvial flood can be widespread as the overflow may affect downstream tributaries, overtopping defences and flooding nearby inhabited areas. Fluvial flooding consists of two main types:

- Overbank flooding – this occurs when water rises steadily and overflows over the edges of a river or stream;
- Flash flooding – this is characterized by an intense, high velocity torrent of water that occurs in an existing river channel with little to no notice. Flash floods are very dangerous and destructive not only because of the force of the water, but also the hurtling debris that is often swept up in the flow.

12.1.2 Definition of EA Modelled Fluvial Flood Risk Zones

Fluvial flood risk is assessed using flooding maps produced by the Environment Agency. These maps use available historic data and hydraulic modelling to define zones of flood risk. The maps allow a site to be defined in terms of its flood zone (e.g. 1, 2, 3) and in terms of the overall flood risk (very low, low, medium or high). It is important to note that existing flood defences are not taken into account within the models or the maps. The EA fluvial flood zones are defined as follows:

- Flood zone 1: Less than 1 in 1000 (0.1%) annual probability of flooding;

- Flood zone 2: Between 1 in 100 (1%) and 1 in 1000 (0.1%) annual probability of flooding;
- Flood zone 3: Greater than 1 in 100 (1%) annual probability of fluvial flooding.

Flood zone 3 is split into two sub-categories (3a and 3b) by LLFAs depending on whether the land is considered to be a functional flood plain (i.e. an important storage area for flood waters in extreme events).

- Flood zone 3a: Greater than 1 in 100 (1%) annual probability of fluvial flooding and/or greater than 1 in 200 (0.5%) annual probability of tidal flooding;
- Flood zone 3b: Functional flood plain (definition specific to the LLFA). Less than a 1 in 20 (5%) annual probability of fluvial and/or tidal flooding.

12.1.3 Main Potential Sources of Local Fluvial Flooding

The nearest potential source of fluvial flooding to the site is considered to be both unnamed culverted watercourses, located 430m South West of the site and 378m North East of the site. The River Stort is also in close proximity to the site, located 1.2km West from the proposed site.

12.1.4 Records of Historic Fluvial Flooding Incidents

The EA's historic and recorded flood outline maps show the locations and extents of historic flooding. These maps do not indicate that there has been historic flooding at or in the vicinity of the site. Copies of these maps are available in Appendix 4.

12.1.5 Designated Fluvial Flood Risk Zone for the Site

The site is considered to be located within Flood Zone 3a as defined by the Environment Agency and the LLFA indicating that it has a Greater than 1 in 100 (1%) annual probability of fluvial flooding.

12.1.6 Potential Sources of Tidal Flooding

The area in which the site is located is considered unlikely to be affected by tidal flooding.

12.1.7 Flood Defences

The EA's flood defence map which is available in Appendix 7 shows that the site benefits from flood defences. These defences include high ground, located 430m South West of the site adjacent to Stortford Hall Park and high ground 378m North East of the site.

12.1.8 Peak River Flow Climate Change Allowances

The EA's climate change allowances for peak river flow maps show that the site is considered to be in the Upper Lee Management catchment. The climate change allowances for this catchment are available in Appendix 11.

In flood zones 2 or 3a for:

- essential infrastructure – use the higher central allowance
- highly vulnerable – use central allowance (development should not be permitted in flood zone 3a)
- more vulnerable – use the central allowance
- less vulnerable – use the central allowance
- water compatible – use the central allowance

In flood zone 3b for:

- essential infrastructure – use the higher central allowance
- highly vulnerable – development should not be permitted
- more vulnerable – development should not be permitted
- less vulnerable – development should not be permitted
- water compatible – use the central allowance

The central allowance for water compatible developments indicates that a climate change allowance of 20% should be used.

12.1.9 Climate Change - EA Modelled Predictions of Fluvial and Tidal Flood Levels and Extents

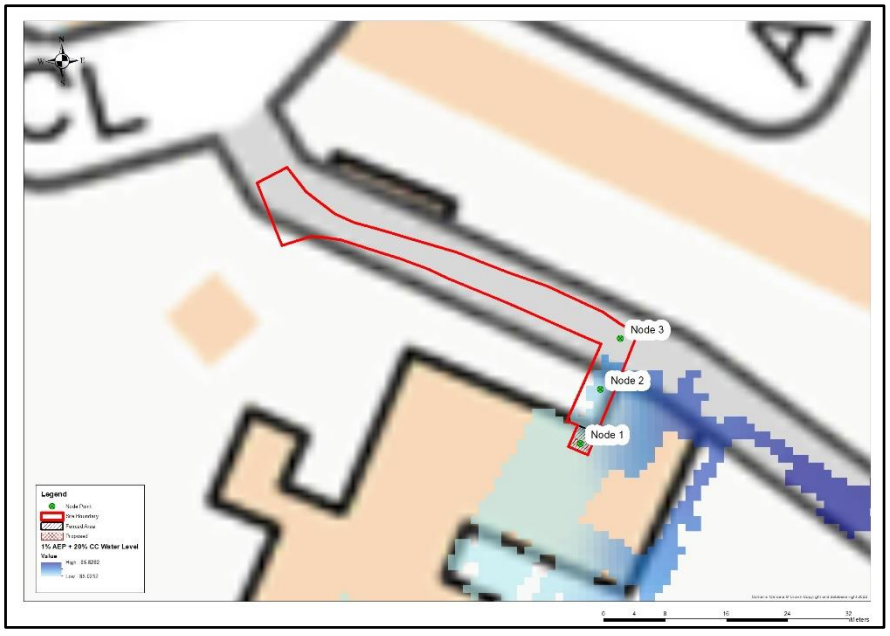
The EA Product 6 dataset which is presented in Appendix 11 provides modelled flood levels and flows for model node points close to the site. These are summarised in Table 3 and Figure 4 below.

Table 3: EA modelled expected flood depths (m) and levels (mAOD) for different scenarios.

River Stort - 2015 JBA Model							
		1% AEP		1% AEP + 20% CC		0.1% AEP	
Node	**LiDAR (EA Elevation Data) (mAOD)***	**Depth (m)**	**Level (mAOD)**	**Depth (m)**	**Level (mAOD)**	**Depth (m)**	**Level (mAOD)**
Node 1	85.14	0.02	**85.16**	0.03	**85.17**	0.05	**85.19**
Node 2	85.20	0.02	**85.22**	0.02	**85.22**	0.03	**85.23**
Node 3	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**

** LiDAR Elevation data has been calculated through subtracting the flood depths from the flood levels, provided by the EA.*

Figure 4: Node Point Map with 1% AEP + 20% CC Flood Level



The ASHP is impacted during all three fluvial events to very shallow flooding depths. During the 1% AEP modelled flood event the ASHP is impacted to a maximum depth of 0.02m to a level of 85.16mAOD.

During the 1% AEP + 20% modelled fluvial scenario the ASHP floods to a maximum depth of 0.02m to a level of 85.17mAOD.

During the 0.1% extreme fluvial scenario the ASHP is impacted to a maximum depth of 0.03m to a level of 85.19mAOD.

Flooding does not exceed a flood depth of 0.03m during any of the modelled scenarios.

The flood data provided by the EA product 6 data, indicates that the flood flow route on site is directly through an onsite existing buildings and in line with the proposed development. Based on the modelled flood levels being extremely low, this would be considered to be unlikely and may only appear on the mapping due to the historic topographical data used in the EA modelled data set.

12.1.10 Long Term Fluvial/Tidal Flood Risk Considering Flood Defences

The EA's long term flood risk maps give an indication of the actual risk associated with flooding after taking into account the effect of any flood defences in the area. Copies of maps for the site which are available in Appendix 9 indicate that the long-term risk from fluvial flooding to the site is very low.

12.2 Pluvial (Surface Water) Flood Risk

A pluvial, or surface water flood, is caused when heavy rainfall creates a flood event independent of an overflowing water body. Surface water flooding occurs when high intensity rainfall leads to run-off which flows over the ground surface, causing ponding in low-lying areas when the precipitation rate or overland flow rate is greater than the rate of infiltration, or return into watercourses. Surface water flooding can be exacerbated when the underlying soil and geology is saturated (as a result of prolonged precipitation or a high-water table) or when the drainage network has insufficient capacity.

12.2.1 Mechanisms of Pluvial Flooding

The chief mechanisms for surface water flooding can be divided into the following categories:

- Runoff from higher topography;
- Localised surface water runoff – as a result of localised ponding of surface water;
- Sewer Flooding – areas where extensive and deep surface water flooding is likely to be influenced by sewer flooding. Where the sewer network has reached capacity, and surcharged, this will exacerbate the flood risk in these areas;
- Low Lying Areas – areas such as underpasses, subways and lowered roads beneath railway lines are more susceptible to surface water flooding;
- Railway Cuttings –railway infrastructure cut into the natural geological formations can cause extra surface run off and pooling disrupting service and potentially affecting adjacent structures;
- Railway Embankments – discrete surface water flooding locations along the up-stream side of the raised network rail embankments where water flows are interrupted and ponding can occur;
- Failure of artificial sources (i.e. man-made structures) such as such as canals and reservoirs.

12.2.2 Main Potential Sources of Local Pluvial Flooding

The main potential source of pluvial flooding to the site is considered to be surface water ponding and flooding associated with heavy rainfall.

12.2.3 Records of Historic Pluvial Flooding Incidents

Examination of the LLFA's Level 1 SFRA revealed evidence of pluvial flooding in the vicinity of the site. This particular flood incident occurred 360m South West of the site, however it is not specific on the type of incident or the reason for occurrence.

A map showing the location of surface water flooding incidents is available in Appendix 4 .

12.2.4 Surface Water Flood Risk from Artificial Sources (Reservoirs and Canals)

An examination of OS mapping and the EA's mapping revealed that the site is in close proximity to the River Stort Navigation Canal, which is located 1.2km West of the proposed site.

12.2.5 Sewer Flooding

Examination of the LLFA's Level 1 SFRA revealed evidence of sewer flooding on or in the vicinity of the site. Within the CM23 5 postcode there have been 8no. recorded flood incidents.

A map showing recorded incidents of sewer flooding is available in Appendix 4.

12.2.6 Climate Change - Modelled Predictions of Surface Water Run-off Flooding

Mapping of the predicted extent and depth of surface water flooding for the 1 in 30-year, 1 in 100-year, and 1 in 1000-year rainfall return periods provided by the EA are available in Appendix 6.

During the 1 in 30-year and 1 in 100-year modelled pluvial events, the site remains dry.

During the 1 in 1000-year modelled pluvial events the site is impacted to a maximum flood depth of 300mm. However, the proposed Air Source Heat Pump (ASHP) would remain dry during this event.

12.2.7 Long Term Surface Water Flood Risk

The EA's long term flood risk maps which are available in Appendix 9 indicate that the long term risk of flooding from surface water is considered to be very low.

12.3 Groundwater Flood Risk

Groundwater flooding occurs when water rises from an underlying aquifer (i.e. at the location of a spring) to such a level where it intersects the ground surface and inundates the surrounding land. Groundwater flooding tends to occur after long periods of intense precipitation, in often low-lying areas where the water table is likely to be at a shallow depth. Groundwater flooding is known to occur in areas underlain by principal aquifers, although increasingly it is also being associated with more localised floodplain sands and gravels. A high groundwater table also has the potential to exacerbate the risk of surface water and fluvial flooding by reducing rainfall infiltration capacity, and to increase the risk of sewer flooding through sewer/groundwater interactions.

12.3.1 Historic Records of Groundwater Flooding

Examination of the LLFA's Level 1 SFRA revealed evidence of flooding in the vicinity of the site. This incident occurred 360m South West of the site, however it is not specific on the type of incident or the reason for occurrence.

A map showing the locations of historic groundwater flooding incidents is available in Appendix 4.

12.3.2 Susceptibility to Groundwater Flooding

The Groundwater Flood Susceptibility Map provided by BGS and presented in Appendix 10 indicates that the site does not have the potential for groundwater flooding to occur. The Groundwater Depth map also provided by BGS indicates that the groundwater level may range between approximately less than 3mbgl to between 3-5mbgl where the entrance to the site is situated.

12.4 Critical Drainage Area

A Critical Drainage Area (CDA) may be defined as "a discrete geographic area (usually a hydrological catchment) where multiple and interlinked sources of flood risk (surface water, groundwater, sewer, main river and/or tidal) cause flooding in one or more Local Flood Risk Zones during severe weather thereby affecting people,

property or local infrastructure". A CDA is defined in the Town and Country Planning (General Development Procedure) (Amendment) (No. 2) (England) Order 2006 as "an area within Flood Zone 1 which has critical drainage problems and which has been notified to the local planning authority by the Environment Agency".

The site is not located within a Critical Drainage Area.

13 Potential Impacts of the Development on Local Flood Risk

13.1 Changes to Impermeable Area and Building Footprint

Changes in ground cover arising from the development are presented in Table 4 and Table 5 below.

The areas outline only refer the redline boundary, not the entire site area which forms the Summercroft Primary School.

Table 4: Existing and proposed site ground cover.

	Impermeable Area (m^2)	Permeable Area (m^2)	Total Area (m^2)
Existing	218	53	271
Proposed	219	52	271

Table 5: Break down of existing and proposed site uses

Use	Existing (m^2)	Proposed (m^2)	Difference (m^2)
Building	0	0	0
Impermeable Paving	218	219	**+1**
Permeable Paving	0	0	0
Garden	53	52	**-1**
Total	271	271	-

The development will increase the impermeable area by 1m^2. It is considered unlikely that it will impact upon flood flow and surface water runoff rates given the size of the development.

13.2 Impacts on Flood Storage and Flood Flow Routes

As the development will change the site's built-up area by 1m^2, it is unlikely to have a significant impact on flood flow pathways and local flood storage given the size of the development and the proposed mitigation measures introduced.

14 Flood Risk Mitigation Measures

14.1 SuDS

Planning practice guidance (PPG) which is prepared by the Ministry of Housing, Communities and Local Government (DCLG) states that developers and Local Authorities should seek opportunities to reduce the overall level of flood risk in the area through the layout and form of the development, and the appropriate application of sustainable drainage techniques.

As such, the developer has the option to implement a SuDS strategy in line with the drainage hierarchy as outlined in Table 6 below to reduce surface water discharges from the site. However it should be noted the size of the site restricts a large number of SuDS from being implemented:

Table 6: SuDS Options

- Store rainwater for later use;
- Use infiltration techniques, such as porous surfaces in non-clay areas;
- Attenuate rainwater in ponds or open water features for gradual release;
- Attenuate rainwater by storing in tanks or sealed water features for gradual release;
- Discharge directly to a water course;
- Discharge rainwater directly to a surface water sewer/drain;
- Discharge to a combined sewer.

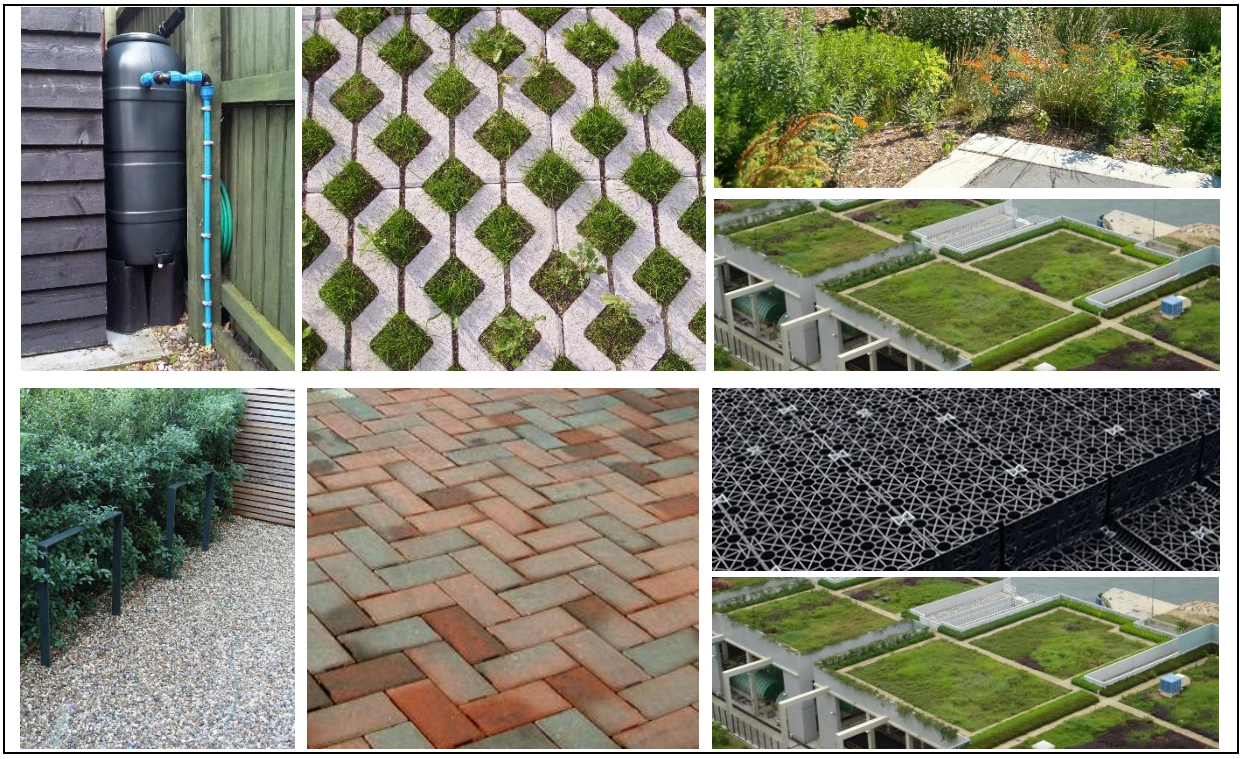


Figure 3: Surface water storage facilities and potential SuDS features - rainwater harvesting, on-site tank storage, rain garden soak-away and green roofs. (Source: UK SuDS Manual)

Given the nature and scale of the development it is considered that there are limited opportunities for implementing SuDS. Measures such as rainwater harvesting and permeable paving should be considered. A full SuDS strategy is outside the scope of works of this FRA.

14.2 Flood Resilience

Flood resilient construction uses methods and materials that reduce the impact from a flood, ensuring that structural integrity is maintained, and the drying out and cleaning required, following inundation and before reoccupation, is minimised.

14.2.1 Finished Floor Levels

The approximate average ground level of the proposed fenced area is 85.06mAOD.

For **vulnerable developments**, the EA's Standing Advice states that the finished floor level of the lowest habitable room in any building, Finished Floor Levels (FFL) should be a minimum of 300mm above one of the following, whichever is higher;

- Average Ground level; Or
- Estimated flood level 1% AEP plus CC; Or
- The Adjacent roadway;

During the 1% AEP + 20% fluvial event the proposed ASHP (Air Source Heat Pump) is impacted to a maximum flood depth of 0.02m to an approximate level of 85.22mAOD.

The ASHP is situated on rubber footings which increase the height from the ground level to the main body of the ASHP by 200mm to an approximate level of 85.40mAOD. The proposed design would also position the ASHP on a 150mm thick concrete plinth, raising the ground level to a total level of approximately 85.55mAOD.

As such, this would place the ASHP above both the modelled fluvial (1% AEP + CC% and 0.1% AEP) and extreme modelled pluvial event (1 in 1000-year event).

14.2.2 Compensatory Flood Storage (CFS)

The proposed ASHP would not be impacted by the 1% AEP + CC% event. As such CFS is not required.

14.2.3 Flood Resilience Construction Measures

In terms of achieving resilience, there are two main strategies, whose applicability is dependent on the water depth the property is subjected to. These are:

- Water Exclusion (Flood Resistance) Strategy - should be employed where predicted flood depths are less than 0.3m and are likely to be for short duration. Emphasis is placed on minimising water entry and giving occupants time to relocate ground floor contents, maintaining structural integrity, and on using materials and construction techniques to facilitate drying and cleaning;
- Water Entry (Flood Resilience) Strategy - Flood resilience measures are designed to allow water in but to limit damage and allow rapid re-occupancy. Resilience measures should be employed where flood depths are greater than

0.6m and where it is likely that structural damage will occur due to excessive water pressure.

Given that flood depths less than 0.3m are predicted in extreme scenarios, the water exclusion strategy should be considered to be the most applicable for this site:

Water Exclusion Strategy:

There are a range of flood protection devices/methods that can be used in the Water Exclusion Strategy including:

- Using materials and construction with low permeability;

Flood resilience design and measures that will be implemented are outlined below. Water-resistant and resilient materials will be utilized throughout the construction to minimize the flood risk and potential impacts.

Floor construction:

- Use of a concrete plinth 150mm thick;
- Damp proof membrane of impermeable polythene at least 1200 gauge

Doors:

- Seal doors around edges and openings. UPVC or composite material will be used with passive protection meaning that minimal intervention will be required in the event of flooding.

Underground drainage:

- Avoid use of metal for any underground piping;
- Use closed cell insulation for pipes that are below the predicted flood level;
- Provide non – return valves for the drainage system to prevent back water flow;

As well as the above the following flood resilience features should be applied as part of the development:

- Utility services such as fuse boxes, meters, main cables, gas pipes, phone lines and sockets will be positioned as high as practicable;
- All external openings for pipes or vents below 400mm to be sealed around pipe or vent with expanding foam and mastic.

14.3 Emergency Plan

14.3.1 Assessment of Danger to People

The dangers associated with flood water to people are possible injury and/or death. This can occur as a result of drowning or being carried along by the waters into hard objects or vice versa. The risk to life is largely a function of the depth and velocity of the floodwater as it crosses the floodplain. Fast flowing deep water that contains debris would represent the greatest hazard.

The assessment of danger to people from walking in floodwater is described in the Flood Risks to People guidance documents (FD2321_TR1 and FD2321_TR2) by DEFRA/EA.

Danger can be estimated by the simple formula:

$$\mathbf{HR = d \times (v + 0.5) + DF}$$

where, HR = (flood) hazard rating; d = depth of flooding (m); v = velocity of floodwaters (m/sec); and DF = debris factor.

The scoring methodology and calculation matrix for this is summarised in Appendix 13.

The EA Product 6 data indicates that the maximum depth of flooding at the site in the 1% AEP plus climate change event would be 0.08m. This equates to a Flood Hazard Rating (HR) score of 0.51 indicating that the flood waters would constitute danger for some. The flood hazard rating would therefore be Low.

15 Conclusions and Recommendations

This assessment has considered the potential risks to the application site associated with flooding from fluvial, tidal, surface water, artificial and groundwater sources and the potential impacts of climate change.

A review of LLFA's PFRA and SFRA as well as data provided by the EA was undertaken. The main findings of the review and assessment are provided below:

- Development is minor and less vulnerable so Sequential and Exception Tests should not be required. LLFA to decide.
- The nearest watercourse to the site are both unnamed culverted water courses located 430m South West of the site and 378m North East of the site. The nearest main watercourse is the River Stort, which is located 1.2km West from the proposed site.
- The EA define the site as being within Flood Zone 3a;
- The height of the ASHP will be set at 350mm above the ground level at a approximately of 85.55mAOD;
- CFS is not required;
- EA mapping indicates that the site does benefit from flood defences. These defences include high ground, located 430m (SW) and 378m (NE) of the site;
- One specific flood incident occurred 360m (SW) of the site;
- The site is not within a CDA. It is in a postcode (CM23 5) that has had 8 sewage flooding incidents;
- The development will increase the impermeable and built-up area at the site by $1m^2$ which will negligible impact on local flood risk given the scale of the development and propose mitigation measures;
- Flood resilient materials and construction methods will be used so as to ensure that the impacts of any potential flooding are minimised as much as possible;

The proposed development is considered to be in general compliance with local planning policy and the NPPF.

16 References

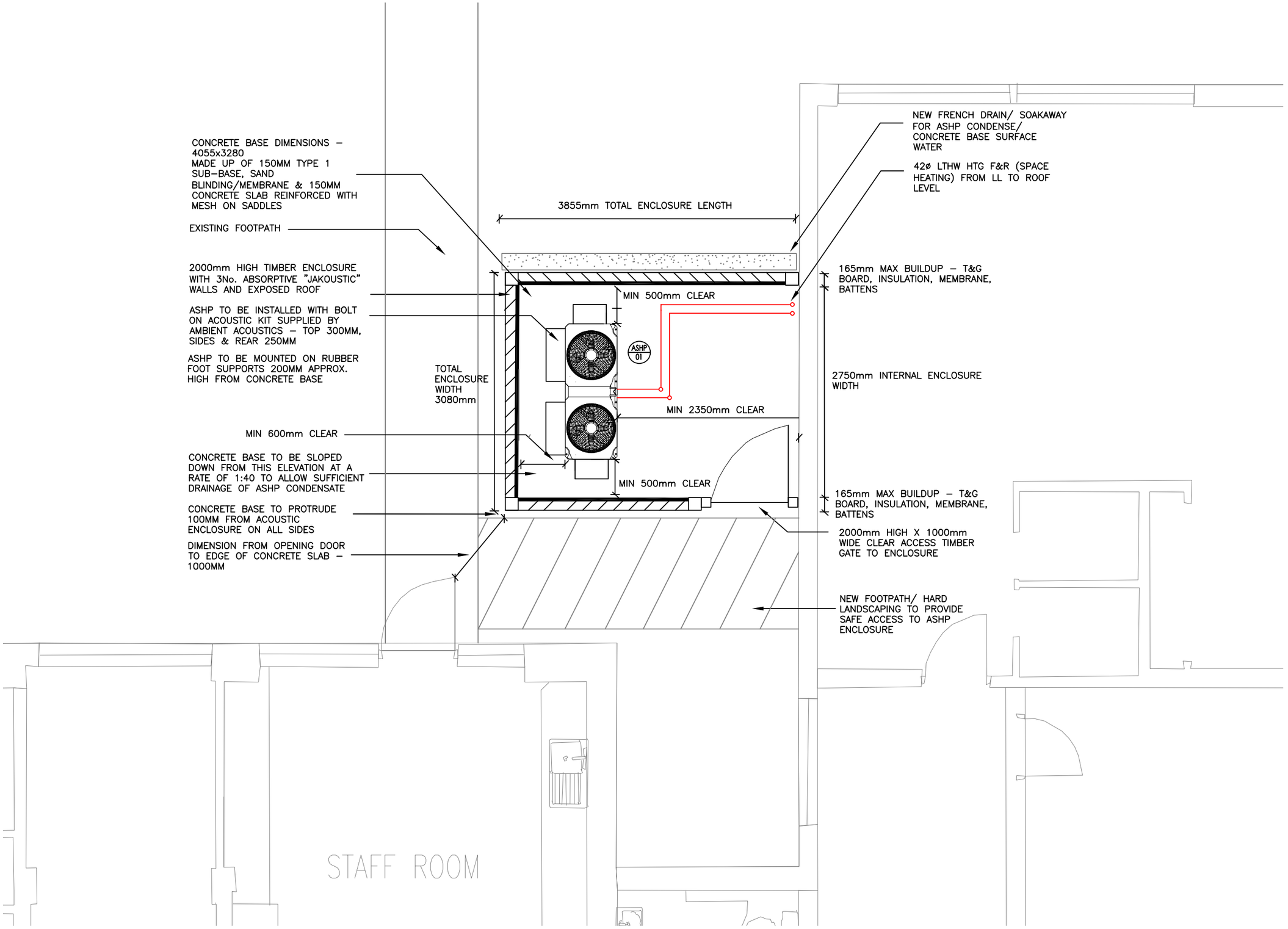
1. Communities and Local Government - National Planning Policy Framework NPPF, July, 2021.
2. Communities and Local Government - Planning Practice Guidance: Flood Risk and Coastal Change, Updated 06 March 2014.
3. Strategic Flood Risk Assessment, East Hertfordshire Strategic Flood Risk Assessment, November 2008
4. Local Plan, East Herts District Plan, 2018
5. Surface Water Management Plan, East Hertfordshire District Surface Water Management Plan, March 2017
6. CIRIA, Defra, Environment Agency – UK SuDS Manual, 2015.

17 Appendices

17.1 Appendix 1 – Site Photographs

17.2 Appendix 2 – Development Plans

See next page.



GENERAL NOTES

REV.	DESCRIPTION	DATE
A	FOR APPROVAL – FOLLOWING COMMENTS	21/02/24
–	FOR APPROVAL	21/02/24

FOR APPROVAL

SES MECHANICAL SERVICES LTD
TELFORD WAY
SEVERALLS BUSINESS PARK
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CO4 9QP
TEL: 01206 845333
FAX: 01206 844601
EMAIL: sales@sesmechanical.co.uk
WEB: www.sesmechanical.co.uk
HEATING • AIR CONDITIONING • DESIGN • INSTALLATION • SERVICE • MAINTENANCE
Mechanical Services Limited

PROJECT
SUMMERCROFT PRIMARY SCHOOL

TITLE
ASHP COMPOUND GENERAL ARRANGEMENT

DRAWING/JOB REF. J1604	DRAWING NO. 05
DATE 26.02.2024	
SCALE 1:50 @ A3	REVISION A

0 A1 SHEET 10

SHEET SIZE CHECK. WHEN PRINTED TO THE CORRECT SIZE THIS LINE SHOULD BE 10cm LONG (A1 SIZE DRAWING)

Existing Elevation A @ 1:50

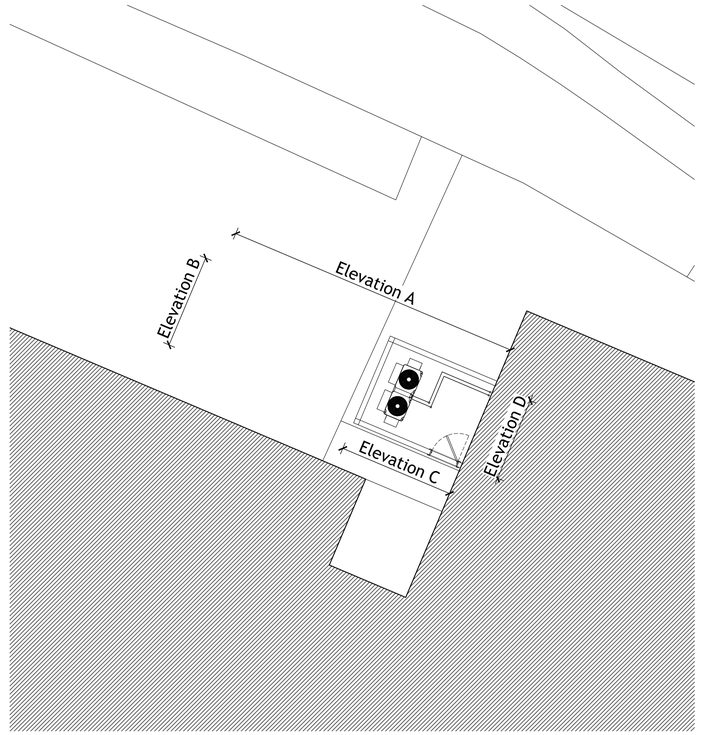
0 1 2 3 4 5

Scale in metres

Proposed Elevation A @ 1:50

0 1 2 3 4 5

Scale in metres



Proposed Plan @ 1:100

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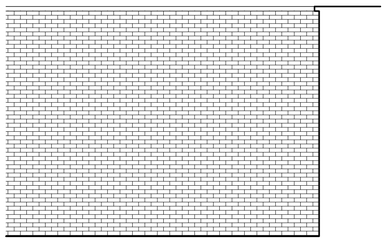
Scale in metres



Existing Elevation B @ 1:50

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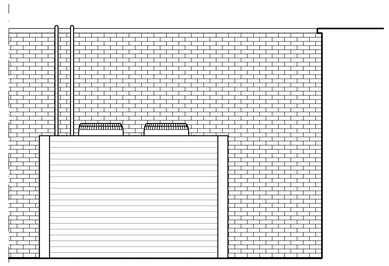
Scale in metres



Proposed Elevation B @ 1:50

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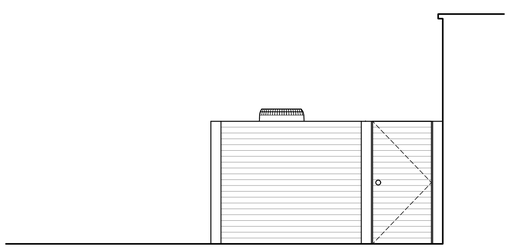
Scale in metres



Proposed Elevation C @ 1:50

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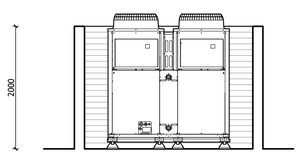
Scale in metres



Proposed Elevation D @ 1:50

0 1 2 3 4 5

Scale in metres

Rev	Amendment	Date

PLANNING

Client: Summercroft Primary School

Project: Plaw Hatch Close, Bishop's Stortford CM23 5BJ

Title: Existing and Proposed Elevations

Dwg. no:	Rev:
1069-PL-001	B

Scale:	Drawn:	Date:
1:50/100 @A1	EA	Mar 2024

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3 Carvers Farm, Dunton Rd
Billericay, Essex, CM12 9TY

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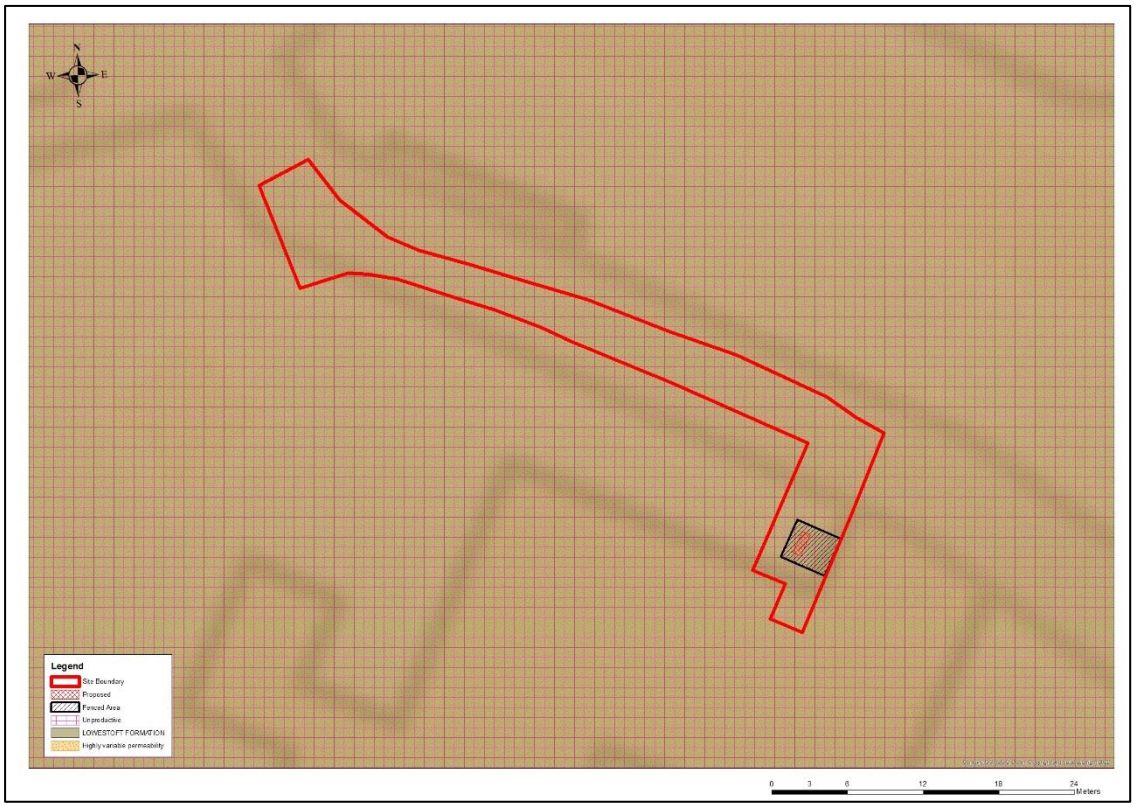
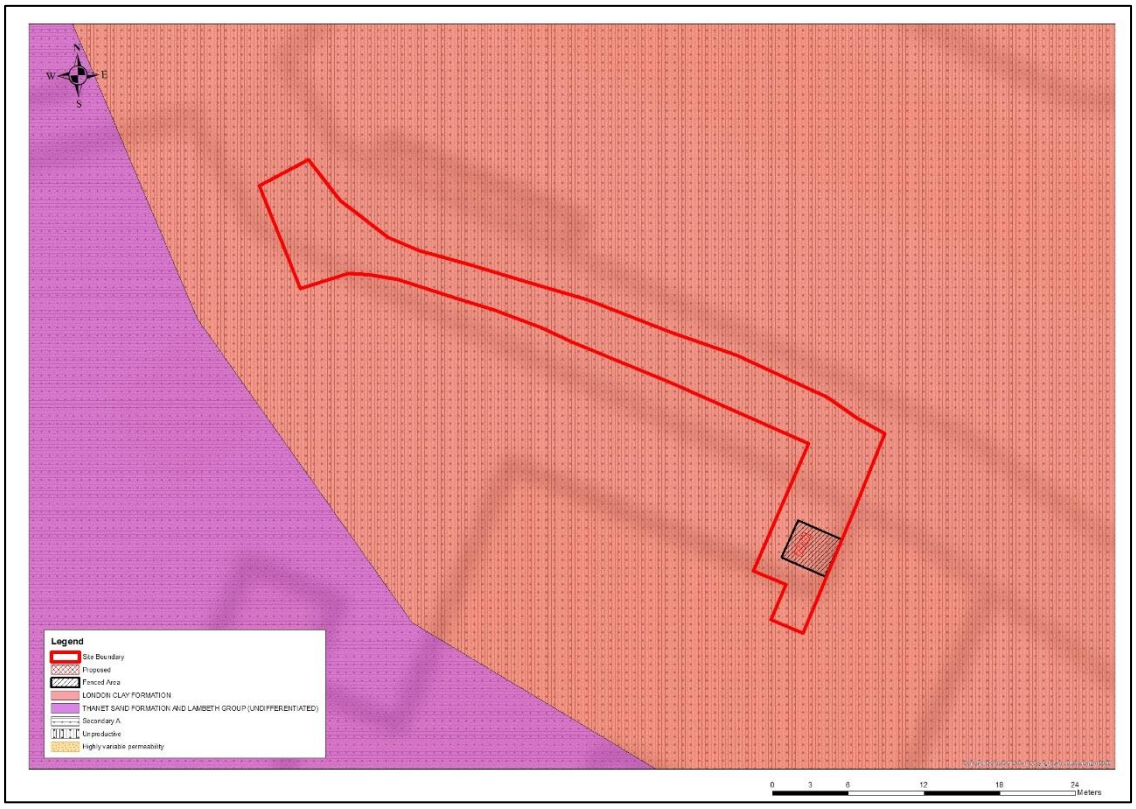
E info@academyestate.co.uk
www.academyestate.co.uk

17.3 Appendix 3 – Environmental Characteristics

17.3.1 Superficial Hydrogeology Map



17.3.2 Bedrock Hydrogeology Map

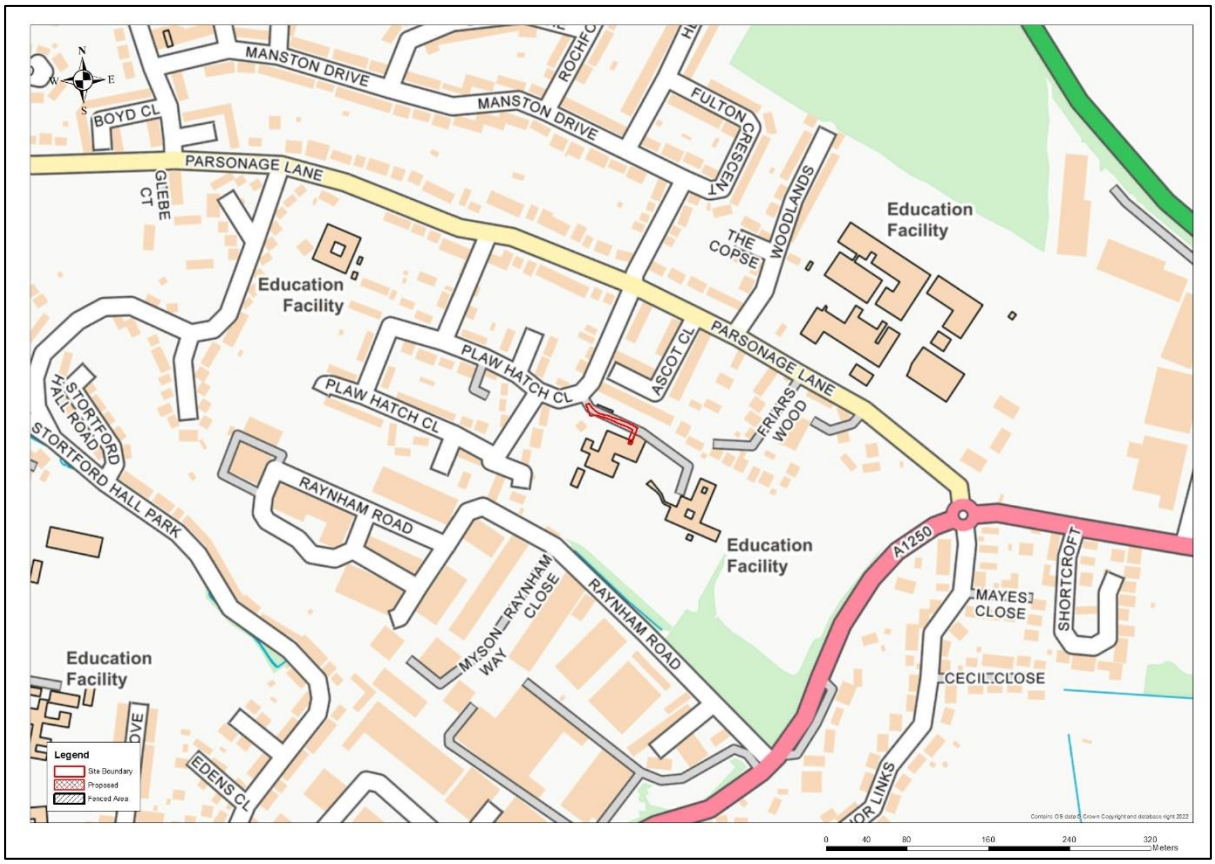


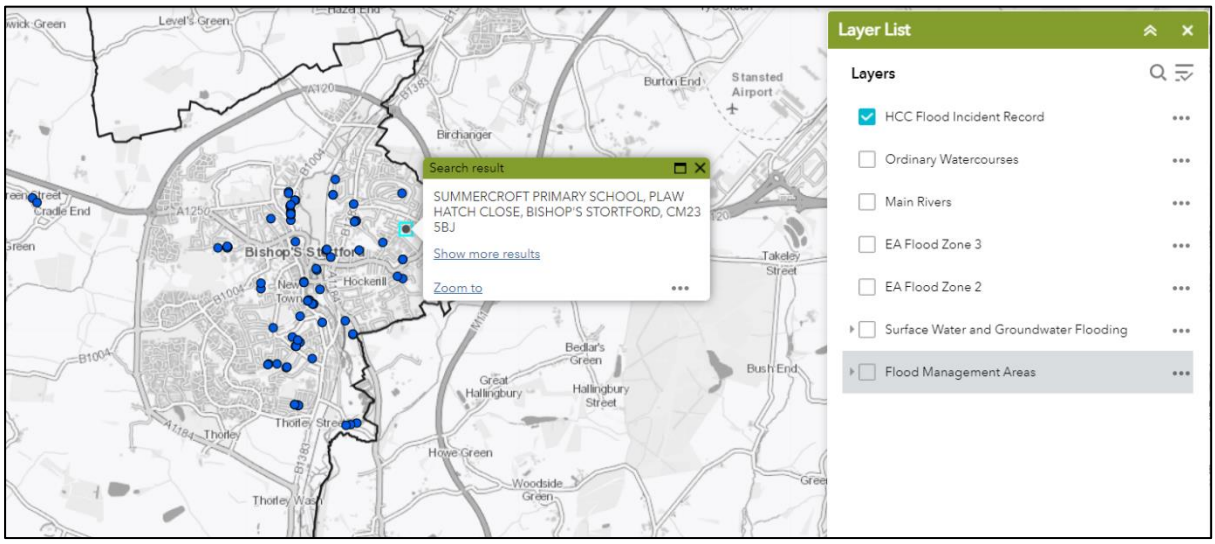
17.3.3 Topography Map


N
W
E
S
85.07
85
84.97
85.05
85.14
85.23
85.26
85.39
85.42
85.47
85.2
85.08
85.06
Legend
Ground Level
Site Boundary
Proposed
Fenced Area
Topography
Value
High : 86.527
Low : 84.697
0
3
6
12
18
24
Meters

17.4 Appendix 4 – Historical Flood Incident Maps

17.4.1 EA Historic and Recorded Flood Outlines



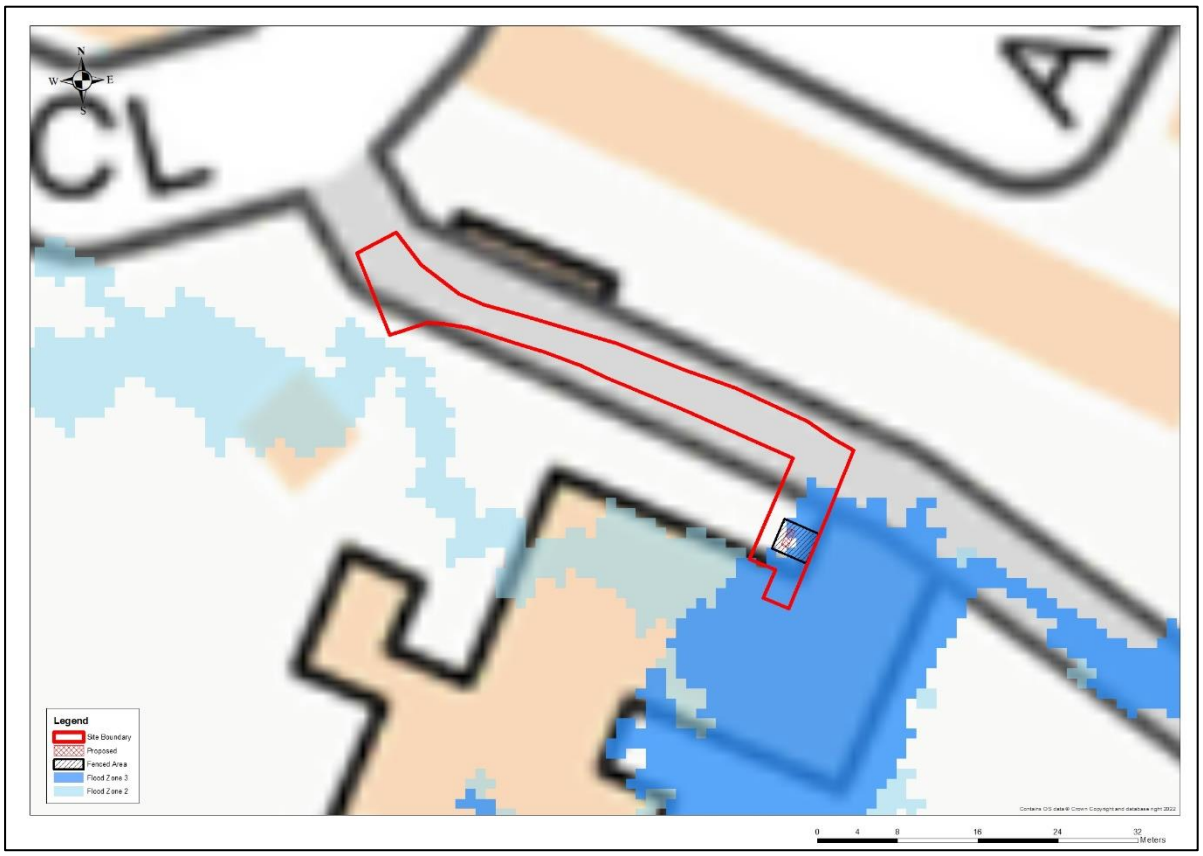


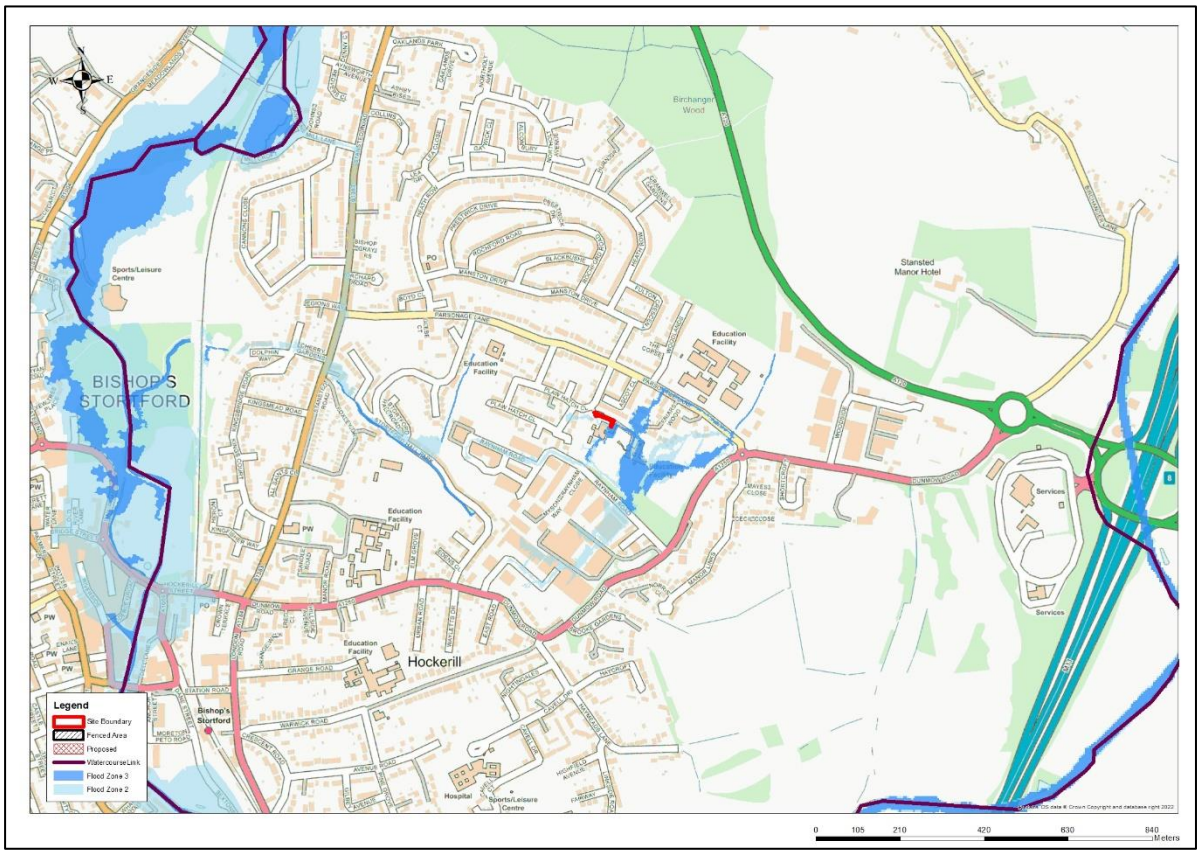
17.4.2 Map of Recorded Sewer Flooding

Table 5-8: DG5 Register recorded flood incidents

Post Code	Recorded Flood Incidents	Post Code	Recorded Flood Incidents
AL6 0	4	SG120	4
CM210	6	SG127	8
CM219	16	SG128	18
CM226	1	SG129	6
CM231	1	SG137	4
CM232	14	SG138	1
CM233	16	SG141	2
CM234	2	SG142	10
CM235	8	SG143	21
RH4 3	0	SG2 7	8
SG106	2	SG2 9	1
SG111	3	SG3 6	6
SG112	4	SG9 9	13
Total: 179			
Note: Based on information provided on 12/07/16			

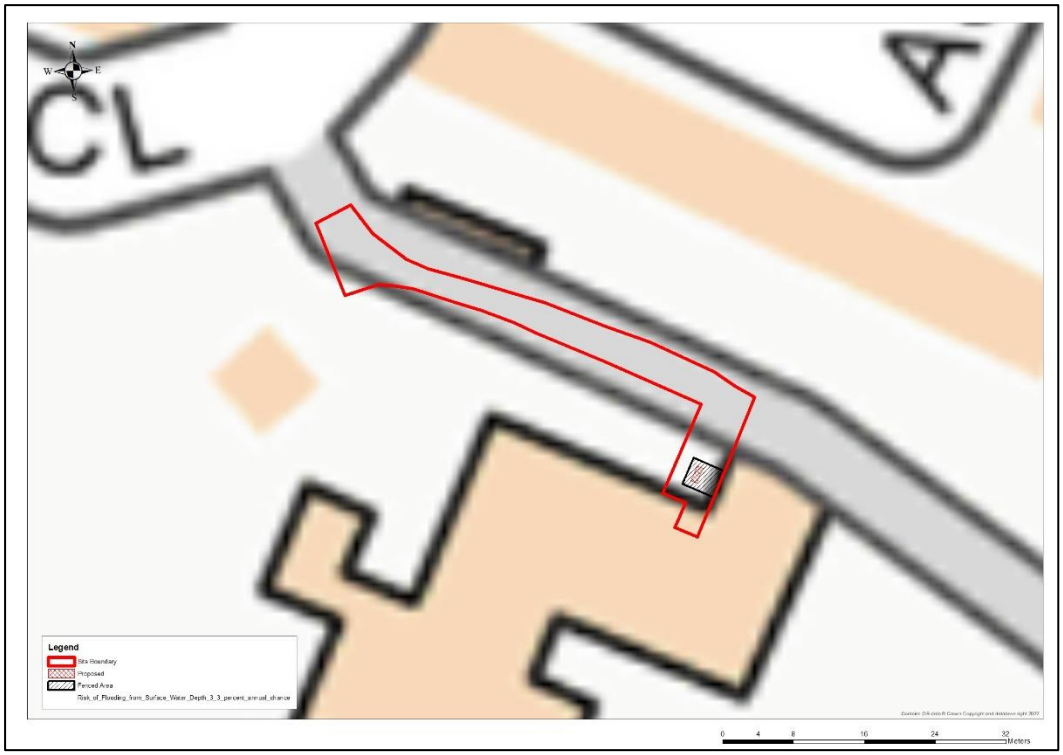
17.5 Appendix 5 - EA Flood Zone Map



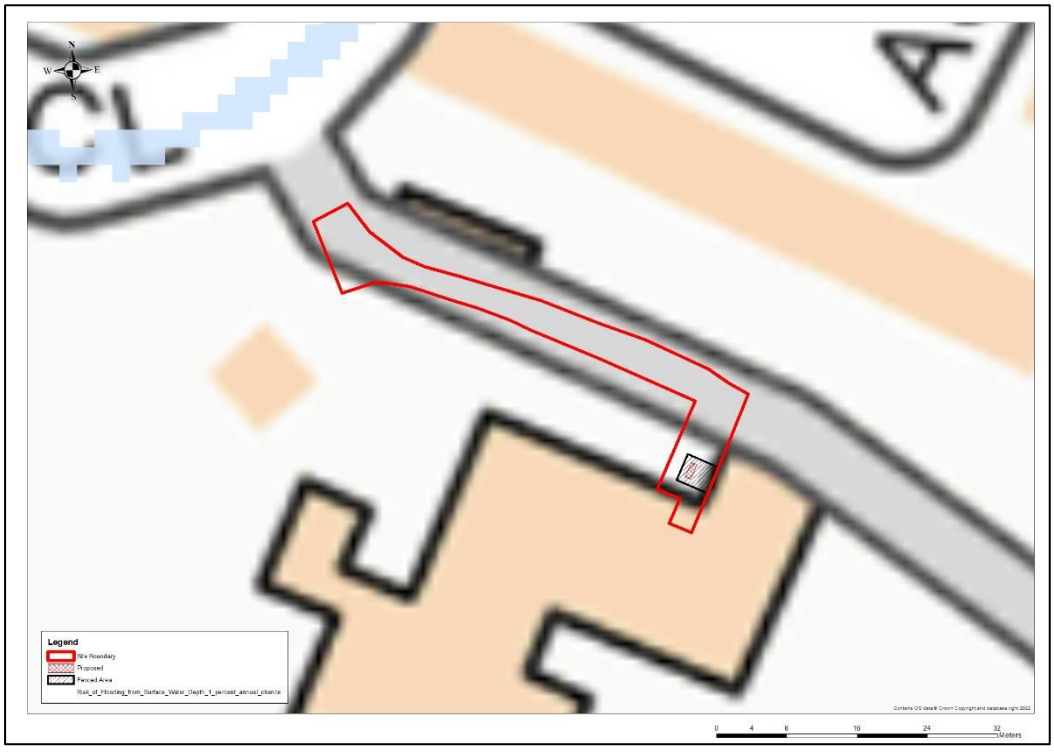


17.6 Appendix 6 – Surface Water Flood Extent and Depth Maps

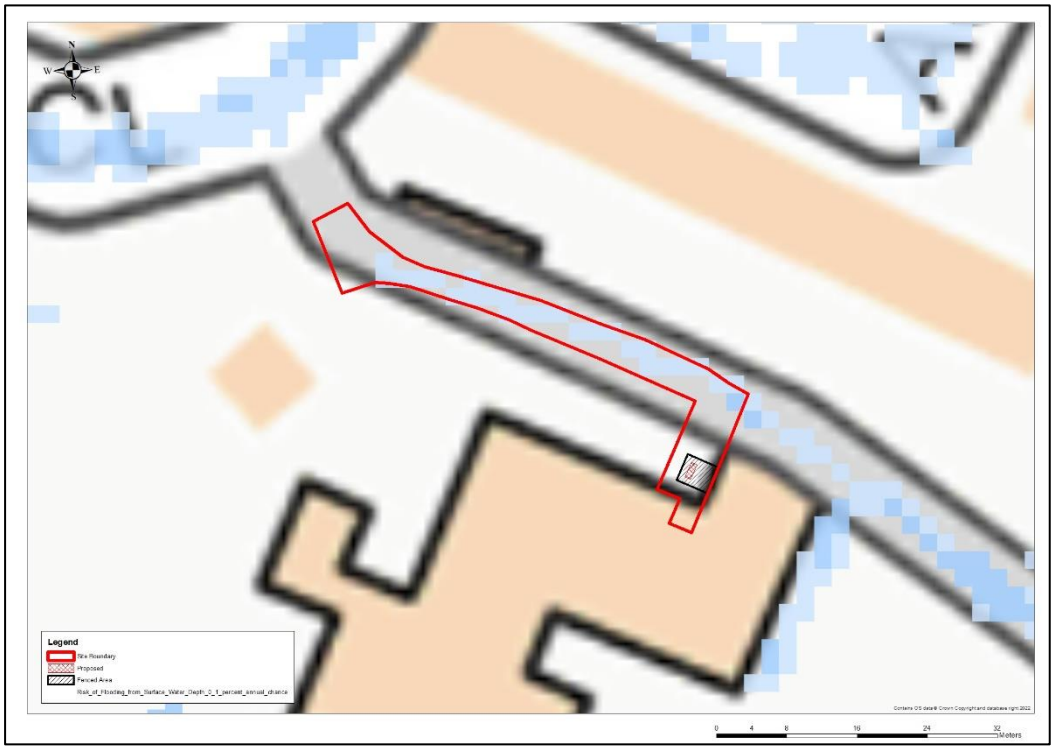
17.6.1 Predicted surface water flood depth for the 1 in 30-year return period (Source: EA, 2016).



17.6.2 Predicted surface water flood depth for the 1 in 100-year return period (Source: EA, 2016).

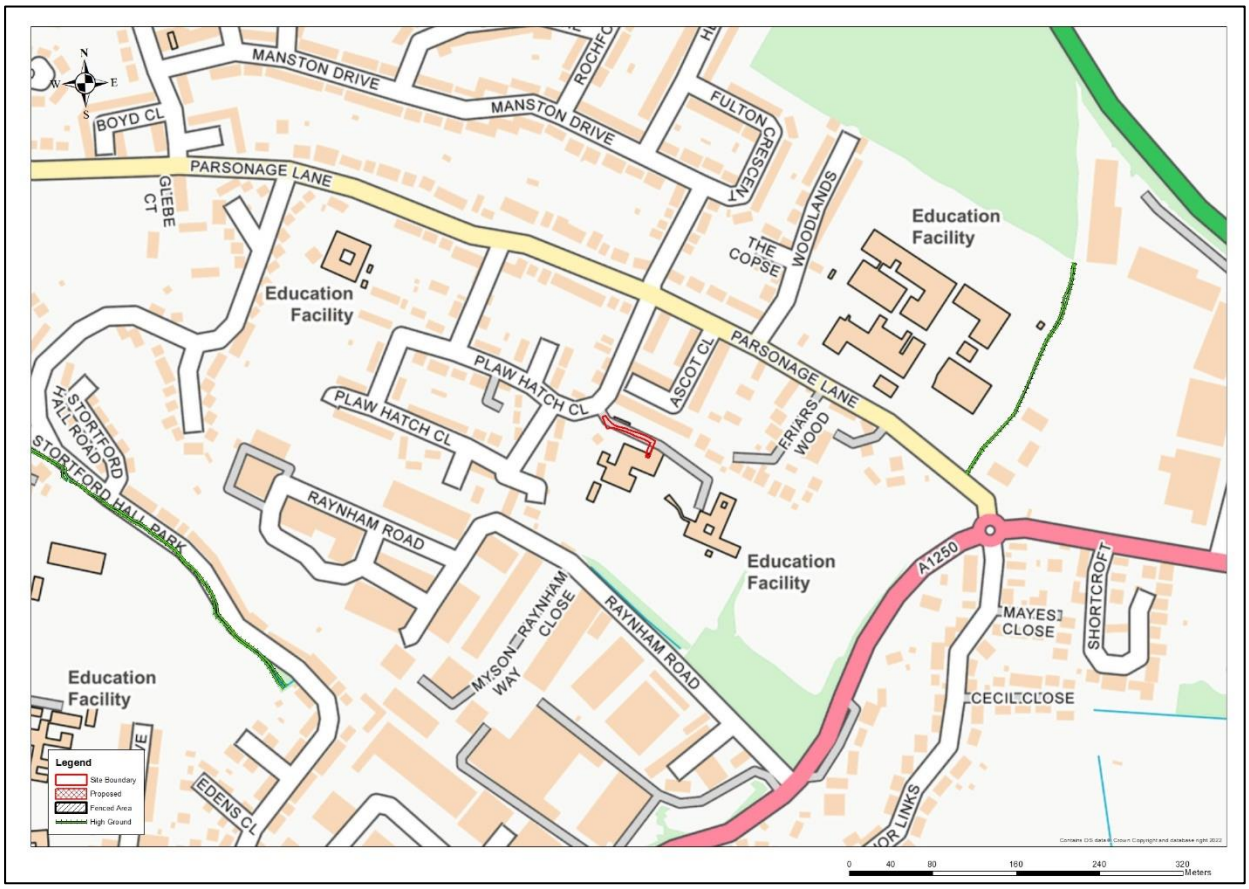


17.6.3 Predicted surface water flood depth for the 1 in 1000-year return period (Source: EA, 2016).

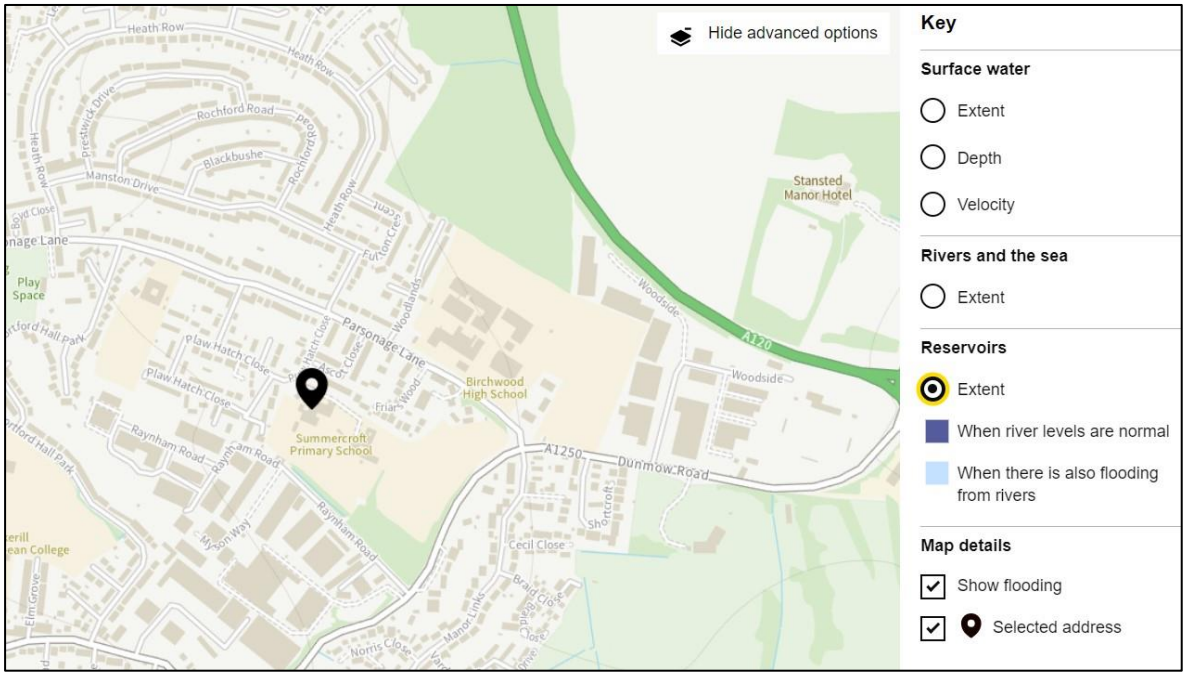


17.7 Appendix 7 –Flood Defence and Reservoir Flood Risk Maps

17.7.1 EA flood defence map



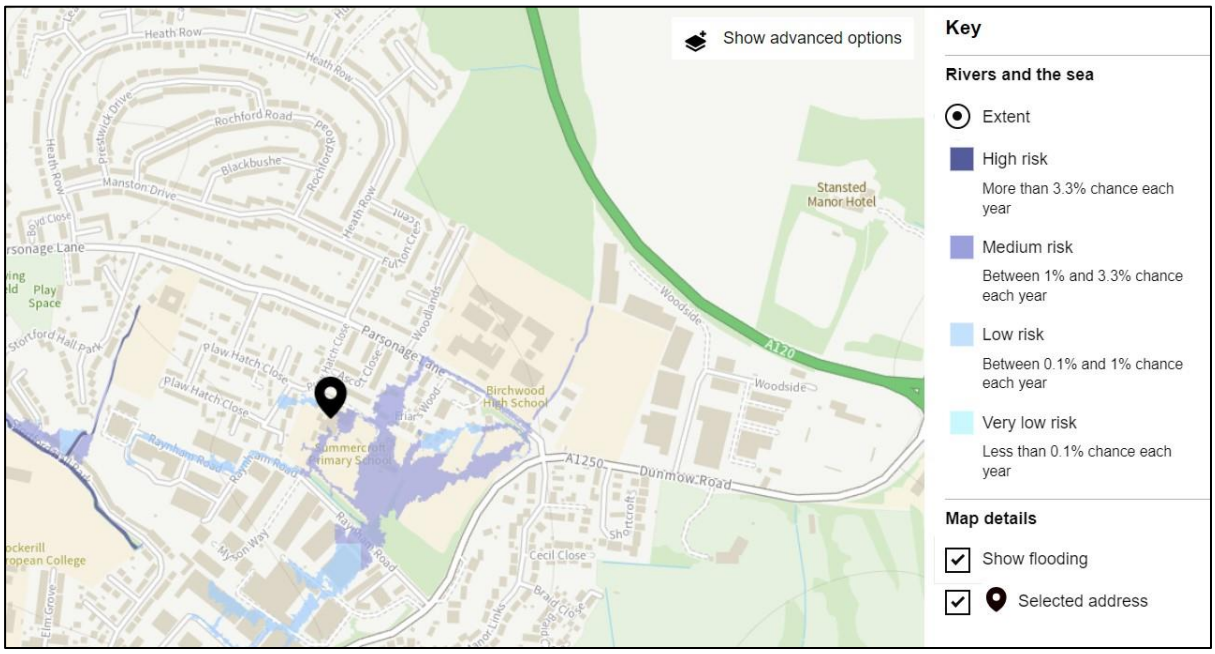
17.7.2 Reservoir Flood Risk Map

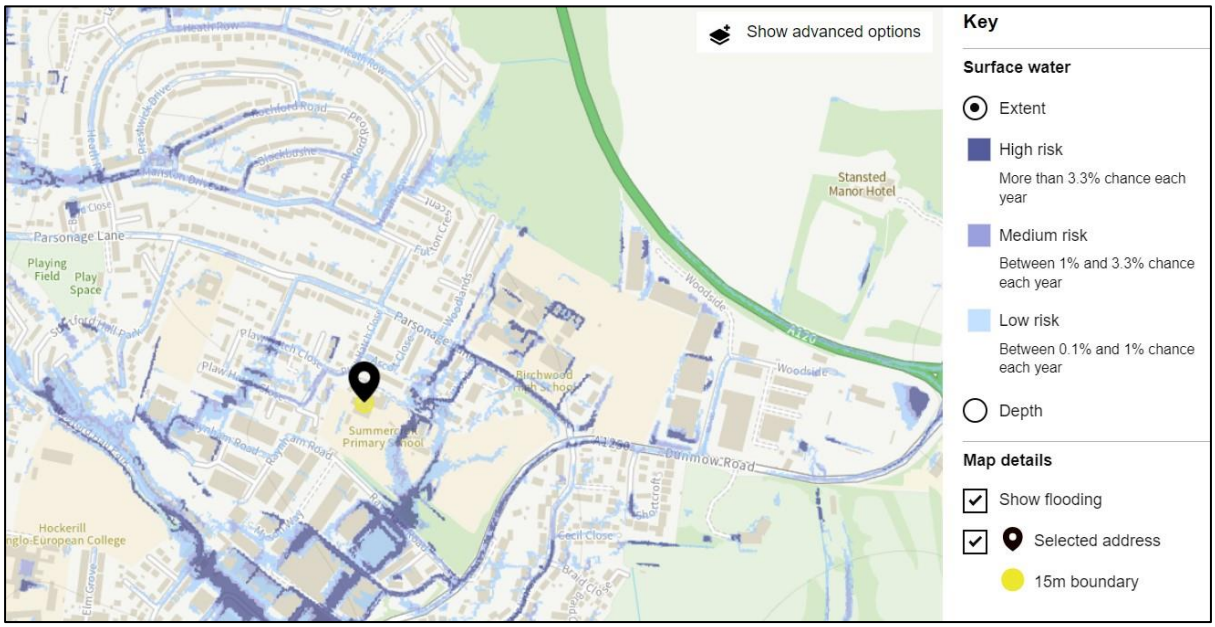


17.8 Appendix 8 – Risk of Flooding from Multiple Sources Map

Not available at the time of writing.

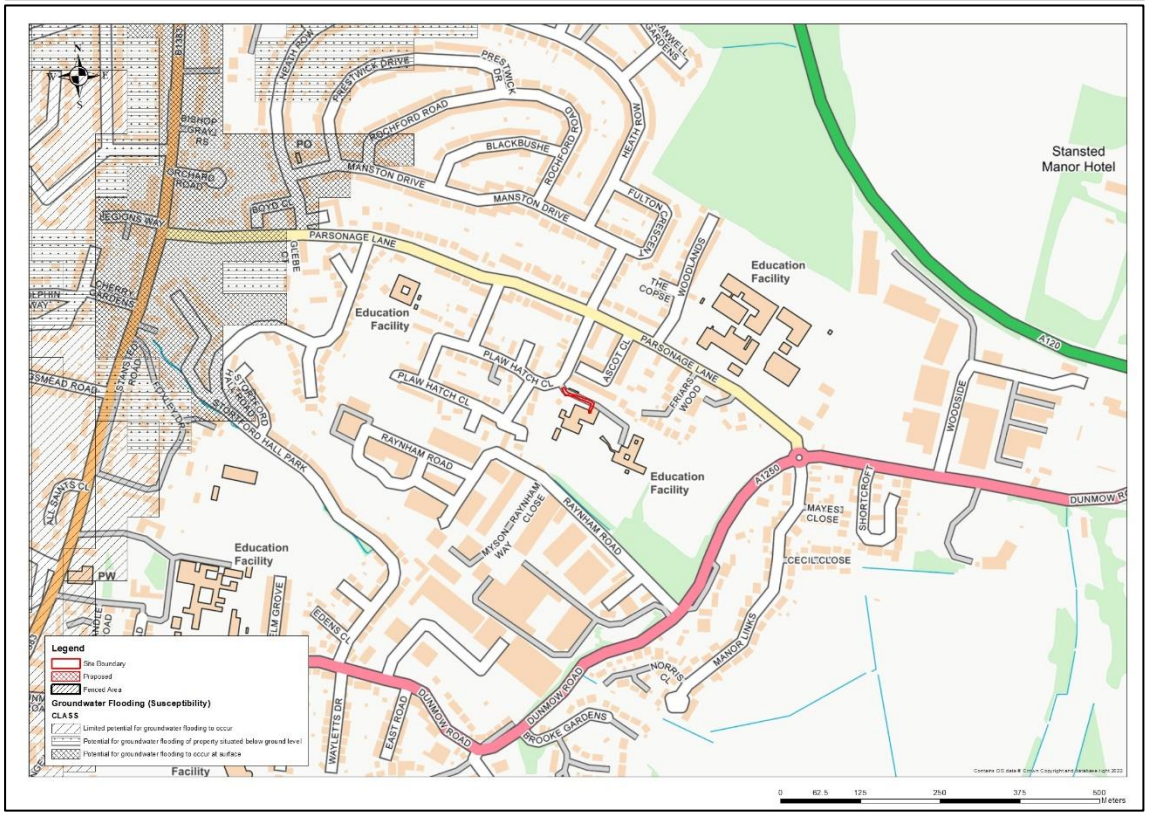
17.9 Appendix 9 – EA's Long Term Flood Risk Maps





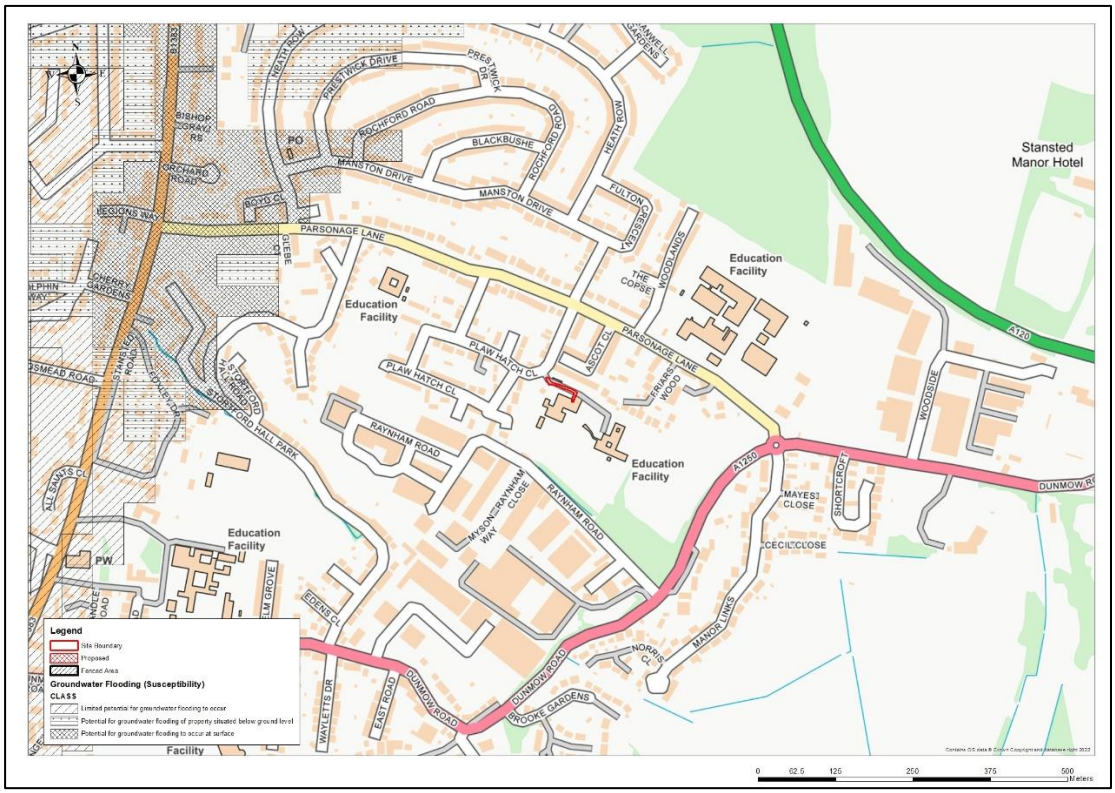
17.10 Appendix 10 – Groundwater Flood Maps

17.10.1 Groundwater Flooding (Susceptibility) Map (BGS) and Potential Depth to the Groundwater Water Map (BGS)

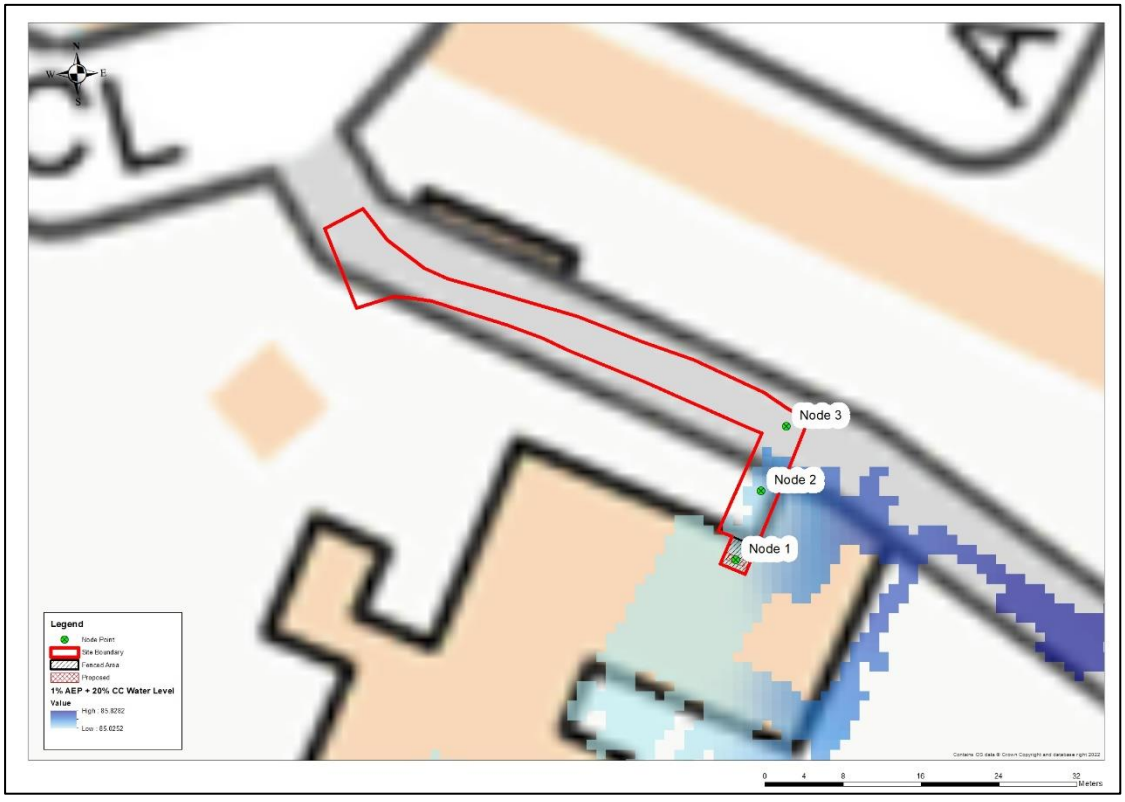


17.11 Appendix 11 - EA Product 6 (Detailed Flood Risk) Data

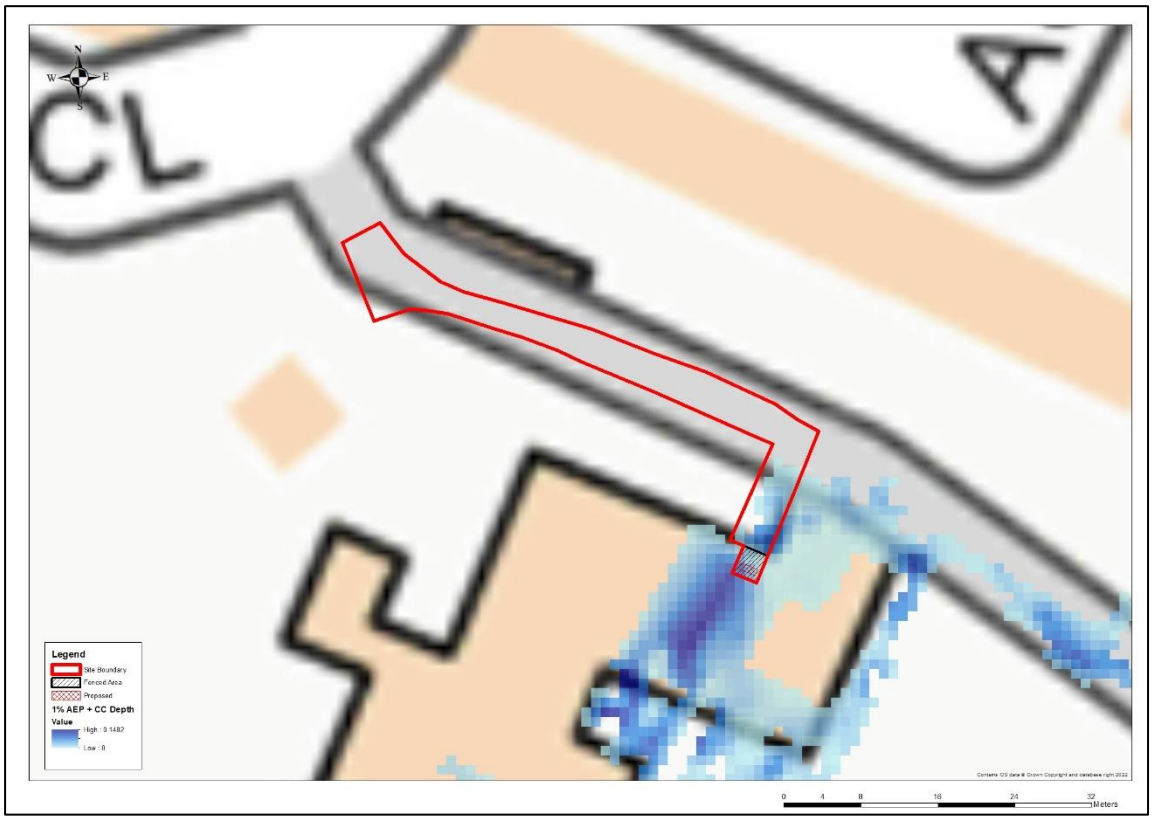
17.11.1 EA Climate Change Allowances for Peak River Flow



17.11.2 Node Location Map



17.11.3 Fluvial Flood Depths during the 1% AEP + 20% CC Scenario Map



17.11.4 Hazard Rating During the 1% AEP + 35% CC Scenario Map

17.12 Appendix 12 – Safe Egress to Flood Zone 1 Map

17.13 Appendix 13 – Calculation of Flood Hazard Rating

Flood Hazard Rating Scores – based on DF score of 0

Velocity	Depth									
	0.25	**0.50**	**0.75**	**1.00**	**1.25**	**1.50**	**1.75**	**2.0**	**2.25**	**2.50**
0.0	0.13	0.25	0.38	0.50	0.63	0.75	0.88	1.00	1.13	1.25
0.5	0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50
1.0	0.38	0.75	1.13	1.50	1.88	2.25	2.63	3.00	3.38	3.75
1.5	0.50	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50	5.00
2.0	0.63	1.25	1.88	2.50	3.13	3.75	4.38	5.00	5.63	6.25
2.5	0.75	1.50	2.25	3.00	3.75	4.50	5.25	6.00	6.75	7.50
3.0	0.88	1.75	2.63	3.50	4.38	5.25	6.13	7.00	7.88	8.75
3.5	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00
4.0	1.13	2.25	3.38	4.50	5.63	6.75	7.88	9.00	10.13	11.25
4.5	1.25	2.50	3.75	5.00	6.25	7.50	8.75	10.00	11.25	12.50
5.0	1.38	2.75	4.13	5.50	6.88	8.25	9.63	11.00	12.38	13.75

Summary of Scores

	Score From	Score To	Flood Hazard	Description
	<0.75	0.75	Low	Exercise Caution
Class 1	0.75	1.5	Moderate	Danger for some
Class 2	1.5	2.5	Significant	Danger for most
Class 3	2.5	20.0	Extreme	Danger for all

Values for Debris Factor for different flood depths

Depths	Pasture/Arable Land	Woodland	Urban
0 to 0.25	0	0	0
0.25 to 0.75	0.5	1	1
d>0.75 and/or v > 2	0.5	1	1

- The “danger to some” category includes vulnerable groups such as children, the elderly and infirm. “Danger: Flood zone with deep or fast
- flowing water”
- The “danger to most” category includes the general public.

- The danger to all category includes the emergency services.

A flood emergency plan is considered to be an acceptable way of managing flood risk where the flood hazard has been given a “very low hazard” rating. In some instances, flood emergency plans may also be acceptable where the rating is “danger for some”. However, it is unlikely to be an acceptable way of managing residual flood risk where the hazard to people classification is “danger for most” or “danger for all”.