MEMO

TO	Seamus Keenan / Manny Gault, DfI	**FROM**	Tim Jolley, Martin Hughes
DATE	18 March 2021	**CONFIDENTIALITY**	Confidential
SUBJECT	DM34 Adoption of DfI Flood Risk Guidance (Feb 2019) v1.0		
DISTRIBUTION LIST	**Department for Infrastructure (DfI):** **WSP:** PM, Flooding, Drainage, Environment and Highways Teams		

1 BACKGROUND

This note sets out WSP's approach to checking the A5WTC Specimen Design for climate change allowances given in *"Technical Flood Risk Guidance in relation to Allowances for Climate Change in Northern Ireland"* published by DfI Water & Drainage Policy Division in February 2019 (referred to as the February 2019 guidance) and specifically, the use of fluvial allowances based on a higher 90% probability level and a higher 95 percentile Relative Sea Level for coastal design.

The February 2019 guidance states that *"where a strategically important development is being designed or assessed for climate impacts or, where risk to life or major economic losses could occur should design levels be overtopped, it may be more precautionary to use allowances based on the 90% and 95% percentiles for fluvial and coastal design respectively"*. The guidance advises that these higher probability runs are used as 'sensitivity tests' to determine whether there are any 'cliff-edge' effects where the flooding consequences may suddenly become extremely severe. If this test yields potentially severe effects, adoption of the higher level of confidence is advised for the proposed development.

Through discussion with DfI Roads, DfI Rivers and DfI Water & Drainage Policy Division, it has been established that the A5WTC should be considered as a strategically important development and therefore, the sensitivity checks should be carried out. DfI Water & Drainage Policy Division confirmed that the 90% probability level for fluvial design should be taken as +35%. A copy of this correspondence has been included with this paper.

2 CLIFF-EDGE EFFECTS

A cliff-edge effect is defined in the February 2019 guidance as a point at which *"flooding consequences may suddenly become extremely severe."*

For the purpose of the A5WTC assessment, a cliff-edge will be defined by an increase in DMRB significance classification such that the +35% significance is at least moderate. If flood risk is already assessed as very large significance, then a cliff-edge is defined as an increase in the number of residential or commercial properties at risk. DMRB Volume 11, Section 3, Part 10, HD 45/09 sets out the classification scheme for flood risk. While HD 45/09 has been superseded by LA 113, the classification scheme has remained unchanged.

The classification takes account of the importance and magnitude of flood risk at potential receptors. The following tables are the flood risk criteria taken from HD 45/09 and also the A5WTC Flood Risk Assessment dated October 2015.

Importance	Criteria	Typical Examples
Very High	Attribute has a high quality and rarity on regional or national scale	Floodplain or defence protecting more than 100 residential properties from flooding
High	Attribute has a high quality and rarity on local scale	Floodplain or defence protecting between 1 and 100 residential properties or industrial premises from flooding.
Medium	Attribute has a medium quality and rarity on local scale	Floodplain or defence protecting 10 or fewer industrial properties from flooding.
Low	Attribute has a low quality and rarity on local scale	Floodplain with limited constraints and a low probability of flooding of residential and industrial properties.

Table 1: Estimating the Importance of Flood Risk Attributes (from HD 45/09, Table A4.3)

Magnitude	Criteria	DMRB Typical Example (Table A4.4 HD 45/09)	A5WTC Adopted Differentiator for Estimating Magnitude of Impact
Major Adverse	Results in loss of attribute and / or quality and integrity of attribute	Increase in peak flood level (1% annual probability) >100mm	Major disruption to floodplain connectivity and / or length of road within floodplain >500m
Moderate Adverse	Results in effect on integrity of attribute, or loss of part of attribute	Increase in peak flood level (1% annual probability) >50mm	Moderate disruption to floodplain connectivity and / or length of road within floodplain between 100m – 500m
Minor Adverse	Results in some measurable change in attributes quality and vulnerability	Increase in peak flood level (1% annual probability) >10mm	Minor disruption to floodplain connectivity and / or length of road within floodplain between 50m – 100m
Negligible	Results in effect on attribute but of insufficient magnitude to affect the use or integrity	Negligible effect in peak flood level (1% annual probability) +/- 10mm	Length of road within floodplain <50m

Table 2: Flood Risk Magnitude Criteria (from FRA Volume 1, 2015, Table 2.4.1,)

The magnitude and importance are combined to give the significance as shown in Table 3.

Importance\Magnitude	Negligible	Minor	Moderate	Major
Very High	Neutral	Moderate/Large	Large/Very Large	Very Large
High	Neutral	Slight/Moderate	Moderate/Large	Large/Very Large
Medium	Neutral	Slight	Moderate	Large
Low	Neutral	Neutral	Slight	Slight/Moderate

Table 3: Flood Risk Significance Matrix

Where a cliff-edge effect occurs then the higher probability assessments will be used for design of the highway and mitigation measures.

This approach represents a risk-based approach to the design review, in that the review focuses on those areas where flood risk is most sensitive to the scheme. Attention will be given to those

areas where an increase in the climate change allowance has the potential to move an area from moderate to large for example, rather than from neutral to slight.

3 DESIGN CHECKS

As the A5WTC is already at Specimen Design stage, there is an emphasis on checking the current design against the February 2019 guidance to determine the need for any design revision and the options available should changes be required.

Section 1 of the scheme in the vicinity of Strabane is a specific case, as it is known that any increase in the climate change allowance potentially puts properties at risk and therefore, this model will be tested using combinations of the 35% climate change fluvial flows and the 95%-ile Relative Sea Level.

A simplified process has been developed to minimise the number of model iterations and design updates elsewhere. The staged process is summarised below:

- All culverts will be initially tested using the 20% climate change allowance to ensure that 600mm freeboard can still be achieved. The flood compensatory storage will also be checked to ensure it is sufficient to mitigate the 1 in 100 year + 20% baseline floodplain.
- All culverts will then be tested using the 35% climate change allowance and their freeboard confirmed. If they have sufficient freeboard, then the flood outlines and depths will be generated to check that there are no impacts beyond the vesting line. If any impacts on the floodplain wholly lie within the vesting line, then no action is required. If, however, there are impacts beyond the vesting line, then work will be undertaken to assess if additional flood storage within the vesting line will address the impacts.
- For those culverts that do not have sufficient freeboard with a 35% climate change allowance, the 35% and 20% floodplain results will be compared to determine if there are cliff-edge effects. If cliff-edge effects are present, then the scheme will be designed for the 35% climate change flow. If no cliff-edge effects are present, then the scheme will be assessed and mitigated on the basis of the 20% climate change flow.

Using this approach, any revised design work would only be undertaken in those areas where the 35% climate change allowance leads to an unacceptable increase in flood risk **and** where flooding consequences suddenly become extremely severe when the allowance increases from 20% to 35%.

4 CONCLUSION

The approach presented in this note, while following the advice given in the February 2019 guidance, could lead to different parts of the scheme adopting different climate change allowances depending on the presence of cliff-edge effects.