JOINT HYDROLOGICAL POSITION STATEMENT

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SSA C
Mid Wales (Powys) Conjoined Wind Farms Public Inquiry

INTRODUCTION

1 This document is a Joint Hydrological Position Statement (or Statement of Common Ground) that has been produced for the purpose of submission to the Mid-Wales Conjoined Wind Farms Public Inquiry.

2 The document has been agreed by appropriately qualified experts appointed by the applicants of the three conjoined inquiry wind farm schemes that are within Strategic Search Area C (SSA C) namely Vattenfall (Llanbadarn Fynydd), Fferm Wynt Llaithddu (Llaithddu), and Celtpower Ltd (Llandinam). Part or all of the application site for each of the three schemes is within the catchment of the River Wye Special Area of Conservation (SAC),

3 Each of the three applicants has already provided information to support an in-combination assessment to comply with a request for additional information from the Competent Authority (DECC). They have conducted both 'stand alone' assessments and cumulative/in-combination impact assessments, which have been reported in their respective EIA documentation. However NRW has maintained objections to all three applications on the grounds that *"insufficient information has been provided by the applicants to support an in-combination assessment of the River Wye SAC"* . NRW has provided to the Inquiry a document entitled *'Scope of Habitats Regulation Assessment (HRA) of proposed windfarms and gridline in the River Ithon sub-catchment on the River Wye SAC'* (CON-003-007). This scope identifies the information that NRW believe should be supplied to DECC to enable it to carry out such in-combination assessment.

4 As stated in the report published by DECC. 'Review of Guidance on the Assessment of Cumulative Impacts for Onshore Wind Farms' (CPL-HYD-026), **… significant environmental effects from wind farms in the fields of ecology and hydrology '*can generally be scoped out; assuming sound proposals for mitigation, and this approach can be adopted for cumulative effects*'(p46. para 3)**.

5 This position statement contains our professional opinion on a) the likelihood of change to the hydrological processes of the relevant River Wye SAC sub-catchment / management unit as a consequence of the three schemes both cumulatively and in-combination with the baseline contribution from other likely land use developments; b) the efficacy of mitigation measures applied to wind farm projects and c) the need for any further information or analysis.

BACKGROUND INFORMATION

The River Wye SAC Core Management Plan

6 The NRW scoping document (CON-003-007) states

"the management unit that is potentially vulnerable to impacts from the group of windfarms and gridline being considered at the Public Inquiry is the River Wye Ithon sub-catchment"

and that

"*the feature that is potentially vulnerable to impacts…is Atlantic salmon, specifically in relation to important spawning areas"*.

This is derived from the NRW Core Management Plan for the River Wye (the CMP)[1], which also provides the hydrological management requirements for this feature. NRW has provided data which has allowed the nearest spawning locations to the sites to be mapped. These are shown in the attached Figure 1.

Characteristics of the River Ithon sub-catchment and impact of construction works on hydrological processes

7 The characteristics of the River Ithon sub-catchment, the location of the wind farm schemes within the sub-catchment, and their distance from salmon spawning areas, are all important to understanding the nature of pollution or sediment transport in this region.

8 In contrast to many other rivers in the UK, the River Wye has a very large catchment area (4,136 km^2). The River Ithon sub-catchment (Management Unit 7 in the River Wye SAC CMP) covers 361km^2 (8.7% of the total Wye catchment) and therefore captures a relatively large volume of rainfall.

9 The River Ithon sub-catchment area has medium to high rainfall. The rainfall is generally distributed over the year, although it is more frequent in the winter months, leading to higher river flows in winter than in summer.

10 The bedrock in the upper part of the catchment is of very low permeability and the soils are thin. As a result there is relatively little infiltration and storage of water in the soils following rainfall events, and so rainfall run-off rates are high. This means that most of the water from rainfall flows overland and enters the rivers rapidly, with very little seeping into the rivers through groundwater. This is reflected in the low Base Flow Index (BFI)[2] (0.38) for the

1 CCW (2008) Core Management Plan (Including Conservation Objectives) for River Wye Special Area of Conservation.
2 The BFI may be thought of as a measure of the proportion of the river runoff that derives from stored sources; the more permeable the rock, superficial deposits and soils in a catchment, the higher the baseflow and the more sustained the river's flow during periods of dry weather. Thus the BFI is an effective means of indexing catchment geology. For instance, rivers draining impervious clay catchments (with minimal lake or reservoir storage) typically have BFIs in the range 0.15 to 0.35,

subcatchment both at the headwaters and lower in the subcatchment[3].

11 As stated above (para 3), NRW's focus on salmon spawning areas reflects the objectives of the CMP[4]. Since Atlantic salmon has been identified as one of the most sensitive species (see para 6 above), particularly with regard to biological water quality[5], conservation management of the SAC for Atlantic salmon will support all its other qualifying features,. *"provided that the components of favourable conservation status for the watercourse … are secured*" (p19; 4.2.3). .

12 One of the core components of favourable conservation status for the [species and habitats] of the watercourse, and for salmon, is hydrological condition, which encompasses both hydrological processes and water chemistry. The CMP (p6) states that "*hydrological processes, in particular river flow (level and variability), and water chemistry, determine a range of habitat factors of importance to the SAC features, including current velocity, water depth, wetted area, substrate quality, dissolved oxygen levels and water temperature. Maintenance of both high 'spate' flows and base-flows is essential. Reductions in flow may reduce the ability of the adults of migratory fish to reach spawning sites*". The CMP also states that the current 'unfavourable' status for Atlantic salmon results from "*failure of the Management Target for adult run size*, *a precautionary assessment of juvenile distribution and abundance, and the presence of adverse factors*, [particularly] ***the potential for flow depletion and localised water quality failures*** **[including]** ***acidification due to forestry…in the upper reaches of the Wye and Ifron***" (p33).

13 The impact assessments for the individual wind farm developments indicate that construction (and operation and decommissioning) of each of the wind farms will have no measurable effect on river flows (i.e. the wind farm developments either alone or in combination will not affect current velocity, water depth, wetted area or water temperature). This is on account of the limited storage potential of the upper catchment (see para 10) that might be replaced by infrastructure[6]. There would be no measurable changes to the upper catchment runoff rates or BFI even in the absence of the proposed mitigation measures. The CMP conservation objectives of maintaining the level and variability of spate flows and low flows are therefore not put at risk by any of the wind farm developments individually or in combination. Hydrological processes will therefore not be considered further.

14 The focus of this position statement is water chemistry, in particular on substrate (river bed) quality (and possible dissolved oxygen levels) associated with the potential run-off of pollutants, notably suspended sediments (we understand this to represent NRW's primary concern).

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whereas most Chalk streams have a BFI greater than 0.9 as a consequence of the high groundwater component in the river discharge.

3 National River Flow Archives for gauging stations 55011 (Llandewi) and 55015 (Disserth).

4 *Ibid.* ref 1.

5 *Ibid.* p22

6 This includes construction over peat or peaty soils, which by their nature are waterlogged, at or near saturation and hence limited capacity to infiltrate rainfall. These soils are characterised by high runoff rates.

Distance of sediment transport in relation to location in catchment

15 All of the SSA-C schemes (including not only the wind farms before the inquiry but also other proposed SSA-C wind farms) are located wholly or partly in the upper catchment/headwaters of the River Ithon. The potential for sediment transport within any water body is largely determined by the energetics of the river or stream, and sediment transport distances have been found to increase with basin size. That is, the larger the catchment area, the higher the river flow, and the more likely that sediment will be transported for longer distances. A location on a watercourse in the upper catchment will itself have less of a catchment area, lower water volume, and therefore a lower potential to transport sediment long distances than a location further downstream. Studies have shown that for headwater streams, sediment transport distances generally range from 800 metres to a few kilometres, while in very large downstream river catchments (eg >30 time the size of the Wye), sediment can be deposited and re-mobilised over hundreds of kilometres e.g. CPL-HYD-024[7]. Therefore any activities at the head of a catchment (such as wind farm construction) that might cause sediment to enter a watercourse will pose a much lower risk to downstream sites than similar activities taking place lower in the catchment.

16 Measurements in the River Ithon confirm that locations in the upper catchment have lower water volumes and lower flow rates than locations further downstream, and therefore have less potential for long-distance sediment transport[8]. The nearest gauging station/recording point to the schemes is approximately 20km downstream at Llandewi (55011), and the next gauging station is a further 15 km or so downstream at Disserth (55016) (see Figure A). Highflows measured at the lower point, Disserth, are up to up to five times greater than those measured at the higher point - Llandewi. Although there is no long-term hydraulic information upstream of Llandewi, it is clear that the river flows and sediment-transport potential at the location of the wind farm schemes, 20km further upstream from Llandewi, would be significantly less than at Llandewi. This is why the position of the wind farm developments within the catchment, and their relative distance to recorded salmon spawning areas is important.

River Ithon baseline

17 By way of context, the main land use in the Ithon sub-catchment is sheep pasture, with some forestry. The CMP indicates that the most significant sources of diffuse pollution and siltation already occurring within the Wye catchment are from agriculture and forestry felling, while the River Ithon sub-catchment in particular has low water quality in places due to diffuse (nutrient) pollution from agriculture. The impact of forestry (both operation and felling) on sediment releases has been the subject of a number of studies, including in upland catchments in

7 In Whitling P et al 2005. Suspended sediment sources and transport distances in the Yellowstone River basin Geological Society of America Bulletin, March/April, 2005, v. 117, no. 3-4, p. 515-529.

8 Any sediment that does enter the upper tributaries of a watercourse would therefore require several transport events (high flow periods) for it to reach the nearest spawning areas; however, most sediment generated by construction activities will not reach any tributaries of the SAC due to the distances and incorporated mitigation.

Wales[9], with the single most cause of increased sediment loads being that of the installation of forestry drainage ditches, which can lead to sediment concentrations of over 2 orders of magnitude from pre-afforestation rates[10]. Despite such activities, the recorded water quality in catchment is classified as A- good quality[11].

Mitigation / preventative measures

18 The question to be addressed therefore is *'how could wind farm projects make a difference to this baseline?*'

19 Leaving aside the low risk of sediment transport due to location within the catchment discussed above, there are mitigation measures that can be put in place that will prevent or minimise sediment or other pollutants entering watercourses. As noted in para 4 above, '*significant hydrological effects, including cumulative / in-combination effects from wind farms can generally be scoped out of environmental impact assessment, if there are 'sound proposals for mitigation'.* While additional care may be required when addressing sensitive receptors such as European sites, a low level of environmental impact from wind farms on the water environment is expected. This is because the construction of wind farm schemes is now well understood, and avoidance and minimisation of potential impacts to the water environment are built in at the early design stage, primarily through good track design, good drainage design, and establishing buffer zones and setback distances from watercourses. This good design is supported by guidelines for best practice wind farm construction (eg the BWEA Best Practice Guidelines for Wind Energy Development[12] and SEPA's Engineering in the Water Environment Good Practice Guide (CPL-HYD-015). These set out that the published Pollution Prevention Guidelines (PPG) are to be applied in managing construction practices. It is standard practice for wind farm conditions to include requirements for preparation and approval of construction method statements, water quality monitoring plans, and pollution prevention plans that set out measures to prevent or address any incident of

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9 Newson, M.D. & Leeks, G.J.L. 1987. Transport processes at a catchment scale: a regional study of increasing sediment yield and its effects in mid-Wales, UK. In: Sediment transport in gravel bed rivers, edited by C. Thorne, J. Bathurst & R.D. Hey. Chichester: John Wiley.

Arkell, B., Leeks, G.J.L., Newson, M.D. & Oldfield, F. 1983. Trapping and tracing: some recent observations of supply and transport of coarse sediment from upland Wales. Spec. Publ. int. Assoc. Sedimentol., 6, 107-119.

Blackie, J.R., Hudson, J.A. & Johnson, R.C. 1986. Upland afforestation and water resources: preliminary analyses of phase 1 of the Balquhidder catchment studies. (Progress report.) Wallingford: Institute of Hydrology.

Burt, T.P., Donohoe, M.A. & Vann, A.R. 1984. A comparison of suspended sediment yields from two small upland catchments following open ditching for forestry drainage. Z. Geomorph., n.s., 51-62.

Leeks, G. J. L.; Roberts, G. 1987 The effects of forestry on upland streams - with special reference to water quality and sediment transport. In: Good, J. E. G., (ed.) Environmental Aspects of Plantation Forestry in Wales. Grange-over-Sands, NERC/ITE, 64-69. (ITE Symposium, 22).

Murgatroyd, A.L. & Ternan, J.L. 1983. The impact of afforestation on stream bank erosion and channel form. Earth Surf. Process. Landf., 8, 357-369.

10 Robinson, M. & Blyth, K. 1982. The effect of forestry drainage operations on upland sediment yields. Earth Surf. Process. Landf., 7, 85.

11 Environment Agency (now NRW) water quality data 2009.

12 BWEA Best Practice Guidelines for Wind Energy Development 1994 (contributing groups included CCW, Montgomeryshire Council, RSPB, English Nature)

pollution.

20 Wind Farm developers generally provide more mitigation than is required by these guidelines. For example, all three of the wind farm schemes we act for have met, and in most cases have exceeded, the setback distances stipulated both by law and relevant guidance[13]. Similar preventative measures are not currently a requirement of permits for forestry felling operations, or for agricultural land uses, even though those activities pose a greater threat to the qualifying features of the SAC than wind farm construction (para 17).

THE STATEMENT

21 Each of the SSA-C wind farm proposals before the inquiry has been assessed as having a low likelihood of causing changes to the baseline water quality and quantity at its respective location within the catchment, and that any such changes would be low to negligible. This conclusion applies no matter what the baseline is, or what other contributions might be from other developments. These assessments have been accepted by NRW. There are therefore no significant effects 'alone' as a result of any one wind farm.

22 In order to develop a realistic worst-case scenario for in-combination effects, the wind farms have been reviewed against the criteria below. For any, even theoretical, possibility to arise of combined effects, all of the following conditions would need to occur:

a. construction of at least two developments at the same time;

b. failure of preventative mitigation measures in these developments at the same time;

c. the developments need to be close enough to each other to enable the pollutant or sediment load to combine;

d. The location of salmon spawning habitat needs to be close enough downstream of the developments to receive the combined sediment load;

e. Any such combined sediment load would need be great enough to result in permanent deposition of silts at the spawning locations, or reduced dissolved oxygen especially during spawning seasons.

23 Even assuming (a) and (b) occur, the three SSA-C wind farms before the inquiry are not close enough to each other to have any combined effect with each other.

24 The Llandinam scheme is proposed at the headwaters of the Ithon and is the highest location in the catchment of the three SSA C schemes before the inquiry. An analysis of connectivity and Pollution Risk Appraisal[14] has identified key elements of the project, including the limited

13 Land Drainage Byelaws (Wales) 10 m ; PPG05 (oils storage), 10 m of a watercourse and 50 m from a well, borehole or spring); CIRIA (2006) C648 Control of water pollution from linear construction projects. Technical Guidance - None recommended; SEPA 2009 Engineering in the Water Environment Good Practice Guide: Temporary Construction Methods , Buffer strip of vegetation 5-10 m wide to trap sediment. Use along with other mitigation.
14 Annex C of the Llandinam updated 'Information to inform an HRA' August 2013.

amount of infrastructure in proximity to watercourses, and concluded that increased sediment levels would not be detectable at the boundary of the wind farm application site. No sediment from the Llandinam scheme could reach the SAC boundary. Upon leaving the Llandinam site, the watercourses feed directly into the northern Llaithddu turbines. Even if Llandinam and Llaithddu are assumed to be built at the same time, for Llaithddu there would be no contribution to the baseline water quality from construction of Llandinam, and Llandinam should be excluded from any further assessment of the in-combination effects in this subcatchment.

25 The northern Llaithddu turbines are located approximately 4km upstream from the SAC boundary along the Blue Lins Brook. The southern turbines are located approximately 2.5 km upstream from the SAC boundary. If there were to be any sediment transport, it would occur along narrow headwater streams. Even without any preventative measures, it is highly unlikely that any residual sediment generated by the Llaithddu development could be transported for 2.5 to 4km from its position in the subcatchment to the SAC boundary. NRW has agreed in relation to the assessment of Llaithddu alone that:-

"It should be possible to conclude that the [Llaithddu] project will have no impact on the integrity of the [River Wye Site of Special Scientific Interest] or the SAC if suitable conditions are attached to the project to ensure that the necessary measures are in place to avoid adverse effects on the integrity of the SAC."[15]

The preventative measures that ensure Llaithddu will not have an impact alone will be equally effective in ensuring it does not have an in-combination impact on the SAC with any other development. Llaithddu should therefore be excluded from any further assessment of the in-combination effects in this subcatchment.

26 The location of salmon spawning areas relative to the proposed wind farms in the sub-catchment is shown in Figure 1. From a hydrological perspective, the first potential Atlantic salmon spawning site that enters into consideration as conceivably being affected by any combination of the developments proposed in the catchment is located at the confluence of the Blue Lins Brook and the Ithon (NRW sampling ref. W032d). This is approximately 0.9km downstream of Llanbadarn Fynydd, but 5.8km downstream of the Llaithddu boundary and 7.2km from the Llandinam boundary. Due to the lower river flows in this upper catchment and the distances involved, there is a negligible likelihood of any sediment at all being transported from either the Llandinam site or the Llaithddu site to this location. It is our opinion that even if Llaithddu and Llanbadarn Fynydd or any other potential developments are assumed to be constructed at the same time, and there is a failure of preventative measures at those sites at the same time, Llaithddu would not make any contribution to the sediment baseline at this potential spawning location. Hence the Llaithddu scheme should be excluded from any further in-combination assessment.

15 Statement of common ground between Fferm Wynt Llaithddu and NRW on hydrology (FWLC-SOCG-005) para 6.2

27 A draft HRA was produced for the Llanbadarn Fynydd scheme by DECC[16] in 2012. It considered the in-combination effects with Llandinam, Llaithddu, all other wind farms in the SSA-C, and other developments. Having set out its reasoning, DECC concluded as follows:

a. the applicant (Vattenfall) provided sufficient information to enable a reasoned judgement to be made on the likelihood of significant environmental effects as a result of the construction and operation of the Llanbadarn Fynydd Wind Farm, alone and in-combination with other plans and projects, which included the incorporation of well-established mitigation measures that are likely to be substantially effective; and

b. the proposal, including all mitigation, monitoring and management measures, will not have a significant effect on the River Wye SAC, either alone or in combination with other wind farms, and an 'appropriate assessment' under the Conservation of Habitats and Species Regulations (2010) is not required.

28 There is no evidence before the inquiry that would suggest a different conclusion nor are we aware of any other such evidence. On this basis, it is considered that the Llanbadarn Fynydd scheme should also be excluded from any further 'in-combination' assessment.

29 The proposed 132 kV grid line for Llandinam is located almost entirely outside the River Wye Catchment and River Ithon sub-catchment (see Figure 1). On current plans, the substation and approximately 6km (at most) of the Llandinam – Welshpool over-head line will be located within the Wye catchment. Much of the route runs along the Severn – Wye catchment boundary (and so those parts that do lie within the Wye catchment are near the head of the catchment). The route does not cross any of the main tributaries of the Ithon, and is at least 2.4km from the SAC boundary.

30 The other potential grid connections (referred to as CC1, L1 and L2 by SPEN) exist as route corridors only. However CC1 (the SSA C connection to the Mid-Wales interconnector) will be almost entirely outside of the Wye catchment. The only section within the Wye catchment will roughly coincide with the location of Hirddywel wind farm (and will therefore be at least 4km from the SAC and at the head of the catchment);

31 Construction works for all grid connections will be small-scale, short-duration, localised and temporary

32 The amount of sediment (or other contaminants) potentially released as a consequence of construction of each wind farm or their respective grid lines is so small as to be within the margin of error of any attempt to model sediment transport in the catchment or estimate dilution. There would be limited, if any, technical merit in attempting to model the situation. Instead, as recommended in the Entec report published by DECC (see para 4), the focus should be on the design of mitigation measures based on NRW best practice set out in

16 DECC (2012) *Record of the judgement of likely significant effect required under Regulation 61 of the Conservation of Habitats and Species Regulations 2010 for an application under section 36 of the Electricity Act 1989: Nuon Renewables Ltd/Vattenfall: Section 36 consent for the construction and operation of a 51 MW Wind Farm near Llanbadarn Fynydd, Powys*. Final version of HRA released for consultation, 21 May 2012. DECC, London.

relevant PPGs, as described in each of the applicants' environmental impact assessments.

33 Mitigation measures are to be taken into account when determining whether there is a likely significant effect for the purposes of HRA. The mitigation measures proposed by the developers are long-established standard best-practice measures, which have been recommended by the statutory regulators for the water environment including NRW. They are continually reviewed based on actual examples of pollution prevention. Hence, there is a high degree of confidence in their implementation and effectiveness.

34 The assessment work previously submitted to the inquiry has demonstrated for each wind farm that the mitigation can be relied on to ensure that there is 'negligible risk' of effects on the River Wye SAC. NRW has previously stated that it does not consider these schemes likely to have a significant effect on the River Wye SAC on their own. The assessment work from each of the developers also included an in-combination assessment. These assessments also concluded that there is 'negligible risk' of in-combination effects on the River Wye SAC. In view of the foregoing, our professional opinion is that these conclusions should stand.

CONCLUSIONS

35 It is our professional opinion that the three schemes, either alone, collectively or 'in-combination' with the other developments in the catchment, will not make a significant change to the hydrological processes of the River Wye either in terms of water quality or water quantity. As regards impact on water quality, the large scale of the sub-catchment, the large volume of water in the catchment, the relatively small proportion of the sub-catchment occupied by each scheme, and, importantly, the spatial positioning of each of the schemes within the sub-catchment relative to each other, to any other proposed wind farm scheme or any other activity, and to the likely receptor locations mean that, without mitigation, there will be either no additional sedimentation effect or a negligible effect within the SAC. Nonetheless mitigation measures are proposed.

36 We consider that mitigation measures which are now standard practice, including reactive monitoring during construction, and which may be required by condition, will reduce any risk further. This is supported by the Entec review of guidance for cumulative impact assessment published by DECC (referred to above (para 4)), which states (pp27-28): *'When considered in the context of the overwhelming dominance of trends in agricultural and forestry land-use as determinants of changes in the extent and quality of habitats, and natural variation over time in species populations, it is credible to assume that in only very exceptional circumstances will direct effects in aggregation between windfarm sites have any potential to be cumulatively of concern let alone significant (in EIA terms). It is not unreasonable to assume that any such aggregate effects that may be of significance are likely to be readily apparent to those considering individual applications who can inform consideration of specific detailed measures*

to avoid unacceptable effects. Exceptions to this are considered to be the potential for cumulative indirect effects on habitats and species via the water regime, however ***it is generally possible to avoid significant adverse effects on the water quality and ecology of watercourses (including economically important fish stocks) through the incorporation of standard environmental protection measures in construction and operational protocols'*** [our emphasis].

37 It is our professional opinion that any attempt to undertake a quantitative analysis such as modelling of sediment transport to calculate dilution of sediments (as stated in the NRW scope of works) would be flawed due to the extremely small amounts of sediment predicted, which would be lost in the uncertainty and error margins of any model.

38 Given the minimal impacts, even under a worst-case scenario, the wind farms are unlikely to have any collective effect on water quality or collectively to have any significant effects in combination with other activities e.g. forestry, agriculture or construction of grid connections.