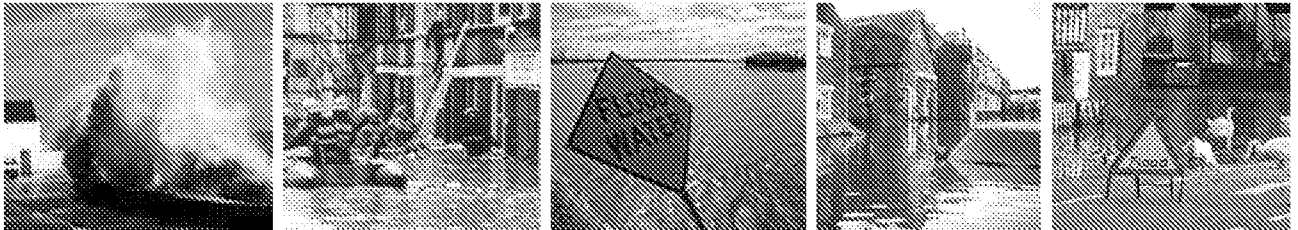


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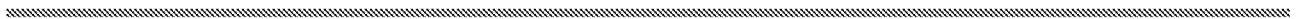
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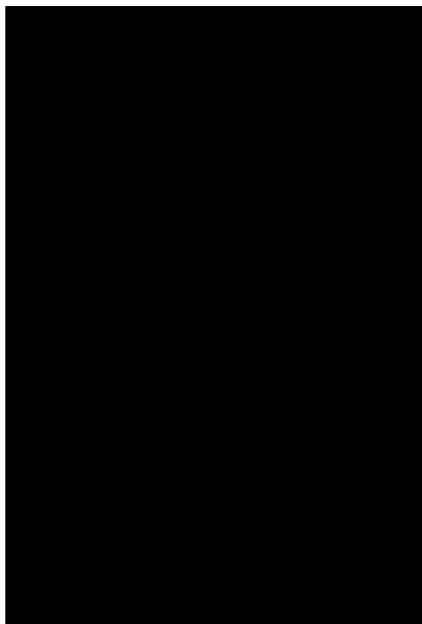


Client: Riverside Caravan Centre

Flood Risk Assessment for the
Proposed Development at Riverside
Caravan Centre, Bognor Regis

September 2019





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Flood Risk Assessment for the Proposed
Development at Riverside Caravan Centre,
Bognor Regis

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1 Background and Scope of Appraisal

Flooding is a major issue in the United Kingdom. The impacts can be devastating in terms of the cost of repairs, replacement of damaged property and loss of business. The objectives of the Flood Risk Assessment (FRA) are therefore to establish the following:

- whether a proposed development is likely to be affected by current or future flooding from any source
- whether the development will increase flood risk elsewhere within the floodplain
- whether the measures proposed to address these effects and risks are appropriate
- whether the site will pass the second element of the Exception Test (where applicable).

Herrington Consulting has been commissioned by Riverside Caravan Centre to prepare a Flood Risk Assessment (FRA) for the proposed development at **Riverside Caravan Centre, Bognor Regis, West Sussex, PO22 9NE.**

This appraisal has been undertaken in accordance with the requirements of the National Planning Policy Framework (2019) and the National Planning Practice Guidance Suite (March 2014) that has been published by the Department for Communities and Local Government. The *Flood Risk and Coastal Change* planning practice guidance included within the Suite represents the most contemporary technical guidance on preparing FRAs. In addition, reference has also been made to Local Planning Policy.

To ensure that due account is taken of industry best practice, this FRA has been carried out in line with the CIRIA Report C624 'Development and flood risk - guidance for the construction industry'.

2 Development Description and Planning Context

2.1 Site Location and Existing Use

The site is located approximately 1.6km inland of the coastal frontage of Bognor Regis and is situated adjacent to the industrial estate. In total the site covers an area of approximately 17.1 hectares and the location of the site in relation to the surrounding area and the Aldingbourne Rife is shown in Figure 2.1. The section of the site which is the subject of this FRA is outlined in blue. The site plan included in Appendix A.1 of this report gives a more detailed reference to the site location and layout.

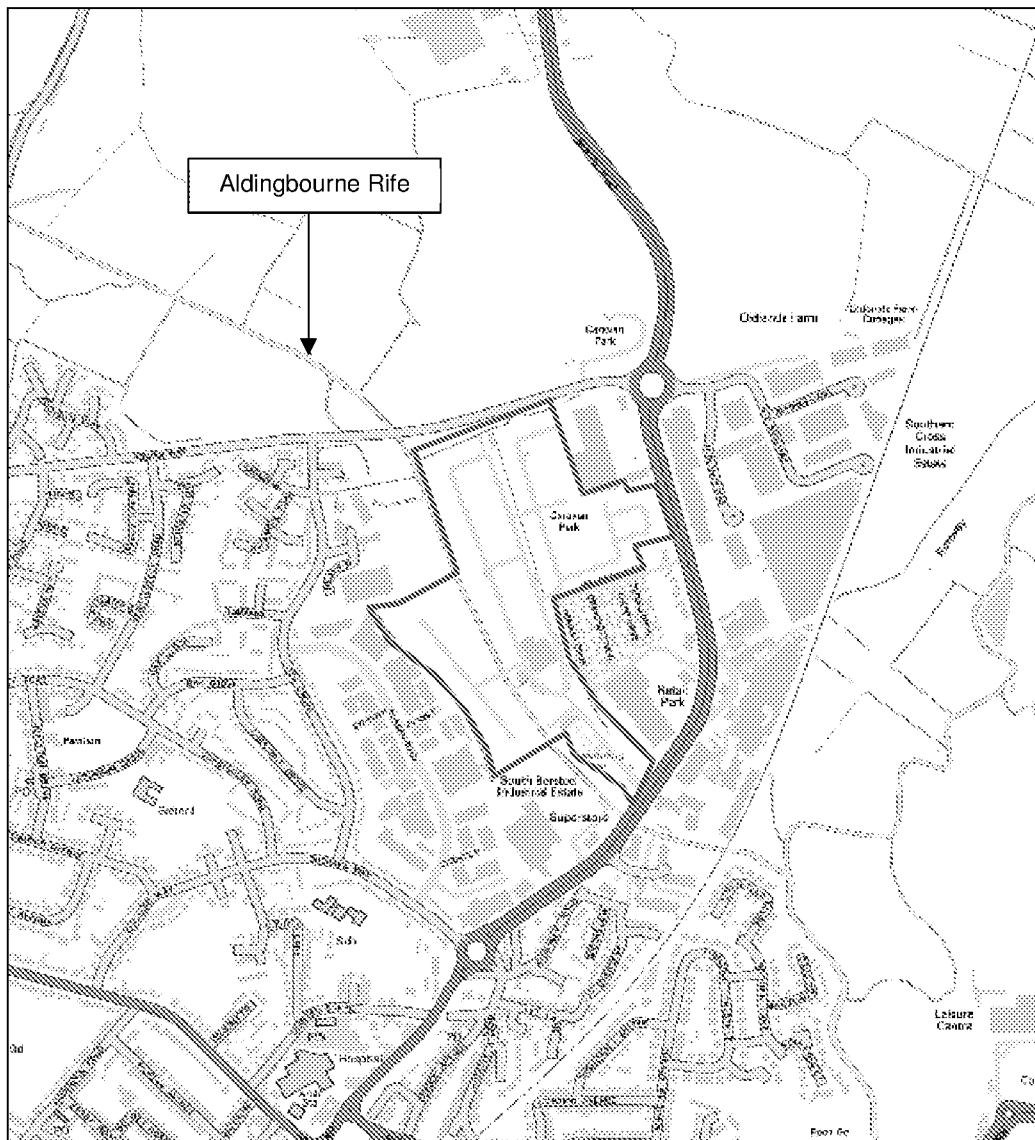


Figure 2.1 – Location map (Contains Ordnance Survey data © Crown copyright and database right 2019). Application site outlined in red.

2.2 Proposed Development

Approval has previously been granted in 2013 to extend the occupancy period for an smaller section of the site to 10 months of the year. The applicant now seeks to change the tourist occupancy period for the entire development site to 12 months.

2.3 The Sequential and Exception Test

The National Planning Policy Framework (NPPF) requires the Sequential Test to be applied at all stages of the planning process and generally the starting point is the Environment Agency's flood zone maps. These maps and the associated information are intended for guidance, and cannot provide details for individual properties. They do not take into account other considerations such as existing flood defences, alternative flooding mechanisms and detailed site based surveys. They do, however, provide high level information on the type and likelihood of flood risk in any particular area of the country. The flood zones are classified as follows:

Zone 1 – Low probability of flooding – This zone is assessed as having less than a 1 in 1000 annual probability of river or sea flooding in any one year.

Zone 2 – Medium probability of flooding – This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding or between 1 in 200 and 1 in 1000 annual probability of sea flooding in any one year.

Zone 3a – High probability of flooding - This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding or 1 in 200 or greater annual probability of sea flooding in any one year.

Zone 3b – The Functional Floodplain – This zone comprises land where water has to flow or be stored in times of flood and can be defined as land which would flood during an event having an annual probability of 1 in 20 or greater. This zone can also represent areas that are designed to flood in an extreme event as part of a flood alleviation or flood storage scheme.

The location of the site is shown on the Environment Agency's flood zone map in Figure 2.2 and the information provided by this map has been interrogated and summarised in Table 2.2 below.

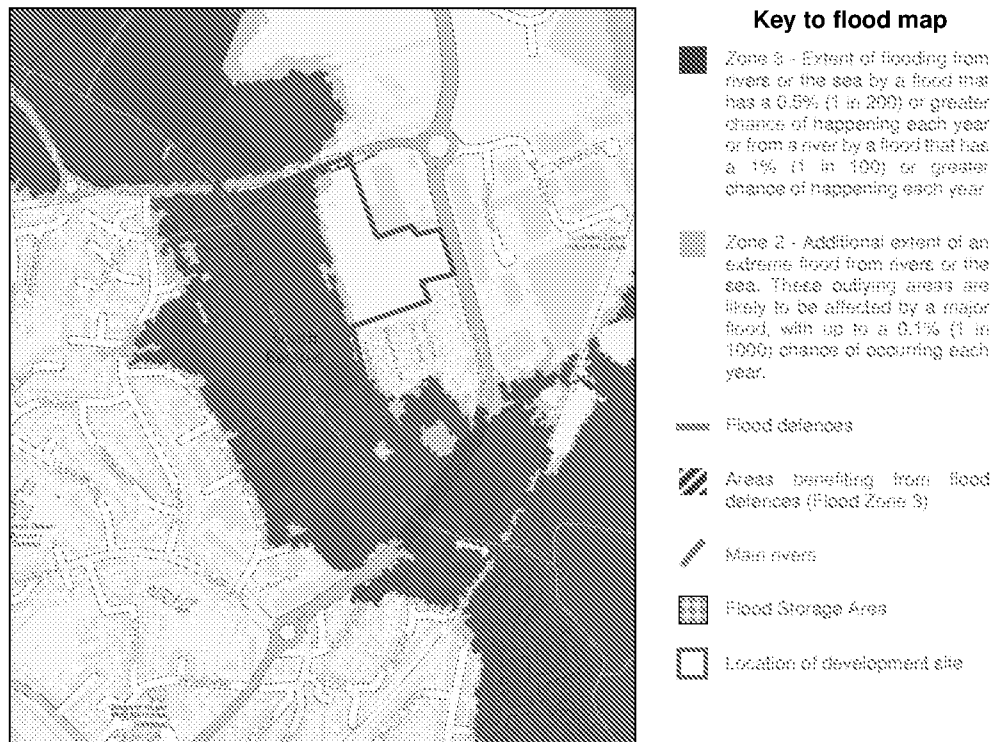


Figure 2.2 – Flood zone map showing the location of the development site (@ Environment Agency)

The above mapping shows the development site is partially located within Flood Zones 2 and 3 and identifies that the site does not benefit from existing flood defences that have been constructed in the last 5 years. This mapping does not distinguish between high risk areas and the functional floodplain, i.e. Zones 3a and 3b. This is an important differentiation that needs to be made by the FRA because the NPPF states that no development, other than essential transport and utilities infrastructure, should be located within the functional floodplain.

The functional floodplain is defined by the NPPF as land where water has to flow or be stored in times of flood during events that have a probability of occurrence of 1 in 20 (5%) or greater in any one year. The Planning Practice Guidance goes on to further clarify this by adding the following definition:

The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. But land which would flood with an annual probability of 1 in 20 (5%) or greater in any year, or is designed to flood in an extreme (0.1%) flood, should provide a starting point for consideration and discussions to identify the functional floodplain. Areas which would naturally flood with an annual exceedance probability of 1 in 20 (5%) or greater, but which are prevented from doing so by existing infrastructure or solid buildings will not normally be defined as functional floodplain.

Based on information provided by the Environment Agency and that derived as part of this appraisal, the following functional floodplain test is applied:

Do predicted flood levels show that the site will be affected by an event having a return period of 1 in 20 years or less?	X
Is the site defended by flood defence infrastructure that prevents flooding for events having a return period of 1 in 20 years or greater?	X
Does the site provide a flood storage or floodwater conveyance function?	X
Does the site contain areas that are 'intended' to provide transmission and storage of water from other sources?	X
Is site within the functional floodplain (Zone 3b)?	No

Table 2.1 – Functional floodplain test.

The flood zone mapping and associated information has been summarised in Table 2.2 below.

Flood Zone (percentage of site within zone)		Source of flooding	Benefiting from existing flood defences*
Zone 1	30%	N/A	N/A
Zone 2	10%	River (Tidal)	No
Zone 3a	60%		
Zone 3b	0%	-	-

(*) The flood zone maps only recognise defences constructed within the last 5 years

Table 2.2 – Flood zone classification.

The NPPF states that the Local Planning Authority (LPA) should apply the sequential approach as part of the identification of land for development in areas at risk from flooding. The overarching objective of the Sequential Test is to ensure that lower risk sites are developed before sites in higher risk areas. When applying the Sequential Test, it is also necessary to ensure that the subject site is compared to only those sites that are available for development and are similar in size.

In this case a Sequential Test assessment has not been undertaken in support of this FRA. However, the proposals for the Riverside Caravan Centre are simply to extend the occupancy period and do not include the construction of new buildings or an increase in the number of caravans on the site. Consequently, it is considered that both the Sequential and Exception Test are not applicable in this case.

Notwithstanding this, the NPPF requires that all sites located within Flood Zones 2 and 3 are subject to a Flood Risk Assessment and to meet the requirements for flood risk reduction. The primary focus of this report is therefore to appraise the risk of flooding from all key sources.

3 Definition of Flood Hazard

3.1 Site Specific Information

In addition to the high level flood risk information shown in the Environment Agency (EA) flood zone maps, additional data from detailed studies and other information sources is referenced. This section summarises the additional information collected as part of this FRA.

Site specific flood level data provided by the EA – The EA has been consulted as part of the development of this FRA and a copy of their response is included in Appendix A.2 of this report.

Information contained within the SFRA – The Arun District Council SFRA (2016) contains detailed mapping showing the extent of flooding from a wide range of sources. This document has been referenced as part of this site-specific FRA.

Site-specific topographic surveys – A site-specific topographic survey has not been undertaken at this stage, however, inspection of aerial height data (LiDAR) records shows that the land levels of the site vary between 0.7m and 4.8m Above Ordnance Datum Newlyn (AODN). In general, land levels fall across the site towards the Aldingbourne Rife which runs through the centre of the site.

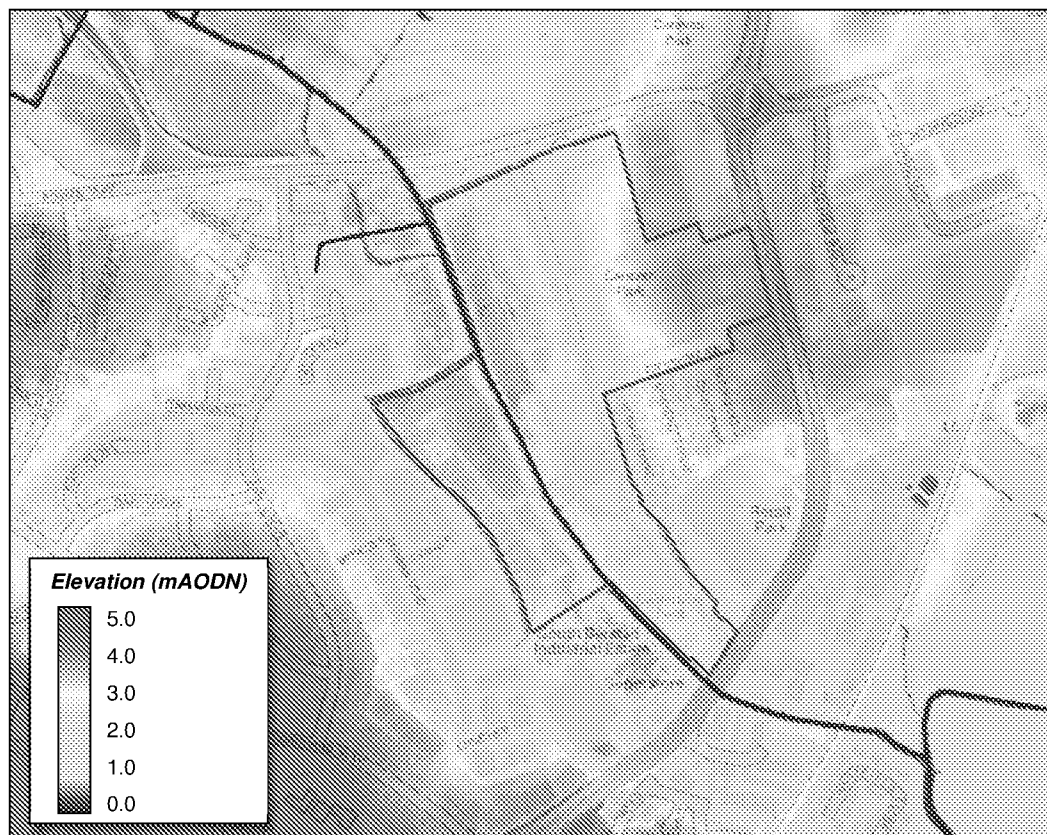


Figure 3.1 – 1m aerial height data showing land levels across the site and surrounding area.

Site Photos – The site has been photographed as part of the topographic survey and a set of the photographs that are referenced on the topographic survey drawing in Appendix A.1 and can be viewed and downloaded via the following link.

<https://photos.app.goo.gl/Llu5VSLPZiamrSke7>

Geology – Reference to the Geological Survey map for this location shows that the underling solid geology in the location of the subject site is Chalk. Overlying this are superficial deposits of River Terrace deposits and raised Marine deposits as shown in Figure 3.2 below.

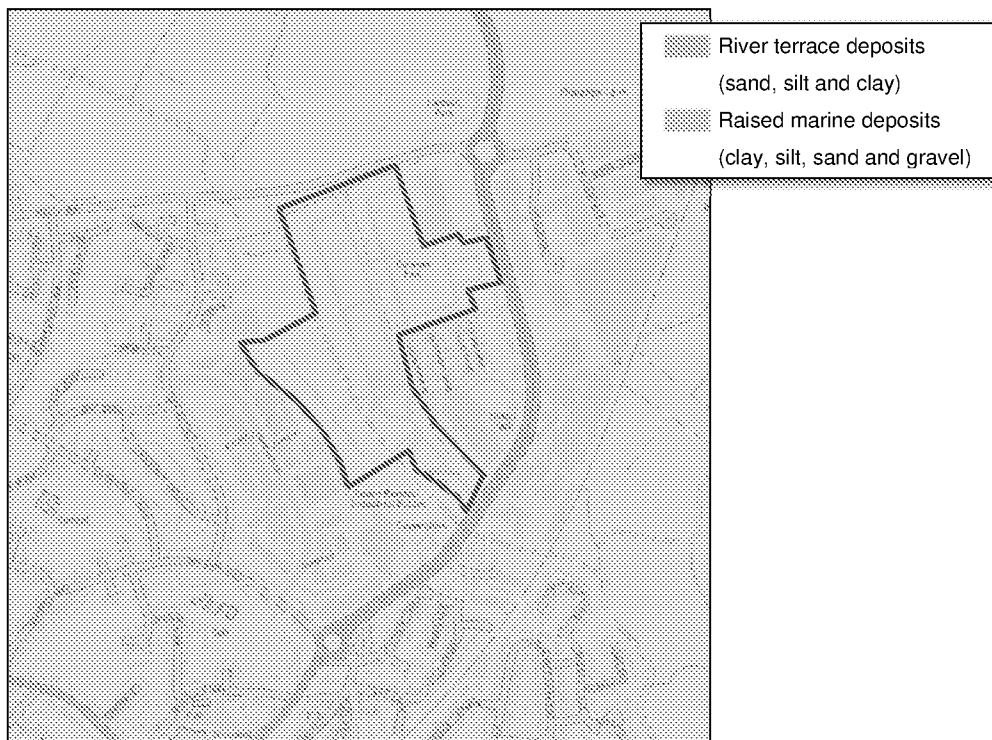


Figure 3.2 – Geology map showing the superficial deposits on the site. (© British Geological Survey, Mapping contains Ordnance Survey Data © Crown copyright and database right 2019)

Historic flooding – Information provided by the EA shows that there are no records of historic flooding at the site from a main river or the sea. The Arun District Council SFRA shows that there has been a historic record of fluvial flooding on site, however, no further information has been provided or revealed through desktop study.

3.2 Potential Sources of Flooding

The main sources of flooding have been assessed as part of this appraisal. The specific issues relating to each one and its impact on this particular development are discussed below. Table 3.1 at the end of this section summarises the risks associated with each of the sources of flooding.

Flooding from Rivers – The main site lies partially within Flood Zone 2 and Flood Zone 3 of the Aldingbourne Rife (main river) as shown on the Environment Agency's flood map. The Rife is

approximately 7km in length and has a number of drainage ditches feeding into it along its length. At its downstream extent river flow is conveyed under the sea defence wall and across the foreshore by two independent gravity outfall structures. However, when tidal conditions and river flows dictate, flow is pumped over the sea wall using three pumps and siphons, discharging into a stilling bay on the upper foreshore (Arun District Council SFRA). From site observations the Rife is on average between six and eight metres wide through the Caravan Centre.

The chalk geology of the South Downs has a significant influence on the behaviour of this watercourse, and others of similar character, across the Sussex coastal plain. Downstream of the Downs, the topography flattens and geology is less permeable. This, combined with discharge being constrained during high tides, means that the area is relatively poorly drained. Flooding from Rifes across the Sussex Coastal Plain can result in relatively shallow depths of flooding and can affect large areas for a significant amount of time.

This source of flood risk has therefore been examined in more detail as part of this FRA.

Flooding from Ordinary or Man-made Watercourses – Natural watercourses that have not been enmained and man-made drainage systems such as irrigation drains, sewers or ditches could potentially cause flooding.

Inspection of the site and surrounding area reveals that the low-lying land in this location is drained by a network of man-made land drains. The primary role of these artificial watercourses is to reduce the groundwater level within the surrounding land, with pumps or tidal sluices being used to discharge flows to the sea. Extreme rainfall, the failure of a pumping station or the tide-locking of the tidal outlet can prevent the system discharging, which may result in increased water levels in the network of drains and ditches. However, due to the large and relatively flat nature of the land that is drained, the consequence of such an event is likely to be water logging of the ground and shallow flooding in the lower-lying areas. The risk and consequence of an extreme event from this source is, however, significantly less than from a tidal flood event described above. The mitigation measures designed to protect against flooding from the river and the sea (discussed in later sections of this report) will provide the site with additional protection against the risk of flooding from the watercourses. For these reasons, the risk of flooding from this source is considered to be low.

Flooding from the Sea – The site lies within a coastal Flood Zone as shown on the EA's 'Flood Map for Planning'. The maps are used as a consultation tool by planners to highlight areas where more detailed investigation into the risk of flooding is required. The fact that the site lies within Flood Zone 3 means that the risk of flooding from this source is examined in more detail in this FRA.

Flooding from Land (overland flow and surface water runoff) – Overland flooding typically occurs in natural valley bottoms as normally dry areas become covered in flowing water and in low spots where water may pond. This flooding mechanism can occur almost anywhere, but is likely to be of particular concern in any topographical low spot, or where the pathway for runoff is restricted by terrain or man-made obstructions.

Figure 3.3 below is an extract of the Environment Agency's 'Flood Risk from Surface Water' map which can be interrogated to identify whether the site is located in an area at risk of surface water flooding.

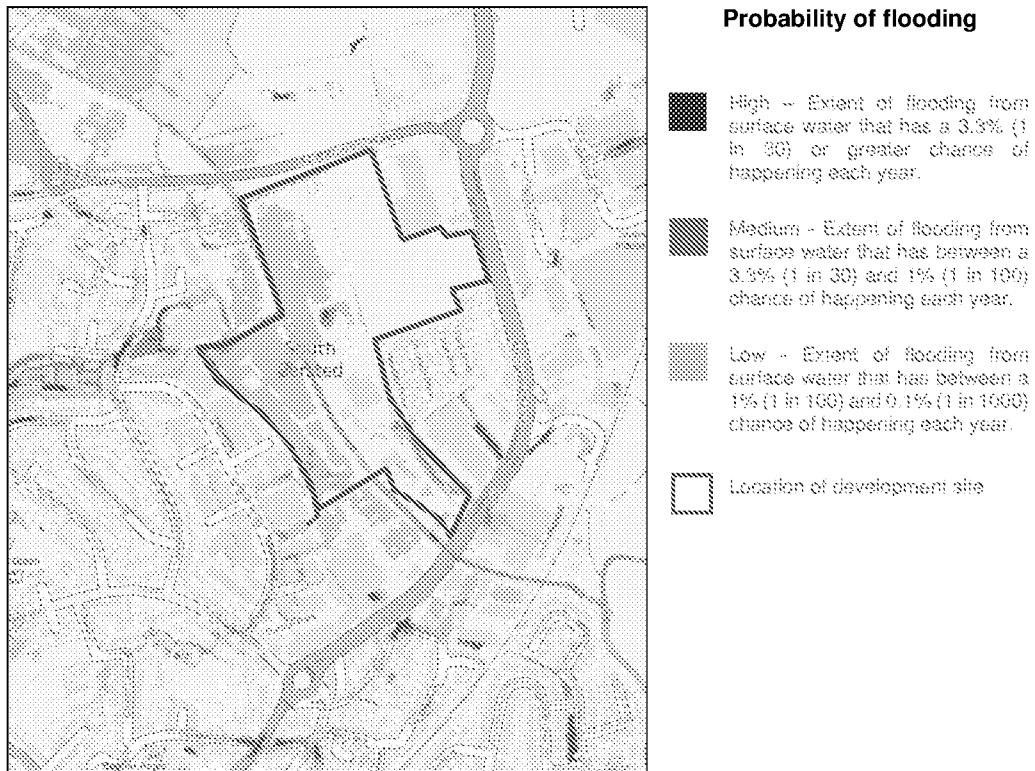


Figure 3.3 – Surface water flooding map showing the location of the development site (@ Environment Agency)

From Figure 3.3, it is evident that the majority of the development site is shown to be at 'very low' risk of flooding from surface water. It is only some areas, which lie in proximity to the river Aldingbourne Rife, that are shown to be at 'low' risk of surface water flooding.

Inspection of aerial height data of the site shows that the site partially lies within the river valley of the Aldingbourne Rife with land levels falling across the site towards the river. Consequently, rain falling on the higher ground of the site will be directed towards the river during an extreme rainfall event. The river will intercept overland flows and direct water away from the site towards the sea via two outfalls.

However, the river in the model used to create the surface water mapping is represented as a dry channel, meaning water will accumulate within the valley in the model. Once the water shown to accumulate within the ditch exceeds the channel banks, water is shown to encroach and pond within the lower-lying surrounding areas as presented in Figure 3.3 above. However, the maps do not take into consideration that the river is flowing and as such, in reality water would drain water away from the site before it could affect the lower-lying areas surrounding the river. Consequently,

it is concluded that the extent of flooding associated with a surface water flood event is overestimated by the maps and is likely to be significantly lower.

Notwithstanding this, the mapping does indicate that flooding could occur in the lower-lying parts of the valley if the river has insufficient capacity to contain all of the runoff generated during an extreme rainfall event. Such an event would be attributed to fluvial flooding and therefore, the risk of flooding from the river is considered in more detail in the Section 5 of this report.

Flooding from Groundwater – Water levels below the ground rise during wet winter months, and fall again in the summer as water flows out into rivers. In very wet winters, rising water levels may lead to the flooding of normally dry land, as well as reactivating flow in ‘bournes’ (streams that only flow for part of the year).

Inspection of this groundwater flood risk mapping data provided by the British Geological Society shows that the general area in which the development site lies is identified as being at high risk from groundwater flooding. The more detailed mapping on groundwater emergence provided as part of the Defra Groundwater Flood Scoping Study (May 2004), which shows areas where groundwater flooding has occurred in the past and also areas that are potentially vulnerable to groundwater emergence has also been referenced as part of this FRA. This shows that no groundwater flooding events were recorded during the very wet periods of 2000/01 or 2002/03 and that the site itself is not located within an area where groundwater emergence is predicted.

The map in Figure 3.2 shows the geology in the area surrounding the study location and from this it can be seen that the superficial deposits within the subject site are predominantly Brickearth with some alluvial deposits adjacent to the watercourse. The solid geology in this area is Chalk and whilst chalk can be a good medium for groundwater flow, the caravan centre is located some distance from spring lines at the foot of the South Downs scarp and at the boundary between Upper Greensand and Gault Clay geological layers, which is where the majority of groundwater emergence occurs. Taking into account all of the above information, the site-specific risk of groundwater flooding is considered to be low.

Flooding from Sewers – In urban areas, rainwater is typically drained into surface water sewers or sewers containing both surface and wastewater known as “combined sewers”.

Whilst the exact extent of the sewer network has not been confirmed, reference to the topographic survey identifies a number of manhole covers across the site. Flooding can result when a sewer is overwhelmed by heavy rainfall, becomes blocked, or has inadequate capacity; this will continue until the water drains away. Notwithstanding this, if water was to exit the sewer network in this area, i.e. as a result of a blockage or an extreme rainfall event, the topography of the site suggests that water would exit the sewer network in the lower-lying areas adjacent to the Aldingbourne Rife following the fall of the land. The mitigation recommended within the report, designed to manage the risk of tidal and fluvial flooding, will be sufficient to limit the risk of flooding from sewer flooding. Information contained within the SFRA shows that there are no historic records of sewer flooding at the site. Consequently, the risk of flooding from this source is considered to be low.

Flooding from Reservoirs, Canals and other Artificial Sources – Non-natural or artificial sources of flooding can include reservoirs, canals, and lakes, where water is retained above natural ground level. In addition, operational and redundant industrial processes including; mining, quarrying, sand and gravel extraction, may also increase the depth of floodwater in areas adjacent to these features.

The potential effects of flood risk management infrastructure and other structures also needs to be considered. For example; reservoir or canal flooding may occur as a result of the facility being overwhelmed and/or as a result of dam or bank failure.

Inspection of the OS mapping for the area shows that there are no artificial sources of flooding within close proximity to the site. In addition, the EA's 'Flood Risk from Reservoirs' website shows that the site is not within an area considered to be at risk of flooding from reservoirs. Therefore, the risk of flooding from this source is considered to be *low*.

A summary of the overall risk of flooding from each source is provided in Table 3.1 below.

Source of flooding	Initial level of risk	Appraisal method applied at the initial flood risk assessment stage
Rivers	Appraised further in Section 5	OS mapping and the EA's 'Flood Map for Planning'
Sea/Estuaries		OS mapping and the EA's 'Flood Map for Planning'
Ordinary and man-made watercourses	Low	OS mapping and aerial height data
Overland flow	Low	Environment Agency 'Flood Risk from Surface Water' map, historic records contained within the Arun District Council SFRA, aerial height data and OS mapping
Groundwater	Low	BGS groundwater flood hazard maps, Defra Groundwater Flood Scoping Study, site-specific geological data, aerial height data, OS mapping and historic records in the SFRA
Sewers	Low	Aerial height data, OS mapping and historic sewer records contained within the SFRA
Artificial sources	Low	OS mapping and Environment Agency 'Flood Risk from Reservoirs' flood map

Table 3.1 – Summary of flood sources and risks.

3.3 Existing Flood Risk Management Measures

As part of their response, the EA has confirmed that the development site benefits from high ground which provides a 1 in 5 year standard of protection. The defence has a condition grade of 'fair' and is privately maintained.

Furthermore, the sea defences along the Bognor Regis frontage consist of shingle beaches stabilised by rock and timber groynes. There is also a seawall to the rear of shingle beaches providing an enhanced standard of protection of 1 in 200 years. The rear wall has a crest height of 5.64m AODN and is in good condition. The defences along this section of coastline are maintained by the Environment Agency.

4 Climate Change

When the impact of climate change is considered it is generally accepted that the standard of protection provided by current defences will reduce with time. The global climate is constantly changing, but it is widely recognised that we are now entering a period of accelerating change. Over the last few decades there have been numerous studies into the impact of potential changes in the future and there is now an increasing body of scientific evidence which supports the fact that the global climate is changing as a result of human activity. Past, present and future emissions of greenhouse gases are expected to cause significant global climate change during this century.

The nature of climate change at a regional level will vary: for the UK, projections of future climate change indicate that more frequent short-duration, high-intensity rainfall and more frequent periods of long-duration rainfall of the type responsible for the recent UK flooding could be expected.

These effects will tend to increase the size of flood zones associated with rivers, and the amount of flooding experienced from other inland sources. The rise in sea level will change the frequency of occurrence of high water levels relative to today's sea levels. It will also increase the extent of the area at risk should sea defences fail. Changes in wave heights due to increased water depths, as well as possible changes in the frequency, duration and severity of storm events are also predicted.

To ensure that any recommended mitigation measures are sustainable and effective throughout the lifetime of the development, it is necessary to base the appraisal on the extreme flood level that is commensurate with the planning horizon for the proposed development. The NPPF and supporting Planning Practice Guidance Suite state that residential development should be considered for a minimum of 100 years, but that the lifetime of a non-residential development depends on the characteristics of the development. For commercial development, a 60 year design life is typically assumed. The development that is the subject of this FRA is for holiday use of caravans and therefore, a conservative approach has been adopted and the design life has been assumed to be 100 years.

4.1 Potential Changes in Climate

Extreme Sea Level

Global sea levels will continue to rise, depending on greenhouse gas emissions and the sensitivity of the climate system. The relative sea level rise in England also depends on the local vertical movement of the land, which is generally falling in the south-east and rising in the north and west. The accompanying Planning Practice Guidance Suite to the NPPF provides allowances for the regional rates of relative sea level rise and these are shown in Table 4.1.

Administrative Region	Net Sea Level Rise (mm/yr) Relative to 1990			
	1990 to 2025	2026 to 2055	2056 to 2085	2086 to 2115
East of England, East Midlands, London, SE England (south of Flamborough Head)	4.0	8.5	12.0	15.0
South West	3.5	8.0	11.5	14.5
NW England, NE England (north of Flamborough Head)	2.5	7.0	10.0	13.0

Table 4.1 – Recommended contingency allowances for net sea level rise

From these values it can be seen that the extreme flood level at the site will change with time and that this change is not linear. The 1 in 200 year flood level at the site has therefore been calculated for a number of steps between the current day and the year 2115 and these values are shown in Table 4.2 below.

Year	1 in 200 year extreme water level (m AODN)
Current day (year 2019)	3.77
2025	3.84
2055	4.09
2075	4.33
2085	4.45
2115	4.90

Table 4.2 – Climate change impacts on extreme flood levels

Based on the table above and the assumed lifetime of the development of 100 years, the extreme sea level is taken as **4.90m AODN**.

Peak River Flow

Recognising that the impact of climate change will vary across the UK, the allowances show the anticipated changes to peak river flow by river basin district. The proposed development site is covered by the South East River Basin District, as defined by the Environment Agency River Basin maps.

For each district a range of climate change allowances are provided for different time epochs over the next century, which correlate with the planning horizons for the varying classifications of development.

For each epoch there are three climate change allowances defined. These represent different levels of statistical confidence in the possible emissions scenarios on which they are calculated. The three levels of allowance are as follows:

- Central: based on the 50th percentile
- Higher Central: based on the 70th percentile
- Upper End: based on the 90th percentile

As well as encouraging sustainable development to meet the demands of a growing population, the NPPF also promotes a precautionary approach. For more vulnerable development in areas of higher risk of flooding, a higher percentile allowance is recommended in order to manage the risk of flooding over the lifetime of the proposed development. The Environment Agency has therefore provided guidance regarding the application of the climate change allowances and how they should be applied in the planning process. The range of allowance for the river basin in which the development site is located are shown in Table 4.3 below.

River Basin District	Allowance Category	2015 to 2039	2040 to 2069	2070 to 2115
South East	Upper End	25%	50%	105%
	Higher Central	15%	30%	45%
	Central	10%	20%	35%

Table 4.3 – Recommended peak river flow allowances for each epoch for the South East river basin district (1961 to 1990 baseline).

For more vulnerable development with a design life of 100 years in Flood Zone 3a, a **Higher Central** climate change allowance is recommended. From Table 4.3 above, it can be seen that the recommended climate change allowance for this site is a **45%** increase for all peak river flows.

All of the above recommended allowances for climate change should be used as a guideline and can be superseded if local evidence supports the use of other data or allowances. Additionally, in the instance where flood mitigation measures are not considered necessary at present, but will be required in the future to account for changes in the climate, a "managed adaptive approach" can be adopted. This approach allows appropriate mitigation measures to be incorporated into the development in the future to combat the impacts of climate change.

5 Probability and Consequence of Flooding

When appraising the risk of flooding to new development it is necessary to assess the impact of the 'design flood event' to establish depths, velocities and the rate of rise of floodwater under such conditions. Flood conditions can be predicted for a range of return periods and these are expressed in either years or as a probability, i.e. the probability that the event will occur in any given year, or Annual Exceedance Probability (AEP). The design flood event is taken as the 1 in 100 year (1% AEP) event for fluvial flooding and the 1 in 200 year (0.5% AEP) event for sea or tidal flooding, including an appropriate allowance for climate change (refer to Section 4.1).

Section 3.2 of this report has identified that the site could be at risk of flooding from the Aldingbourne Rife (fluvial) and from the sea (tidal). Consequently, the EA has been consulted as part of this assessment and a copy of their response is included in Appendix A.2 of this report. The detailed information provided contains modelled flood levels for a number of node points located across the development site. The location of the node points with respect to the subject site is shown in Figure 5.1 below.

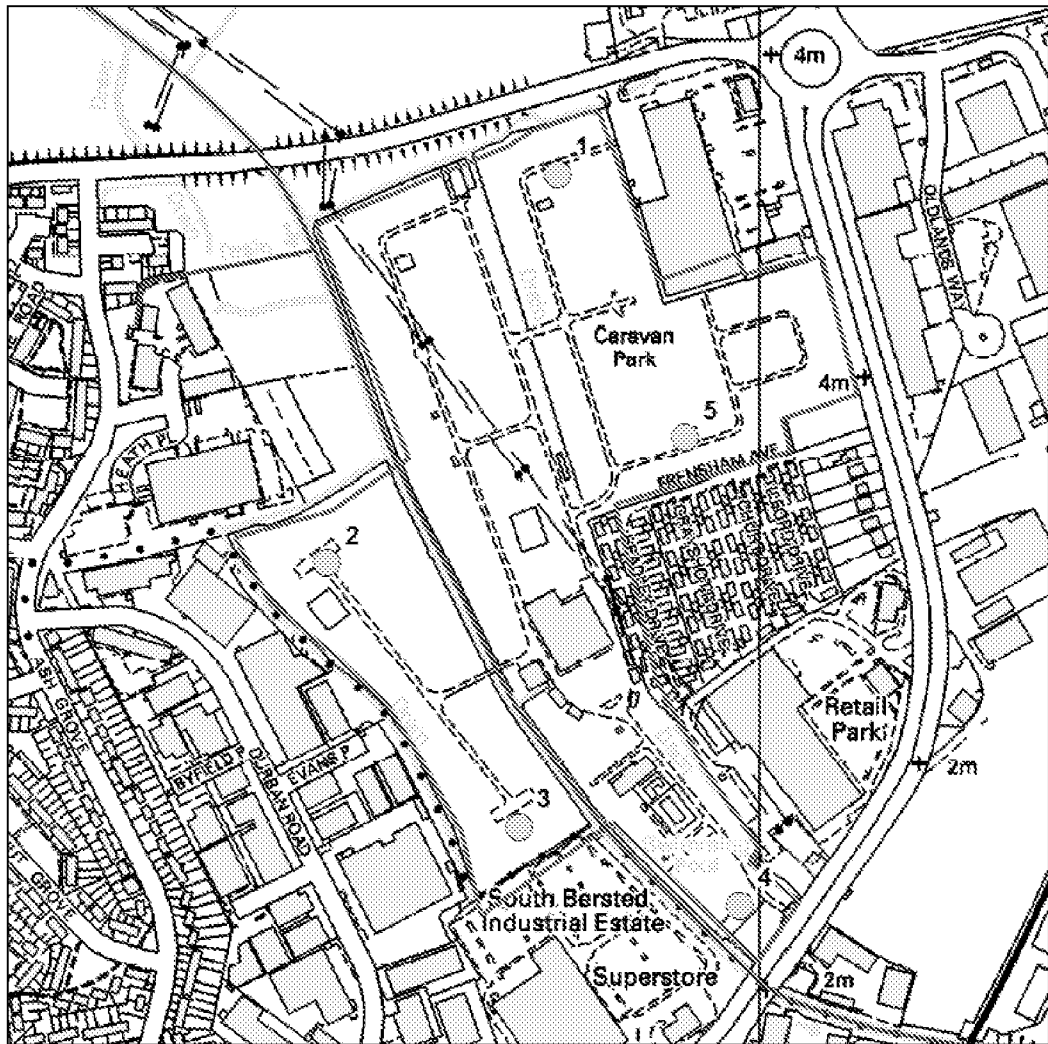


Figure 5.1 – Flood node location map (provided by the EA). Development site outlined in red.

The data provided has been taken from the River Arun to East Head Model, completed in 2016 and contains modelled flood level data for both 'defended' and 'undefended' scenarios for both fluvial and tidal flooding. Notwithstanding this, Section 3.3 has identified that the development site benefits from existing defence infrastructure and therefore, it is considered more appropriate to use the 'defended' scenarios in this instance to determine the design flood event.

Consequently, the following sections appraise both the fluvial and tidal risk of flooding to the development site in more detail.

5.1 The Tidal Risk of Flooding

Actual Risk

Table 5.1 below shows the predicted flood level provided by the EA. Flood levels for node point 4 have been referenced, as these represent the highest flood level across the site.

Return Period in Years (% AEP)	Modelled flood levels at Node 4 (m AODN)
1 in 200 year (0.5%)	-
1 in 200 year (0.5%) - 2070	-
1 in 200 year (0.5%) - 2115	1.18
1 in 1000 year (0.1%)	-

Table 5.1 – Modelled tidal flood level within the Caravan Centre. “-” indicates that the node point is not affected.

From the Table above, it is evident that the development site is currently protected from flooding under both the 1 in 200 year and 1 in 1000 year return period events. Even if an allowance for climate change is taken into consideration for the future year 2070, the development site is shown to remain dry.

It is only if 100 years of climate change is applied that the development site could partially be subject to flooding, with the maximum flood level predicted to reach 1.18m AODN. Figure 5.2 below shows the predicted extent of flooding under such a scenario.

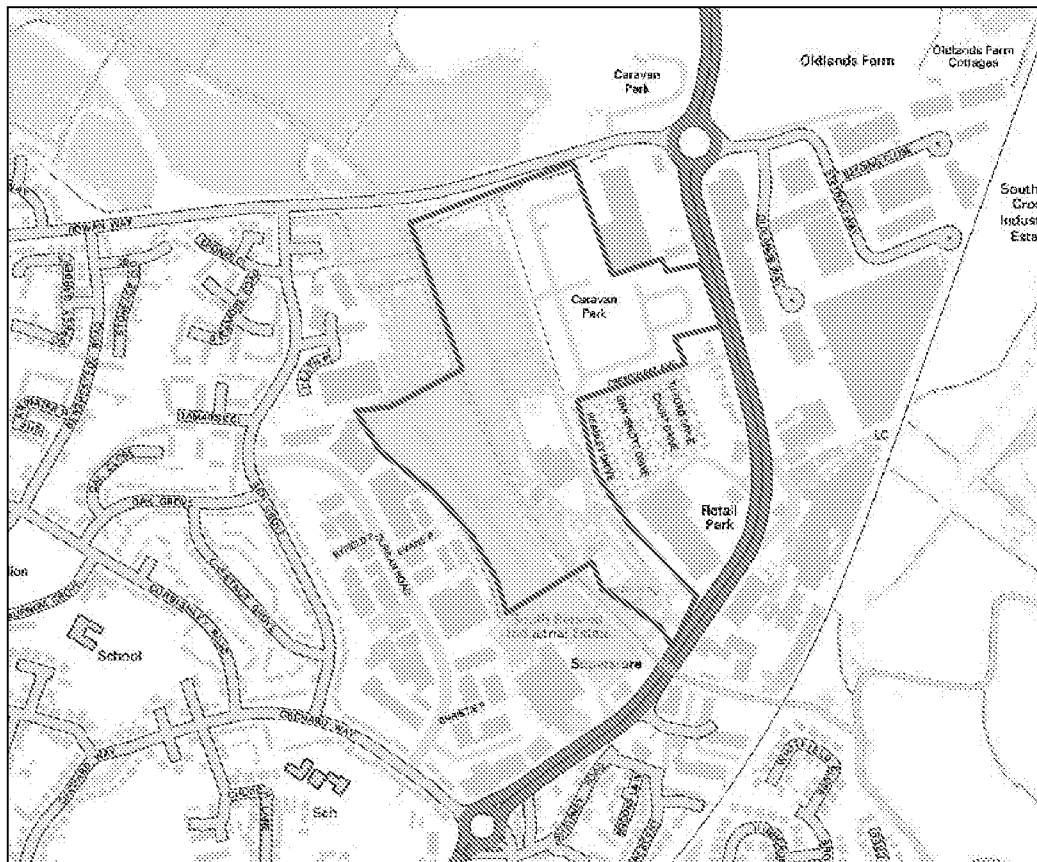


Figure 5.2 – Maximum ‘defended’ predicted flood extent for the 1 in 200 year flood event including 100 years of climate change (i.e. future year 2115), plotted using 1m aerial height data.

From the Figure above, it can be seen that the eastern half of the development site remains dry. It is only areas directly surrounding the Aldingbourne Rife and the drainage ditches to the west, which are shown to be flooded. Comparison of the flood level with land levels in these areas identifies that the maximum predicted depth of flooding does not exceed 0.48m.

Residual Risk

Whilst it has been demonstrated that the existing defence infrastructure does provide a high standard of protection for tidal flooding, there is always the risk that a small section of this infrastructure could fail; either as a result of structural failure, or through less predictable mechanism such as ship impact or an act of terrorism. This is known as the *residual risk* of flooding.

The only way that the impact of such a scenario can be quantified is through the use of detailed numerical breach modelling. Although breach modelling has previously been provided as part of the 2009 SFRA, the data does not include an allowance for climate change, as required by the NPPF. Detailed breach modelling has not been undertaken as part of the latest Arun District Council SFRA. Consequently, in the absence of flood level data for a breach under the design flood scenario, the flood levels provided by the EA for the undefended scenario have been referenced to represent a worst-case scenario.

Inspection of the data provided by the EA for the undefended scenario shows that if 100 years of climate change is taken into consideration, the maximum predicted flood level at the site is 3.6m AODN. Under this scenario, the easternmost area of the development site is shown to remain dry with the predicted depth of flooding increasing to 2.9m towards the Aldingbourne Rife.

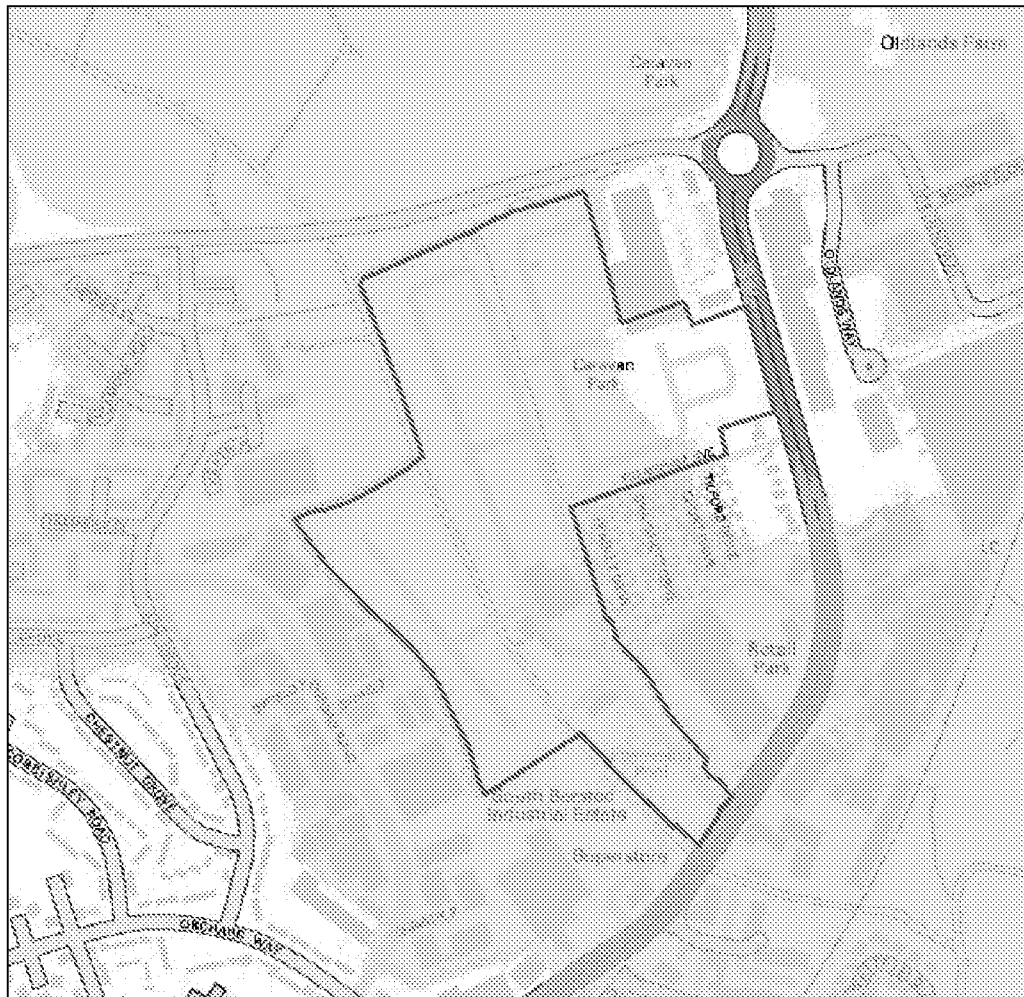


Figure 5.3 - Maximum '**undefended**' predicted flood extent for the 1 in 200 year flood event including 100 years of climate change (i.e. future year 2115), plotted using 1m aerial height data.

Notwithstanding this, the EA's undefended scenario represents an unrealistic scenario whereby the entire defence infrastructure is removed. In reality, a breach would only result in a small section of the defences failing, whilst the remainder of the defences would continue to provide protection to the wider area. Consequently, it should be recognised that the undefended results significantly overestimate the risk of flooding to the development site from a breach and the impact of a breach is likely to be significantly less.

5.2 The Fluvial Risk of Flooding

The Aldingbourne Rife runs through the centre of the development site and as such, the risk of flooding from this source has been considered in further detail. Table 5.2 below shows the maximum flood levels predicted at the site for the 'defended' scenarios.

Return Period in Years (% AEP)	Modelled flood levels at Node 4 (m AODN)
1 in 20 year (5%)	-
1 in 100 year (1%)	-
1 in 100 year (1%) + 45%CC	1.47
1 in 1000 year (0.1%)	-

Table 5.2 – Modelled fluvial flood levels within the Caravan Centre. “-” indicates that the node point is not affected.

From Table 5.2 it can be seen that the development site would remain dry up to and including the 1 in 1000 year flood event under current day conditions. Notwithstanding this, when an allowance for climate change is taken into consideration, as required by the EA, the maximum predicted flood level at the site is 1.47m AODN. Figure 5.3 below shows the maximum predicted extent of flooding across the site under this scenario.

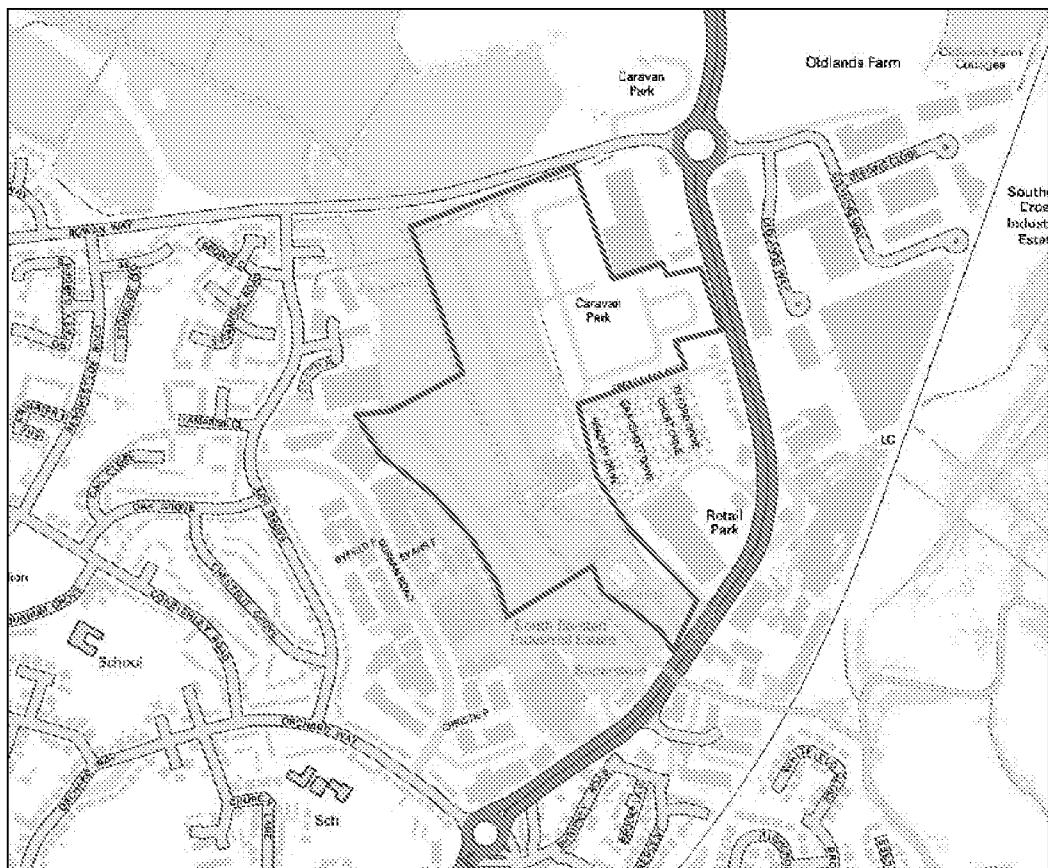


Figure 5.3 – Maximum predicted flood extent for the 1 in 100 year flood event including a 45% increase in peak river flow, plotted using 1m aerial height data.

Figure 5.3 above shows that the eastern half of the development site would remain dry under the design event conditions. It is only the lower-lying western half of the development site which could flood with depths of flooding predicted to be less than 0.77m towards the Aldingbourne Rife.

Exceedance Event

When considering residual risk, it is necessary to consider the impacts of a flood event that exceeds the design event. The EA's guidance for climate change allowances (refer to Section 4.1) recommends that a higher climate change allowance is considered, to represent an event which exceeds the design flood event. In this instance, this is the 1 in 100 year return period event including a 105% increase in peak river flow (i.e. 'Upper End' allowance).

Inspection of the data provided by the EA shows that the maximum modelled flood level at the site under this exceedance scenario is 2.27m AODN. When this flood level is compared to land levels at the site, the western half of the site could be flooded to a maximum depth of 1.57m. However, the eastern half of the site will remain outside the predicted flood extents for the exceedance event. This scenario represents a sensitivity test only and consequently, the mitigation measures recommended within this report have simply been designed to limit the impact of such an event.

5.3 Rate of Rise of Floodwater

Tidal Flooding

With regards to tidal flooding, the onset of flooding from a breach in the sea defence infrastructure will, by its nature, happen quickly. However, given the distance from the coastline, it is anticipated that floodwater will not reach the development site rapidly. Once floodwater does encroach onto the development site, the lower-lying areas surrounding the Aldingbourne Rife would flood first. Due to the vast extent of the floodplain into which the water can flow, there will be a delay before the maximum depth of flooding is reached.

Fluvial Flooding

In addition to the size and nature of the flood compartment, an indication of the behaviour and response of the catchment to extreme rainfall events can also be inferred from the catchment characteristics obtained from the Flood Estimation Handbook (FEH) database. In terms of the response of the catchment to extreme rainfall, there are two key parameters; the size of the catchment and its baseflow index (BFIHOST).

The area of the catchment that drains into the Aldingbourne Rife at this location is approximately 52km², which is relatively large. The BFIHOST value is 0.78, which suggests that the flow in the river is predominantly derived from baseflow. Taking these parameters into consideration, it is possible to conclude that this catchment is likely to be relatively slow to respond to extreme rainfall events and therefore the rate of rise is unlikely to be rapid.

6 Offsite Impacts and Other Considerations

6.1 Displacement of Floodwater

In this case, the proposals are simply for an extension to the opening period of the holiday caravan park and does not comprise any alterations or additions to the caravans on site. Consequently, the proposals will not result in a loss of flood storage and compensatory floodplain storage is not required.

6.2 Public Safety and Access

The NPPF states that safe access and escape should be available to/from new developments located within areas at risk of flooding. The Practice Guide goes on to state that access routes should enable occupants to safely access and exit their dwellings during design flood conditions and that vehicular access should be available to allow the emergency services to safely reach the development.

When the proposed development is considered, it can be seen that the site is unaffected by flooding from both tidal and fluvial sources under current day conditions. It is only when an allowance for climate change is taken into consideration that the lower-lying areas surrounding the Aldingbourne Rife could be subject to flooding. Under these scenarios, safe and dry access to the lower-lying areas is likely to be unavailable during the peak of the flood event.

Consequently, it is recommended that the managers of the site sign up to the EA's Early Flood Warning Service (refer to Section 7.2) to inform visitors of the potential risk of flooding and evacuate the site before the onset of floodwater. Figure 6.1 below shows that the maximum predicted depth of flooding along the access road on site does not exceed 0.25m. It is generally considered that walking or driving through shallow floodwater is acceptable and as such, safe access can be gained from the eastern boundary of the site towards the south and then onto Shrimpney Road, which provides access north away from the flood risk area.

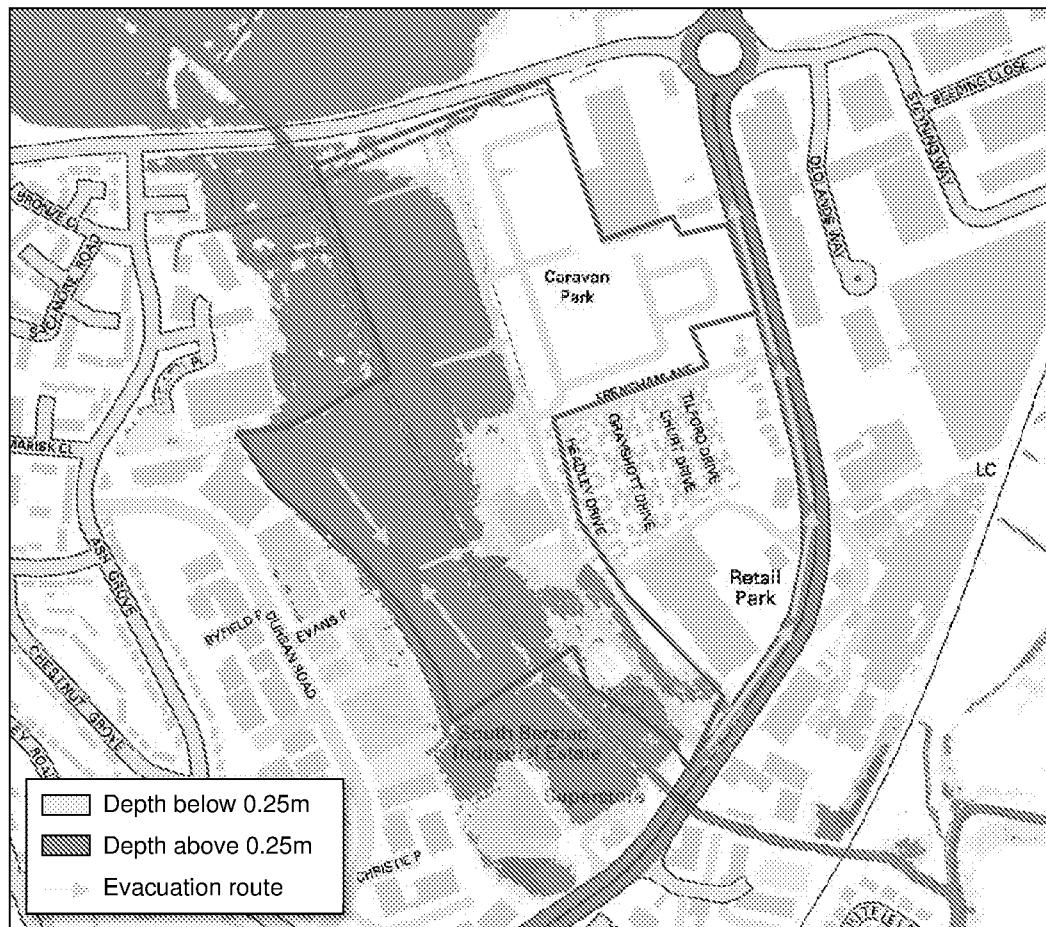


Figure 6.1 – The predicted 100 year (plus climate change) flood extent of the Aldingbourne Rife illustrating the safe access/egress route.

Even if insufficient time is available to evacuate the entire site, it is evident from Figure 6.1 above that there is an area to the east of the site which is shown to remain dry. Consequently, occupants of the holiday park will be able to seek safe refuge on site in an area located outside the predicted extent of flooding.

6.3 Proximity to Watercourse and Flood Defence Structures

Under the Water Resources Act 1991 and Land Drainage Byelaws, any proposals for development in close proximity to a 'main river' would need to take into account the EA's requirement for an 8m buffer zone between the river bank and any permanent construction such as buildings or car parking etc. This buffer zone increases to 16m for tidal waterbodies and sea defence infrastructure.

Inspection of OS mapping reveals that the development site is located approximately 1500m from the defences and as such will not compromise any of the EA's or LPA's maintenance or access requirements

It is recognised that the caravans on site are located within 8m of the banks of the Aldingbourne Rife. Notwithstanding this, the proposals are simply for an extension to the occupancy period of the

existing caravans and do not comprise any changes to the site layout. Consequently, the proposals would not reduce the existing access to the river and are considered appropriate.

6.4 Impact on Fluvial and Coastal Morphology and Impedance of Flood Flows

The development proposals will not result in any physical changes to the site or its boundaries that about the watercourse. As such it is considered that the proposals will not affect the morphology of the river.

In terms of the way in which the development would interact and modify flood flows, its location and size with respect to the flood risk area and the flow path has to be considered. However, given that the development is simply to change the occupancy allowance for the existing caravans, there is no potential for the proposals to impede or change flood flow regimes.

7 Flood Mitigation Measures

The key objectives of flood risk mitigation are:

- to reduce the risk of the development being flooded.
- to ensure continued operation and safety during flood events
- to ensure that the flood risk downstream of the site is not increased by increased runoff
- to ensure that the development does not have an adverse impact on flood risk elsewhere

The following section of this report examines ways in which the risk of flooding at the development site can be mitigated.

Mitigation Measure	Appropriate	Comment
Careful location of development within site boundaries (i.e. Sequential Approach)	X	
Raising floor levels	X	
Land raising	X	
Compensatory floodplain storage	X	The proposals are for a change of occupancy period of the existing holiday caravans on site. As there will be no changes the layout of the site, these measures are not considered appropriate.
Flood resistance & resilience	X	
Alterations/ improvements to channels and hydraulic structures	X	
Flood defences	X	
Flood warning	✓	Refer to Section 7.1
Surface water management	X	Refer to Section 7.2

Table 7.1 – Appropriateness of mitigation measures.

7.1

Flood Warning

The EA operate a flood forecasting and warning service in areas at risk of flooding from rivers or the sea, which relies on direct measurements of rainfall, river levels, tide levels, in-house predictive models, rainfall radar data and information from the Met Office. This service operates 24 hours a day, 365 days a year.

Whilst the probability of an event of sufficient magnitude to cause floodwaters to reach the levels discussed in this report is very low, the risk of such an occurrence is always present. With the sophisticated techniques now employed by the EA to predict the onset of flood events the opportunity now exists for all residents within the flood risk area to receive early flood warnings.

This forewarning could be sufficient to allow managers to evacuate the site and prepare the site for a flood event. It is therefore recommended that the managers of the site sign up to the EA's Flood Warning Service either by calling 0345 988 1188, or by visiting;

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

Table 2 of the *Flood Risk and Coastal Change* planning practice guidance states that '*sites used for holiday or short-let caravans and camping*' are classified as 'More Vulnerable' and therefore should be '*subject to a specific warning and evacuation plan*'. A site-specific Flood Evacuation Plan (FEP), should detail any actions to be taken by the occupant to limit the risk of flooding and consequently, any actions such as evacuation and closure of the site, should be taken upon receipt of a Flood Alert or Flood Warning, which should be received at least six hours before the high tide. Occupants and staff should not wait until a severe flood warning has been issued.

A detailed site-specific FEP has been prepared by Herrington Consulting to accompany this report. It is therefore recommended that the owner of the site use this document in combination with the EA's flood warning service.

7.2

Surface Water Management

The general requirement for all new development is to ensure that the runoff is managed sustainably and that the development does not increase the risk of flooding at the site, or within the surrounding area.

In this instance, the proposals are simply for an extension to occupancy and does not include any alterations to the site layout. As such, the proposals will not result in an increase in impermeable area and consequently, the surface water runoff from the development site will not increase as a result of the proposed development. It is therefore concluded that the development will not increase the risk of flooding offsite as a result of surface water runoff.

8 Conclusions and Recommendations

The key aims and objectives for a development that is to be sustainable in terms of flood risk are summarised in the following bullet points:

- the development should not be at a significant risk of flooding, and should not be susceptible to damage due to flooding.
- the development should not be exposed to flood risk such that the health, safety and welfare of the users of the development, or the population elsewhere, is threatened
- normal operation of the development should not be susceptible to disruption as a result of flooding and safe access to and from the development should be possible during flood events
- the development should not increase flood risk elsewhere
- the development should not prevent safe maintenance of watercourses or maintenance and operation of flood defences by the EA
- the development should not be associated with an onerous or difficult operation and maintenance regime to manage flood risk; the responsibility for any operation and maintenance required should be clearly defined
- the development should not lead to degradation of the environment
- the development should meet all of the above criteria for its entire lifetime, including consideration of the potential effects of climate change

In determining whether the proposals for development at the Riverside Caravan Centre are sustainable in terms of flood risk and compliant with the NPPF and its Technical Guidance, all of the above have been taken into consideration as part of this FRA.

The caravan site currently has permission for occupancy for 10 months of the year and the proposals are simply to extend the occupancy period to 12 months (with the same planning use). Consequently, it is assumed that both the Sequential and Exception Test are not applicable. Notwithstanding this, the NPPF requires a flood risk assessment to be prepared for development in Flood Zones 2 and 3 to meet the requirements for flood risk reduction. Consequently, the risk of flooding has been considered across a wide range of sources and it is only when considering an allowance for climate change over the next 100 years, that the development site could be at risk of flooding from the Aldingbourne Rife and the sea.

Nonetheless, it should be recognised that the caravans are already in situ and as such the level of risk will not increase. On the basis that the holiday use will remain (i.e. not intended for permanent residency) and the number of caravans are not increased, the application to extend the time limit from a 10 month to a 12 month holiday season will not increase the existing risk of flooding to the development or offsite.

In addition, there are already mitigation measures in place to protect the people using the caravans and these measures include a robust Flood Evacuation Plan and a quick response warning system, which takes effect as soon as an EA's flood warning has been issued.

Consequently, it is therefore concluded that the proposals to extend the occupancy period are appropriate in terms of flood risk and will not increase the risk to the occupants.

9 Appendices

Appendix A.1 – Drawings

Appendix A.2 – Environment Agency Flood Report

Appendix A.1 – Drawings

Riverside Caravan Centre, Shripney Road, Bognor Regis



Location Plan (Contains Ordnance Survey data © Crown copyright and database right 2013)

11/11/13

Appendix A.2 – Environment Agency Flood Report

Toby Vaughan

Herrington Consulting Ltd.

Canterbury Office - Units 6 & 7, Barham
Business Park, Elham Valley Road,
Canterbury, CT4 6DQ

London Office - 6-8 Bonhill Street,
London, EC2A 4BX

Our ref: SSD138981

Date: 03/09/2019

Dear Toby Vaughan,

**Enquiry Regarding Product 4 for Flood Risk Assessment for Site Address
Riverside Caravan Centre, Shripney Road, Bognor Regis, PO22 9NE.**

Thank you for your enquiry which was received on 14 August 2019.

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

The information on Flood Zones in the area relating to this address is as follows:

The site is in an area located within Flood Zone 3 as shown on our Flood Map for Planning (Rivers and Sea).

Note - This information relates to the area that the above named property is in and is not specific to the property itself as it is influenced by factors such as the height of door steps, air bricks or the height of surrounding walls. We do not have access to this information and is not currently used in our flood modelling.

Flood Zone definitions can be found at www.gov.uk/guidance/flood-risk-and-coastal-change#Table-1-Flood-Zones

Flood Defences

There are flood defences in the form of a high ground. The Asset ID is 50152. The estimated standard of protection is 1 in 5 years (20% AEP). The estimated condition grade is fair. The asset is maintained by Private.

Model Information

The model used was the River Arun To East Head Model which was completed by JBA Consulting in 2016.

Flood History

We hold no record of previous flooding events affecting this site.

Please note our records are not comprehensive and may not include all events. I recommend contacting the Lead Local Flood Authority, **West Sussex County Council** or the Local Authority, **Arun District Council** for a more comprehensive flood history check.

FRA advisory text

Name	Product 4
Description	Detailed Flood Risk Assessment Map for Riverside Caravan Centre, Shripney Road, Bognor Regis, PO22 9NE.
Licence	<u>Open Government Licence</u>
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 2018 Ordnance Survey 100024198.

Data Available Online

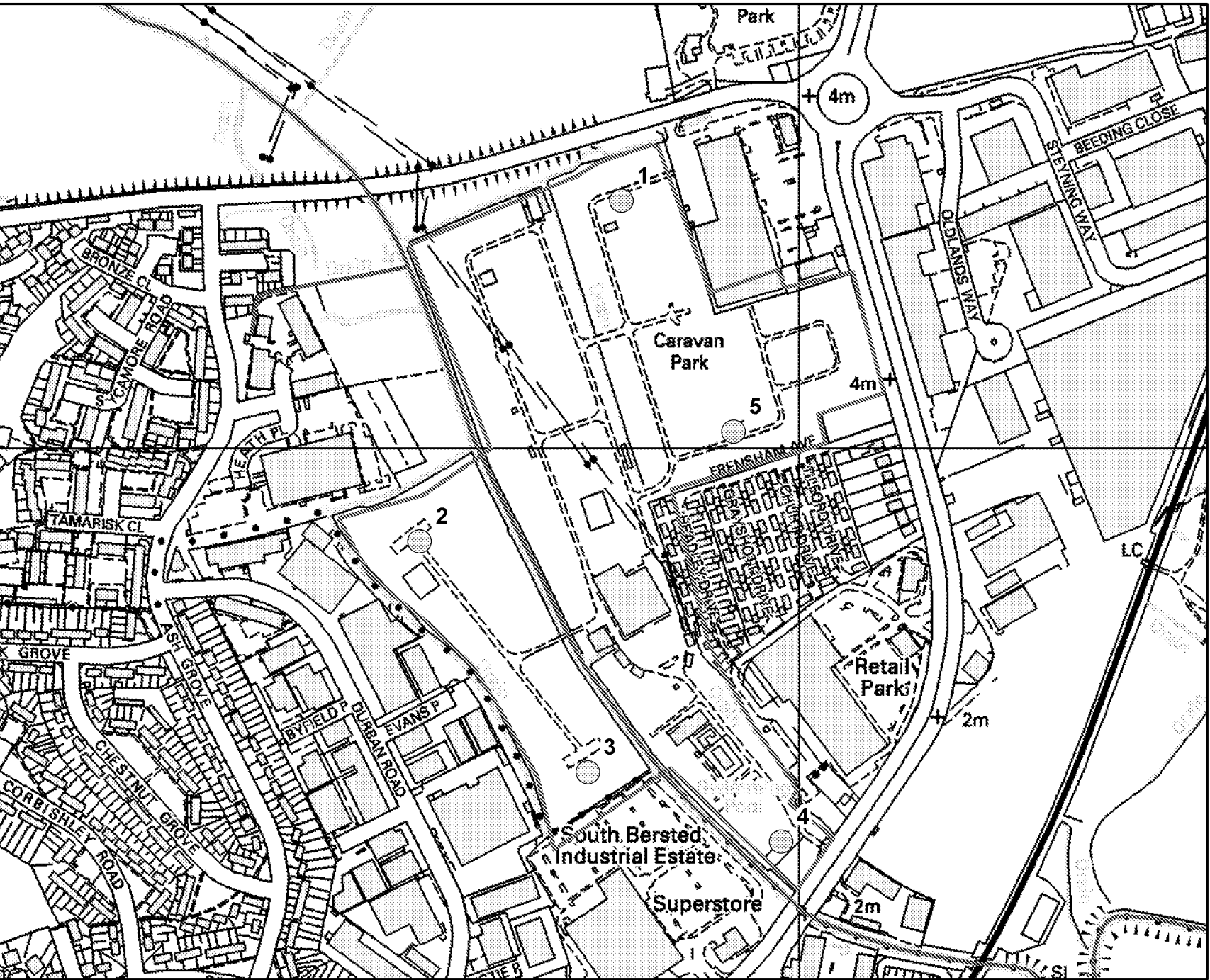
Many of our flood datasets are available online:

- 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,

Misha Misri
Flood & Coastal Risk Management Officer,
Partnership & Strategic Overview,
West Sussex,
Solent and South Downs



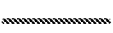


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N

Legend

-  Site Nodes
-  Main River
-  Site Boundary

Scale: 1:5,000



0 0.1 0.2

Kilometers

Product 4 Flood Risk Data Requested by: Herrington Consulting Ltd.

Site: Riverside Caravan Centre, Shripney Road, Bognor Regis, PO22 9NE

Table 1: Water Levels: Fluvial Undefended

Node Ref	NGR		Modelled Flood Levels in Metres AOD					
	Eastings	Northings	Undefended Annual Exceedance Probability					
			5%	1%	1% +CC (35%)	1% +CC (45%)	1% +CC (105%)	0.1%
1	493834	101231	-	-	-	-	-	-
2	493645	100913	-	-	1.68	1.78	2.27	-
3	493802	100698	-	-	1.67	1.77	2.25	-
4	493892	100633	-	-	1.67	1.77	2.24	-
5	493938	101015	-	-	-	-	-	-

Table 2: Water Levels: Fluvial Defended

Node Ref	NGR		Modelled Flood Levels in Metres AOD					
	Eastings	Northings	Defended Annual Exceedance Probability					
			5%	1%	1% +CC (35%)	1% +CC (45%)	1% +CC (105%)	0.1%
1	493834	101231	-	-	-	-	-	-
2	493645	100913	-	-	1.46	1.47	2.27	-
3	493802	100698	-	-	1.45	1.45	2.25	-
4	493892	100633	-	-	1.45	1.45	2.24	-
5	493938	101015	-	-	-	-	-	-

Table 3: Water Levels: Tidal Undefended

Node Ref	NGR		Modelled Flood Levels in Metres AOD			
	Eastings	Northings	Undefended Annual Exceedance Probability			
			0.5%	0.5% (2070)	0.5% (2115)	0.1%
1	493834	101231	-	2.67	3.60	-
2	493645	100913	1.81	2.70	3.60	2.12
3	493802	100698	1.83	2.74	3.60	2.14
4	493892	100633	1.85	2.77	3.60	2.16
5	493938	101015	-	-	3.60	-

Office Address: Guildbourne House, Chatsworth Road, Worthing BN11 1LD.
 Customer services line: 03708 506 506. Email: enquiries@environment-agency.gov.uk
www.gov.uk/government/organisations/environment-agency

Table 4: Water Levels: Tidal Defended

Node Ref	NGR		Modelled Flood Levels in Metres AOD			
			Defended Annual Exceedance Probability			
	Eastings	Northings	0.5%	0.5% (2070)	0.5% (2115)	0.1%
1	493834	101231	-	-	-	-
2	493645	100913	-	-	1.07	-
3	493802	100698	-	-	1.09	-
4	493892	100633	-	-	1.18	-
5	493938	101015	-	-	-	-

Table 5: Water Depths: Fluvial Undefended

Node Ref	NGR		Modelled Flood Depths in Metres					
			Undefended Annual Exceedance Probability					
	Eastings	Northings	5%	1%	1% +CC (35%)	1% +CC (45%)	1% +CC (105%)	0.1%
1	493834	101231	-	-	-	-	-	-
2	493645	100913	-	-	0.70	0.81	1.30	-
3	493802	100698	-	-	0.71	0.81	1.29	-
4	493892	100633	-	-	0.46	0.56	1.02	-
5	493938	101015	-	-	-	-	-	-

Table 6: Water Depths: Fluvial Defended

Node Ref	NGR		Modelled Flood Depths in Metres					
			Defended Annual Exceedance Probability					
	Eastings	Northings	5%	1%	1% +CC (35%)	1% +CC (45%)	1% +CC (105%)	0.1%
1	493834	101231	-	-	-	-	-	-
2	493645	100913	-	-	0.48	0.50	1.30	-
3	493802	100698	-	-	0.47	0.47	1.29	-
4	493892	100633	-	-	0.23	0.23	1.02	-
5	493938	101015	-	-	-	-	-	-

Table 7: Water Depths: Tidal Undefended

Node Ref	NGR		Modelled Flood Depths in Metres			
			Undefended Annual Exceedance Probability			
	Eastings	Northings	0.5%	0.5% (2070)	0.5% (2115)	0.1%
1	493834	101231	-	0.29	1.22	-
2	493645	100913	0.85	1.72	2.63	1.15
3	493802	100698	0.91	1.81	2.67	1.21
4	493892	100633	0.72	1.64	2.47	1.03
5	493938	101015	-	-	0.42	-

Table 8: Water Depths: Tidal Defended

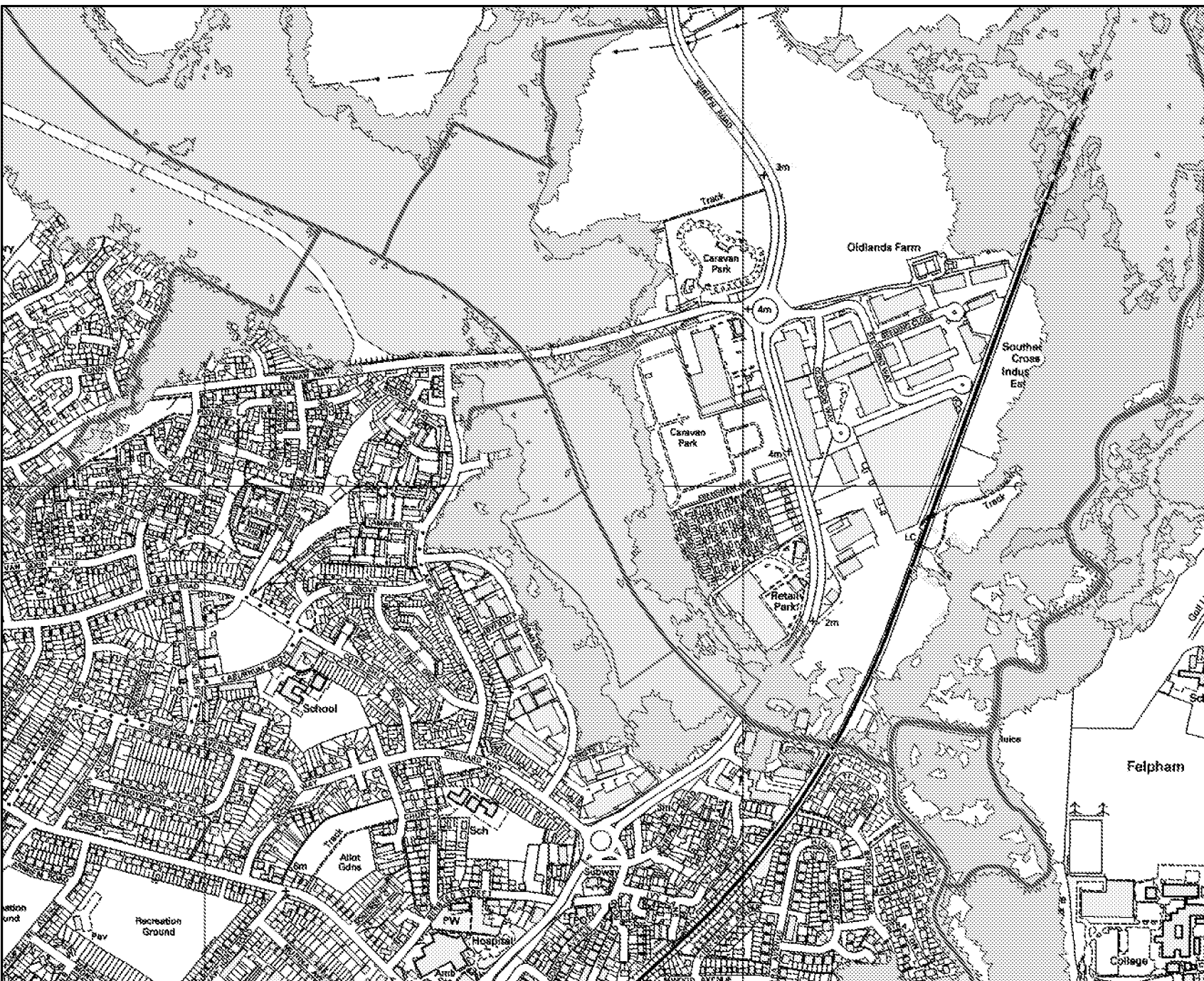
Office Address: Guildbourne House, Chatsworth Road, Worthing BN11 1LD.
Customer services line: 03708 506 506. Email: enquiries@environment-agency.gov.uk
www.gov.uk/government/organisations/environment-agency

Node Ref	NGR		Modelled Flood Depths in Metres			
	Eastings	Northings	Defended Annual Exceedance Probability			
			0.5%	0.5% (2070)	0.5% (2115)	0.1%
1	493834	101231	-	-	-	-
2	493645	100913	-	-	0.11	-
3	493802	100698	-	-	0.17	-
4	493892	100633	-	-	0.08	-
5	493938	101015	-	-	-	-

All levels taken from: River Arun To East Head Model.

Produced on: 03/09/2019

There is no additional information or health warnings for these levels/depths or the model from which they have been produced.



Legend

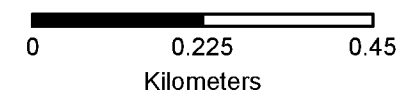
-  Main River
 Site Boundary
 1% AEP Plus Climate Change (35%) (Defended Fluvial)
 1% AEP Plus Climate Change (45%) (Defended Fluvial)
 1% AEP Plus Climate Change (105%) (Defended Fluvial)

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

Climate Change (CC) for fluvial models is based on an increase in river flows of 35, 45 & 105% for undefended scenarios

Defended scenarios only show the superseded 20% increase in flows

Scale: 1:10,000







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Legend

- Main River
- Site Boundary
- 0.5% AEP (Defended Tidal)
- 0.5% AEP (2070) NPPF (Defended Tidal)
- 0.5% AEP (2115) NPPF (Defended Tidal)
- 0.1% AEP (Defended Tidal)

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

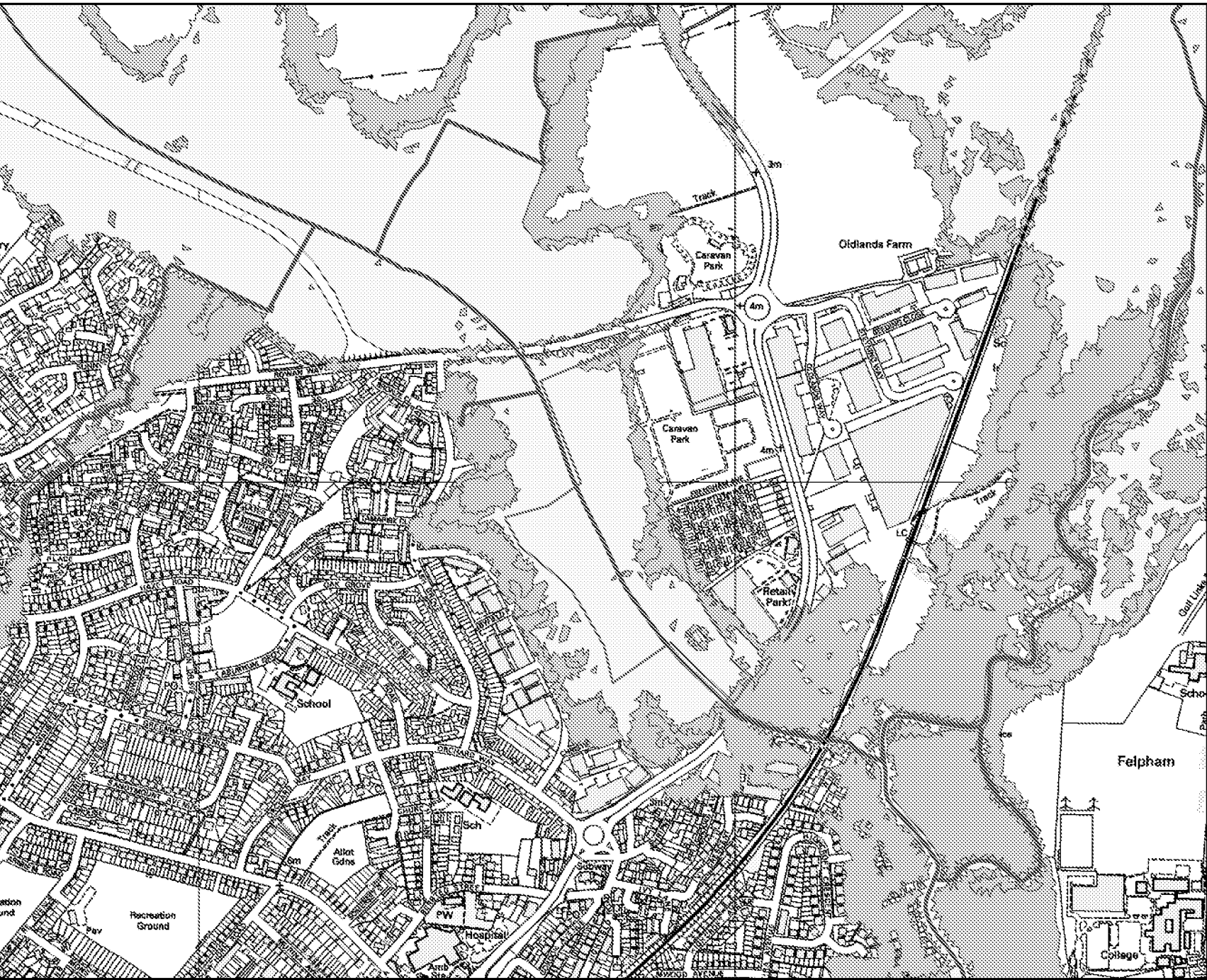
Scale: 1:10,000

0

0.225

0.45

Kilometers





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Legend

- Main River
- Site Boundary
- 1% AEP Plus Climate Change (35%) (Undefended Fluvial)
- 1% AEP Plus Climate Change (45%) (Undefended Fluvial)
- 1% AEP Plus Climate Change (105%) (Undefended Fluvial)

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

Climate Change (CC) for fluvial models is based on an increase in river flows of 35, 45 & 105% for undefended scenarios

Defended scenarios only show the superseded 20% increase in flows

Scale: 1:10,000

0

0.225

0.45

Kilometers



Environment
Agency



N

Legend

-  Main River
-  Site Boundary
-  0.5% AEP (Un defended Tidal)
-  0.5% AEP (2070) NPPF (Un defended Tidal)
-  0.5% AEP (2115) NPPF (Un defended Tidal)
-  0.1% AEP (Un defended Tidal)

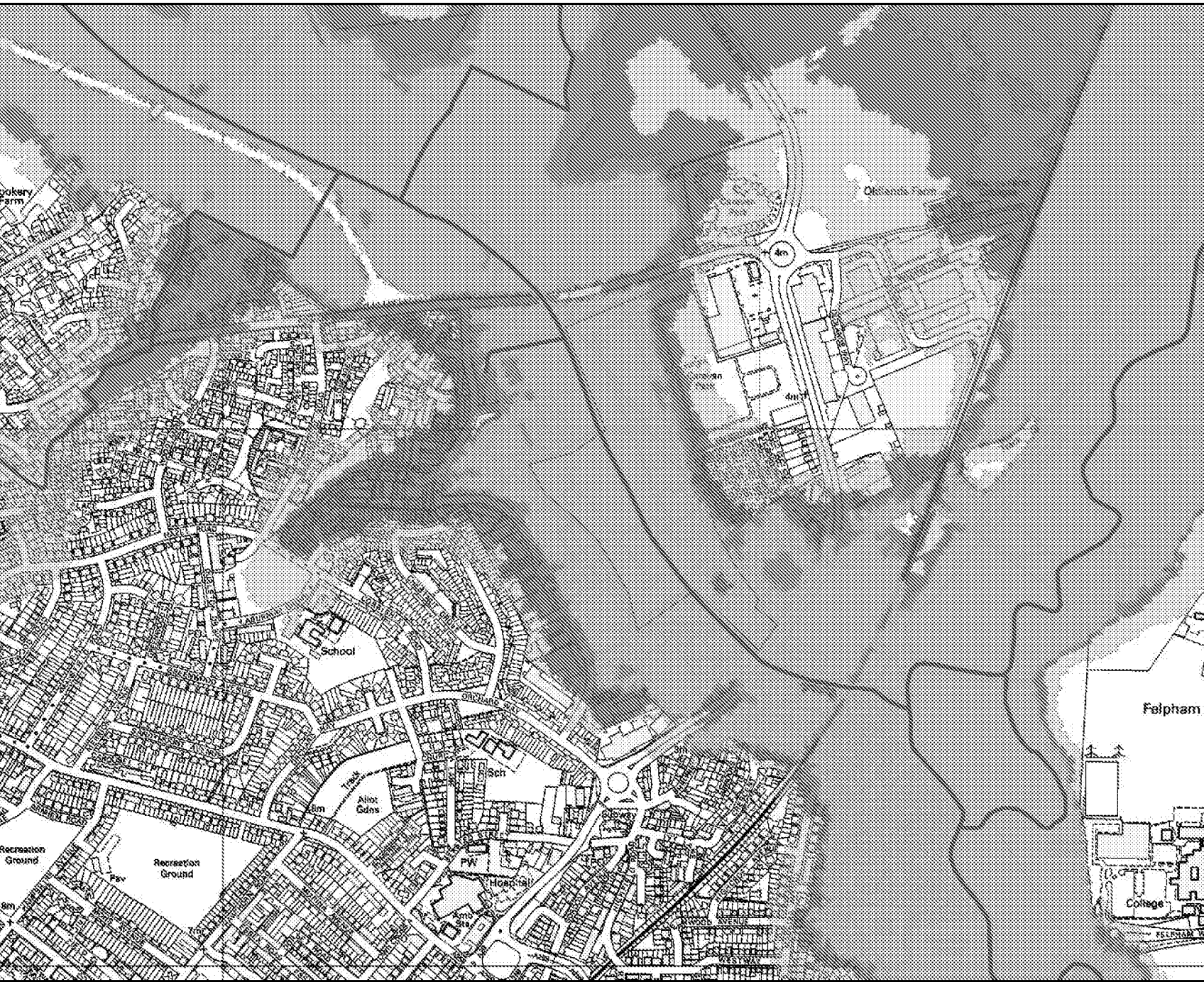
Annual Exceedance Probability (AEP) The probability of a flood of a particular magnitude, or greater occurring in any given year.

Scale: 1:10,000



00.2250.45

Kilometers



AIMS Flood Defence Map. Centred PO22 9NE. Created 3/9/2019.

Legend

Instrument (3rd party maintained)

-  Asset type not defined
-  Active Monitoring
-  Passive Monitoring

Channel Crossing (3rd party mainta

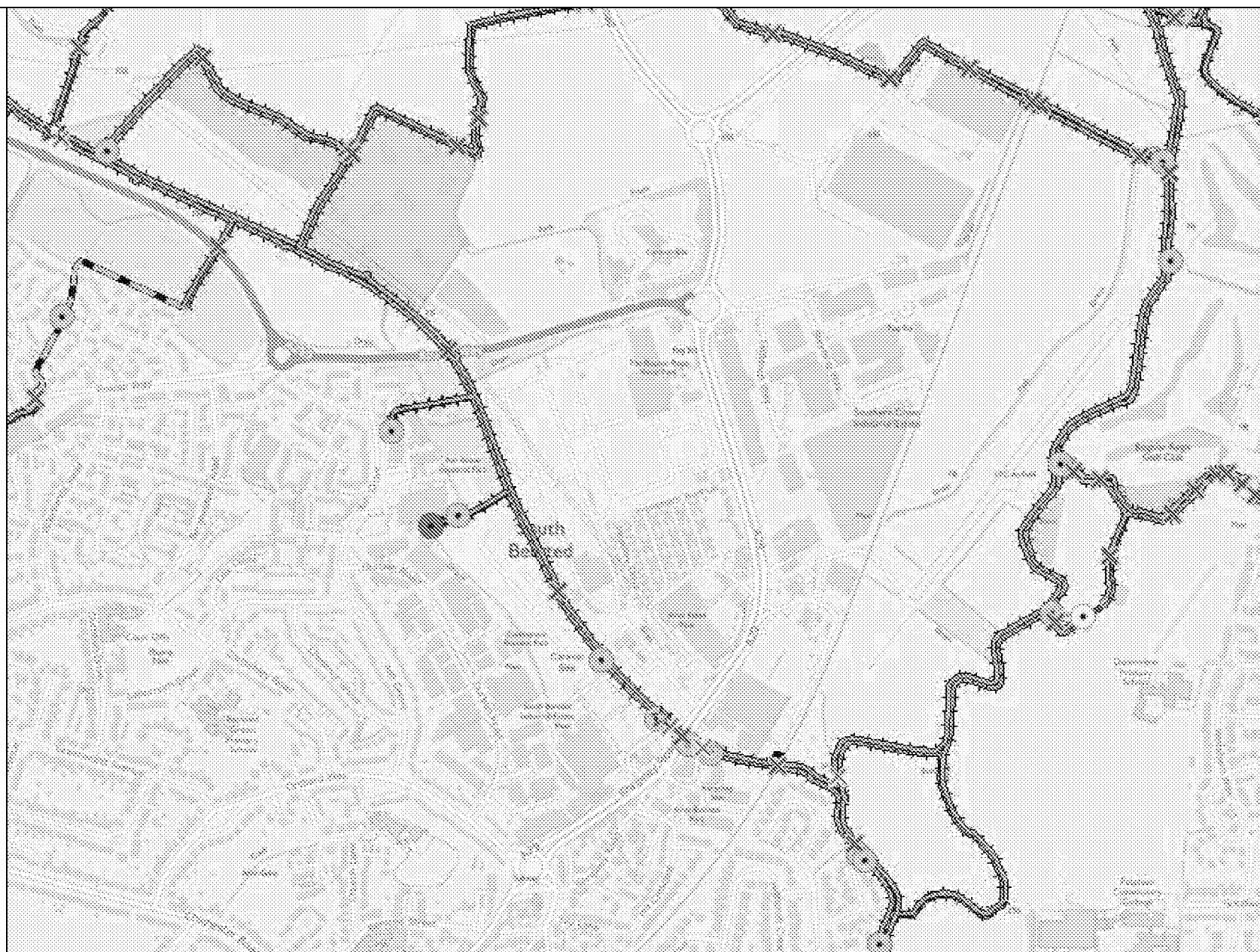
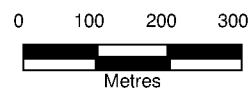
- ✖ Asset type not defined
- ✖ Bridge
- ✖ Utility Services

Structures (3rd party maintained)

-  Asset type not defined
-  Control Gate
-  Draw Off Tower
-  Fish Pass
-  Hydrobrake
-  In Channel Stoplogs
-  Inspection Chamber
-  Jetty
-  Outfall
-  Screen
-  Spillway
-  Stilling Basin
-  Weir

Defences (3rd party maintained)

-  Asset type not defined
-  Embankment
-  Wall
-  Flood Gate
-  Demountable Defence
-  Bridge Abutment
-  High Ground
-  Beach



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