



# Explanatory note on the difference between our planning guidance and the Future Flood Maps

November 2023

Version 4

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Note that SEPA's guidance on [Climate Change Allowances for Flood Risk Assessment in Land Use Planning](#) represents SEPA's most up to date position on climate change related flood risk for land use planning, and the Future Flood Maps provide a strategic level indication of future sensitivities only.

As per National Planning Framework 4 (February 2023), for planning purposes, a site 'at risk of flooding' or 'in a flood risk area' means there is 'an annual probability of being flooded of greater than 0.5% which must include an appropriate allowance for future climate change'. This risk of flooding is indicated on SEPA's Future Flood Maps. For site specific assessments, an appropriate allowance for climate change should be taken from the latest available guidance and evidence available for application in Scotland. There are key differences between the Future Flood Maps and the guidance, and these are detailed and explained below.

## Non-technical explanation:

SEPA's Future Flood Maps (referred to as the maps hereafter) provide information on how the areas at risk of river or coastal flooding in a 0.5% Annual Exceedance Probability event may change due to climate change. These maps will be used as an initial baseline screening tool to identify areas at risk of flooding for land use planning purposes.

Users should be aware that the climate change uplifts used in the maps are currently based upon different projections to those used in SEPA's guidance on [Climate Change Allowances for Flood Risk Assessment in Land Use Planning](#).

In short, for **coastal flooding** the maps use allowances that are smaller than those in the guidance, except for the maps in the Outer Hebrides where from November 2023 the allowances used have the same basis as the allowances in the guidance.

For **fluvial flooding** the maps and guidance are not consistent at the present time for both larger and smaller catchments. For larger catchments, the maps generally use allowances that are smaller than those in the guidance.

These differences exist because both the maps and the guidance are based on UK climate projections, which are frequently refined over time due to improvements in both our understanding of the climate system and to climate modelling. Work required to update the maps in line with the projections is more resource-intensive than that required to update the guidance. As we have made a clear commitment to keep the guidance up to date so that it reflects the best scientific information available, it is likely to be the case that some differences will persist between the maps and the guidance for some time to come, though their precise form will evolve. We will keep the difference between the two products under continual review, with the longer-term aim of ensuring both are in alignment.

More detail on the current difference is provided below.

#### **Technical detail:**

##### **Emissions Scenario**

The climate change allowances used for both the maps and the guidance are based on the UK Climate Projections.

The maps are generally based on UK Climate Projections 2009, which was the best information available at the time when the national flood hazard modelling was carried out in 2011-2013. However, the more recent UK Climate Projections 2018 were used in the development of the guidance on sea level rise and peak river flow projections, and from November 2023, the coastal maps for the Outer Hebrides.

The UK Climate Projections provide information on a range of possible futures depending on the level of action taken to control the concentration of greenhouse gases in the atmosphere (referred to as different emissions scenarios), and how the climate responds to changes in the concentration of greenhouse gases (exceedance probability for a particular level of change in a variable within an emissions scenario).

In both the maps and the guidance, a High Emissions Scenario has been used, which assumes limited or no global action to tackle climate change so that emissions continue to rise. This High Emissions Scenario differs in the way it has been defined in the UK Climate Projections 2009, where it is referred to as the High Emissions Scenario and the more recent UK Climate Projections 2018, where it is referred to as Representative Concentration Pathway 8.5. However, both are broadly consistent in terms of the assumed global temperature increase by the end of century.

## Coastal flooding

As noted above, for coastal flooding the maps use allowances that are smaller than those in the guidance, except for the maps in the Outer Hebrides, which were updated in November 2023.

The **maps for most of Scotland** are based on the UK Climate Projections 2009 High Emissions Scenario 95<sup>th</sup> percentile for the year 2080, while the allowances in the guidance are based upon UK Climate Projections 2018 Representative Concentration Pathway 8.5 (High Emissions Scenario) 95<sup>th</sup> percentile for the year 2100.

Projections for global sea level rise increased between UK Climate Projections 2009 and UK Climate Projections 2018 largely due to improved understanding of land ice melt, so that the UK Climate Projections 2018 are higher than the UK Climate Projections 2009 for the same time frame and equivalent emissions scenario, however, there is also a difference in the time frame used for the guidance and the maps.

Comparison of the level of sea level rise used in the maps with the UK Climate Projections 2018 shows that the scenario the maps for most of Scotland are based upon is broadly equivalent to the UK Climate Projections 2018 50<sup>th</sup> percentile for 2100, for a high emissions scenario. This means that with limited global action to tackle climate change there is a 1 in 2 chance that the actual level of sea level rise will be higher than that in the maps by 2100, but only a 1 in 20 chance it will be higher than that in the guidance by 2100.

The **maps in the Outer Hebrides** are based on uplifts from the UK Climate Projections 2018 Representative Concentration Pathway 8.5 (High Emissions Scenario) 95<sup>th</sup> percentile for the year 2100 which is the same as the basis for the allowances in the guidance.

There are a small number of other areas where alternative uplifts have been used within the maps, where the available scenario was used if it was suitably consistent with the UK Climate Projections 2009 High Emissions 95<sup>th</sup> percentile for year 2080 scenario generally used for the coastal maps. See Table 3 of the Appendix of the Future Flood Map Summary on SEPA's [Developing Our Knowledge](#) web page for more information.

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## River flooding

### Catchments > 50km<sup>2</sup>

For catchments larger than 50 km<sup>2</sup>, the maps are based on flow uplifts for river basin regions from the Centre for Ecology and Hydrology 2011 report (CEH 2011 report) for SEPA, “An assessment of the vulnerability of Scotland’s river catchments and coasts to the impacts of climate change<sup>1</sup>”. There are some areas where alternative uplifts have been used within the maps - see Table 2 of the appendix of the Future Flood Map Summary on SEPA’s [Developing Our Knowledge](#) web page.

The allowances in the guidance, for river catchments >50km<sup>2</sup> excluding catchments in Orkney and Shetland, are peak river flow allowances based on a 2020 study commissioned by the Environment Agency (and contributed to by SEPA to ensure outputs covered Scotland) and carried out by the UK Centre for Ecology and Hydrology to assess the impact of climate change on fluvial flood peaks (this study is referred to as ‘CEH 2020 study<sup>2</sup>’ henceforth). The CEH 2020 study used the UK Climate Projections 2018 (UKCP18). The guidance recommends peak rainfall intensity allowances are used for catchments of any size in Orkney and Shetland as CEH 2020 study data was only available for catchments with an area greater than 100km<sup>2</sup>.

### Catchments < 50km<sup>2</sup>

For catchments smaller than 50 km<sup>2</sup> the maps and guidance are also inconsistent at present.

The guidance recommends the use of peak rainfall intensity uplifts for catchments <30km<sup>2</sup> and for river catchments of any size in Orkney and Shetland. The peak rainfall intensity allowances are based on the analysis of the UKCP18 local projections published in 2021 by the FUTURE-DRAINAGE<sup>3</sup> project and applied on a river basin region basis.

For river catchments between 30km<sup>2</sup> and 50km<sup>2</sup> (excluding those in Orkney and Shetland) the guidance recommends use of either peak rainfall intensity uplifts or peak river flow uplifts from the CEH 2020 study, depending on which uplift would produce a greater increase in flow.

The scenario used in the maps, however, uses the peak river flow uplifts from the CEH 2011 report for all catchment sizes >3km<sup>2</sup> and in all river basin regions, including Orkney and Shetland. SEPA’s

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<sup>1</sup> Kay, A., Crooks, S., Davies, H., & Reynard, N. (2011). An assessment of the vulnerability of Scotland's river catchments and coasts to the impacts of climate change. Wallingford: Centre for Ecology and Hydrology.

<sup>2</sup> Kay, A.L., Rudd, A.C., Fry, M., Nash, G., Allen, S. 2021. Climate change impacts on peak river flows: combining national-scale hydrological modelling and probabilistic projections. Climate Risk Management 31 (2020).

<sup>3</sup> [FUTURE DRAINAGE: Guidance for Water and Sewerage Companies and Flood Risk Management Authorities: Recommended uplifts for applying to design storms, 2021, Prepared by Murray Dale, JBA Consulting](#)

river flood maps do not include modelling of flooding from very small watercourses with catchment areas less than 3km<sup>2</sup>.

### Surface water

A future surface water flood map has not been published at the current time. We intend to publish a surface water Future Flood Map in a future release of the SEPA Flood Maps. This will use new information from UK Climate Projections 2018 on how climate change may affect short-duration high-intensity rainfall events that are typically responsible for surface water flooding. This will be informed by guidance on rainfall uplifts for short duration rainfall from the 2021 FUTURE-DRAINAGE<sup>4</sup> project.

The published surface water present day low likelihood flood map layer used the medium likelihood flood event with an increase in rainfall intensity of 20% nationally for the 2080s based on Department for Environment, Food & Rural Affairs guidance (2006), which represented the best understanding at the time. This layer may provide a first indication of those areas potentially at risk from surface water flooding in the future, however, due to projected changes in rainfall intensity it may not show all locations that may be affected in the future, and the 20% increase in rainfall intensity everywhere is lower than the rainfall uplifts from the 2021 FUTURE-DRAINAGE<sup>5</sup> project study used in the guidance.

### Planned guidance updates

The guidance will be updated based upon feedback from users and as new evidence on climate science evolves. When the guidance is updated, we will inform key stakeholders including flood risk consultants and planning authorities.

### Comparison summary

**Table 1** provides a useful summary comparison of the information used in the maps relative to the guidance.

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<sup>4</sup> [FUTURE DRAINAGE: Guidance for Water and Sewerage Companies and Flood Risk Management Authorities: Recommended uplifts for applying to design storms, 2021, Prepared by Murray Dale, JBA Consulting](#)

<sup>5</sup> [FUTURE DRAINAGE: Guidance for Water and Sewerage Companies and Flood Risk Management Authorities: Recommended uplifts for applying to design storms, 2021, Prepared by Murray Dale, JBA Consulting](#)

**Table 1**

| Source of Flooding                                   | Future Flood Map scenario  | Land Use Planning Guidance Version 3   |  |
|--|--|--|--|
| <p><b>Coastal (sea level rise)</b></p>               | <p><b>Outer Hebrides:</b><br/>UKCP18 RCP8.5 95<sup>th</sup>ile for 2100. Varies around the coast of the Outer Hebrides: 0.91-0.95m</p> <p><b>Rest of Scotland:</b><br/>UKCP09 High 2080 95<sup>th</sup>ile (broadly equivalent to the UKCP18 RCP8.5 50<sup>th</sup>ile for 2100)</p> <p>Varies around coast: 0.46-0.63 m</p> | <p>UKCP18 2100 RCP 8.5 95<sup>th</sup>ile.</p> <p>Applied by river basin region. Varies around coast 0.85-1.02 m</p> |  |
| <p><b>River (% uplift applied to high flows)</b></p> | <p>Flow uplifts from CEH 2011 study using UKCP09 High 2080s (2070-2099) 67<sup>th</sup> %ile</p>   | <p>Catchments &gt; 50 km<sup>2</sup> excluding catchments in Orkney and Shetland</p>                                 | <p>Peak river flow allowances by river basin region based on the CEH 2020 study using UKCP18 RCP 8.5 2080s (2070-2099) 67<sup>th</sup> %ile.</p>   |
|  |  | <p>Catchments (excluding those in Orkney and Shetland) 30-50 km<sup>2</sup></p>                                      | <p>Depending on which uplift results in the greater increase in flow, either:</p> <ul style="list-style-type: none"> <li>- peak river flow allowances based on the CEH 2020 flow uplift (as above).</li> <li>- peak rainfall intensity uplift on river basin region basis using the 2021 FUTURE-DRAINAGE project (UKCP18 RCP 8.5, 50<sup>th</sup> percentile, 2070s time horizon, 3-hour duration).</li> </ul> |
|  |  | <p>Catchments &lt; 30 km<sup>2</sup> or river catchments of any size in Orkney and Shetland</p>                      | <p>Peak rainfall intensity uplift on river basin region basis using the 2021 FUTURE-DRAINAGE project (UKCP18 RCP 8.5, 50<sup>th</sup> percentile, 2070s time horizon, 3-hour duration).</p>  |

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|----------------------|---|--|
| <b>Surface water</b> | Future surface water flood map not published at the current time, intend to publish in a later release.<br><br>Note that the present day low likelihood scenario for surface water uses medium likelihood +20% rainfall intensity everywhere. | Peak rainfall intensity uplift on river basin region basis using the 2021 FUTURE-DRAINAGE project (UKCP18 RCP 8.5, 50 <sup>th</sup> percentile). |
|----------------------|---|--|

**Update Summary**

| <i>Version</i> | <i>Description</i>  |
|----------------|---|
| Version 2      | Update to reflect change to peak river flow projections (UKCP 2018)         |
| Version 3      | Updates to reflect NPF4 adoption  |
| Version 4      | Updated to reflect update to the coastal future flood maps in November 2023 |

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