The risk of flooding this site is addressed in the expert opinion prepared by Mr Jaap Filkweert in his assessment of the access to the site being restricted in the future by flooding, form which we can draw several conclusions and observations that can be equally applied to the The Mill as well as the access road.

BACKGROUND & PARAMETERS

1. Seaward of the original alignment of the roadway there is a shingle beach, which ties into the Climping dunes and beach at its eastern end, and into the Climping car park at its western end. The beach includes timber groynes which were installed to limit shingle movement, but the Environment Agency indicates that these are now failing, following the storms during the 2019/20 winter. There used to be a flood embankment between the beach and access road, which was prone to regular overtopping and breach. The embankment was washed away in February 2020. The storm washed the materials from the beach and embankment across the access road and onto the farmland. These materials have since been reshaped into a new beach and shingle bank, up to ~30m landwards of the beach's previous position, and largely covering the access road The Environment Agency has reinforced the new bank's landward side by placement of imported shingle, aiming to improve its resilience to overtopping.
2. The basic answer to the question of whether the sea defences will be breached flood the site is yes, as this has already occurred several times.
3. The Environment Agency currently manages the shoreline between Elmer and the River Arun, which includes the Climping frontage. Its adopted Strategy for the frontage along the access road to The Property, described in the River Arun to Pagham Flood and Coastal Erosion Risk Management Strategy (Environment Agency, 2015), is to maintain in the short term, using a reactive patch and repair maintenance approach until this is no longer economically viable. This point could be reached, either because the annual maintenance budget is exceeded, or the costs for re-instatement of the present defences following significant damage exceeds the budget available. The 2015 Strategy indicated that continuation of maintenance works would become uneconomic once annual maintenance spend exceeds £70,000 'on a two-year rolling basis'.
4. Any form of increased maintenance, or investment in a capital scheme, is very unlikely.
5. There is, however, a small chance that the Environment Agency could continue its current maintenance approach in a scenario where the costs do exceed £70,000 per year, namely if the additional costs were borne by contributions from third parties such as local landowners. Such a 'Partnership Funding' approach exists for capital flood and coastal management schemes, but is not yet common practice for maintenance activities, so it would require development and adoption of a new process. This will not fundamentally change the maintenance approach, but it could increase the duration of continuation of maintenance into the future.
6. The future scenarios for management of the shoreline are all based on the current reactive patch and repair maintenance approach, but there is a range of possibilities for the duration:
   - Cessation of management in the very short term (2020);
   - Continuation of current reactive patch and repair maintenance approach for a number of years; and
   - Continuation of current reactive patch and repair maintenance approach into the long term.
7. <u>For ground levels</u>: the relevant parameter is the 'undisturbed' ground level, below the dynamic shingle. Exact measurements are not available, but the profile suggests that this is around 2.5m above Ordnance Datum (OD+2.5m) near the 2018 position of the shingle bank. The undisturbed ground level is then predicted to gradually drop to around

OD + 2.0m over approximately 100m landward of the shingle bank. Consequently, as the beach moves inland as expected in the future, it will gradually move onto a lower undisturbed ground level, down to OD + 2.0m.

8. For tidal levels: the Environment Agency based the predicted tidal levels for 2100 on the sea level rise scenario presented in its 2016 guidance (Environment Agency, 2016). Mean High Water is for this purpose simplified as the average of Mean High Water Neap (MHWN) and Mean High Water Spring (MHWS), which is around OD + 2.1m for 2019 and around OD + 3.0m for 2100.
9. The standard of the current shingle bank is likely to be a 50% per year chance of minor breach and a 0.5% per year chance of major breaches such as in the winter of 2019/20, based on judgement of the following factors: the foreshore appears to have eroded which reduces wave dampening; but on the other hand the shingle ridge is now supported on its landward side with imported shingle, increasing its resilience to breach, and its more landward alignment is less exposed
10. If maintenance were to continue (assuming reactive patch and repair maintenance, potentially including importation / recycling of shingle), this would not fundamentally change the broad direction of travel for the shoreline, including its range of scenarios and broad timescales.

FUTURE EVENTS

Short Term (Up To Around Year 5)

In the next few years, developments are strongly dependent on the storms that happen to occur (whereas for the longer term this evens out and trends can become apparent). This is the case for both hazards (erosion and flooding).

Erosion / Shoreline Position:

There is a small but realistic chance (around 2.5% cumulatively over the coming 5 years) that the shoreline will shift further inland. If this happens, it is likely to be up to approximately 20 metres.

The shoreline position is strongly dependent on the occurrence of severe storms such as in the winter of 2019/20, causing a major breach of the shingle bank, which is then reinstated in a set-back position (naturally if the system contains enough sediment, or through human intervention). The chance of similar storms occurring is estimated to be approximately 0.5% per year which occurs each year, so after 5 years, the chance of a major breach having occurred is approximately 2.5%. Each severe storm could cause a set-back of around 20 metres, such as experienced in the Winter 2019/20 storms.

Flooding:

The chance of a minor breach causing flooding is estimated to be approximately 50% per year for the winter of 2020/21.

For the following years, flood likelihood depends on whether there is continued maintenance:

- If so, the current flooding likelihood of 50% per year will be sustained in the short term (i.e. after each breach, the standard is returned to that level); and
- If not, then the likelihood will increase rapidly after an initial breach, and there could be flooding multiple times per year, whenever a storm and a high tide coincide.

Medium Term (Year 10)

Erosion:

For the medium term, there is a very significant chance that the shoreline will shift further and is likely to move between 40 and 120 metres inland.

Flooding:

Similar to the short term, flood likelihood strongly depends on whether there is continued maintenance. At this timescale, the impacts of climate change are expected to be insignificant:

- If so, the current flooding likelihood of 50% per year will be sustained in the short term (i.e. after each breach, the standard is returned to that level). I expect that potential increase of wave loading due to foreshore erosion is balanced by the more sheltered alignment.
- If not, then there could be flooding multiple times per year, whenever a storm and a high tide coincide.

Long Term (Year 50)

Erosion:

For the long term, the shoreline will shift further inland, and this could follow two distinct scenarios: by year 50, it could either still be in a similar position to Year 10 (around 100 metres inland), or it could have moved around 500 metres inland.

Flooding:

Even in the long term, flood likelihood depends on whether there is continued maintenance. At this timescale however, the impacts of climate change do become significant, with Mean High Water reaching ground level. There is also a chance of increased storminess, although there is no scientific consensus to enable quantification of this impact. The scenarios related to maintenance are as follows:

- If maintenance continues, the likelihood of flooding will start to increase because this is unlikely to keep pace with sea level rise, and flooding will become an annual or even more frequent occurrence. This also makes it less likely that maintenance will be continued (although this will strongly depend on future coastal management responsibilities and funding sources, which are very uncertain).
- If not, there could be flooding at each spring tide (every two weeks) or even more.

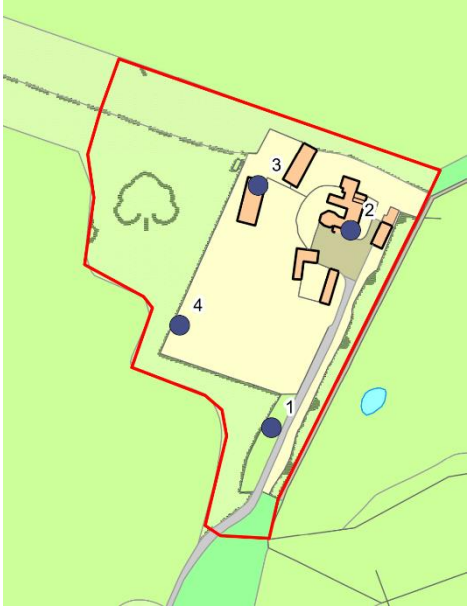
ENVIRONMENT AGENCY PRODUCT 4 DATA

On request, the EA confirmed the following about this site:

1. The site is in an area located within Flood Zone 1, 2 & 3 as determined by the River Arun to East Head Coastal Modelling from 2016
2. While the EA do not hold records of flooding events, they acknowledged that a flood in 2020 was caused by a breach in the coastal defences, defined by EA as a sand and shingle beach maintained by EA, in stormy conditions.

The flood risk (Product 4) data is based on existing HA hydraulic models for existing 0,5% annual probability events with an allowance for climate change, and those allowances were updated in December 2019.

Predicted water levels and depths during flood events were provided for four nodes within the site where protection is and is not maintained



Node	Ex. Level	Flood Level	
		Undefended Annual Exceedance Probability	
		0,5% (2070)	0,5% (2115)
1	4,0m	4,31m	4,82m
2	3,75m	4,04m	4,60m
3	3,92m	4,35m	4,71m
4	3,78m	4,34m	4,80m

Node		Flood Level	
		Defended Annual Exceedance Probability	
		0,5% (2070)	0,5% (2115)
1	4,0m	4,1m	4,35m
2	3,75m		4,09m
3	3,92m		4,28m
4	3,78m		4,28m

Node		Flood Depth	
		Undefended Annual Exceedance Probability	
		0,5% (2070)	0,5% (2115)
1	4,0m	0,55m	1,07m
2	3,75m	0,09m	0,65m
3	3,92m	0,08m	0,42m
4	3,78m	0,15m	0,54m

Node		Flood Depth	
		Defended Annual Exceedance Probability	
		0,5% (2070)	0,5% (2115)
1	4,0m	0,34m	0,6m
2	3,75m		0,14m
3	3,92m		0,04m
4	3,78m		0,26m

Outline maps provided as part of this date show, these levels of flood and water level at the nodes mean that the site will be flooded. The data also demonstrates that the site is not at risk of flooding from surface water, so the risk is always and only from the sea.

CONCLUSIONS

In the short term (up to around 2025) there is a small but realistic chance that the shoreline will shift further inland, by approximately 20 metres. The likelihood of flooding remains at 50% per year if maintenance is continued or could increase rapidly if it is ceased.

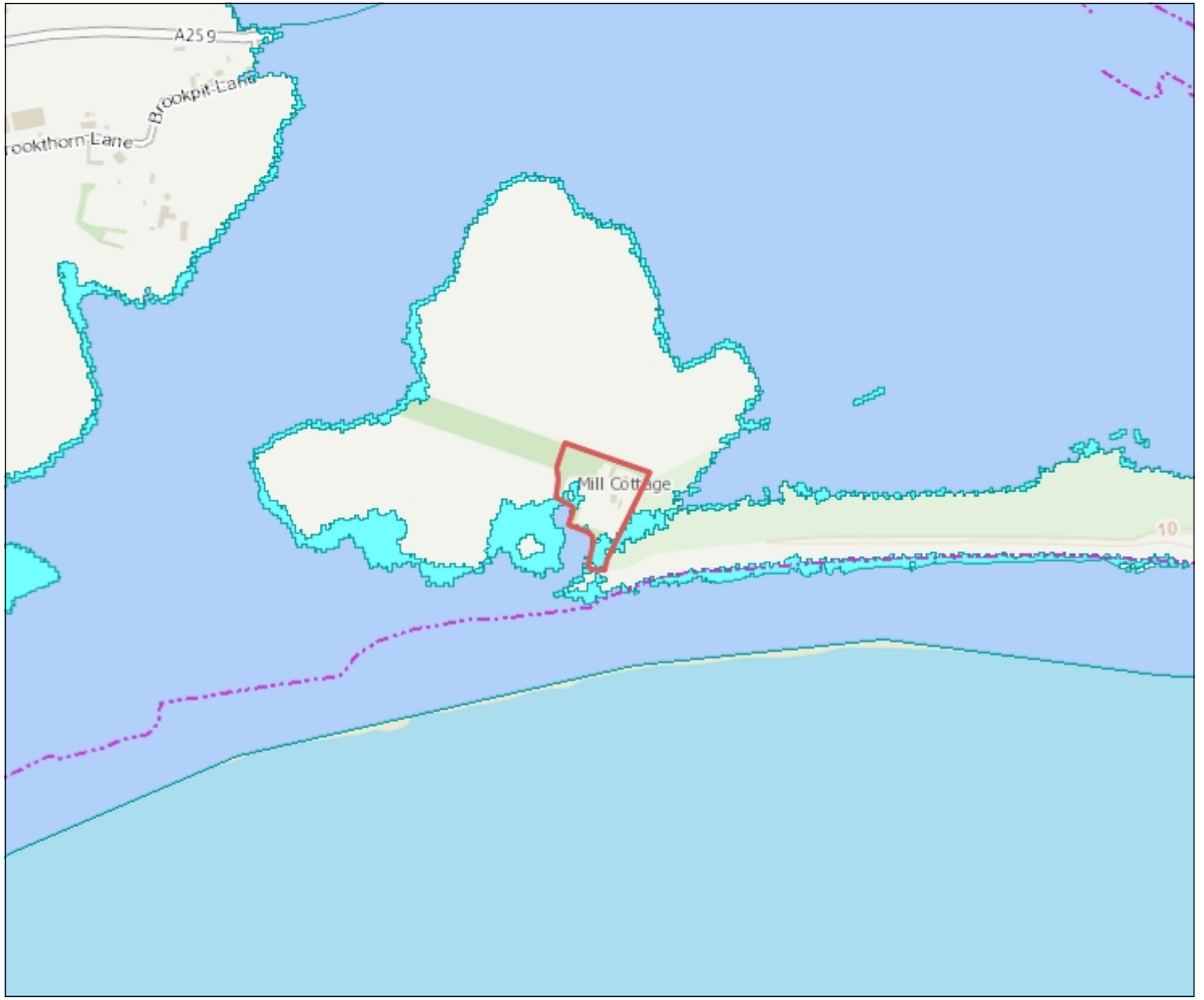
In the medium term (up to around 2030) there is a very significant chance that the shoreline will shift further inland, by between 40 metres and 120 metres. The likelihood of flooding remains at 50% per year if maintenance is continued; if not, there could be flooding multiple times per year. The restriction of access depends on the selected road alignment

In the long term (up to around 2070) the shoreline will shift further inland, and this is expected to be either by around 100 metres or by around 500 metres. The likelihood of flooding will start to increase above 50% per year if maintenance is continued; if not, there could be flooding every few weeks.

The impact of these shifts in the shoreline on The Mill site is that it will become marooned more frequently as the condition of the shoreline deteriorates while maintenance is reduced and eventually withdrawn altogether, a situation that could feasibly become permanent. In light of this, a form of protection is needed at the entrance to the site to protect the site from this ingress over the next few years

The Product 4 Data predicts, furthermore, that whole site is at risk in the future from flooding from the sea irrespective of the defences being maintained or not and it is likely that new modelling using current and recent data and records will predict that flooding will be earlier and possibly higher. Local defences will be needed to address those in due course but the proposal currently being considered will be a fundamental part of that.

Flood Map for Planning (Rivers and Sea). Centred BN17 5RG. Created 02/02/2021.



Environment Agency

1: 10,000

0 Metres 250

N W E S

Flood Map for Planning (Rivers & Sea)

- 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 occuring each year.

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Modelled Flood Outlines (Defended Tidal). Centred BN17 5RG. Created 02/02/2021.

Environment Agency

N

Legend

- 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

ARUN DISTRICT COUNCIL CM/10/21/PL

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Modelled Flood Outlines (Undefended Tidal). Centred BN17 5RG. Created 02/02/2021.

Environment Agency

N

Legend

- Site_Boundary
- 0.5% AEP (Undefended Tidal)
- 0.5% AEP (2070) NPPF (Undefended Tidal)
- 0.5% AEP (2115) NPPF (Undefended Tidal)
- 0.1% AEP (Undefended 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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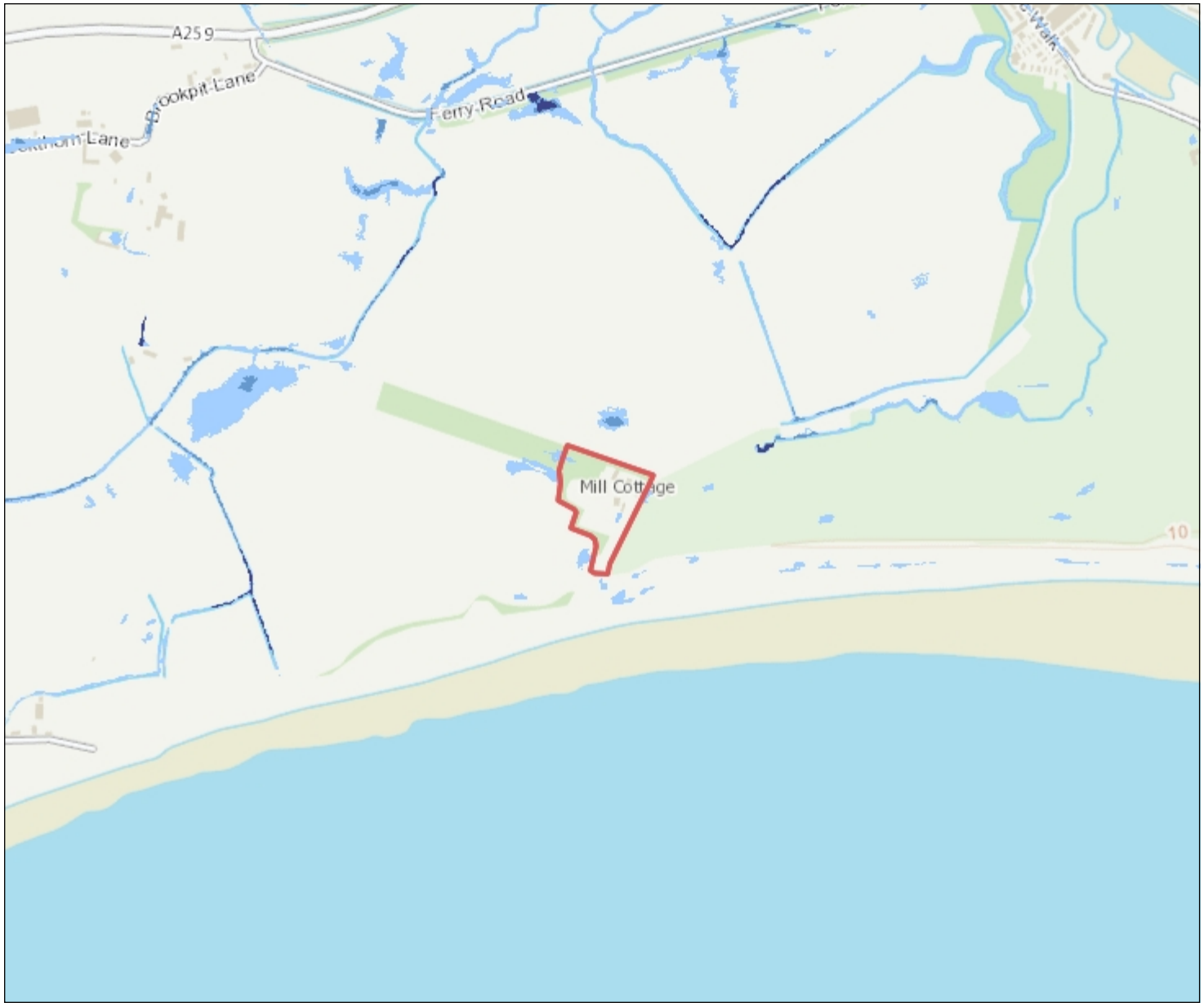
Risk of flooding from Surface Water. Centred BN17 5RG. Created 02/02/2021.



Environment Agency

1: 10,000

0 Metres 250

N W E S

Likelihood of flooding from Surface Water

- High (>=3.3%)
- Medium (3.3% - 1%)
- Low (1% - 01%)
- Very Low
- Flood Extent 1 in 30
- Flood Extent 1 in 100
- Flood Extent 1 in 1000

Likelihood of flooding from Surface Water

High:	Greater than or equal to 3.3% (1 in 30) chance in any given year
Medium:	Less than 3.3% (1 in 30) but greater than or equal to 1% (1 in 100) chance in any given year
Low:	Less than 1% (1 in 100) but greater than or equal to 0.1% (1 in 1,000) chance in any given year
Very Low:	Less than 0.1% (1 in 1,000) chance in any given year

This information is shown on the Risk of Flooding from Surface Water map on GOV.UK.

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