

FLOOD RISK ASSESSMENT

Site Address

Land at Fieldview Bungalow and Piper Motors
Gloucester Road
Leigh
GL19 4AA

Client

Ms Sarah Baker

Date

15/01/2019



**CONSULTING GEO-ENVIRONMENTAL
ENGINEERS AND SCIENTISTS**

Phase 1 Contaminated Land Desk Studies, Geo-Environmental Site Investigations, Environmental Due Diligence, Flood Risk Assessments, Surface Water Management Strategies (SuDS), Ecology, Noise and Air Quality Assessments, Environmental Management Systems, GIS & Data Management Systems

1 Document Control



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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
TBC	Tewkesbury Borough Council
SWMP	Surface Water Management Plan
SFRA	Strategic Flood Risk Assessment
CDA	Critical Drainage Area
SuDS	Sustainable 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

3 Disclaimer

This report and any information or advice which it contains, is provided by STM Environmental Consultants Ltd (STM) and is solely for use by Ms Sarah Baker (Client).

STM has exercised such professional skill, care and diligence as may reasonably be expected of a properly qualified and competent consultant when undertaking works of this nature. However, STM gives no warranty, representation or assurance as to the accuracy or completeness of any information, assessments or evaluations presented within this report. Furthermore, STM accepts no liability whatsoever for any loss or damage arising from the interpretation or use of the information contained within this report. Any party using or placing reliance upon any information contained in this report, do so at their own risk.

4 Executive Summary

Location	Land at Fieldview Bungalow and Piper Motors, Gloucester Road, Leigh, GL19 4AA Grid reference: 387106, 225272
Proposed Development	Change of use of existing dwelling to ancillary sales and office use, extension of display area and provision of customer parking area in association with the sale of motorhomes.
Main Sources of Flooding	Fluvial pathways from Leigh Brook located to the south and east of site and surface water ponding predicted on site.
Flood Zone	The majority of the site is within Flood Zone 2 with the southern boundary being within Flood Zone 3a.
Flood Defences	The area does not benefit from EA maintained flood defences. However, the site has its own flood gate, flood wall, bund and drainage ditch. The functionality and effectiveness of these is unknown.
Records of Historic Flooding	Multiple events resulting in flooding across the site from 1948 to 2007.
Fluvial Flood Risk	Medium – Past recorded incidents identified. Site benefits from its own flood defences.
Surface Water Flood Risk	Low to Medium – Ponding scenarios are present across the site during extreme rainfall events.
Groundwater Flood Risk	Low – Site is susceptible to groundwater flooding. However, no recorded groundwater flooding incidents were identified.
Flood Risk from Artificial Sources	Low – No significant artificial sources of flooding identified.
Development Impacts on Local Flood Risk	The development will not increase the site impermeable area and therefore unlikely to increase local flood risk.
Surface Water Management	SuDS would reduce current surface water run off rates. However, BGS mapping indicates that there is limited potential for infiltration SuDS.
Sequential and Exception Tests	Development is considered to be minor and non vulnerable so Sequential and Exception Tests should not be required. LLFA to decide.
Proposed Flood Risk Mitigation Measures	<ul style="list-style-type: none">  The development will implement standard flood mitigation measures;  A community emergency flood plan will be implemented.  Business Owners will sign up for EA Emergency Flood Warning Direct Service;  Safe egress to Flood Zone 1 is only a 6-minute walk away.
Conclusions	Provided the proposed mitigation measures are implemented, it is considered that flood risks to the proposed development will be manageable.

5 Introduction

STM Environmental Consultants Limited (STM) was appointed by Sarah Baker (Client) to provide a Flood Risk Assessment (FRA) to support a planning permission for the change of use of existing dwelling to ancillary sales and office use, extension of display area and provision of customer parking area in association with the sale of motorhomes at a site located at the Land at Fieldview Bungalow and Piper Motors, Gloucester Road, Leigh, GL19 4AA (the Site).

6 Background

6.1 Site Location

The Site is centred at national grid reference 387106, 225,272 and is located at Land at Fieldview Bungalow and Piper Motors, Gloucester Road, Leigh, GL19 4AA. A site location plan is available in [Appendix 1](#). Photographs of the site are available in [Appendix 2](#).

6.1.1 Local Planning Authority

The Site falls within the jurisdiction of Tewkesbury Borough Council in terms of the planning process.

6.1.2 Lead Local Flood Authority

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

6.2 Site Area

The site has an area of 0.36 ha.

6.3 Site Current and Surrounding Land Uses

6.3.1 Site Current Land Use

The site is currently used for commercial vehicle sales and it also includes a residential dwelling.



6.3.2 Surrounding Land Use

The surrounding area is mainly open agricultural fields. To the west/north-west of the site is a caravan park.

6.4 Proposed Development


The proposed development is located at Fieldview Bungalow and Piper Motors, Gloucester Road, Leigh, GL19 4AA (the Site). It includes the change in use of the existing dwelling to ancillary sales and office use, extension of display area and provision of customer parking area in association with the sale of motorhomes. Further details including drawings of the development plans are available in [Appendix 3](#).

7 Context

7.1 National Planning Policy Framework (NPPF)

The NPPF 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 10 entitled "Meeting the challenge of climate change, flooding and coastal change" deals specifically with flood risk. Among other things it states that LPAs should try to ensure that "inappropriate development in areas at risk of flooding is avoided by directing development away from areas at highest risk, but where development is necessary, making it safe without increasing flood risk elsewhere". It further states that when determining planning applications, LPAs should "only consider development appropriate in areas at risk of flooding where, informed by a site-specific flood risk assessment following the Sequential Test, and if required the Exception Test, 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; and

development is appropriately flood resilient and resistant, including safe access and escape routes where required, and that any residual risk can be safely managed, including by emergency planning; and it gives priority to the use of sustainable drainage systems.

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.

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; and
- the development does not hinder the creation and maintenance of a continuous signed and managed route around the coast.

7.2 EA Standing Advice on Flood Risk

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

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




8 Report Aims and Objectives

The purpose of this report is to establish the flood risk to the site from all potential sources and to propose suitable mitigation methods to reduce any risks to an acceptable level. It aims to demonstrate that 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.

9 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) Level 1 Strategic Flood Risk Assessment (SFRA) produced by the LLFA outlining flood risk from various sources within the borough.

10 Site Environmental Characteristics

10.1 Hydrology

The nearest main watercourse is the Leigh Brook which, at its nearest point, is located 120m west of site.

10.2 Geology

Data from the British Geological Survey indicates that the underlying superficial geology is characterised as Alluvium. It should be noted though that these deposits cover only the southern section of the site. The underlying bedrock geology is characterized as Salford Shale Member.

10.3 Hydrogeology

The site lies upon a Secondary A superficial aquifer and a Secondary B bedrock aquifer. Maps are available in [Appendix 4](#).

10.4 Topology

The site is level at 11.9 – 12.1mAOD. A topographical survey is available in [Appendix 4](#).

11 Historic Flood Events

The PFRA and Level 1 SFRA produced by the LLFA and maps from the EA provide information regarding historic flooding events and incidents.

Section 4 of the LLFA's PFRA summarises the available information on past flooding within the borough. Flooding events have been identified in January 1939, March 1947, July 1968, December 1981, January 1990, April 1998, December 2000 and Summer 2007. The summer 2007 floods were considered to be significant and were due to a number of extreme rainfall events throughout June and July which resulted in flooding from surface water overloading drainage systems and high-water levels in rivers and brooks.

A copy of these maps is available in [Appendix 5](#).

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) Flood Risk

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.

12.1.1 Main Potential Sources of Local Fluvial Flooding

The main source of fluvial flooding to the site is considered to be the Leigh Brook.




12.1.2 Records of Historic Fluvial Flooding Incidents

The Historic Flood Map which is available in [Appendix 5](#) shows that the site has been subject to numerous historical flood events spanning from 1947 up to 2007.



12.1.3 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 and 1 in 1000 annual probability of flooding;
-  Flood zone 3 - Greater than 1 in 100 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 annual probability of fluvial flooding and/or greater than 1 in 200 annual probability of tidal flooding;
-  Flood zone 3b: functional flood plain (definition specific to the LLFA). Less than a 1 in 20 annual probability of fluvial and/or tidal flooding;

12.1.4 Designated Fluvial Flood Risk Zone for the Site

The majority of the site is located within fluvial flood zone 2 as defined by the EA and LLFA. A small portion along the southern boundary of the site is located in fluvial flood zone 3a. This indicates the majority of the site has between a 0.1% and 1% annual potential risk of flooding. A map showing the flood zones is available in [Appendix 6](#).

12.1.5 Modelled Predictions of Fluvial Flood Levels

The site is not impacted by the 0.1% or the 1% AEP of flooding of the River Severn. The Outline Map of the EA flood modelling is available as part of the EA Product 4 Data in [Appendix 11](#).

12.2 Tidal (Sea) Flood Risk

Tidal flooding may be described simply as the inundation of low-lying coastal areas by the sea, or the overtopping or breaching of sea defences. Tidal flooding may be

caused by seasonal high tides, storm surges and where increase in water level above the astronomical tide level is created by strong on shore winds or by storm driven wave action.

12.2.1 Potential Sources of Tidal Flooding







The site is over 50km away from any coastline or estuarine system. The SFRA does not indicate that the site is within a zone of tidal influence.


12.3 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.

12.3.1 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 ponding 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.

12.3.2 Records of Historic Pluvial Flooding Incidents

Examination of the LLFAs Level 1 SFRA revealed no records of pluvial flooding on or in the vicinity of the site.

12.3.3 Modelled Predictions of Surface Water Run-off Flooding

Mapping of the predicted extent and depth of surface water flooding for the 1 in 30, 1 in 100 year and 1 in 1000-year rainfall return periods provided by the EA are available in [Appendix 7](#).

The maps show that the site would be impacted during the 1 in 30-year. The extent would be isolated to the north of the site, north of Piper motors, and would be below 150mm in depth. The extent of the flooding increases during the 1 in 100-year event within the north of the site around Piper Motors. The flood depths remain at 150mm. Finally, the central and southern areas of the site also become subject to surface water flooding during a 1 in 1000-year precipitation event with potential depths of 600mm.

12.3.4 Sewer Flooding

The site is not located within a Critical Drainage Area. No records of sewer flooding were available from the LLFA or Tewkesbury Borough Council.

12.3.5 Surface Water Flood Risk from Artificial Sources

OS mapping shows no indication of significant reservoirs or canals within the area of the site. The EA's reservoir flood risk map indicates that the site does not lie within an area that is at risk of reservoir flooding.

12.4 Groundwater Flood Risk

Groundwater flooding occurs when water rises from the underlying aquifer at the location of a spring – where the underlying impermeable geology meets the ground surface. This tends to occur after much longer 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.

12.4.1 Historic Records of Groundwater Flooding

No records of groundwater flooding were identified in the review of data from the LLFA or TBC.

12.4.2 Susceptibility to Groundwater Flooding

The Groundwater Flood Susceptibility Map provided by BGS, which is available in [Appendix 8](#) indicates that the potential for groundwater flooding to occur at the surface exists. The Groundwater Depth Map also provided by BGS indicates that the groundwater level may be at approximately 3mbgl.

12.5 Flood Defences

The EA's map of areas benefitting from flood defences shows no indication of any flood defences in the vicinity of the site.

The client has provided a plan showing flood defences that have been installed at the site. These include a flood gate, flood wall and bund and a drainage ditch running along the northern boundary of the site. This plan is presented in [Appendix 3](#).

1.1.1 Long Term Risk of Flooding

The Environment Agency provides mapping which gives an indication of the overall flood risk from fluvial, tidal and surface water sources considering the presence of river defences. This indicates that there is a low to medium risk from fluvial flooding while the risk from surface water (non-artificial) flooding is considered to be low.

2 Potential Impacts of the Development on Local Flood Risk

12.6 Changes to Impermeable Area of the Site

It is understood that the development will utilise the existing site footprint and no additional buildings will be developed on site. The proposal will be introducing a new customer car parking area which is designed to be permeable. Although the site is landscaped, it is understood that the landscaping is in fact laid on top of the previous hardstanding (the site was previously a Little Chef car park) with soil only being 100 to 150mm in depth.

As such the development will not result in significant change to the impermeable area of the site. As it does not involve the placement of impermeable structures at the site, it should not impact on flood flow paths. This is not considered to be significant given the surrounding area in which the site is located (i.e. mainly open agricultural fields).

12.7 Potential Impacts on Local Flood Risk

As the proposed development will not alter the existing site footprint, it is unlikely to adversely impact local flood risk.

12.8 SuDS

The Department for Communities and Local Government 's (DCLG) Planning practice guidance and Planning system (PPGPS) 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 mentioned above the proposal will not increase the impermeable site area. Nevertheless, the developer has the option to implement SuDS measures in line with the drainage hierarchy that will reduce surface water run-off rates to greenfield rates.

Although the development of a SuDS strategy is outside of the scope of this report, the BGS maps (see [Appendix 9](#)) were examined to assess the potential for infiltration techniques to be employed at the site. The maps indicate that the site has variable draining soils and that the ground water table may be at less than 3mbgl suggesting that there is limited opportunity for employing infiltration methods. Consideration should be given to the implementation of permeable paving in combination with other measures such as rainwater harvesting.

13 Flood Risk Mitigation Measures

2.1.1 Finished Floor Levels

In general, for a less vulnerable development to be considered safe, the EA would expect the finished floor levels of the development are set to 300mm above the 1 in 100-year + CC flood level or 300mm above the breach flood level, whichever is higher.

As outlined in section 12.2.4 the site would not be impacted by flooding during extreme fluvial scenarios. Depths of approximately 150mm will be witnessed during the 1 in 100-year surface water flooding scenario.

However, as the proposal involves the change of use of the existing dwelling to a less vulnerable use, it is considered acceptable to retained finished floor levels as existing.

2.1.2 Flood displacement storage

All new development within Flood Zone 3 must not result in a net loss of flood storage capacity. Where possible, opportunities should be sought to achieve an increase in the provision of floodplain storage.



Where proposed development results in a change in building footprint, the developer must ensure that it does not impact upon the ability of the floodplain to store water, and should seek opportunities to provide a betterment with respect to floodplain storage.



The proposals are to be located within Flood zone 2. As such, they will not impact on the capacity of the floodplain to store water. Flood displacement storage is therefore not considered to be required.

2.1.3 Flood Resilience 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 strategy - where emphasis is placed on minimising water entry whilst maintaining structural integrity, and on using materials and construction techniques to facilitate drying and cleaning. This strategy is favoured when low flood water depths are involved (not more than 0.3m).
-  Water entry strategy - buildings are at significant risk of structural damage if there is a water level difference between outside and inside of about 0.6m or more. This strategy is therefore favoured when high flood water depths are involved (greater than 0.6m).


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

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


Floor construction:

-  Use of ceramic tiles or stone floor finishes is recommended;
-  Avoid the use of MDF carpentry.

Walls:

-  A damp – proof course, 250 mm above ground level, to prevent damp rising through the wall is recommended;

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.

2.2 EA Flood Warnings Direct Service Subscription

The business owners will subscribe to the EA Flood Warnings Direct Service which is a free service offered by the EA providing flood warnings direct to people by telephone, mobile, email, SMS text message and fax. The EA aims to provide 2 hours' notice of flood, day or night, allowing timely evacuation of the site.

The agency operates a 24-hour telephone service on 0345 988 1188 that provides frequently updated flood warnings and associated floodplain information. In addition, this information can also be found at <https://fwd.environment-agency.gov.uk/app/olr/home> along with recommendations on what steps should be taken to prepare for floods, what to do when warnings are issued, and how best to cope with the aftermath of floods.

13.1 Safe Egress

Safe egress to Flood Zone 1 is available by exiting the site via the main entrance and travelling 80m north east up the A38. Directions of this route are presented in [Appendix 10](#).

In relation to the danger from flood waters that may be experienced during an evacuation, the hazard is considered to be low as surface water flood depths are likely to be below 300mm and water velocities are likely to be less than 0.25m/s along the route.




2.3 Emergency Flood Plan

A community Emergency Flood Management Plan will be implemented across the site to deal with any flood events.

14 The Sequential and Exception Tests

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 (e.g. from commercial to residential) unless the development is a caravan, camping chalet, mobile home or park home site.

If alternative sites of lower flood risk are not available then the proposed development may require an Exception Test 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 1 and are defined in terms of Flood Zone and development vulnerability classification.

Table 1: 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	X	Exception Test required	✓	✓
Zone 3b	Exception Test required	X	X	X	✓

The development is considered to be minor and less vulnerable. The commercial development will be located within Flood Zone 2 and marginally with Flood Zone 3a and as such the Sequential and Exception Tests are unlikely to be required. LLFA to decide.

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

-  The main source of potential flooding to the site is the Leigh Brook;
-  The EA defines the majority of the site as being within flood zone 2 with a small part along the southern boundary being within flood zone 3a;
-  There is no EA maintained flood defences in the area. However, the site benefits from its own onsite flood defences;
-  Historical records of fluvial flooding were found at the site. No records of surface water or groundwater flooding were identified;
-  The site is not located within a CDA; it is not in an area that has witnessed significant sewer flooding incidents;
-  As the development will not result in a change in the impermeable area of the site, it is unlikely to increase flood risk in the area;
-  A community emergency plan will be implemented. All occupants will subscribe to the EA Flood Warnings Direct Service;



Safe egress routes to flood zone 1 is easily accessible.

In view of all of the above, it is considered that the overall flood risk to the development is low.

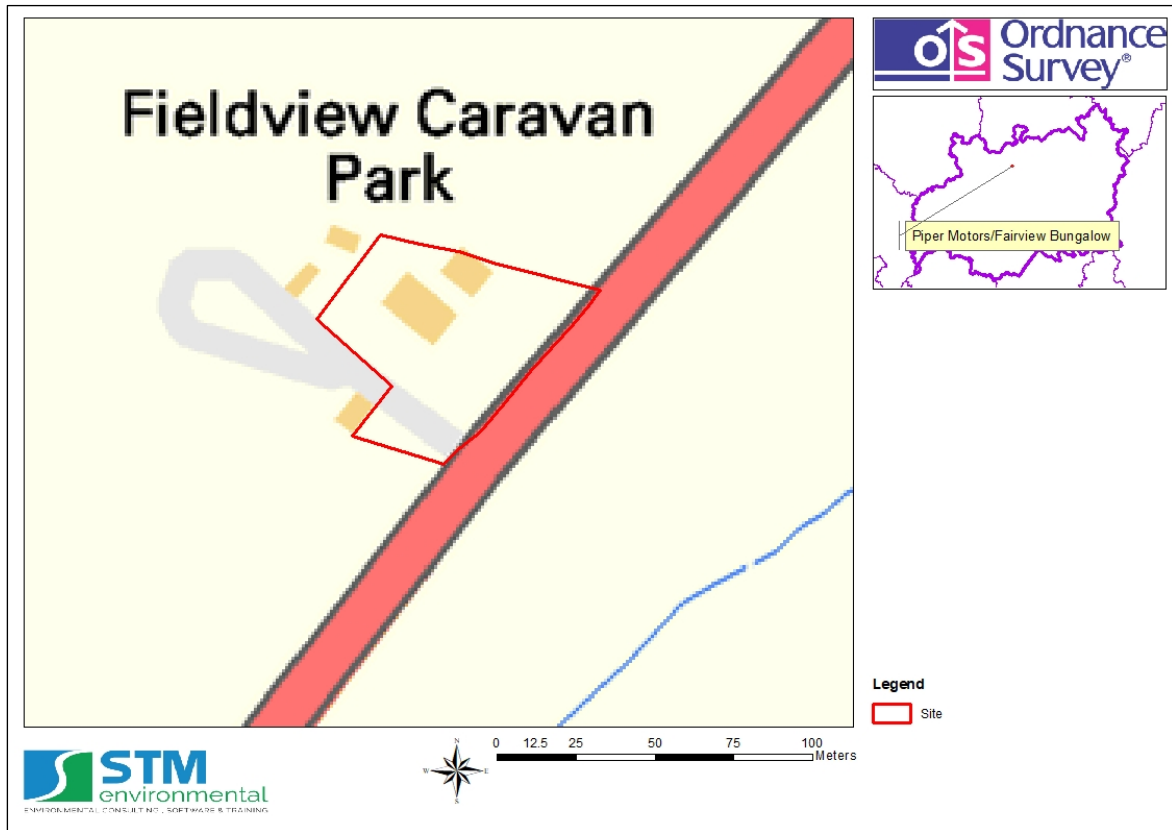


16 References

1. Communities and Local Government - National Planning Policy Framework NPPF, March 2012.
2. Communities and Local Government - Planning Practice Guidance: Flood Risk and Coastal Change, Updated 06 March 2014.
3. Strategic Flood Risk Assessment - Gloucester County Council: Tewkesbury Borough Council – September 2008.
4. CIRIA, Defra, Environment Agency – UK SuDS Manual, 2015.
5. Greater London Authority – London Sustainable Drainage Action Plan, 2015.
6. Google Maps accessed December 2018.

17 Appendices

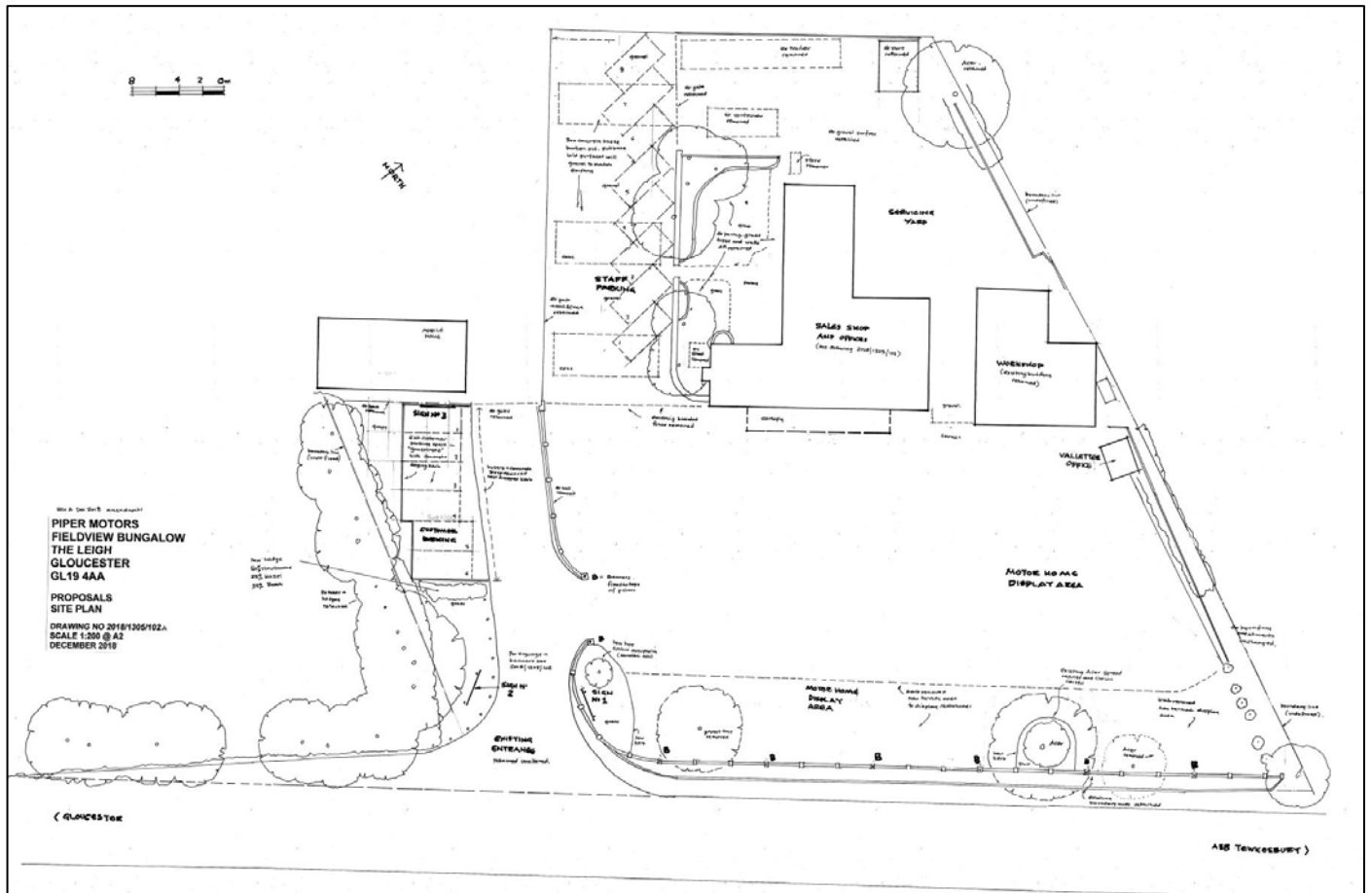
17.1 Appendix 1 – Site Location Map



17.2 Appendix 2 – Photographs of the Site

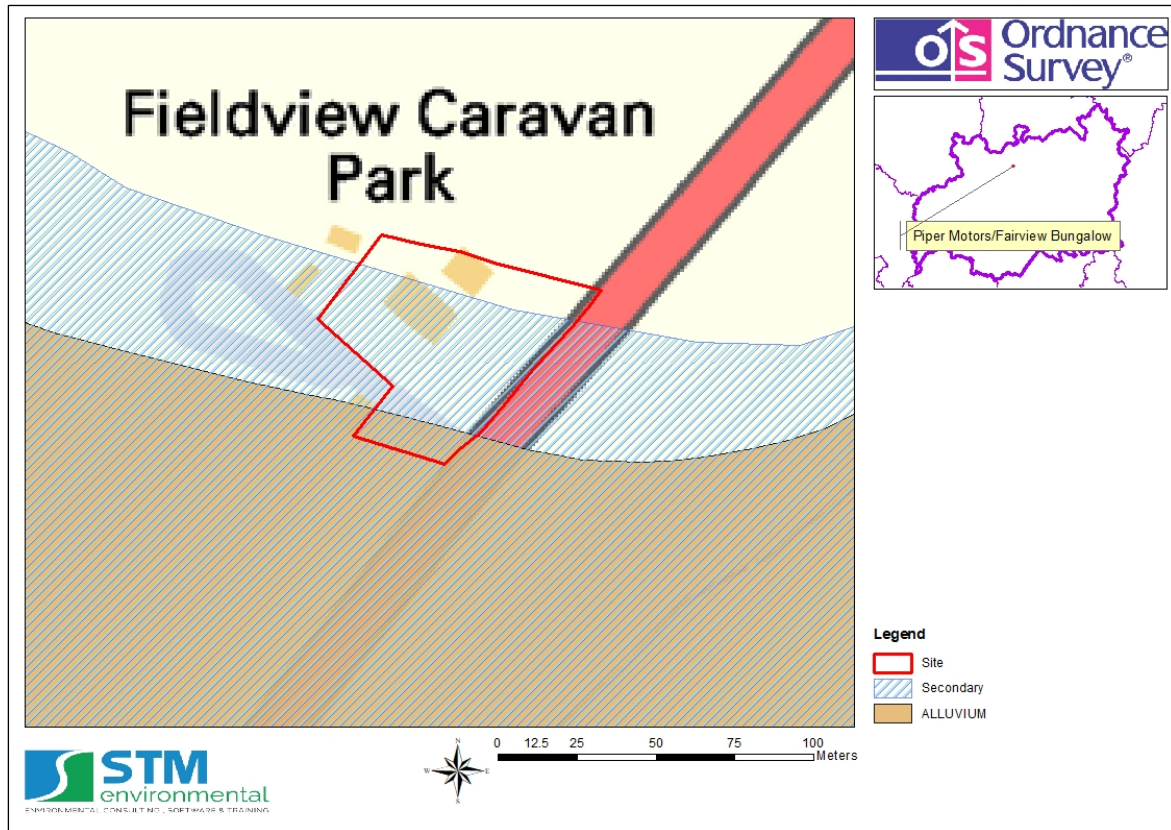


17.3 Appendix 3 – Development Plans

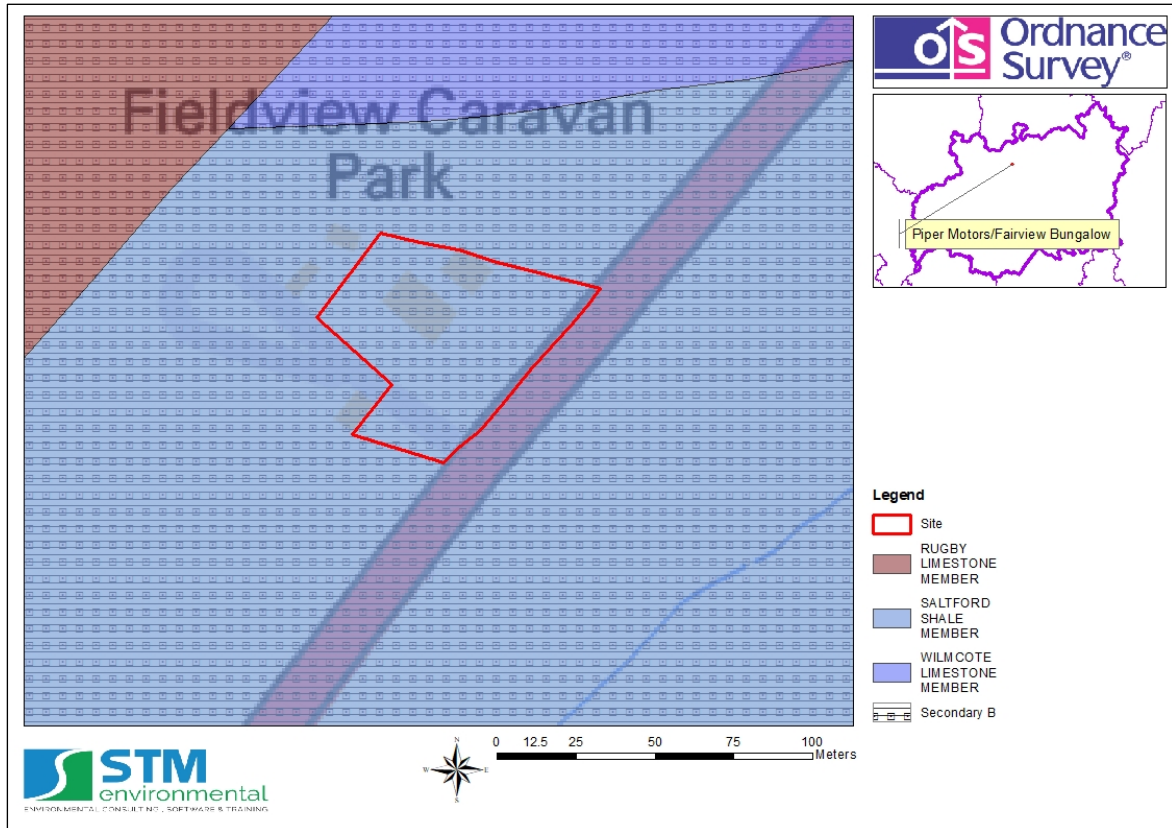


17.4 Appendix 4 – Environmental Characteristics

17.4.1 Superficial Hydrogeology Map



17.4.2 Bedrock Hydrogeology Map

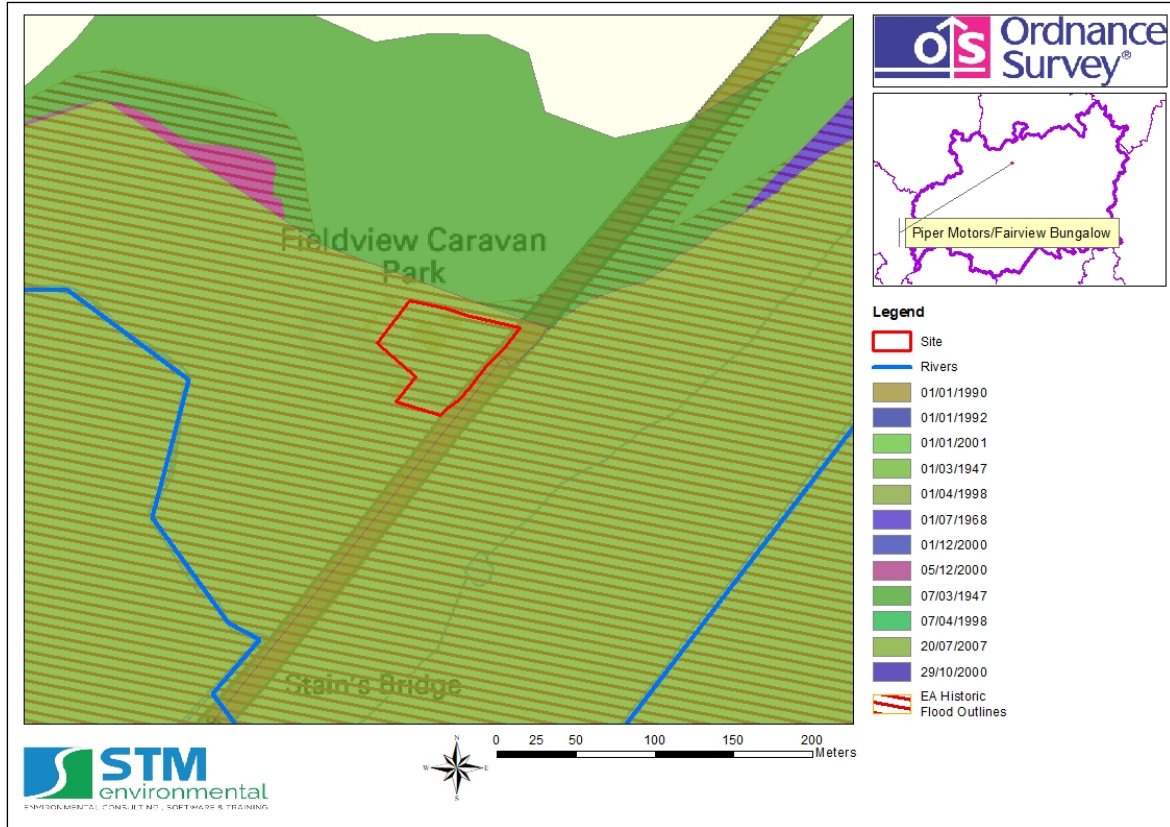


17.4.3 Topographical Survey Map (PDF)

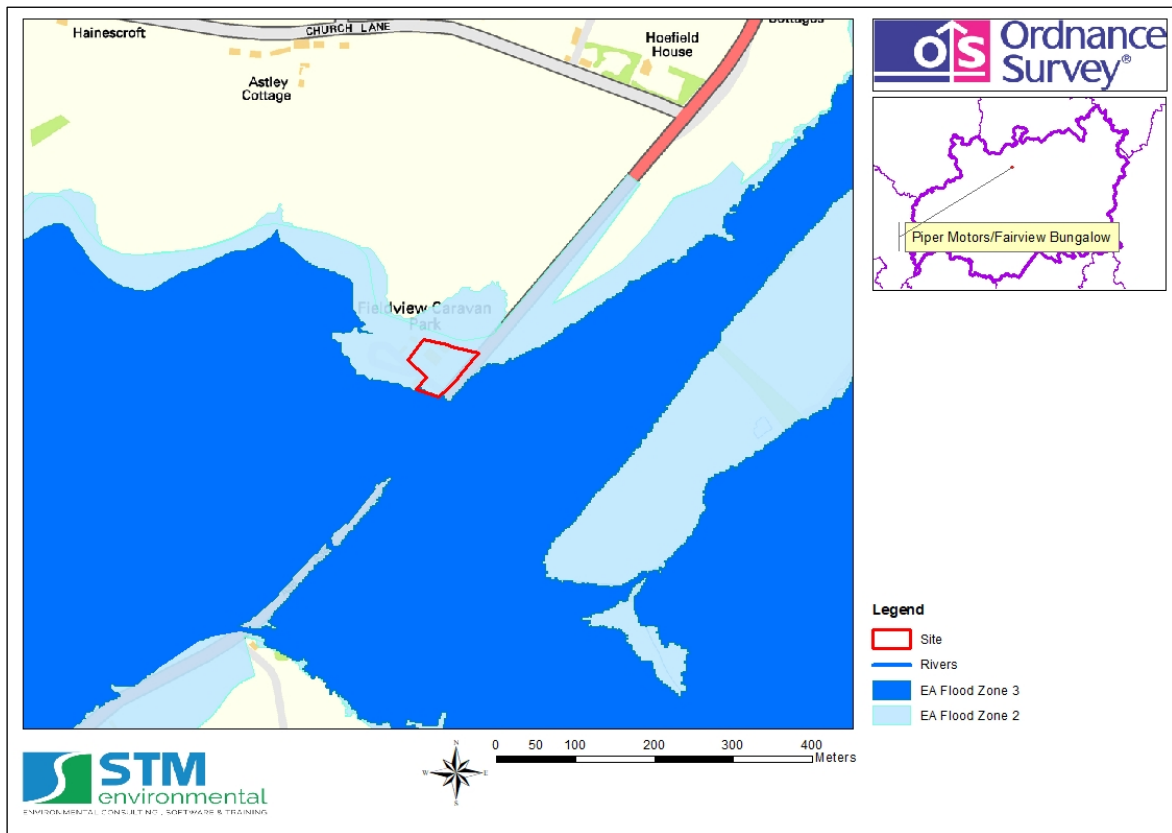
17.5 Appendix 5 – Historical Flood Incident Maps

17.5.1 EA Historic Flood Outlines

17.5.2 Back to Section: 11.1.2 Records of Historic Fluvial Flooding Incidents



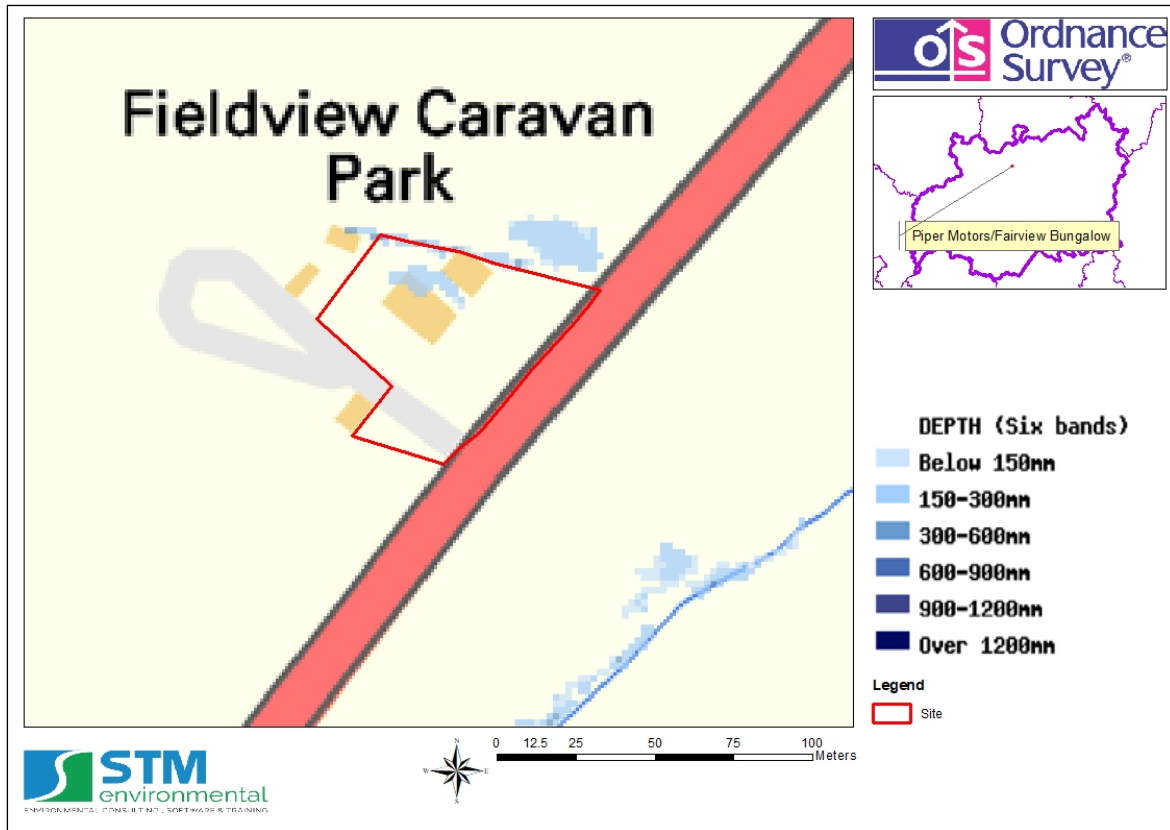
17.6 Appendix 6 - EA Flood Zone Map



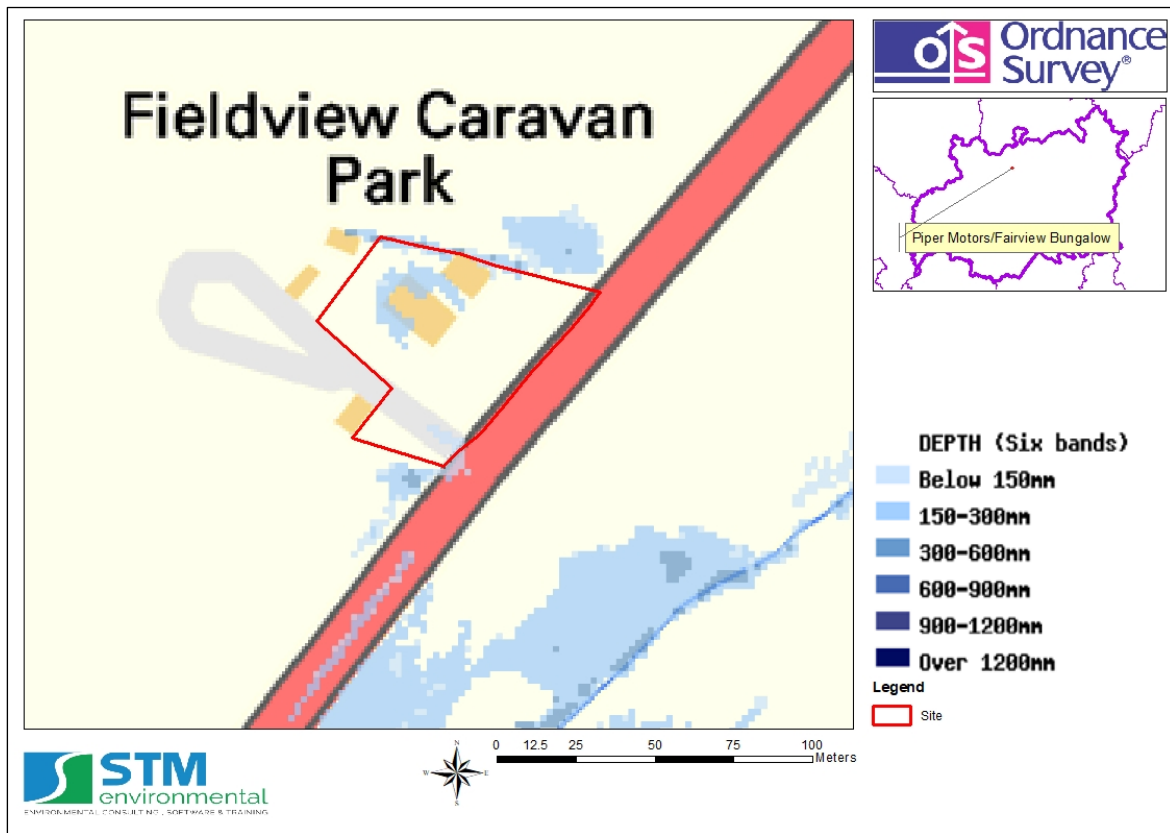
[Click to go to 11.1.4 Designated Fluvial Flood Risk Zone for the Site](#)

17.7 Appendix 7 – Surface Water Flood Extent and Depth Maps

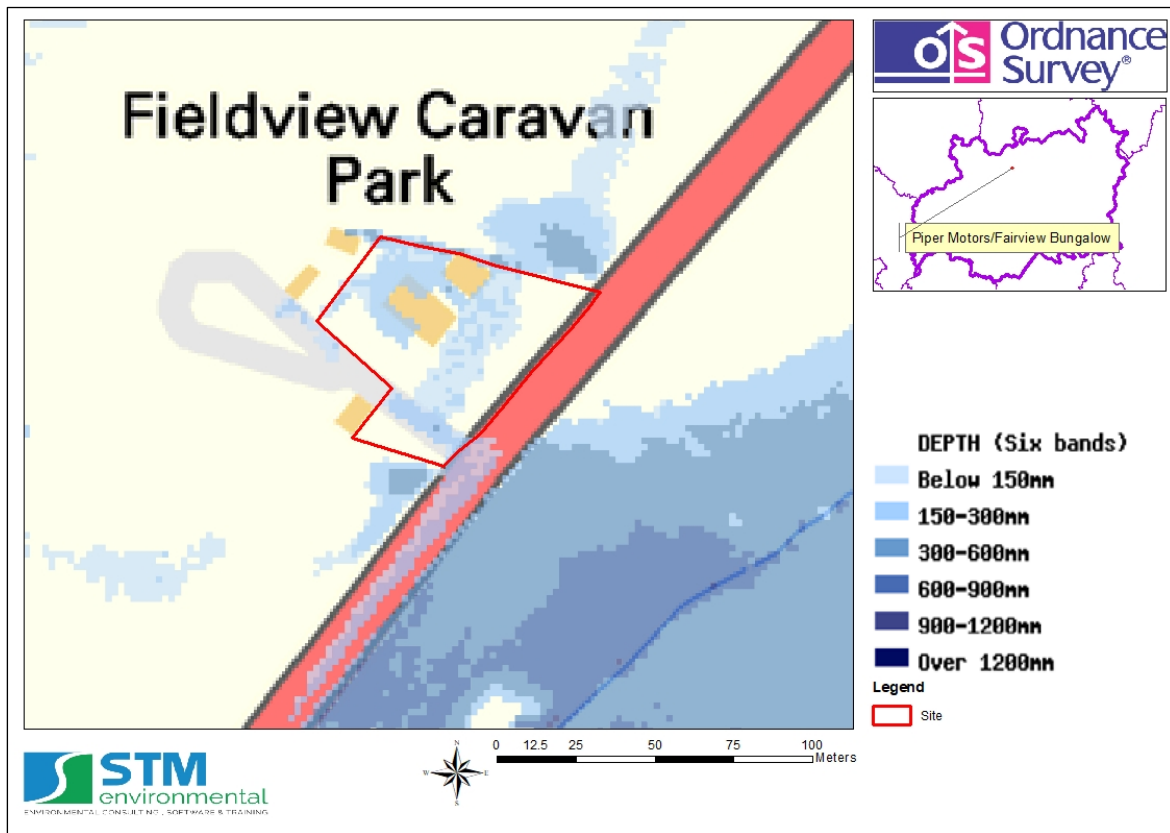
17.7.1 Predicted surface water flood depth for the 1 in 30-year return period (Source: EA, 2016).
EA, 2016).



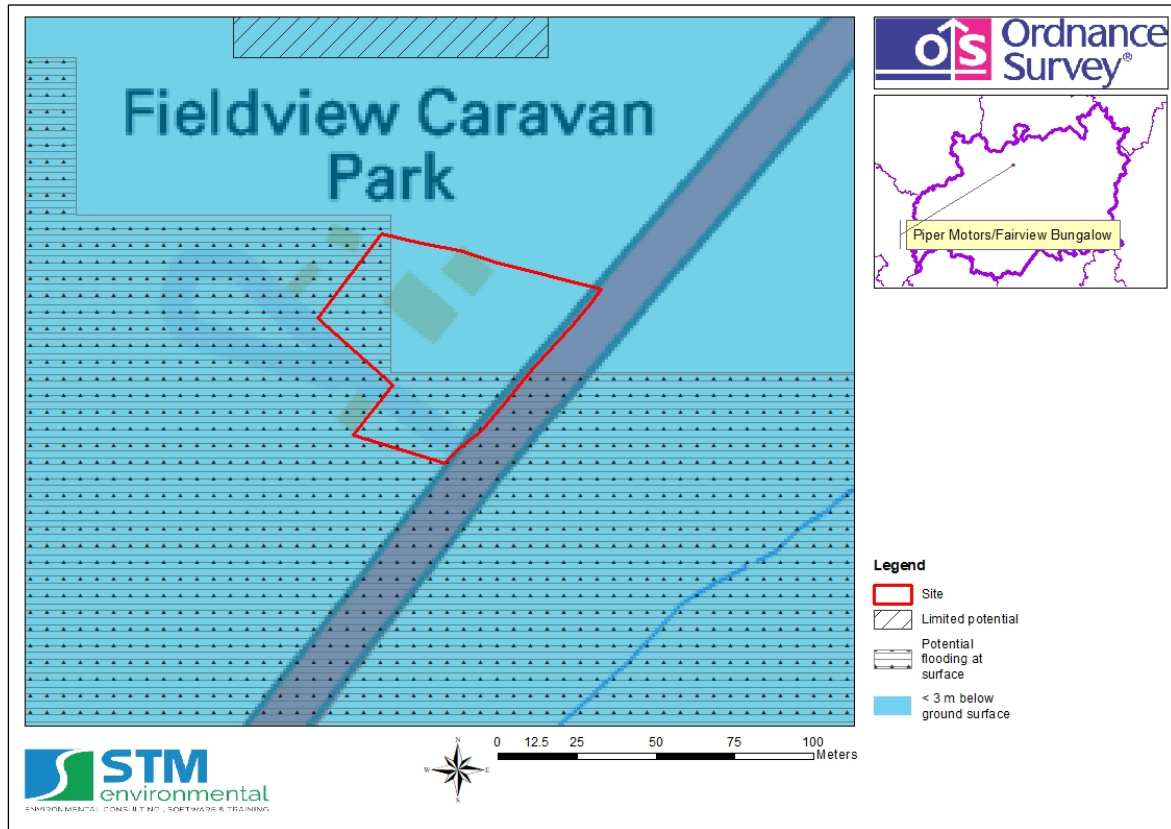
17.7.2 Predicted surface water flood depth for the 1 in 100-year return period (Source: EA, 2016).



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



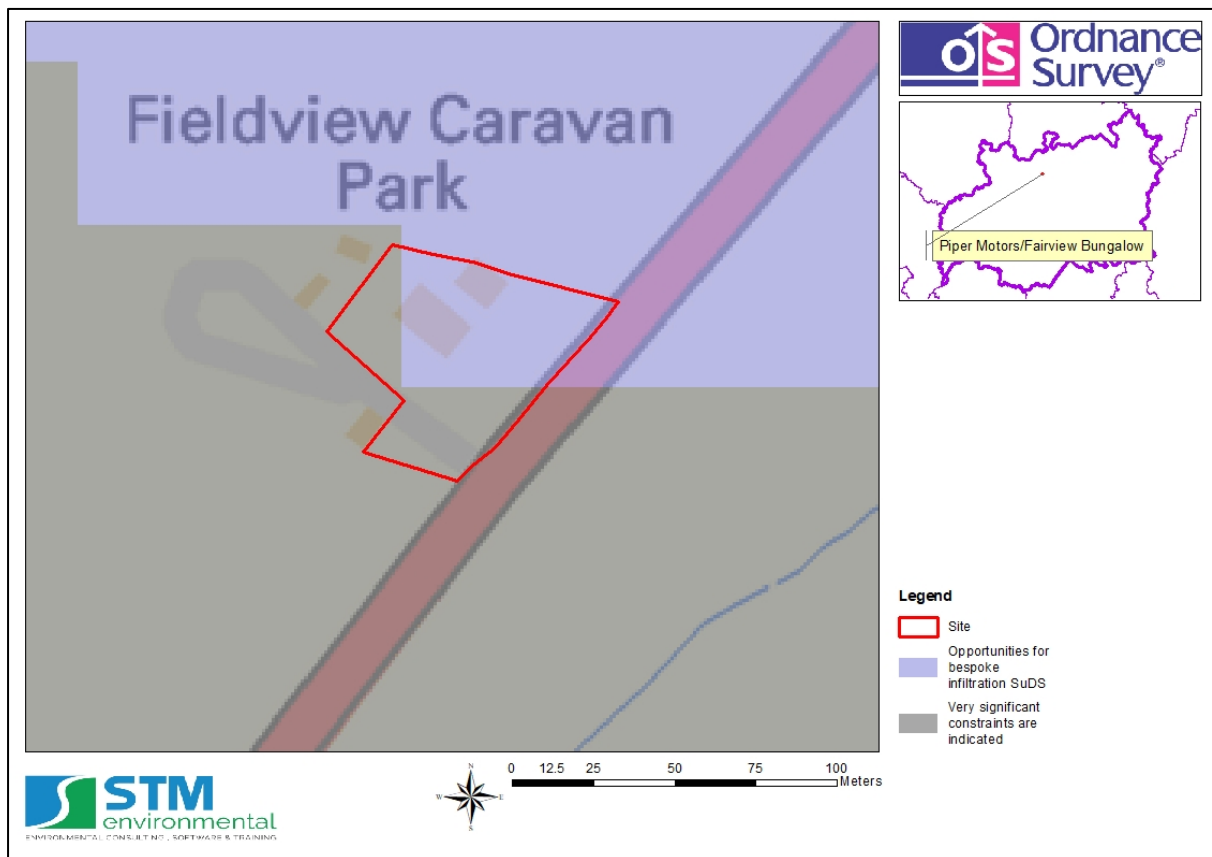
17.8 Appendix 8 – Groundwater Flood Susceptibility Map



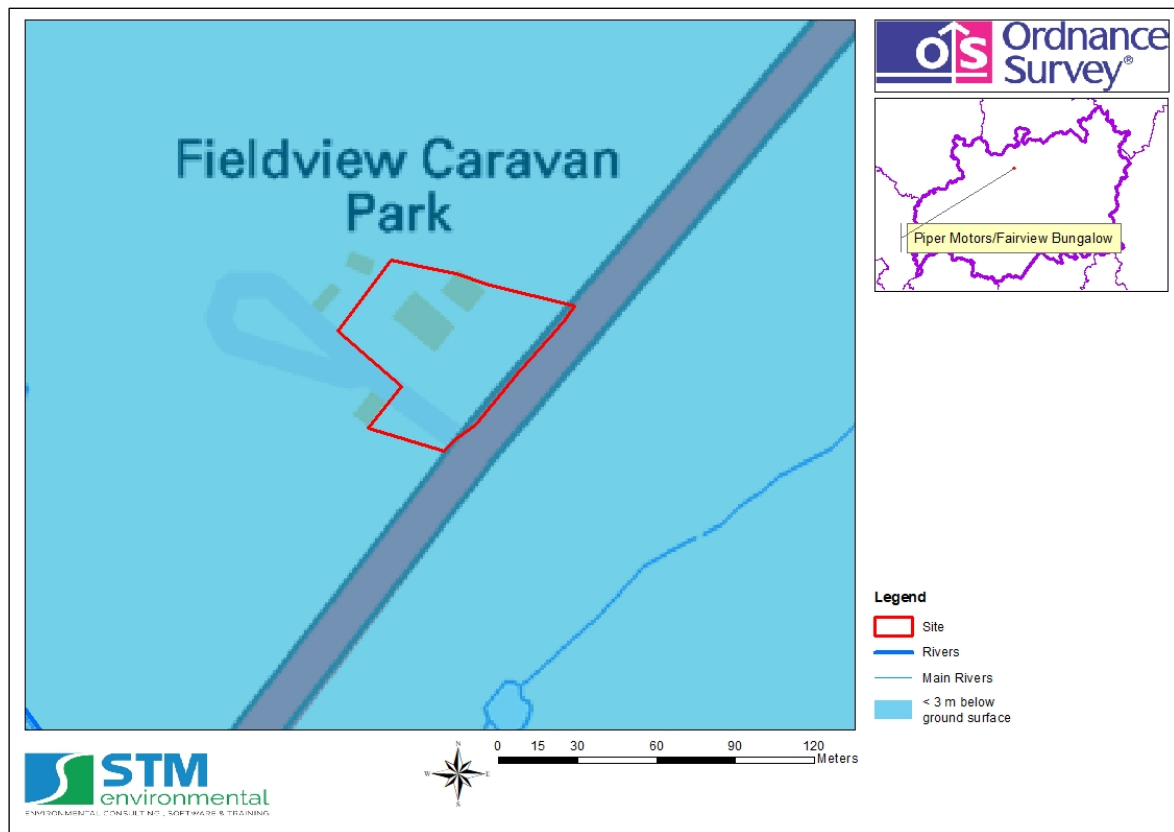
[Click to go to section 11.4 Groundwater Flood Risk](#)

17.9 Appendix 9 - SuDS Potential Maps

17.9.1 BGS Map Showing Infiltration Potential at the Site



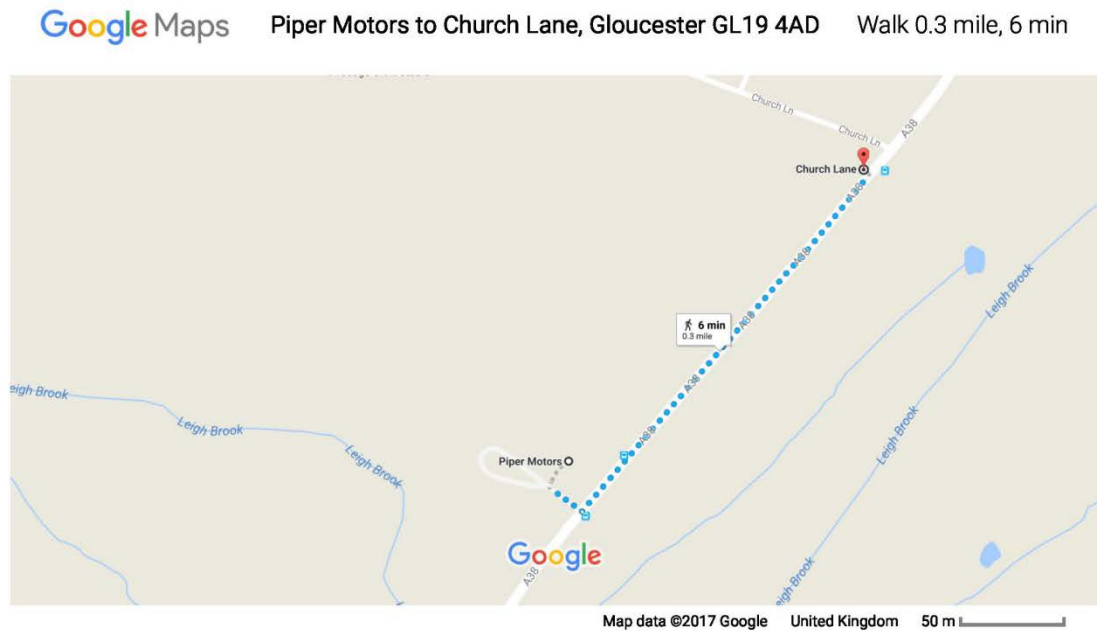
17.9.2 BGS Map Showing Potential Depth to the Groundwater Water Table



[Click to go to Section 11.7 SuDS](#)

17.10 Appendix 10 - Safe Egress to Flood Zone 1 Map

Click



Piper Motors

Fieldview Bungalow/Gloucester Rd, Gloucester GL19 4AA

Use caution - may involve errors or sections not suited for walking

- ↑ 1. Walk south-east towards A38
▲ Restricted-usage road
128 ft
- ↶ 2. Turn left onto A38
📍 Destination will be on the left
0.3 mi

Church Lane

Gloucester GL19 4AD

These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.

17.11 Appendix 11 – EA Product 4 (Detailed Flood Risk) Data



Francesca Caggiano
STM Environmental
Unit 6, Crane Mews
32 Gould Road
Twickenham
London
TW2 6RS

Our ref: 101187
Your ref:
Date: 18 October 2018

Dear Francesca

Enquiry regarding Product 4 for Fieldview Bungalow, The Leigh, Glos, GL19 4AA

Thank you for your enquiry which was received on 26 September.

We respond to requests under the Freedom of Information Act 2000 and Environmental Information Regulations 2004. The information is attached.

I enclose product 4 data, flood map, node map, outline map and CC guidance.

Name	Product 4
Description	Detailed Flood Risk Assessment Map for GL19 4AA
Licence	Open Government Licence
Information Warnings	n/a
Information Warning - OS background mapping	<i>The mapping of features provided as a background in this product is © Ordnance Survey. It is provided to give context to this product. The Open Government Licence does not apply to this background mapping. You are granted a non-exclusive, royalty free, revocable licence solely to view the Licensed Data for non-commercial purposes for the period during which the Environment Agency makes it available. You are not permitted to copy, sub-license, distribute, sell or otherwise make available the Licensed Data to third parties in any form. Third party rights to enforce the terms of this licence shall be reserved to OS.</i>
Attribution	Contains Environment Agency information © Environment Agency and/or database rights. Contains Ordnance Survey data © Crown copyright 2017 Ordnance Survey 100024198.

Data Available Online

Many of our flood datasets are available online:

- Flood Map For Planning ([Flood Zone 2](#), [Flood Zone 3](#), [Flood Storage Areas](#), [Flood Defences](#), [Areas Benefiting from Defences](#))
- [Risk of Flooding from Rivers and Sea](#)
- [Historic Flood Map](#)
- [Current Flood Warnings](#)

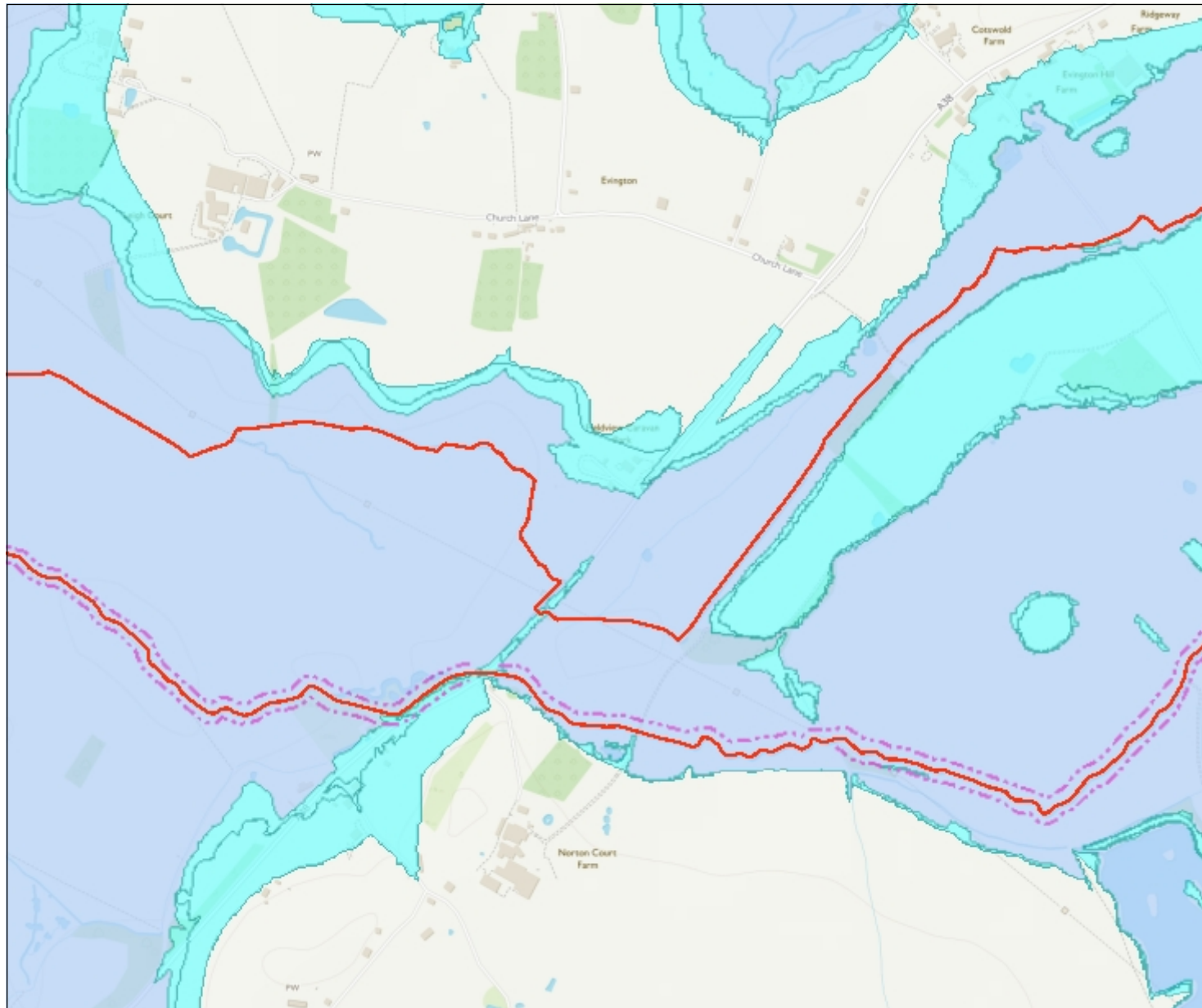
Please get in touch if you have any further queries or contact us within two months if you'd like us to review the information we have sent.

Yours sincerely

Diane Edwards
Customers & Engagement Officer
West Midlands Area

For further information please contact the Customers & Engagement team on
Tel. 02084 747856
Direct e-mail:- enquiries_WestMids@environment-agency.gov.uk

Flood Map for Planning (Rivers and Sea) Centred on GL19 4AA - created 12/10/2018 [101187]



1: 10,000

0 Metres 250



Flood Map for Planning (Rivers & Sea)

- Statutory Main Rivers
- - - Defences
- Flood Storage Areas
- Areas benefiting from flood defences
- Flood Zone 3
- Flood Zone 2

Flood Map Areas (assuming no defences)

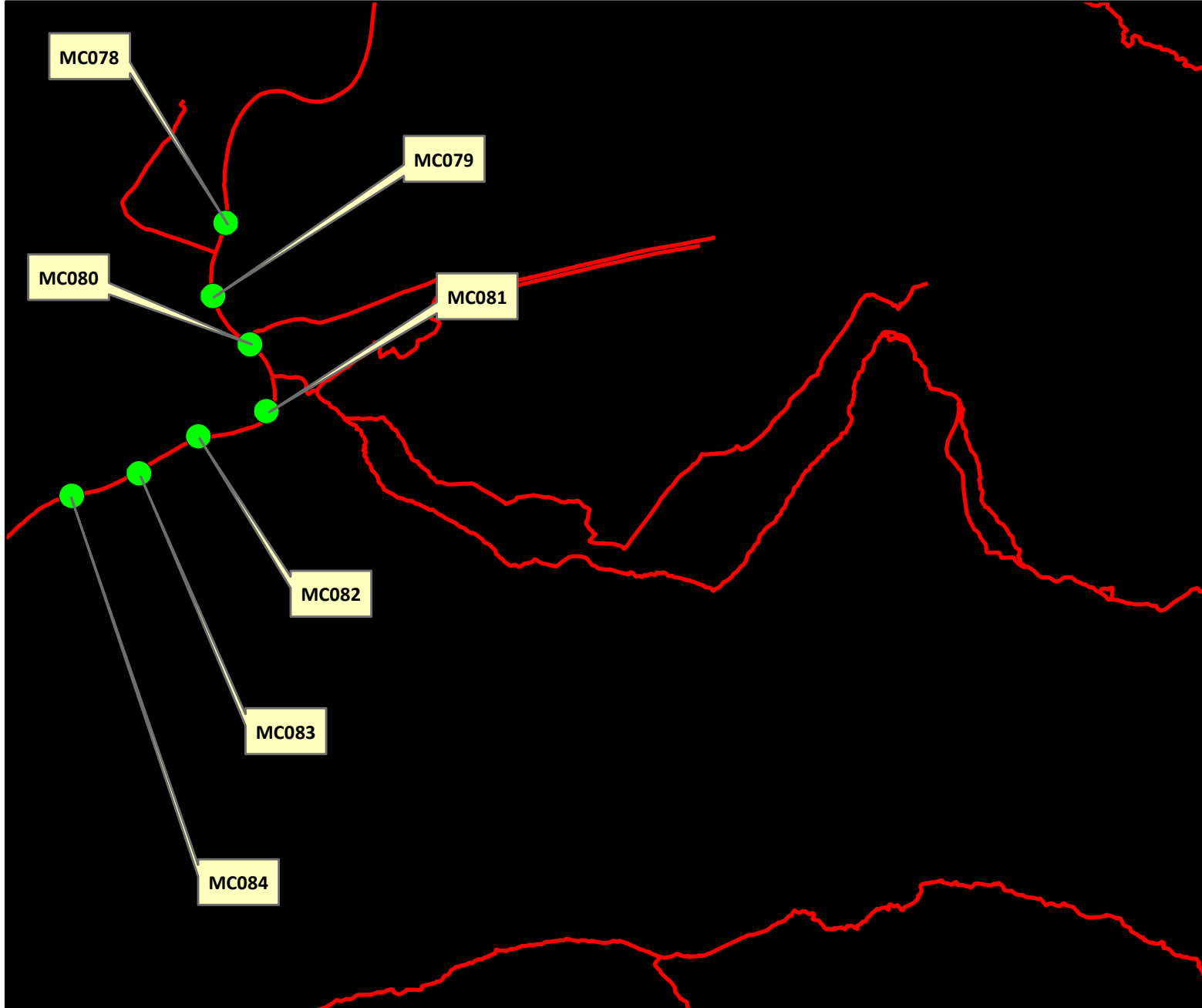
Flood Zone 3 shows the area that could be affected by flooding:

- from the sea with a 1 in 200 or greater chance of happening each year
- or from a river with a 1 in 100 or greater chance of happening each year.

Flood Zone 2 shows the extent of an extreme flood from rivers or the sea with up to a 1 in 1000 chance of occurring each year.

Node Location Map

Centred on (387082, 225270) - Created 17/10/2018 [101187]



Scale 1:40,000



Legend

-  1D Nodes
-  Main River

Created by Partnership and Strategic Overview Team, West Midlands

Modelled Flood Outlines




Centred on (387082, 225270) - Created 17/10/2018 [101187]



Scale 1:40,000



Legend

-  Main River
-  1% AEP (1 in 100yr) - River Sever
-  0.1% AEP (1 in 1000yr) - River Sever

Annual Exceedance Probability (AEP) represents the probability of a flood of a particular magnitude, or greater, occurring in any given year.

Created by Partnership and Strategic Overview Team, West Midlands

Product 4 (Detailed Flood Risk Data) for GL19 4AA

Reference number: [101187]

Date of issue: 17 October 2018

Model Information

The following information and attached maps contain a summary of the modelled information relevant to the area of interest. The information provided is based on the best available data as of the date of issue.

Model Name	Release Date
River Severn Tidal	2007
Caveat	
1D Combination Model of Tidal & Fluvial	

Flood Map for Planning (Rivers and Sea)

The Flood Map for Planning (Rivers and Sea) indicates the area at risk of flooding, **assuming no flood defences exist**, for a flood event with a 0.5% chance of occurring in any year for flooding from the sea, or a 1% chance of occurring in any year for fluvial (river) flooding (Flood Zone 3). It also shows the extent of the Extreme Flood Outlines (Flood Zone 2) which represents the extent of a flood event with a 0.1% chance of occurring in any year, or the highest recorded historic extent if greater. The Flood Zones refer to the land at risk of flooding and **do not** refer to individual properties. It is possible for properties to be built at a level above the floodplain but still fall within the risk area.

This Flood Map only indicates the extent and likelihood of flooding from rivers or the sea. It should also be remembered that flooding may occur from other sources such as surface water, sewers, road drainage, etc.

Flood zones

- **Zone 1** - The area is within the lowest probability of flooding from rivers and the sea, where the chance of flooding in any one year is less than 0.1% (i.e. a 1000 to 1 chance).
- **Zone 2** - The area which falls between the extent of a flood with an annual probability of 0.1% (i.e. a 1000 to 1 chance) fluvial and tidal, or greatest recorded historic flood, whichever is greater, and the extent of a flood with an annual

probability of 1% (i.e. a 100 to 1 chance) fluvial / 0.5% (i.e. a 200 to 1 chance) tidal. (Land shown in light blue on the Flood Map).

- **Zone 3** - The chance of flooding in any one year is greater than or equal to 1% (i.e. a 100 to 1 chance) for river flooding and greater than or equal to 0.5% (i.e. a 200 to 1 chance) for coastal and tidal flooding.

Flood Zones do not provide information on flooding from groundwater or other sources.

Areas Benefitting From Defences

Where possible we show the areas that benefit from the flood defences, in the event of flooding:

- from rivers with a 1% (1 in 100) chance in any given year, or;
- from the sea with a 0.5% (1 in 200) chance in any given year.

If the defences were not there, these areas would flood. Please note that we do not show all areas that benefit from flood defences.

The associated Dataset is available here: <https://data.gov.uk/dataset/flood-map-for-planning-rivers-and-sea-areas-benefiting-from-defences>

Node Data/ Modelled Levels

The attached flood map will show a selection of 1D model node points near to your site. The fluvial levels and flows for these node points are shown below.

Fluvial / Tidal Flood Levels (m AOD)

The modelled levels are given in m AOD (N), m AOD indicates metres Above Ordnance Datum (Newlyn).

The information is taken from the model referenced above and does not include the updated climate change figures.

			Annual Exceedance Probability - Maximum Water Levels (m AOD) (Undefended)									
Node Label	Easting	Northing	20% Fluvial, 1.33% Tidal	20% Fluvial, 1% Tidal	20% Fluvial, 0.5% Tidal	20% Fluvial, 0.5% Tidal inc. 20% Climate Change	20% Fluvial, 0.1% Tidal	1.33% Fluvial, 50% Tidal	1% Fluvial, 50% Tidal	1% Fluvial, 50% Tidal inc. 20% Climate Change	0.5% Fluvial, 50% Tidal	0.1% Fluvial, 50% Tidal
MC078	384460	227212	11.19	11.19	11.19	11.33	11.19	11.61	11.67	12.04	11.80	12.56
MC079	384373	226712	11.17	11.18	11.18	11.33	11.18	11.60	11.67	12.03	11.80	12.56
MC080	384626	226380	11.13	11.14	11.14	11.32	11.14	11.61	11.67	12.04	11.80	12.56
MC081	384737	225923	11.06	11.06	11.06	11.29	11.07	11.59	11.65	12.03	11.79	12.56
MC082	384274	225751	11.01	11.01	11.01	11.27	11.03	11.58	11.65	12.02	11.78	12.54
MC083	383863	225495	10.98	10.98	10.99	11.26	11.00	11.57	11.64	12.01	11.78	12.54
MC084	383405	225340	10.98	10.99	10.99	11.26	11.01	11.57	11.64	12.01	11.77	12.52

Fluvial / Tidal Flood Flows (m³/s)

The fluvial flood flows for the model nodes are measured in cubic metres per second, or cumecs (m³/s).

			Annual Exceedance Probability - Maximum Water Flows (m ³ /s) (Undefended)									
Node Label	Easting	Northing	20% Fluvial, 1.33% Tidal	20% Fluvial, 1% Tidal	20% Fluvial, 0.5% Tidal	20% Fluvial, 0.5% Tidal inc. 20% Climate Change	20% Fluvial, 0.1% Tidal	1.33% Fluvial, 50% Tidal	1% Fluvial, 50% Tidal	1% Fluvial, 50% Tidal inc. 20% Climate Change	0.5% Fluvial, 50% Tidal	0.1% Fluvial, 50% Tidal
MC078	384460	227212	593.2	592.8	591.2	655.5	588.2	746.3	761.0	898.3	809.9	1168.6
MC079	384373	226712	534.1	533.6	533.3	512.5	531.7	595.0	611.1	740.0	657.9	977.8
MC080	384626	226380	487.0	486.5	485.4	485.5	484.0	513.9	515.9	564.9	512.4	792.4
MC081	384737	225923	514.2	514.1	513.4	513.1	511.4	536.6	541.1	531.6	539.8	618.8
MC082	384274	225751	470.0	469.9	469.9	461.8	471.1	481.6	486.2	468.0	486.3	474.4
MC083	383863	225495	446.4	446.1	446.4	443.2	448.5	463.8	458.3	442.5	452.1	466.6
MC084	383405	225340	381.8	393.1	380.7	393.1	380.6	391.2	386.8	393.7	387.1	403.0

Modelled Flood Extents

Please find attached a map showing the results of the model (referenced above) for your area. This shows modelled flood extents, not taking into account flood defences. Climate change will increase flood risk due to overtopping of defences.

Climate Change

In February 2016 the '[Flood Risk Assessments: Climate Change Allowances](#)' were published on GOV.UK. This is in replacement of previous climate change allowances for planning applications. The data provided in this product does not include the new allowances. You will need to consider this data and factor in the new allowances to demonstrate the development will be safe from flooding. The fluvial climate change factors are now more complex and a single uplift percentage across England cannot be justified.

The Environment Agency will incorporate the new allowances into future modelling studies. For now, it remains the applicant's responsibility to demonstrate through their proposal and flood risk assessments that new developments will be safe in flood risk terms for its lifetime.

Recorded Flood Outlines

Following an examination of our records of historical flooding we do hold records of flooding for this area, please find tabulated information below for these recorded flood events.

Flood event code	Flood event date	Recorded Level m AOD(N)	Source of flooding	Cause of flooding
2283	March 1947	-	Fluvial	Channel capacity exceeded, no raised flood defences.
2475	April 1998	11.2 @ Haw Bridge Not recorded @ Ashleworth	Fluvial	Channel capacity exceeded, no raised flood defences.
2257	December 2000	11.61 @ Haw Bridge 11.38 @ Ashleworth	Fluvial	Channel capacity exceeded, no raised flood defences.
2854	July 2007	12.22 @ Haw Bridge 12.03 @ Ashleworth	Fluvial	Channel capacity exceeded, no raised flood defences.

The corresponding recorded flood outline/s can be accessed here:

<https://data.gov.uk/dataset/recorded-flood-outlines1>

The Recorded Flood Outlines take into account the presence of defences, structures, and other infrastructure where they existed at the time of flooding. It includes flood extents that may have been affected by overtopping, breaches or blockages. Any flood extents shown do not necessarily indicate that properties were flooded internally. It is also possible that the pattern of flooding in this area has changed and that this area would now flood or not flood under different circumstances.

Please note that our records are not comprehensive and that the map is an indicative outline of areas which have previously flooded, not all properties within this area will have flooded. It is possible that other flooding may have occurred that we do not have records for.

You may also wish to contact your Local Authority or Internal Drainage Board (where relevant), to see if they have other relevant local flood information.

Flood Defences

Flood defences within the area of interest are listed below.

Flood defences do not completely remove the chance of flooding. They can be overtopped by water levels which exceed the capacity of the defences.

The associated Dataset is available here: <https://data.gov.uk/dataset/spatial-flood-defences-including-standardised-attributes>

Defence description	Location	Asset Maintainer	Protection Type
Embankment	Left Bank	Environment Agency	Fluvial
Embankment	Right Bank	Environment Agency	Fluvial

Planning development/s

If you have requested this information to help inform a development proposal, then you should note the information on GOV.UK on the use of Environment Agency Information for Flood Risk Assessments. You can also request pre application advice:

<https://www.gov.uk/planning-applications-assessing-flood-risk>

<https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion>

Supporting Information

Surface Water

Managing the risk of flooding from surface water is the responsibility of Lead Local Flood Authorities. The 'risk of flooding from surface water' map has been produced by the Environment Agency on behalf of government, using information and input from Lead Local Flood Authorities.

You may wish to contact your Local Authority who may be able to provide further detailed information on surface water.

It is not possible to say for certain what the flood risk is but we use the best information available to provide an indication so that people can make informed choices about living with or managing the risks. The information we supply does not provide an indicator of flood risk at an individual site level. Further information can be found on the Agency's website:

<https://flood-warning-information.service.gov.uk/long-term-flood-risk>

Flood Risk from Reservoirs

The Flood Risk from Reservoirs map can be found on the Long Term Flood Risk Information website:

<https://flood-warning-information.service.gov.uk/long-term-flood-risk/map?map=Reservoirs>

Flood Alert & Flood Warning Area

We issue flood alert/warnings to specific areas when flooding is expected. If you receive a flood warning you should take immediate action.

You can check whether you are in a Flood Alert/Warning Area and register online using the links below:

<https://www.gov.uk/check-flood-risk>

<https://www.gov.uk/sign-up-for-flood-warnings>

If you would prefer to register by telephone, or if you need help during the registration process, please call Floodline on 0345 988 1188.

The associated dataset for flood warning areas is available here:

<https://data.gov.uk/dataset/flood-warning-areas3>

The associated dataset for flood alert areas is available here:

<https://data.gov.uk/dataset/flood-alert-areas2>

Flood Risk Activity Permits

We now consider applications for works, which may be Flood Risk Activities, under Environmental Permitting Regulations. This replaces the process of applying for a Flood Defence Consent. You may need an environmental Permit for flood risk activities if you want to do work:

- in, under, over or near a main river (including where the river is in a culvert)
- on or near a flood defence on a main river
- in the flood plain of a main river
- on or near a sea defence

Please go to this website to find out more about how to apply:

<https://www.gov.uk/guidance/flood-risk-activities-environmental-permits>.

Please be aware that Bespoke and Standard Rules permits can take up to 2 months to determine and will incur a charge.

Further details about the Environment Agency information supplied can be found on the GOV.UK website:

<https://www.gov.uk/browse/environment-countryside/flooding-extreme-weather>