Adran yr Economi a'r Seilwaith
Department for Economy and Infrastructure

Llywodraeth Cymru
Welsh Government

Objection Ref OBJ0270

File Ref WG/REB/OBJ0270.14 – GWT/Ward

Response to Objector's Evidence: Professor Neil Ward

(Gwent Wildlife Trust)

1. GROUNDS FOR OBJECTION

1.1. Details

1.1.1. Professor Neil Ward, on behalf of Gwent Wildlife Trust, submitted a Statement of Evidence dated February 2017 in relation to the draft statutory Orders associated with the Welsh Government's proposals for the M4 Corridor around Newport, which has been received via the Programme Officer.

1.1.2. The Welsh Government understands the evidence submitted within both Statements to be based on the following:

Water Quality

1. Considers that no comment has been made with respect to cadmium and that the Event Mean Concentration proposed in Annex 1 of Appendix SS16.1 (December 2016 ESS) is higher than the EQS.
2. Considers that the quoted EQS value for cadmium has been given no justification.
3. Considers that section 3.6 of Appendix SS16.1 does not adequately address the issue of sediment accumulation and requests detail as to proposed sediment monitoring and analysis.
4. Has raised concerns regarding proposed sediment removal option and the resulting impact upon the reed bed integrity (and subsequent Water Treatment Area efficiency).
5. Considers that the effect of salt addition has not been considered, specifically with respect to enhanced solubilisation of heavy metals from sediment and the impact of accumulation upon biota.
6. Considers that sediment levels of organics, including oil-based combustion products and spills, plus PAHs rapidly accumulate in WTA sediments due to the increasing organic matter levels (surrounding the areas of the reed biomass). This effectively complexes and adsorbs organic chemicals with the sediment producing a reservoir of these chemicals. Increased storm flow will increase the 'insoluble' fraction of these organics, especially PAHs, which float on the surface of the WTA outflow water, or are suspended as particulates in the water, leading to increased levels leaving the WTA as 'treated' storm water. Considers that

Sediment analysis, monitoring/chemical analysis and removal/treatment are therefore essential issues that must be clearly addressed in the ES (and not as stated in quotations above).

7. States that the full elemental data for fluoranthene is not provided and the issue of fluoranthene has not been addressed (based upon the statement within the December 2016 ESS – Appendix 16.3, Section 1.3.9).

8. Refers to existing cases of motorway runoff treatment areas performing poorly as a result of inadequate maintenance.

2. REBUTTAL

2.1. Points Raised

2.1.1. Some of the above points have already been addressed in previous proofs of evidence. Others are dealt with by topic by the relevant witness in the following sections, in addition to their general proofs of evidence, to which readers should also make reference in their entirety for a full understanding of the Welsh Government's case. For ease of reference the places where the above points are addressed in this Rebuttal are listed in the table below:

Objector's point reference	Rebuttal paragraph reference	Objector's point reference	Rebuttal paragraph reference
1	2.2.1	5	2.2.4
2	2.2.1	6	2.2.3
3	2.2.2	7	2.2.5
4	2.2.3	8	2.2.6

2.2. Richard Graham (Water Quality)

2.2.1. Response to **Point 1 and Point 2** (Considers that no comment has been made with respect to cadmium and that the Event Mean Concentration proposed in Annex 1 of Appendix SS16.1 (December 2016 ESS) is higher than the EQS) and (Considers that the quoted EQS value for cadmium has been given no justification):

1. The project team has been collecting data from reens across the Gwent Levels since 2015, a total of 133 analyses to date. Cadmium (dissolved, filtered) was analysed for 128 times and identified only three times above the laboratory Limit of Detection (LOD), of which one result was above the EQS.

2. The value stated in Annex 1 of SS16.1 (December 2016 ESS) is the WFD GES (Good Ecological Status) standard for cadmium (WFD Directions 2015, Schedule 3, Part 3, Table 1) as cited by NRW for the revised standard to be applied to the Gwent Levels SSSI (details of the agreement are included within sections 1.3.15 – 1.3.20 of Appendix SS16.1 of the December 2016 ESS, and have since also been included in the agreed (and in the process of being signed) Statement of Common

Ground (SoCG) between NRW and Welsh Government). The value of 0.9 ug/l is the Maximum Allowable Concentration (MAC) value. The WFD Annual Average (AA) value is 0.15 ug/l.

3. Cadmium is a potential pollutant of concern present in low concentrations within road run off. The DMRB guidance on road run off risk assessment (HAWRAT) states an average Event Mean Concentration (EMC) for total cadmium of 0.63 ug/L. The prescribed annual average Gwent Levels SSSIs NRW Trigger Level for cadmium is 0.15 ug/L, equal to the Water Framework Directive Standard. To reduce the cadmium EMC concentration to the NRW Trigger Level concentration would require a treatment attenuation factor of approximately 76%. The SoCG that has been agreed between NRW and Welsh Government states that the risk of breaching the Trigger Level as a consequence of the proposed discharges to reens of treated run off is low and that unacceptable impact to the Gwent Levels ecosystem is unlikely.

4. It is acknowledged that recently constructed road schemes in the UK have included systems designed to treat road run off prior to discharge to water courses. In particular, the Newbury A34 bypass incorporates 9 water treatment areas of varying designs along the 13.5km section of dual carriageway, each with different catchments and specifications that include similar treatment systems to those proposed for the scheme including oil interceptors, sediment traps, grass channels, lagoons and reed beds.

5. I have reviewed two papers co-authored by Professor Ward, upon which he draws some comparisons on road run off treatment performance data. One is for two discharges from the A34 bypass at Newbury (Hares and Ward, 2004) - referred to as Pond J and Pond K - and the other is concerning discharges from the M25 at Oxted and Leatherhead (Hares and Ward, 1999). The Newbury discharges have been studied over a 3¼ year period starting from the year of commencement of operation in 1998 (Hares and Ward, 2004). For both treatment areas, run off flows through similar treatment areas prior to discharge into the River Lambourn. The treatment areas comprise an oil interceptor, silt trap incorporating a grass verge flowing into a combined flood attenuation pond and surface flow

reed bed termed a biofiltration pond. The drained carriageways serving these treatment areas do not incorporate grass lined channels.

6. Heavy metals, comprising lead, cadmium, copper and zinc, were measured in sediments at both the inlet and outlet to the treatment areas allowing a treatment efficacy to be calculated. Pond J achieved reduction in sediment concentrations for the stated heavy metals of 59%, 59%, 65% and 76% respectively. Pond K achieved reduction in sediment concentrations for the stated heavy metals of 79%, 86%, 73% and 71% respectively. Both ponds showed higher degrees of efficacy at earlier stages of the 3 ¼ year operational life of the bypass.

7. For Pond K the conclusions of the study stated that a rapid decrease in heavy metal levels in sediment through the reed bed system was revealed and that the presence of a well-established reed bed system in this pond is responsible for dissipating storm water inflow velocity thus allowing sedimentation processes to occur.

8. For Pond J, the study stated that in contrast, high heavy metal levels in sediments were reported throughout and also at the outlet. This was due to an ill established reed bed system causing a short residence time within this pond which may limit sedimentation and filtration processes.

9. The M25 studies looked at heavy metal concentrations in water discharges. The designs of the two referenced treatment areas are different. The Oxted water treatment area comprises a silt trap leading to a dry pond, the outlet of which passes through an oil interceptor prior to discharge in the receiving watercourse. The Leatherhead system comprises a wet biofiltration, leading to an oil interceptor the outlet of which flows into sedimentation pond before passing through a second oil interceptor prior to discharge in the receiving watercourse. The drained carriageways serving these 2 treatment areas do not incorporate grass lined channels.

10. In conclusion, the M25 study states that the removal efficiencies of heavy metals within the biofiltration pond at Leatherhead are higher than those from the corresponding dry detention pond facility at Oxted and that the residence time is substantially longer at Leatherhead than at Oxted. It is noteworthy that all the proposed Scheme's water treatment areas

comprise permanently wet attenuation lagoons acting as sedimentation ponds. The study also concludes that removal of particulate material through the attainment of a long residence time from motorway surface to receiving watercourse will predominantly affect the heavy metal removal efficiency, especially as a majority of the motorway-derived heavy metals exist either as insoluble species or adhered to insoluble particulate material.

11. By contrast, the proposed Scheme's water treatment areas with the inclusion of grass lined channels will achieve higher residence times than is achieved at these A34 and M25 examples.

12. Removal efficiencies are stated in the study for a wide range of heavy metals. For the metals studied in the A34 study, i.e. lead, cadmium, copper and zinc, the Leatherhead treatment area achieves a reduction in concentrations in water of 89%, 90%, 93% and 87% respectively. The study findings for the Oxted water treatment area were 89%, 95%, 88% and 84% respectively.

13. Given the achievement reported for the 4No. studies undertaken on the A34 and M25 treatment areas for cadmium removal of between 59% and 86% for sediments and between 90% and 95% for water, I am satisfied that the proposed water treatment areas are capable of delivering this annual average magnitude of efficacy for the removal of cadmium, which will comprise both soluble and non-dissolved forms.

2.2.2. Response to **Point 3** (Considers that section 3.6 of Appendix SS16.1 does not adequately address the issue of sediment accumulation and requests detail as to proposed sediment monitoring and analysis):

1. Following further consultation with NRW, a Surface Water Monitoring Protocol has been agreed underpinning a Statement of Common Ground (SoCG) with NRW that concludes that no areas of technical disagreement remain with Welsh Government on the proposed discharge of treated road run off to reens. This Monitoring Protocol allows for monthly surface water sampling both at, up gradient of, and downstream of all proposed WTA discharges. Additionally, an annual invertebrate assessment will be undertaken upstream and downstream of all proposed WTA discharges to identify any trends in biological quality that could be attributed to these

discharges. Finally, reen sediment quality will be sampled and tested analytically to determine the presence of any trends in potential accumulation of sediments continuing potential pollutants that my affect water quality or biological quality of the Gwent Levels SSSIs.

2. All field work collecting water, invertebrate and sediment data will be undertaken according to agreed methodology and take account of all pertinent best practice and methodologies. For example, sediment sampling would be carried out in accordance with BS EN ISO 5667-15:2009 (Guidance on the preservation and handling of sludge and sediment samples).

2.2.3. Response to **Point 4 and Point 6** (Has raised concerns regarding proposed sediment removal option and the resulting impact upon the reed bed integrity (and subsequent Water Treatment Area efficiency)) and (Considers that sediment levels of organics, including oil-based combustion products and spills, plus PAHs rapidly accumulate in WTA sediments due to the increasing organic matter levels (surrounding the areas of the reed biomass). (This effectively complexes and adsorbs organic chemicals with the sediment producing a reservoir of these chemicals. Increased storm flow will increase the 'insoluble' fraction of these organics, especially PAHs, which float on the surface of the WTA outflow water, or are suspended as particulates in the water, leading to increased levels leaving the WTA as 'treated' storm water. Considers that Sediment analysis, monitoring/chemical analysis and removal/treatment are therefore essential issues that must be clearly addressed in the ES (and not as stated in quotations above)).

1. The WTAs are designed to handle a 1 in 100 year storm event, plus 30% allowance for climate change. The grass lined channels, in addition to being a method of conveyance, also provide some treatment and storage for highway run off. In treating a storm event of this magnitude, the point by which runoff reaches outfall to the reed bed would still be controlled to the agreed greenfield runoff rate, protecting the reed bed from storm surges.

2. The combination of the aforementioned mechanisms greatly reduces the risk of sediment reaching the reed bed (and eventually the reen) at any significant volume even under storm conditions, and it is unlikely that

large volumes of sediment removal from the reed bed would be necessary as part of the maintenance.

3. Notwithstanding this, the mechanisms by which sediment is removed are detailed within Appendix 16.3 of the March 2016 Environmental Statement. The grass lined channels settle and trap sediment in vegetation, whilst also capturing sediment and pollutants by adhesion to plants. A grit and sediment trap reduces sediment loads with possible adsorbed pollutants, with settlement within the pollution control lagoon. Finally reed beds polish water to filter out significantly remaining suspended particles.

4. It is identified in Appendix SS16.1 in the December 2016 ES Supplement that routine inspection and maintenance will be required to promote the required functionality of the system as a whole. The recovery of sediment is an important element of this. The grass lined channels are designed to trap a large proportion of sediment which will be recovered by dedicated road side maintenance plant. Recovery of sediments by the Pollution Control Lagoon (acting as a sediment trap) will be undertaken by conventional methods. Recovery of sediment from the attenuation lagoons will be required on a less frequent basis but can be undertaken in phases and utilising appropriate methods to prevent large scale reduction in functionality of the pond or remobilisation of sediment bound potential pollutants. Finally, the reed bed is expected to be maintained with the phased replacement of plants to preserve its functionality. This could be done under low flow conditions within the WTA and by selectively taking small areas at a time off line. The recovery of sediment containing bound potential pollutants would be achievable at the same time with the replenishment of clean root zone substrate.

5. Routine inspection and maintenance of the WTAs will ensure that treatment stages have not been compromised. Additionally, a routine inspection and maintenance programme for the grass lined channels has been described within the Monitoring Protocol published for the scheme to be agreed by all parties as per Commitment 174, as referenced at paragraph 2.6.3 of the Statement of Common Ground between Welsh Government and NRW.

6.

7. Details of proposed maintenance of the WTAs - including the grass lined channels - are set out within section 3.2 of Appendix SS16.1 (December 2016 ESS). In addition, a Statement of Common Ground (which appends the Surface Water Monitoring Protocol) has been agreed between Welsh Government and NRW, and includes details of the proposed maintenance. This is further discussed in our response to Point 8.

2.2.4. Response to **Point 5** (Considers that the effect of salt addition has not been considered, specifically with respect to enhanced solubilisation of heavy metals from sediment and the impact of accumulation upon biota):

1. Also included within the Surface Water Monitoring Protocol agreed with NRW within a wider Statement of Common Ground (SoCG) is the proposed mitigation of elevated chloride in run off from rock salt associated with winter treatment of the Scheme. This is due to the recognised sensitivity of the biology of the reen network and features of the SSSI to potentially elevated chloride concentrations, particularly during early spring.

2. A commitment in the Commitments Register states that calcium magnesium acetate (CMA) will be utilised in replacement for rock salt between 1st March and 30th September each year. CMA has minimal impact on aquatic organisms and would mitigate the accumulation of chloride within the treatment systems and subsequently the reens. It will also reduce the risks of remobilisation of sediment bound heavy metals during these times.

3. Monitoring of each Water Treatment Area (WTA) outfall and reen water quality is proposed at each discharge to be assessed during the operational phase of the Scheme on a monthly basis for minimum period of 5 years, as agreed with NRW as part of the SoCG on water quality. This will identify any unacceptable trends in concentrations of potential pollutants that may develop to allow additional inspection and maintenance to be undertaken as necessary. Following this 5 year monitoring period, a report will be produced and make recommendations on a way forward.

4.

2.2.5. Response to **Point 7** (States that the full elemental data for fluoranthene is not provided and the issue of fluoranthene has not been addressed (based upon the statement within the December 2016 ESS – Appendix 16.3, Section 1.3.9)):

1. Please refer to Annex G and H of Appendix 16.2 of the March 2016 Environmental Statement and the September 2016 ESS (Annex G and H, Appendix S16.1) for the laboratory data collected in relation to the Scheme, including results for fluoranthene.
2. The EQS for fluoranthene is stated as 0.1ug/l for the Annual Average and 1ug/l for the MAC (Directive 2008/105/EC; Annex 1 – Part A). Of all 133 analyses for fluroanthene since May 2015, only two exceedances have been recorded for the EQS (MAC).
3. Through an agreed Surface Water Monitoring Protocol that is appended to the SoCG on water quality, NRW have prescribed Trigger Levels for the Gwent Levels SSSIs, which includes a standard for PAHs which refers to the sum of five different PAHs to be screened against the EQS for benzo (a) pyrene in keeping with the recommendation of the Water Framework Directive to use benzo (a) pyrene as a marker for PAH compounds generally. Please refer to Point 2 of section 2.2.1 above regarding the agreed Trigger Levels with NRW.

2.2.6. Response to **Point 8** (Refers to existing cases of motorway runoff treatment areas performing poorly as a result of inadequate maintenance):

1. Maintenance of the WTAs is ensured by the following commitments: 5, 9, 89, 90, 91, 92, 93, 97, 98, 157, 158, 159, 160, 161 (Dec 2016 ESS: Appendix SR18.1 – Register of Commitments).
2. The Surface Water Monitoring Protocol agreed between NRW and Welsh Government to implement monitoring commitments and a programme of inspection and maintenance of the water treatment areas and associated drainage infrastructure for the operational phase of the Scheme. This Protocol describes the monthly chemical and annual biological and sediment sampling and reporting undertaken for a minimum period of 5 years from the commencement of operation of the new section of motorway. Monitoring will be undertaken at points upstream and downstream of each WTA and at the outfall discharge point. Following

this 5 year monitoring period, a report will be produced and make recommendations on a way forward.

3. Should chemical analysis undertaken on treated surface water indicate that sampling data trends suggest insufficient performance of run off treatment systems, or that NRW trigger levels on surface water quality or HAWRAT trigger levels on sediment quality, are at risk of being exceeded, action would be undertaken to identify and rectify such problems.

4. Under the extreme and highly unlikely scenario that WTA are incapable of protecting the water quality of the reens receiving discharges, WTA could be temporally prevented from discharging using penstock valves, polluted water tankered away in the short term or additional water treatment provisions utilised in situ to return clean water to reens until such a time as normal WTA functionality has been resumed.

5. Underpinning these potential contingencies is Commitment No. 2 that states:

   "Attenuation ponds will ensure surface water runoff will meet Water Framework Directive (WFD) and SSSI requirements prior to entering the SSSI reen network."

2.2.7. I confirm that the statement of truth and professional obligations to the inquiry from my main proof still applies.

Annex

Hares R. J. and Ward N. I. (2004), *Sediment accumulation in newly constructed vegetative treatment facilities along a new major road*, Science of the Total Environment 334-335

Hares R. J. and Ward N. I. (1999), *Comparison of the heavy metal content of motorway stormwater following discharge into wet biofiltration and dry detention ponds along the London Orbital (M25) motorway*, Science of the Total Environment 235

Pontier H., May, E. and Williams, J.B. (2001) *Constructed wetlands for the treatment of runoff from the Newbury Bypass*, Water and Environment Journal (Volume 15, 79-156)