PUBLIC INQUIRY
IN THE MATTER OF THE HIGHWAYS ACT 1980
AND THE ACQUISITION OF LAND ACT 1981
AND IN THE MATTER OF:

THE M4 MOTORWAY (JUNCTION 23 (EAST OF MAGOR) TO WEST OF JUNCTION 29 (CASTLETON) AND CONNECTING ROADS) AND THE M48 MOTORWAY (JUNCTION 23 (EAST OF MAGOR) CONNECTING ROAD) AND THE LONDON TO FISHGUARD TRUNK ROAD (EAST OF MAGOR TO CASTLETON)) COMPULSORY PURCHASE ORDER 201-

-and-

THE M4 MOTORWAY (JUNCTION 23 (EAST OF MAGOR) TO WEST OF JUNCTION 29 (CASTLETON) AND CONNECTING ROADS) AND THE M48 MOTORWAY (JUNCTION 23 (EAST OF MAGOR) CONNECTING ROAD) SCHEME 201-

-and-

THE M4 MOTORWAY (WEST OF MAGOR TO EAST OF CASTLETON) AND THE A48(M) MOTORWAY (WEST OF CASTLETON TO ST MELLONS) (VARIATION OF VARIOUS SCHEMES) SCHEME 201-

-and-

THE LONDON TO FISHGUARD TRUNK ROAD (EAST OF MAGOR TO CASTLETON) ORDER 201-

-and-

THE M4 MOTORWAY (JUNCTION 23 (EAST OF MAGOR) TO WEST OF JUNCTION 29 (CASTLETON) AND CONNECTING ROADS) AND THE M48 MOTORWAY (JUNCTION 23 (EAST OF MAGOR) CONNECTING ROAD) AND THE LONDON TO FISHGUARD TRUNK ROAD (EAST OF MAGOR TO CASTLETON) (SIDE ROADS) ORDER 201-

(‘THE M4 CORRIDOR AROUND NEWPORT SCHEME’)

PROOF OF EVIDENCE ON FLOOD RISK
OF
GARY PURNELL
FOR THE NATURAL RESOURCES BODY FOR WALES
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1. INTRODUCTION

1.1. My name is Gary Purnell. I am a Technical Specialist in the Flood Risk Analysis Team of Natural Resources Wales (‘NRW’). I have been employed by NRW since it was created, in April 2013. Prior to this, I was employed by a predecessor authority to NRW, Environment Agency Wales, for 14 years.

1.2. I hold a Batchelor of Science (B.Sc.) Honours Degree in Civil Engineering and have been a Graduate Member of the Institution of Civil Engineers for 11 years. Prior to my employment with Environment Agency Wales, I worked as an Engineering Technician for Rhondda Cynon Taff County Borough Council and its predecessor, Taff Ely Borough Council, for a total of 8 years. I have also worked with a National Housing Developer as an Engineering Assistant for 2 years prior to my Local Government role.

1.3. The majority of my career has been related to water management ranging from designing conventional drainage systems, sewerage treatment, land drainage to flood risk/regulation/planning on ordinary/main river watercourses and within tidal/coastal areas. I have attended and actively participated in many planning appeal hearings in relation to flood risk issues and, most notably a public inquiry where I have previously given evidence and cross examined in respect of flood risk and the requirements of TAN 15.

1.4. My proof of evidence relies upon the information contained within the references section. NRW acknowledges that it has been involved in discussions with Welsh Government and its consultants, including in relation to possible mitigation strategies. As a reasonable public authority, NRW will review its position in the light of any new evidence admitted to the Public Local Inquiry into the M4 Corridor around Newport scheme.
2. RELEVANT BACKGROUND

2.1. The proposed route of the M4 Corridor around Newport crosses the Caldicot and Wentlooge Levels on a raised embankment. Both these areas lie below high water mark within the tidal floodplain. However, they are currently protected from tidal inundation by sea defences located along the coastline of the Severn Estuary. The sea defences mainly comprise earth embankments and, at certain locations, in combination with concrete wave return walls.

2.2. The majority of the sea defences are constructed to a level that provides the requisite standard of protection (SoP) in respect of their crest levels i.e. 0.5% (1 in 200 year) Annual Event Probability (AEP) and, in some areas, up to a SoP of 0.1% (1 in 1000 year) AEP. However, there are some sections of sea defence which have a considerably lower SoP, which can be a low as 20% (1 in 5 year) AEP. Some of these areas have either been recently upgraded by applying a “managed adaptive approach” to the 0.5% requisite SoP over 50 years (from the completion date of the works), or are currently at feasibility stage for improvements in the future.

2.3. There are a number of main rivers which are crossed by the scheme, of which the most significant are the Rivers Usk and Ebbw. These are tidally dominated at the affected locations. Other main rivers include the Monk’s Ditch and St Bride’s Brook/Mill Reen amongst others within the wider Caldicot and Wentlooge Levels area. In addition to the main rivers, there is a vast network of Ordinary Watercourses, commonly referred to as “reens”. These are managed by NRW’s Internal Drainage District (IDD). The proof of evidence of NRW’s Matt Bajowski provides further information on the Gwent Levels IDD.

2.4. The reens primarily deliver:

- Capacity to store fluvial flows during tide-locked conditions in the Severn Estuary;
• A sustainable fresh water supply for agricultural purposes;

• Ecological benefits which support the various species within the Special Site of Scientific Interest (SSSI).

2.5. The sources and locations of surface water (pluvial) flooding can be identified by viewing the Surface Water Maps on NRW’s website.¹ This has proven to show only limited areas where the proposed route of the M4 Corridor around Newport scheme would cross areas susceptible to pluvial flooding. These areas are generally the result of isolated low spots within the digital terrain model used in the surface water flooding model simulations, which do not include any assessment of local drainage regimes.

2.6. The level of the ground water table within the Caldicot and Wentlooge Levels is generally high. Therefore, ground water levels in these areas are typically controlled by adopting a ‘penning system’ to manage levels in the vast network of reens and field ditches. Summer penning levels are set higher than winter levels, which are lowered to maximise flood storage capacity in the network over the winter period. The proof of evidence of NRW’s Matt Bajowski provides detailed information on NRW’s management of water quantity in the Gwent Levels IDD.

2.7. The proposed M4 Corridor around Newport would involve the construction of a dual three-lane motorway between Junction 23 at Magor in the east to Junction 29 at Castleton in the west. The most prominent section of the scheme, in terms of a structure, is the bridge crossing which would be an elevated 2.1 kilometre structure crossing the Rivers Usk and Ebbw. The design for the bridge crossing structure comprises 3 major elements:

• The west approach viaduct would be a 512 metre long structure consisting of seven spans;

• The cable-stayed bridge would be a 752 metre long structure consisting of two long back spans and a 440 metre long main span over the River Usk; and,

• The east approach viaduct would be an 888 metre long structure and consist of 12 spans.

2.8. The bridge piers would be situated outside the tidal mean high water springs (MHWS) of both the rivers Usk and Ebbw. The east and west alignments of the proposed routes either side of the bridge would cross the Caldicot and Wentlooge Levels respectively and would be built upon a low embankment which would tie into the existing junctions at Magor and Castleton, referred to above. Where the alignment ties into Junction 23 at Magor, it is considered necessary to widen the existing M4 highway embankment crossing the St Bride’s Brook/Mill Reen main river. This would result in a northwards extension of the St Brides Brook Underpass/Culvert, which carries this main river.

2.9. NRW has attended numerous meetings with representatives of the Welsh Government and its Consultants to discuss the flood risk issues associated with the M4 Scheme:

• Flood Risk Modelling and Hydrology: 17th September 2015 (NRW offices at Rivers House, St Mellons, Cardiff);

• Flood Risk Issues – FCA: 20th October 2015 at Longcross Court, Cardiff;

• Flood Modelling Outputs: 10th December 2015 (at Rivers House);

• Flood Risk Meeting with Welsh Government (Martin Bates - Transport) and Peter Ireland (RPS): 19th January 2016 (at Rivers House);
Flood Risk Meeting to discuss a Statement of Common Ground (SoCG) between Natural Resources Wales and Welsh Government: 22\textsuperscript{nd} September 2016 (at Rivers House).

Note – the SoCG is subject to agreement and signing off by these parties at the time of writing this proof.

2.10. Welsh Assembly Governments’ Technical Advice Note 15 (TAN15) “Development and Flood Risk” (July 2004) (TAN 15) applies to the flood risk assessment of the M4 Corridor around Newport scheme. This provides technical guidance which supplement the policy set out in Planning Policy Wales (PPW) in relation to development and flooding.

2.11. The aims of TAN 15 are stated at paragraph 3.1:

“The general approach of PPW, supported by this TAN, is to advise caution in respect of new development in areas at high risk of flooding by setting out a precautionary framework to guide planning decisions. The overarching aim of the precautionary framework is, in order of preference, to:-

- Direct new development away from those areas which are at high risk of flooding.

- Where development has to be considered in high risk areas (zone C) only those developments which can be justified on the basis of tests outlined in section 6 and 7 are located within such areas”.

Paragraph 3.2 of TAN 15 states:

“The operation of the precautionary framework is governed by:

- A development advice map containing three zones (A, B and C with subdivision into C1 and C2) which should be used to trigger
the appropriate planning tests in relation to sections 6 and 7 and appendix 1.

- Definitions of vulnerable development and advice on permissible uses in relation to the location of development and the consequences of flooding.”

Paragraph 3.3 of TAN 15 states:

“The precautionary framework should be used for both forward planning and development control purposes.”

Specific criteria are identified within Section 7 and Appendix 1, with particular reference to A1.12, A1.14 and A1.15, which should be satisfied for development to be considered acceptable.

Within A1.2 the prime objectives of a Flood Consequence Assessment is to gain a fully appreciation of:

- The consequences of flooding on the development.

- The consequences (i.e. the overall impacts) of the development on flood risk elsewhere within the catchment for a range of potential flooding scenarios up to that having an annual event probability (AEP) of 0.1% (1 in 1000 year).

- The assessment can be used to establish whether appropriate mitigation measures can be incorporated within the design of the development to ensure that development minimises risk to life, damage to property and disruption to people living and working on the site or elsewhere in the floodplain.

2.12. The Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3 Part 10, HD45/09 – Road Drainage and the Environment (Highways Agency


However, for the purposes of assessing flood risk against the requirements of TAN 15, this is not entirely applicable for the reasons explained in this proof.

2.13. A tidal modelling study of the Caldicot and Wentlooge Levels has been commissioned by NRW. The consultants appointed by NRW were HR Wallingford and Jeremy Benn Associates (JBA). The report entitled ‘Caldicot and Wentlooge Levels Coastal Modelling’ which accompanies this study has now been completed. The outcomes of this study does not contradict the outputs of the ARUP modelling used to date in support of this project.

2.14. In respect of relevant climate change documents referenced in the ES Supplement: Volume 3, Appendix 16.2 FCA dated September 2016 NRW would observe that there were two sets of climate change guidance documents (bullets 1 and 2 below). However, new guidance issued by Welsh Government (WG) in August 2013 will supersede these for development planning purposes (final bullet below) as of 1st December 2016.

- “Welsh Government FCDPAG3 Economic Appraisal Supplementary Note to Operating Authorities—Climate Change Impacts (July 2007)”. Used to consider climate change for land use planning and development control purposes.

- “Welsh Government - Adapting to Climate Change: Guidance for Flood and Coastal Erosion Risk Management Authorities in Wales (December 2011)”. Used to consider climate change within the development of all flood and coastal erosion risk management (FCERM) projects or strategies.
• “Flood Consequence Assessments: Climate change allowances”. Sent by the Chief Planner of WG to Natural Resources Wales and Local Planning Authorities in a letter reference CL-03-16, dated 23rd August 2016. Implementation of climate change projections should be incorporated into Flood Consequence Assessments (FCAs) accompanying planning applications submitted from 1 December 2016.

3. SITE CONTEXT

3.1. Tidal flooding

3.1.1. The proposed route of the M4 corridor would cross the Caldicot and Wentlooge Levels on a raised embankment. These areas lie below the high tidal levels and encompass a significant area of tidal floodplain (albeit currently defended to a varying standard of protection) within the Severn Estuary. The sea defences mainly comprise earth embankments and, in some areas, in combination with wave return walls and engineered revetments.

3.1.2. The majority of the existing sea defences are constructed to a level that provides the requisite standard of protection (SoP) in respect of their crest levels i.e. 0.5% (1 in 200 year) Annual Event Probability (AEP) and, in some areas up to a SoP of 0.1% (1 in 1000 year) AEP at the present time. However, there are some sections of sea defences which have a lower SoP which can be as low as 20% (1 in 5 year) AEP. These areas have either been recently upgraded, or are currently at a feasibility stage for improvements in the future.

3.1.3. The Environment Agency (South West and Midlands Areas) and NRW have prepared a flood risk management Strategy known as the “Severn Estuary Flood Risk Management Strategy” (SEFRMS). This covers the Caldicot and Wentlooge Levels amongst other tidally affected/coastal areas in England.
3.1.4. The SEFRMS predicts that if no further improvements are made to upgrade the sea defences (in line with current climate change predictions), the SoP would decrease to between 5 and 0.5% (1 in 20 and 1 in 200 year) AEP by 2060. Furthermore, by 2110 the sea defences would lose their structural integrity and result in frequent flooding, including significant inundation of the defended areas they protect.

3.1.5. The SEFRMS and accompanying Strategy Appraisal Report (StAR) recommend that the existing tidal defences are improved in their current form to provide a SoP of 0.1% (1 in 1000 year) AEP in pace with climate change over the next 100 years.

3.1.6. According to the information provided in the ES, the proposed M4 scheme would increase tidal flooding elsewhere, to properties south of the new motorway corridor, whilst creating a flood risk benefit for properties to the north.

3.1.7. It is stated in the Flood Consequence Assessment (FCA), March 2016, that:

‘there are significantly more properties which benefit compared to those which are subject to detriment’ [ES, Vol. 3, Appendix 16.1, para.

This is quantified, in Table 3.1 of Appendix 16.1 to the ES, as 2,824 properties (betterment) compared with 708 properties (detriment).

The studies and tidal modelling that has been used to assess the flooding consequences for this scheme to date has been considered fit for purpose. However, we recommend for detailed design of any future scheme the NRW ‘Caldicot and Wentlooge Levels Coastal Modelling’ report and associated tidal model referred to in section 2.13 of this proof is used.

3.1.8. The acceptability criteria in Section 9 of TAN 15 (see: TAN 15, section 7 and Appendix 1) states “no flooding elsewhere”. Further, section A1.9 of...
TAN 15 states “particular attention should be paid to the impact of the development on flood risk elsewhere on the flood plain”. Accordingly, NRW considers that the outcomes, in terms of flood risk of the proposed M4 Corridor around Newport scheme, are non-compliant with TAN 15.

3.1.9. The proposed mitigation set out in the ES for tidal flood risk relies on the deliverables contained within the SEFRMS and the accompanying StAR. There has been no further consideration of other forms of flood risk mitigation to offset the impacts of tidal flooding elsewhere in relation to the M4 scheme. These include:

- Compensating those affected by increased flood risk as a result of the scheme.
- Provision of Individual Property Protection (IPP), again to those affected and, where IPP is a feasible solution.

3.1.10. The FCA published with the ES primarily focusses on the following outcomes to support the negative flood risk impacts of the M4 project:

- It is considered ‘inconceivable’ that future improvements to the coastal defences within the Gwent Levels will not be implemented [ES, Vol. 3, para 6.1.7]. We disagree with this as there has not been any robust commitment or guarantee that funding of any improvements will be provided in the future.
- The economic case for strategic improvements to the tidal defences along the Gwent Levels is robust [ES, Vol. 3, para 6.1.8]. We agree with this as the average benefit cost ratio of the strategic improvements within the Caldicot Levels (Gwent Levels) alone has been assessed as 66.1, [Reference: Table 1-2 of the SEFRMS - Strategy Appraisal Report (StAR): 2nd submission to the LPRG issued 30th April 2014].
- Provided that improvements to the coastal defences are undertaken in line with the SEFRMS, the Scheme will remain flood free during a 0.1% (1 in 1000) AEP tidal event, and have acceptable flood consequences with respect to tidal flood risk over the lifetime of the project i.e. with climate change [ES, Vol. 3, para 6.1.9]. We do not dispute this statement.

3.2. Fluvial flood risk

3.2.1. There are a number of main rivers which would be crossed by the M4 Corridor around Newport scheme, the most significant of which are the Rivers Usk and Ebbw. Those rivers are tidally dominated at this location. Other main rivers include the Monk’s Ditch and St Bride’s Brook/Mill Reen amongst others within the wider Caldicot and Wentlooge Levels area.

3.2.2. In addition to the main rivers, there is a vast network of Ordinary Watercourses, commonly referred to a “reens”. These are managed by NRW’s Internal Drainage District (IDD).

3.2.3. The reens primarily deliver:

- Capacity to store fluvial flows during tide-locked conditions in the Severn Estuary;
- A sustainable fresh water supply for agricultural purposes;
- Ecological benefits which support the various species within the Special Site of Scientific Interest (SSSI).

3.2.4. There has been a significant amount of detailed hydraulic modelling to assess the risk of flooding from pluvial, fluvial and tidal sources. This has been generally accepted by NRW.
3.2.5. The St Brides Brook/Mill Reen main river passes under the existing M4 within a culvert incorporating a cantilevered underpass. This will need to be extended by 71 metres northwards as a result of widening the embankment at this location. The additional hydraulic losses created by this extension will have a corresponding increase by transferring flood levels further upstream from the head of the new culvert. These increases will eventually diminish further upstream. There are no buildings/properties affected by the increase in flood levels, only agricultural land.

3.2.6. To mitigate the increases indicated above, it is proposed to either enter into a ‘right to flood’ agreement with the affected landowner or exercise Compulsory Purchaser Order (CPO) rights. Subject to the agreement(s) being reached, we do not have any concerns with this proposal to mitigate this specific increase in flood risk.

3.3. Other Flooding

3.3.1. Having considered the ES, NRW’s view is that the flood risks from pluvial (surface water) and groundwater sources as a result of the scheme would be in line with the requirements of TAN 15.

4. ISSUES

4.1. Tidal flooding

4.1.1. The construction of a raised embankment across the defended tidal floodplain comprising the Caldicot and Wentlooge Levels would intercept overland tidal flood flows and, prevent these from dispersing further inland in a northerly direction. This would have a corresponding detrimental impact on tidal flood risk elsewhere and is particularly relevant, in this case, for the Caldicot Levels as opposed the Wentlooge Levels. This is due to the extents and encroachment of the proposed embankment within the
Caldicot Levels area which would essentially confine tidal floodwaters to the south of its alignment.

4.1.2. If no improvements to the existing sea defences beyond 2030 are carried out, the consequences of constructing a raised embankment would result in an increase in flood depths to properties already situated within the flood risk area, south of the proposed M4 alignment.

4.1.3. The number of additional properties i.e. not currently affected by tidal flooding, will increase by 49 and 63 within the Caldicot and Wentlooge Levels respectively. These properties will experience depths of flooding up to 0.6 metres in some places.

4.1.4. It is contended within the FCA provided with the ES that it is inconceivable that the SEFRMS will not be implemented. The reasoning for this is set out in Section 3.1.10 of this proof.

4.1.5. NRW considers that the proposals to manage tidal flood risk within the SEFRMS have not been guaranteed over the lifetime of this project. Therefore, the SEFRMS should not be relied upon to permit future development in high flood risk areas, especially within the Caldicot and Wentlooge Levels.

4.1.6. NRW’s position is that, following TAN 15, the proposal to manage tidal flood risk over the next 100 years will need to be supported by a strong commitment by government, with the necessary assurances of funding and robust plans being put in place to implement any of the future works identified.

4.1.7. The estimated costs of improvements to the sea defences along the Caldicot Levels will be in the order of £81 million which includes a 60% Optimism Bias. The average benefit cost ratio of this equates to 66.1. [Reference: Table 1-2 of the SEFRMS - Strategy Appraisal Report (StAR): 2nd submission to the LPRG issued 30th April 2014].
4.1.8. The Welsh Government is committed to the policy of maintaining sea defences to “hold the line” through the adopted Shoreline Management Plan [ES Vol. 3: Appendix 16.1 FCA, para 3.1.3 dated March 2016]. The proposed motorway under the M4 Corridor around Newport scheme would only have adverse effects on tidal flooding elsewhere if the sea defences are overtopped and/or breached by wave action. It is considered in the FCA that “it is inconceivable that SEFRMS will not be implemented” [ES, Vol. 3: Appendix 16.1, para 3.1.20]. NRW’s view is that this is not a satisfactory commitment and does not provide the requisite degree of confidence in the delivery of the improvements outlined in the SEFRMS.

4.1.9. The ES states that, provided that improvements to the coastal defences are undertaken in line with SEFRMS, the Scheme will remain flood free during a 0.1% (1 in 1000 year) AEP tidal event, and have acceptable flood consequences with respect to tidal flood risk up to 2030 i.e. within the first epoch 2010 to 2030 (short term). However, for the remaining epochs 2030 to 2060 (medium term) and 2060 to 2110 (long term), there is a proposed “managed adaptive approach” to improving the sea defences in response to actual sea level rise. The Welsh Government has made no definitive commitment to, or security for, funding for tidal flood defence improvements beyond 2030, which would be contrary to TAN 15. This forms the basis for NRW’s objection to the M4 Corridor around Newport scheme on flood risk grounds as a result of the increased flooding elsewhere.

4.1.10. It is evident from the ARUP baseline tidal flood outlines (Year 2013) for the 0.5%, 0.2% and 0.1% (1 in 200, 500 and 1000 year) AEP events [Appendix A], that whilst the new M4 scheme is not affected, the existing M4 carriageway in the vicinity of the Severn Bridge Toll Booths will flood during these events without improvements to the sea defences at this location. These defences have not been included within the SEFRMS for improvements in the short term. Therefore, it can be concluded that the sea defences along the Caldicot Levels in their entirety do not provide a 0.1% (1 in 1000 year) AEP standard of protection to 2030.
NRW’s study ‘Caldicot and Wentlooge Levels Coastal Modelling’ results in greater flooding within the footprint of the proposed M4 during both the 0.5% and 0.1% AEP events (with existing defences and wave overtopping). This is generally within the eastern and western areas of the Caldicot Levels. However, with climate change predictions applied to these events, the flood risk significantly increases with the majority of the M4 footprint being affected.

4.1.11. Moreover, based on the outcomes of Section 3.1.19 of the FCA (ES Volume 3: Appendix 16.1 dated March 2016), if the sea defences are not improved over the next 100 years in pace with current climate change predictions, the scheme will flood during a 0.1% (1 in 1000 year) by up to 3.59 metres. This figure is the worst case which has been derived by comparing the maximum inundation level of 10.5 mAOD with the lowest carriageway level of 6.91 mAOD. This exceeds the requirements of A1.15 of TAN 15 and will result in a Danger for All (includes Emergency Services) flood hazard rating. Whilst NRW does not object to non-compliance with A1.15, I feel the facts of this residual flood risk should be presented at this point in my proof.

4.1.12. Furthermore, the proposed scheme would also fail the design threshold requirements of A1.14 of TAN 15. This is on the basis that the above depth of flooding is unlikely to diminish by at least a corresponding level for the 0.5% (1 in 200 year) tidal event with climate change.

4.1.13. The three priority schemes to be delivered during the first epoch will bring the existing sub-standard defences up to the same standard as the rest of the sea defences (0.1% AEP/1 in 1000 year to 2030) along the Caldicot and Wentlooge Levels i.e. Tabbs Gout (Sluice Farm) and Portland Grounds (Chapel Farm) have been completed. However, the Stephenson Street scheme is currently at the initial project appraisal stages and has yet to be formally approved for future implementation in the short term. I refer to section 4.1.10 of this proof which confirms that the sea defences
along the Caldicot Levels will not be entirely up to the 0.1% AEP/1 in 1000 year SoP to 2030.

4.1.14. The Design Manual for Roads and Bridges (DMRB) has been used in the ES to assess flood risk impacts associated with the M4 Corridor around Newport scheme [ES, Vol. 3: Appendix 16.1, para 2.2.1]. NRW regards the methodology applied in the DMRB to assess detriment as being far more lenient compared to NRW requirements when assessing new developments against the requirements of TAN 15, and is therefore inappropriate in this instance. NRW considers that Good Practice Guide (GPG) 101 “Producing flood risk hydraulic models and flood consequence assessments for development planning purposes” published September 2015, Section 5 is relevant in this instance.

4.1.15. The proposed scheme is contrary to the requirements of Section 7 and Appendix A of TAN 15. In particular:

Section 7.3

- Minimal disruption to people living and working in the area.
- Minimal potential damage to property
- Minimal impact of the proposed development on flood risk generally

Appendix A1.5

- The impact of the development in terms of flood risk on neighbouring properties and elsewhere on the floodplain.

Appendix A1.9

- Particular attention should be paid to the impact of the development on flood risk elsewhere on the flood plain.
Appendix A1.12

- The cost of future maintenance for all new/approved flood mitigation measures, including defences must be accepted by the developer and agreed with the Environment Agency (Note - now Natural Resources Wales).

- No flooding elsewhere.

4.1.16. Information in the supplement to the ES published in September 2016 with specific reference to the FCA [ES, Vol. 3: Appendix 16.2] confirms the following flood risk impacts [at para. 6.1.30] in terms of detriment to third parties as a result of the project. These impacts appear to have been taken from Tables 9 and 10 of the previous Arup Flooding Assessment, Reference 14/9235 dated 14\textsuperscript{th} July 2014. They have been established from the 0.1\% (1 in 1000 year) tidal flood event with 100 years of climate change plus the Upper Bound Confidence Limit, without the implementation of the flood risk measures within the SEFRMS beyond 2030. Different figures have been given in Mr Canning’s proof of evidence (in bold text in brackets).

Caldicot Levels

755 properties (2000) – Increased Depth of between 0 and 200mm

266 properties (600) – Increased Depth of between 200 and 400mm

6 properties (10) – Increased Depth of between 400 and 600mm

49 properties (not included) – Affected by flooding which do not currently flood

Total = 1076 (2610)
8990 (**13,000**) properties – No significant change

Wentlooge Levels

551 properties (**600**) – Increased Depth of between 0 and 200mm

60 properties (**40**) – Increased Depth of between 200 and 400mm

2 properties (**not included**) – Increased Depth of between 400 and 600mm

63 properties (**not included**) – Affected by flooding which do not currently flood

Total = 676 (**640**)

1917 (**1000**) properties – No significant change

**Overall number affected by detriment is 1,752 (3250) properties**

Whilst the above range of increased flood depths affect properties which are already susceptible to flooding, the onset of flooding will be earlier and over a longer duration in the event of a tidal flood occurring with the magnitudes assessed in the FCA.

4.1.17. NRW recognises that, in terms of tidal flooding, there would be flood risk benefits arising to 6643** properties from the M4 Corridor around Newport scheme. This is a result of the highway embankment preventing tidal ingress within those areas situated to the north of its proposed alignment. Again, these impacts are without the implementation of the flood risk measures within the SEFRMS beyond 2030.

Caldicot Levels
4560 properties (3000) – Reduced Depth of between 0 and 200mm

38 properties (100) – Reduced Depth of between 200 and 400mm

Total = 4,598 (3130*) includes figures* below

Furthermore Paul Canning’s proof confirms the additional betterment as follows:

20* properties – Reduced Depth of between 400 and 600mm

10* properties – Reduced Depth of greater than 1 metre

Wentlooge Levels

2,045 properties (3000) - Reduced Depth of between 0 and 200mm

**Overall number affected by betterment is 6,643** (6130) properties

4.1.18. NRW is not aware of recent examples of projects or schemes comparable to the M4 Corridor around Newport scheme where the delivery of flood mitigation has been committed to and/or subject to implementation over a long term period.

4.1.19. Referring to section 2.13 of this proof, NRW have recommended that Welsh Government and/or their consultants consult NRW further in respect of obtaining this model for detailed design purposes. This model is considered to be the best available information for future design of the scheme.

4.2. **Comment on alternatives / alternative route**

4.2.1. At the time this proof of evidence was being prepared, NRW had not received details of, or been informed that the Welsh Government were considering any of the alternative routes in any detail.
4.2.2. NRW would observe that the proposal often referred to as the “Blue Route” – which would utilise existing infrastructure – would still be susceptible to flood risk without the improvements covered in the SEFRMS or otherwise. As a result of this, based on published information, NRW notes that the Blue Route scheme would also appear to be contrary to the requirements of Section 7 and Appendix A of TAN 15, as highlighted above in Section 4.1.15 of this proof.

5. CONCLUSIONS

5.1. The construction of a raised embankment across the Caldicot and Wentlooge Levels will have a significant impact with regards increased tidal flood risk to property and regionally significant infrastructure.

5.2. The Caldicot Levels will be more affected by changes in flood risk in comparison to the Wentlooge Levels as a result of the proposed M4 scheme.

5.3. The flooding detriment established to those properties already established to be at tidal risk amounts to 1027 and 613 (Paul Canning PoE – 2610 and 640) in the Caldicot and Wentlooge Levels area respectively.

5.4. There will be an additional 112 properties overall in these areas subject to ‘new’ tidal flood risk i.e. they are currently not affected or indeed within the existing tidal flood outlines of the Severn Estuary.

5.5. Reliance on the proposed flood risk management measures contained within the SEFRMS is given to mitigate the detrimental effects on tidal flood risk elsewhere. The implementation of these measures is considered “inconceivable” by the author of the FCA.

5.6. The Welsh Government’s consultants consider that there is a robust and credible economic case that improvements within the SEFRMS can be delivered over the 100 year lifetime of the scheme. NRW does not dispute this
assumption based on the factual Benefit Cost Assessment within the StAR dated 30\textsuperscript{th} April 2014.

5.7. NRW considers that the measures proposed to manage tidal flood risk within the SEFRMS cannot be guaranteed in terms of a satisfactory funding commitment over the lifetime of the M4 Corridor around Newport scheme.

5.8. The proposals are contrary to TAN 15 (see Section 4.1.15 above) which forms the basis for NRW’s objection to the M4 Corridor around Newport scheme on flood risk grounds.

DECLARATION

I confirm that the facts and matters referred to in this proof of evidence are true to the best of my knowledge and belief. The opinions I have expressed represent my true and complete professional opinions on the matters to which they refer.

Signed: [Signature]

Dated: 7 February 2017
6. REFERENCES


6.8. The Environmental Permitting (England and Wales) Regulations 2016 (as amended). [NRW 2.13]

6.9. DMRB Volume 11, Section 3, Part 10 HD45/09 - Road Drainage and the Water Environment (Highways Agency et al, 2009) [NRW 8.7]

6.10. Ove Arup and Partners- M4 Corridor Around Newport: Flooding Assessment 14/9235 dated 14th July 2014 [NRW 8.8]

6.11. Environmental Statement Volume 1: Chapter 16 - Road Drainage and the Water Environment M4CaN-DJV-EWE-ZG_GEN-RP-EN-0004 dated March 2016 [WG 2.3.2]


6.15. H R Wallingford and JBA Consulting “Caldicot and Wentlooge Coastal Modelling – Summary Report: August 2016” produced on behalf of Natural Resources Wales. [NRW 8.10]