



5.3 Flood Zone Definition

The National Planning Policy Framework Definition of Flood Zones

Flood zone	Fluvial	Tidal	Probability of flooding
1	< 1 in 1000 year	<1 in 1000 year	Low probability
2	Between < 1 in 1000 year and 1 in 100 year	Between <1 in 1000 year and 1 in 200 year	Medium Probability
3a	> 1 in 100 year	> 1 in 200 year	High probability
3b	Either > 1 in 20 or as agreed between the EA and the LPA	Either > 1 in 20 or as agreed between the EA and the LPA	Functional flood plain

5.4 Flood Zones – Table 1 NPPG - Flood risk and coastal change

(Note: These Flood Zones refer to the probability of river and sea flooding, ignoring the presence of defences)

Zone 1 - Low Probability
Definition
This zone comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%).
Appropriate uses
All uses of land are appropriate in this zone.
FRA requirements
For development proposals on sites comprising one hectare or above the vulnerability to flooding from other sources as well as from river and sea flooding, and the potential to increase flood risk elsewhere through the addition of hard surfaces and the effect of the development on surface water run-off, should be incorporated in a FRA. This need only be brief unless the factors above or other local considerations require particular attention. See Annex E for minimum requirements.
Policy aims
In this zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area and beyond through the layout and form of the development, and the appropriate application of sustainable drainage techniques.



5.5 Flood Risk Vulnerability Classification – Extract from Table 2 NPPG – Flood risk and coastal change

More Vulnerable

- Hospitals.
- Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels.
- Buildings used for: dwelling houses; student halls of residence; drinking establishments; nightclubs; and hotels.
- Non-residential uses for health services, nurseries, and educational establishments.
- Landfill and sites used for waste management facilities for hazardous waste.
- Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.

5.6 Flood Risk Vulnerability & Flood Zone Compatibility Table

Vulnerability classification flood zone	Essential infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less vulnerable
1	√	√	√	√	√
2	√	√	Exception test required	√	√
3a	Exception test required	√	x	Exception test required	√
3b	Exception test required	√	x	x	x

√ Development is appropriate x development is not appropriate

The above table, taken from Planning Practice Guidance (table 3), confirms that care homes within flood zone 1 is appropriate development.

5.7 Other Flooding Mechanisms

In addition to the potential for assessing flooding from fluvial and tidal sources NPPF also requires that consideration is given to other mechanisms for flooding:

- Flooding from land – intense rainfall, often in short duration, that is unable to soak into the ground or enter drainage systems, can run rapidly off land and result in local flooding.
- Flooding from groundwater – occurs when water levels in the ground rise above the surface elevations.
- Flooding from sewers – In urban areas, rainwater is frequently drained into surface water sewers or sewers containing both surface and waste water sewers known as combined sewers. Flooding can result causing surcharging when the sewer is overwhelmed by heavy rainfall
- Flooding from reservoirs, canals and other artificial sources – Non-natural or artificial sources of flooding can result from sources such as reservoirs, canals lakes etc, where water is held above natural ground levels.



5.8 Local Strategic Flood Risk Assessment SFRA and Local Policy

West Sussex LLFA has adopted the policies shown below to statutory policy and best practice. Policies 1 to 6 set out the requirements for a drainage strategy to be compliant with the NPPF and Non-Statutory Technical Standards for Sustainable Drainage. Policies 7 to 10 set out expectations to be considered within a drainage strategy in response to environmental legislation and guidance that West Sussex County Council and the Local Planning Authorities have a duty to comply with. All the policies reflect the requirements of the Local Flood Risk Management Strategy, Surface Water Management Plans and Local Planning Authority Local Plans.

SuDS Policy 1: Surface runoff not collected for use must be discharged according to the following discharge hierarchy:

- to ground
- to a surface water body
- to a surface water sewer, highway drain, or another drainage system
- to a combined sewer where there are absolutely no other options, and only where agreed in advance with the relevant sewage undertaker.

The selection of a discharge point should be clearly demonstrated and evidenced

SuDS Policy 2: The drainage scheme proposed is to:

- a. protect people and property on the development site from flooding; and,
- b. avoid creating any additional flood risk outside of the development in any part of the catchment, either upstream or downstream.

Any drainage scheme must manage all sources of surface water, including exceedance flows and surface flows from offsite, provide for emergency ingress and egress and ensure adequate connectivity.

For large sites where development is to be phased, there will need to be a strategic site surface water management system that allows different parts of the site to be developed at different times while ensuring that each of the design criteria can be met.

SuDS Policy 3: Mimic Natural Flows and Drainage Flow Paths

1. Drainage schemes should be designed to match greenfield discharge rates and follow natural drainage routes as far as possible; pumps should therefore not form part of drainage schemes.
2. Greenfield runoff should be calculated from IH124 or a similar approved method. SAAR and any other rainfall data used in run-off storage calculations should be based upon FEH rainfall values.

SuDS Policy 4: Seek to Reduce Existing Flood Risk

1. New development should be designed to take full account of any existing flood risk, irrespective of the source of flooding.
2. Where a site or its immediate surroundings have been identified to be at flood risk, all opportunities to reduce the identified risk should be investigated at an early stage and subsequently incorporated at the detailed design stage.



SuDS Policy 5: Maximise Resilience

1. The design of the drainage system must account for the likely impacts of climate change and changes in impermeable area over the design life of the development. Appropriate allowances should be applied in each case.
2. A sustainable drainage approach which considers control of surface runoff at the surface and at source is preferred and should be considered prior to other design solutions.
3. Culverting an existing watercourse should only be considered if there is no feasible alternative.

SuDS Policy 6: Design to be Maintainable

1. A drainage scheme Management and Maintenance Plan should be prepared which demonstrates the function of the drainage system and a schedule of activities, access points, outfalls and any biodiversity considerations.
2. The Management and Maintenance Plan should also include an indication of the adopting or maintaining authority or organisation and may require inclusion within a register of drainage features.

SuDS Policy 7: Safeguard Water Quality

1. When designing a surface water management scheme, full consideration should be given to the system's capacity to remove pollutants and to the cleanliness of the water being discharged from the site, irrespective of the receiving system.
2. Interception of small rainfall events should be incorporated into the design of the drainage system.

SuDS Policy 8: Design for Amenity and Multi-Functionality Drainage design should from the outset consider opportunities for inclusion of amenity and biodiversity objectives and thus provide multi-functional use of open space with appropriate design for drainage measures within the public realm.

SuDS Policy 9: Enhance Biodiversity Drainage design should from the outset consider opportunities for biodiversity enhancement, through optimising the scope for surface systems, consideration of connectivity to adjacent water bodies or natural habitats, and appropriate planting specification.

SuDS Policy 10: Link to Wider Landscape Objectives Drainage design should from the outset consider opportunities to contribute to the wider landscape and ensure proposals are coherent with the surrounding landscape character area.

6.0 Flood Risk to The Development

6.1 Flooding from Fluvial Sources

The proposed development site lies entirely within flood zone 1 which is classified as land assessed as having a less than 1 in 1000 annual probability of river or sea flooding and is appropriate to all uses of land.

It is, therefore, the consideration of this FRA that the site has a low risk of flooding from fluvial sources.

6.2 Flooding from Overland Flows

The surface water flood data for the site, shown below, indicates that there is medium flood risk in some places immediately to the south, outside of the site. It is due to a land depression acting as a pond. Therefore, the risk will be reduced to low.

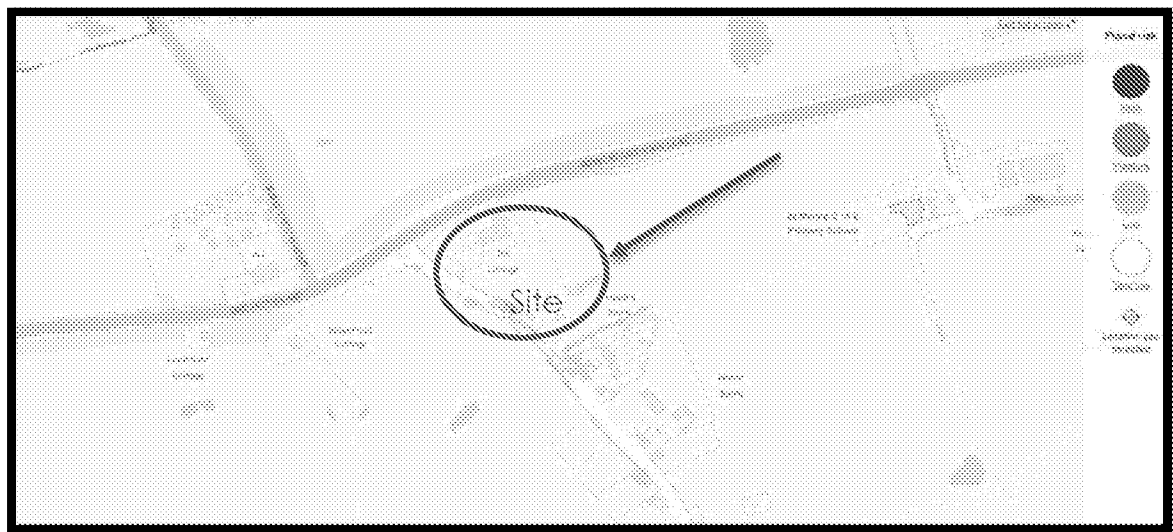


Fig 6.2 – Environment Agency Flood Risk from Surface Water map

It is, therefore, the consideration of this FRA that the site has a low risk of flooding from overland flows.

6.3 Flooding from Rising Groundwater

Significant groundwater flood events have been recorded across the district. This risk is supported by the Areas Susceptible to Groundwater Flooding (AStGWF) mapping suggests that susceptibility to groundwater flooding is generally high across the district. This data shows the proportion of each 1km grid square, where geological and hydrogeological conditions indicate that groundwater might emerge. It does not show the likelihood of groundwater flooding occurring, nor does it take account of the chance of flooding from groundwater rebound (rising groundwater levels resulting from a reduction in abstraction rates from groundwater).

Arun District Council map shows the site completely within the zone of >50% and <75%, and the indicative Risk of Groundwater Flooding prepared by Capita Symonds locates the site within a High-risk area. Both maps can be found in Appendix E. The water table level has been established at a depth of 1mBGL (March 2018)

It is, therefore, the consideration of this FRA that the site has a Medium risk of flooding from rising groundwater levels.



6.4 Flooding from the Local Sewerage Network

The Sewer Incident Report Form data supplied by postcode indicates that in the vicinity of the site there have been 22 recorded flood incidents. Also, the map prepared by the Capita Symonds used in the Strategic Flood Risk Assessment of the Arun District Council shows the site very close to an historic sewer incident. See full document in Appendix F.

The site is however higher than the adjacent drainage networks and so the risk of flooding via this mechanism is considered to be low.

It is, therefore, the consideration of this FRA that the site has a low risk of flooding by surcharging of the local sewer network.

6.5 Flooding from Reservoirs, Canals & Other Artificial Sources

From a review of the local area there are no artificial water sources in close proximity to the site.

It is, therefore, the consideration of this FRA that the site has a low risk of flooding by reservoirs, canals or other artificial sources.



7.0 Flood Risk As A Result Of The Development

7.1 Effect of The Development Generally

Development by its nature usually has the potential to increase the impermeable area with a resultant increased risk of causing rapid surface water runoff to watercourses and sewers, thereby causing surcharging and potential flooding. There is also the potential for pollutants to be mobilised and consequently flushed into the receiving surface water system.

Increases in both the peak runoff rate (usually measured in litres per second l/s) and runoff volume (cubic metres m³) can result.

7.2 Surface Water Drainage & Sustainable Drainage Systems

Sustainable Drainage techniques (SuDS) covers a range of approaches to manage surface water runoff so that-

'Surface water arising from a developed site should, as far as is practicable, be managed in a sustainable manner to mimic the surface water flows arising from the site prior to the proposed development, while reducing the flood risk to the site itself and elsewhere, taking climate change into account. This should be demonstrated as part of the flood risk assessment.'

7.3 Peak Storm Design Criteria

The proposed sustainable drainage techniques for the development should accommodate the peak rainfall event for a 1 in 100 year storm event with an additional 40% allowance for climate change.

7.4 Existing Surface Water Runoff Rates

The site covers an approximate area of 0.84Ha, which consists of a greenfield land with low planting. The existing runoff rates calculated for site are highlighted below in table 7.4:

Return Period	Greenfield Runoff Rate l/s
1 in 1 year	2.5
Qbar	2.9
1 in 30 year	6.7
1 in 100 year	9.4

Table 7.4 Existing Runoff rates

Greenfield runoff rates were calculated using the ICP SuDS Method within Microdrainage Software. Calculations can be found in Appendix G.

7.5 Infiltration Testing

A site investigation has been undertaken and reported no infiltration potential on site.



7.6 Sustainable Drainage Hierarchy

A hierarchical approach has been undertaken in consideration of the application of SuDS in relation to the development. This is in order to meet the design philosophy of ensuring that surface water run-off is managed as close to its source as possible and the existing situation is replicated as closely as possible.

The following drainage hierarchy has been undertaken with reference to the procedures set out in the SuDS Manual (CIRIA C753, 2015) to assess the viability of the application of SuDS techniques to this scheme:

- ✱ store rainwater for later use
- use infiltration techniques, such as porous surfaces in permeable strata areas
- Attenuate rainwater in ponds or open water features for gradual release to a watercourse.
- attenuate rainwater by storing in tanks or sealed water features for gradual release to a watercourse,
- discharge rainwater direct to a watercourse
- ✱ discharge rainwater to a surface water drain
- discharge rainwater to the combined sewer.

The sustainable drainage hierarchy shown above is intended to ensure that all practical and reasonable measures are taken to manage surface water higher up the hierarchy (1 being the highest) and that the amount of surface water managed at the bottom of the hierarchy is minimised. Storing rainwater for later use might be an option but it is not sufficient to accommodate the runoff from the whole development.



The site-specific drainage hierarchy checklist considered for the drainage design for this development is detailed in Table 7.6.

SUDS OPTIONS	Comments	Potential for flow rate control	Volume reduction	Maintenance requirement	Space requirement	Cost	Included in final detailed design
Rainwater harvesting	Rainwater from roof runoff collected for re-use. Cost-benefit considerations	L	M	H	L	H	Pos
Water butts	Rainwater collection from roof runoff. Included in final design	L	L	L	L	L	Y
Living roofs	Vegetated roofs that reduce runoff volume and rate	M	L	M	L	H	Y
Bio-retention	Shallow vegetated areas to retain and treat runoff.	L	L	M	M	L	N
Constructed wetlands	Waterlogged areas that can support aquatic vegetation. Replicates existing conditions and provides ecological benefit.	M	L	H	H/M	M	N
Swales	Shallow grassed drainage channels. Replicates existing conditions	H	M	L	M/H	L	N
Soakaways	Subsurface structures that dispose of water via infiltration.	H	H	L	L	M	N
Permeable pavements	Surface that infiltrate through surface. Retains pollutants.	H	H	M	L	M	N
Tanked storage systems	Oversized pipes or cellular storage.	H	L	L	M	M/H	Y
Infiltration basins	Depressions in the ground to store and release water through infiltration	H	H	H/M	H	M/L	N
Detention basins	Temporary retention of runoff with controlled discharge	H	L	M	H	M/L	N

Table 7.6 Drainage design hierarchy (SuDS techniques considered for use in this scheme)

It should be noted that where the SuDS techniques are noted as feasible or possible it does not necessarily follow that they will all be used. Reference should be made to the drainage strategy drawing in Appendix H, which indicates the drainage proposals.



7.7 SUDS Techniques Employed

Building

Roof runoff from the proposed building is to be collected in a piped gravity drainage network prior to discharge into a pumping station placed near the front entrance. Water will be pumped to a demarcation chamber from where it will flow by gravity into the surface water sewer along Climping Street. Green roofs are proposed and are areas of living vegetation, installed on the top of buildings, for a range of reasons including the reduction of surface water runoff visual benefit, ecological value and enhanced building performance. Water butts are also proposed to reduce the runoff and collect water for later use. To cater for larger storm events & provide the necessary storage an attenuation tank is proposed beneath the site entrance. The pumping station outflow will be restricted to 5 l/s.

Car Park Areas

The drainage associated with the car park areas is to be drained via gullies. Water will flow by gravity until the pumping station.

Exceedance Flows

The drainage system is to be sized and designed to cater for storm events associated with a 1 in 100 year storm event with 40% for climate change. However, should an extreme event occur, the overland flows will be guided away from buildings.

The proposed drainage arrangement plan for the development can be found within Appendix H with the supporting Microdrainage calculations contained within Appendix G.

Return Period	Existing Runoff Rate l/s	Proposed Runoff Rate l/s
1 in 1 year	2.5	5.0
Qbar	2.9	5.0
1 in 30 year	6.7	5.0
1 in 100 year	9.4	5.0

Table 7.7 – Existing and proposed runoff rates

7.8 Flood Risk Management

During the first year of operation of all types of SuDS, inspections should usually be carried out at least monthly (and after significant storm events) to ensure that the system is functioning as designed and that no damage is evident. A full SuDS maintenance guidance can be found in Appendix I.