Wylfa Newydd Nuclear Power Station - Development Consent Order (EN010007)

Written Representation

Biodiversity – Tre'r Gof SSSI and the Temporary Site Campus

Prepared by Teresa Hughes MSc. MCIEEM (Biodiversity Planning)
(North Wales Wildlife Trust 20011639)

Date 4th December 2018 (submitted for Deadline 2), Erratum 5.12.18

YMDDIRIEDOLAETH natur WILDLIFE TRUST GOGLEDD CYMRU NORTH WALES

Contents

Submitted to PINS in error draft: - 1:19, 5th December 2018

Erratum and clean copy provided: - 18:30, 5th December 2018. The details of the Erratum are provided in an appendix at the back of this representation

YMDDIRIEDOLAETH natur WILDLIFE TRUST GOGLEDD CYMRU NORTH WALES

1. Executive Summary

This written representation 'Biodiversity – Tre'r Gof SSSI and the Temporary Site Campus' is provided solely by North Wales Wildlife Trust (NWWT - interested party 20011639). Chapter 3 has been prepared by Teresa Hughes (Biodiversity Planning) and Chapters 4 and 5 by Dr Rod Jones, retired officer of Countryside Council for Wales and NWWT volunteer.

Summary Chapter 3

1.1 NWWT identified very earlier in the consultation process (PAC2[1]) that the site, now proposed for the Temporary Site Campus (TSC), supports a collection of ecological receptors both designated sites (SSSI and Wildlife Site) and assemblages of protected species which is a resource that has greater value than the individual sum of its parts. It is what we have termed a biodiversity hotspot of high and substantive value.

1.2 The TSC is located within the catchment of the groundwater dependant terrestrial ecosystem (GWDTE) Tre'r Gof SSSI, and it is acknowledged by Horizon that the significance of residual impacts will be moderate adverse and major adverse on the SSSI during construction and operation respectively.

1.3 Natural Resources Wales (NRW) indicate in their Relevant Representation to the DCO Examination (RR-088 ∞ 4.2.4 and 4.2.5) that they agree with the conclusion of Horizon's Water Framework Directive Compliance Assessment, that there will be a deterioration in the Ynys Mon Secondary Groundwater Body due to impacts on the GWDTE SSSI and that an Article 4(7) derogation is required under the Water Framework Directive.

1.4 The TSC also supports: -

- the best examples of species rich semi-natural grassland within the WNDA boundary
- foraging chough (Annex I Birds Directive, Schedule 1 Wildlife & Countryside Act, Section 7 Species[2] and local Anglesey LBAP)
- what is now acknowledged to be a nationally important grassland fungi resource (CHEG fungi).
- reptiles (common lizard and adder – Schedule 5 Wildlife & Countryside Act 1981, Section 7 Species),

1.5 In addition, the TSC is located immediately adjacent to one of Horizon's purpose-built mitigation bat barns (European Protected Species - Habitats Regulations 2017).

1.6 NWWT's view is that **the Temporary Site Campus is an Associated Development and there is no obligation for it to be located within the WNDA boundary, we have therefore maintained our PAC3 objection to this element of the Wylfa Newydd proposal.**

1.7 Whilst the facility may only be temporary, NWWT provides evidence that many of the impacts associated with its implementation are not temporary and that some elements of the ecological interest are in essence irreplaceable, in that they cannot be reinstated in a meaningful timescale.

1.8 NWWT consider that the lack of detail and assessment of the diversion of the rising foul main is a material omission.

1.9 It is clear in policy terms from National Policy Statement EN-1 through to Welsh national policy and legislation that both the conservation site hierarchy and the principles of the

[1] PAC2 NWWT consultation NWWT response October 2016
[2] Environment (Wales) Act 2016

mitigation hierarchy should apply to proposals within the catchment of the hydrologically dependant (GWDTE) Tre'r Gof SSSI, due to the acknowledged impacts on the SSSI. This representation also contends, that the imperative of avoidance should be applied to the associated features of biodiversity value within the GWDTE's catchment, as elements of the same ecosystem.

1.10 Within the context of national planning policy and in particular EN-1 the TSC site selection is not compliant with the avoidance of impacts hierarchy, in relation to preventing damage to SSSIs. Horizon have a stated aspiration to minimize risks to the SSSI, but are inconsistent in their approach as they are of the view that the Site Selection process is compliant with EN-1, which is demonstrably not the case.

1.11 Little confidence can be placed in the site selection process due to errors relating to environmental matters. The weighting provided to different themes of the RAG assessment is not transparent and would appear to be somewhat skewed to derive a predetermined outcome.

1.12 In all other circumstances, if this was a stand-alone proposal, as an Associated Development, there would be significant environmental reasons for its refusal in policy terms. In the context of other less environmentally damaging options which have already been secured with environmental legacy, the current proposal is not acceptable even on the desk-based analysis.

1.13 In respect to the ecological resources NWWT conclude: -

1.14 Horizon acknowledge the complexity of the hydrological system of Tre'r Gof SSSI and that this is reflected in the uncertainty ascribed to impacts including in relation to surface water/superficial groundwater both at a catchment level and in relation to springs, seepages and flushes.

1.15 The fungi survey concluded that of the areas surveyed: -

- 3 sites were of national importance (2 on the accessible areas by/in the TSC site)
- The fungi as an assemblage were indicative of good quality grassland and one in particular an indicator of good quality unimproved grassland.
- Anglesey has few sites that support grassland fungi and these high quality sites are worthy of conservation.

1.16 NWWT do not agree with Horizon's conclusion that the CHEG fungi grassland have a restricted distribution which is outside the TSC site boundary. Horizon's assessment has been severely limited by their own actions to obfuscate the importance of the fungi resource by adjusting reports and by the initiation of archaeological studies on the WNDA.

1.17 NWWT agree that the survey methodology adopted for chough is now appropriate, but do not agree with Horizon's interpretation of the results.

1.18 NWWT (and the RSPB) conclude that the TSC forms part of the critical resource for the breeding chough at Wylfa Head and for wintering birds from here or further afield. The TSC will be utilised along with other suitable grassland and coastal heath, as it comes into optimum foraging condition throughout the season and across a sequence of years. It should be noted that the other areas of high chough usage surveyed in 2017, around Porth-y-Pistyll, will also suffer loses of habitat due to the footprint of the development.

1.19 The RSPB have indicated[3] that they are concerned that despite improvements in management at Wylfa Head, which is welcomed, that there will be insufficient quality, extent and continuity of the necessary foraging habitat for chough within the WNDA.

1.20 It is clear that the grasslands across the TSC vary in their composition although they are all species rich to varying degrees. In simplistic terms there are areas where soil depths and soil moisture allow a taller species rich grassland, when the hay crop grows up. Grasslands on shallower soils to the north and those around the rocky outcrops have equally different floristic character from each other and to the remaining grassland. To the east there is a clear transition between deeper soil floristic composition towards that found on the shallower soils. To the extreme north west there is clearly an area of made ground, which due to a good seed source is a small area of 'brownfield' type habitat. The diversity of the types of grassland found across the TSC only adds to its value.

1.21 The importance and value of any areas of either unimproved or species rich semi-improved grassland is worthy of consideration for protection and management interventions to ensure its retention and floristic compositional value. Important biodiversity grasslands also retain less disturbed soil profiles which are important for other biodiversity assemblages such as soil invertebrate assemblages and grassland fungi, in addition to preserving natural drainage systems.

1.22 The TSC, not only supports a valuable species rich floristic grassland resource, but the site is sufficiently unimproved that the soil structure and profiles have been retained and allow it to support the other species/assemblages of biodiversity value. Therefore, the environmental components of the site support multiple features of considerable and substantive ecological value. The contiguity of such conditions is now very rare in the both the modern agricultural landscape and is absent from the developed urban/suburban environment. As a collection of species and habitats the landscape of the Wylfa Head to Porth Wylfa area is greater in value than the sum of each of its component features.

1.23 The only conclusion that can be drawn in relation to reptiles is that common lizard and adder are both present within and adjacent to the TSC, but the distribution of these across the TSC site is unknown and that no attempt has made to assess the population status of either common lizard or adder. This is not true only for the TSC but for the remainder of the WNDA.

1.24 It has been demonstrated that the impacts of the implementation of the TSC is not inconsiderable both in terms of lowering the landform and in trenching to install service utility infrastructure and the surface water drainage system. Both activities have a high risk of interrupting the superficial groundwater flows.

1.25 Additional compaction will result from the ground loading of the new buildings which will further exacerbate impacts on groundwater flows. The introduction of a complex modern surface water drainage system will not allow soil infiltration/percolation and has little probability of success.

1.26 Not only will there be the impacts from installing such a system but there will be the consequent disruption and impact of their removal after 10 years in order to restore the site. It would appear from the single cross-sectional drawing of the TSC that materials will be reimported to raise the ground levels following the decommissioning of the facility.

[3] response to the Examining Authority (ExQ1 Q2.0.21)

1.27 The impacts of implementing the scheme will result in the loss of all other features of substantive value or their availability to support important species. The implementation of the diversion of the rising foul sewer will add cumulatively to the impacts.

1.28 In relation to the proposed ability to reinstate the TSC site to its current condition, NWWT do not agree that the key assets can be re-established/restored, it is our view that all works will require wholesale habitat construction and creation on a virgin landform. Restoration is a technique which uses management to rehabilitate a habitat which has gone into decline and is in unfavourable condition.

1.29 We do not agree that the new landscape on the TSC will represent an enhancement of what is currently present and are of the view that some of the current features cannot be constructed or created.

1.30 The reinstatement of the site will result in more import of materials to re-establish the current landform. There is no information available, and NWWT know of none, where imported material has been used to recreate superficial groundwater drainage regimes. No detail has been provided by Horizon to try to demonstrate how this novel technique will be achieved.

1.31 It is recognised by the statutory agency's scientific department (JNCC), that soil structures which support grassland CHEG fungi cannot be recreated, in fact they indicate that once damaged they are very difficult if not impossible to restore.

1.32 The RSPB[4] knows of no examples of newly created chough-feeding habitat being utilised by choughs, therefore success with "created" habitats cannot be guaranteed.

1.33 The creation of wildflower rich grasslands is valuable in an urban context. However, NWWT, indicate that to recreate the soil profile of an old grassland is not just a matter of the right topsoil handling techniques and seed bed preparation. The spreading of seed across a newly created landform will not replicate the characteristics of the current site, not only in terms of the species present, but also in terms of the matrix of grassland types that provide the nuance to this intimate landform.

1.34 Horizon have begun to prepare a compensation package for the damage that is predicted to occur at Tre'r Gof SSSI. However, it is NWWT's view that the compensation scheme has not yet been able to demonstrate that the proposed sites can compensate for Tre'r Gof SSSI in terms of either extent or quality. The timescale for the schemes implementation is obscure, as are the arrangements for the compensation sites long term management and resourcing.

1.35 NWWT provide a list of matters that would be required within a submission to be able to demonstrate that it is sustainable.

1.36 As a stand-alone proposal it would be anticipated that a local authority ecologist would expect the submission of a greater level of detail in order to provide a view to a DC planning case officer. This would allow the necessary balance to be placed on their consideration of the application, in light of the biodiversity material considerations. This would inform the officer's report and recommendations to the planning committee

1.37 It is NWWT's opinion that in the case of the TSC this has not occurred due to its being subsumed as a 'smaller' part of the much wider power station scheme. It is our opinion that this lack of attention to the location of the TSC as an associated development, which could be allocated to another reasonable and available alternative location, is a considerable oversight.

[4] response to the Examining Authority (ExQ1 Q2.0.21)

Summary Chapter 4

NWWT considers that shipping represents a significant risk to the air quality of the Cemlyn Reserve. It notes that there are a number of mitigation measures which are already applied in other regions/shipping areas and which should be applied to ships using the port (MOLF) namely: -

1. Restriction of port usage to low NOx and sulphur emission vessels
2. Switching off generators and usage of National Grid based electricity supplies during the time vessels are docked rather than 80% of engine power (App5-2 APP-140 doc 6.4.20). This could also help to reduce ambient noise levels.
3. Ensuring ship usage of the port is organised in such a way as to minimise the release of atmospheric pollutants
4. Monitoring of fuel being used to ensure low sulphur fuels
5. Monitoring of air quality and review of procedures if failure to deliver adequate air quality (Marine Licence Code of Construction Practice)

Summary Chapter 5

Wylfa Newydd discharges more waste energy into the Irish Sea than all the electrical energy generated in the whole of Wales. In addition, it sterilises approximately **10,000,000** metric tonnes of water **every day** in the direct cooling discharge with potential further damage to additional amounts of water in the cooling water plume.

This is not an insignificant impact.

Such an impact would be unlikely to be accepted in any other sector than the power generation sector. We accept that the location is best for constraining the impact of the thermal plume and that such a scale of thermal discharge would be unacceptable in constrained locations such as Milford Haven as it is three times the size of the thermal discharge of Pembroke Power Station. Ways of limiting the impact could include: -

1. Reduction of the cooling water discharge to equivalent levels of efficiency as those of the new Hinkley Power Station. In addition, if indirect cooling was used there would be a small reduction in efficiency of the plant, but this would not be associated with a proportionate increase in CO2 emissions as is the case in an oil or gas fired power station.
2. Discontinuous usage of biocides to minimise adverse impacts.
3. Mitigation through enhancement of water quality in other nature conservation sites through provision of resources to better manage water quality in their catchment.

2. Introduction

2.1 This written representation 'Biodiversity – Tre'r Gof SSSI and the Temporary Site Campus' is provided solely by North Wales Wildlife Trust (NWWT - interested party 20011639).

2.2 The representation includes three chapters: -

2.3 Chapter 3 - The Temporary Site Campus prepared for NWWT by Teresa Hughes (Biodiversity Planning). This chapter includes its own introduction but in brief it comprises: -

- The national and local planning context on which to base a decision.
- The veracity of the site selection process.
- A discussion of the baseline data collection and characterisation of the ecological receptors of substantive value, as protected under legislation: -
  - SSSI, Wildlife & Countryside Act 1981
  - Designated non-statutory Wildlife Site (Defra 2006)
  - Annex I, Birds Directive - formally known as Council Directive 2009/147/EC on the conservation of wild birds
  - Schedule 5 species, Wildlife & Countryside Act 1981
  - Section 7 species, (Environment (Wales) Act 2016)
  - European Protected Species, Conservation of Habitats and Species Regulations *2017*
- The consideration of the site as a substantive ecological resource which is greater than the sum of its parts.
- Discussion of the impacts of the implementation, operation and decommissioning of the Temporary Site Campus.
- Investigation of the claim that reinstatement to it current condition is achievable.
- A critique of what additional matters could have been submitted to demonstrate that the scheme could be sustainable and how they might be secured if permission is granted.

2.4 Where necessary NWWT make reference to other evidence before the Examination including the written representation of Dr David Parker on the Landscape and Habitat Management Strategy and the RSPB's response to the Examining Body's questions (ExQ1 Q2.0.21).

2.5 Chapter 4 - considers air quality and its associated impacts, along with additional measures which could be used to mitigate for impacts. This chapter has been prepared by Dr Rod Jones a volunteer with North Wales Wildlife Trust who is a retired CCW Officer (Countryside Council for Wales - Statutory Nature Conservation Organisation).

2.6 Chapter 5 – provides an alternate view of the power stations energy out versus energy lost to the environment due to the once through cooling water system (CWS) that is proposed. It considers briefly the environmental scale of the once through CWS. This chapter has been prepared by Dr Rod Jones.

3. Temporary Site Campus

3.1 NWWT identified very earlier in the consultation process (PAC2[5]) that the site, now proposed for the Temporary Site Campus (TSC), supports a collection of ecological receptors both designated sites (SSSI and Wildlife Site) and assemblages of protected species which is a resource that has greater value than the individual sum of its parts. It is what we have termed a biodiversity hotspot of high and substantive value.

3.2 The TSC is located within the catchment of the groundwater dependant terrestrial ecosystem (GWDTE) Tre'r Gof SSSI, and it is acknowledged (APP-127 doc 6.4.8 Table 8-9) that the significance of residual impacts will be moderate adverse and major adverse on the SSSI during construction and operation respectively. The only exception being in regard to sediment inputs during construction, which are considered as a residual minor adverse impact.

3.3 Natural Resources Wales (NRW) indicate in their Relevant Representation to the DCO Examination (RR-088 ∞ 4.2.4 and 4.2.5) that they agree with the conclusion of Horizon's Water Framework Directive Compliance Assessment, that there will be a deterioration in the Ynys Mon Secondary Groundwater Body due to impacts on the GWDTE SSSI and that an Article 4(7) derogation is required under the Water Framework Directive.

3.4 The TSC also supports: -

- the best examples of species rich semi-natural grassland within the WNDA boundary
- foraging chough (Annex I Birds Directive, Schedule 1 Wildlife & Countryside Act, Section 7 Species[6] and local Anglesey LBAP)
- a nationally important grassland fungi resource (CHEG fungi).
- reptiles (common lizard and adder – Schedule 5, Wildlife & Countryside Act 1981, Section 7 Species),

In addition, the TSC is located immediately adjacent to one of Horizon's purpose-built mitigation bat barns (European Protected Species - Habitats Regulations 2017).

3.5 The TSC lies adjacent to the boundary of Wylfa Head Wildlife Site, which extends from the headland along the coastal fringe to Porth Wylfa providing habitat connectivity, and buffering between the SSSI and the non-statutory designated second tier Wildlife Site. The contiguity of such high value ecological resources underpins the whole ethos of coherent ecological networks as adopted by planning and the landscape scale approach to conservation and habitat management.

3.6 NWWT have consistently stated that "construction related infrastructure should be located outside this northern area of the site"[7]. Since spring 2016 we have also requested that additional analysis should be undertaken of key ecological receptors on the TSC site and that the Environmental Assessment's evaluation of the ecological receptors should be determined in light of this assemblage rather than as single individual elements.

3.7 It was with extreme disappointment that the advocacy of NWWT and the value of the site has consequently been dismissed by Horizon, when extremely late in the Power Station's project design, at the limited PAC3[8] consultation, it transpired that instead of impacts being avoided the TSC would still be sited within the WNDA at this location but

[5] PAC2 NWWT consultation NWWT response October 2016
[6] Environment (Wales) Act 2016
[7] EIA Progress Report NWWT response April 2016
[8] PAC3 NWWT consultation response

that the scale of the proposal would be significantly greater. The number of accommodation units would be raised to 4,000 increasing the footprint of the proposal more than 8 fold.

3.8 NWWT's view is that **the Temporary Site Campus is an Associated Development and there is no obligation for it to be located within the WNDA boundary, we have therefore maintained our PAC3 objection to this element of the Wylfa Newydd proposal.** It should be acknowledged that the provision of the TSC is not a small facility and will house a population of on-site workers which is nearly 3 times the population of the nearest settlement of Cemaes (1,350 [9]). As a consequence of the scale and extent of the development it should be given the highest level of independent scrutiny within the DCO examination, rather than simple acquiescence that it is appropriate given the scale and extent of the other impacts associated with the Power Station itself.

3.9 This is a temporary feature of the proposal, which will be in place for 10 years but may only be operational at maximum capacity for 5 years, subject to workers *wishing* to utilise the facility. Although outside NWWT's remit, there appears no compunction that workers must stay at the Site Campus.

3.10 Whilst the facility may only be temporary, NWWT provides evidence that many of the impacts associated with its implementation are not temporary and that some elements of the ecological interest are in essence irreplaceable, in that they cannot be reinstated in a meaningful timescale.

3.11 This Chapter of our written representation will consider national planning policy in relation to the conservation hierarchy and functioning coherent ecological networks, as well as the over-arching imperatives of the EIA process and the Water Framework Directive.

3.12 NWWT's written representation also considers the TSC site selection process that has been undertaken by Horizon, placing it in a similar context to the planning approach that might be adopted by a planning authority to strategic allocations. We will consider the consistency of the approach adopted across the suite of scoped in sites, along with the confidence that can be placed in the conclusions reached.

3.13 NWWT will go on to consider the veracity of the baseline evidence gathering, the evaluation of the ecological resources and the impacts of the proposal within the planning context.

3.14 Consideration of each ecological receptor of the outline proposals will be provided, but the evaluation will be given of the biodiversity assemblage as a whole, using recognised criteria.

3.15 A critique of the design of the outline scheme will be undertaken in the context of the biodiversity resources. The avoidance of impacts – if any - and the effectiveness of any mitigating measures will be discussed.

3.16 Finally, the written representation will consider the degree of confidence which can be placed on Horizon's statement that once the TSC is decommissioned the area can be 'restored to its current condition' (8.2.3 D&A vol 3 Part 1 of 2 ∞ 3.1.2), when some of the ecological resources may be considered impossible or very difficult to recreate.

3.17 In considering the proposals NWWT, will also include the proposed public foul rising main diversion. The diversion is shown on the 'Proposed Foul Water Drainage Plan' (WN0902-HZDCO-SCA-DRG-00008, APP-016 doc ref 2.6.2). As far as NWWT are

[9] Cemaes population 1,357 in 2011 https://en.wikipedia.org/wiki/Cemaes

aware the proposal to divert the public foul rising main is entirely predicated on the construction of the TSC and is not planned to occur otherwise[10]. The impacts of the diversion are therefore cumulative alongside those of the TSC itself and the lack of assessment of this element of the proposal is considered to be a material omission.

National planning policy and other guidance in relation to biodiversity

3.18 Within the overall DCO submission the Temporary Site Campus is identified as an Associated Development, as such it does not need to be located within the WNDA boundary and although the DCO is reliant on being able to demonstrate accommodation of the site work force, there is no obligation for it to be located at a given proximity to the main construction zone.

3.19 Therefore, this scheme should be considered in planning terms in isolation from the Power Station Proposal, as if it were a stand-alone outline planning proposal, much as the proposals for the off-line works to the A5025, Dalar Hir Park & Ride, Parc Cybi are. This approach, however, does not obviate the need for an in-combination assessment of cumulative impacts. In order to be able to consider this effectively it would be assumed that the proposal would be supported by its own subsidiary Environmental Statement and assessment against the other relevant legislation such as the Habitats Regulation and the Water Framework Directive. Again, the other Associated Developments have these own volumes within the Submission. This has not been the case with the TSC development, so it is not possible to disentangle the elements of the TSC from those of the wider Power Station scheme.

National Policy

3.20 The principals of preservation of ecological resources is well rehearsed in the relevant planning guidance, including within the national guidance on energy. In summary: -

3.21 EN-1 National Planning Policy Statement on Energy (2011) includes specific reference to biodiversity, recognising all features of the mitigation hierarchy, but starting with the overarching premise: -

"*5.3.7 As a general principle, and subject to the specific policies below, development should aim to avoid significant harm to biodiversity and geological conservation interests, including through mitigation and* ***consideration of reasonable alternatives*** *(as set out in Section 4.4 above); where significant harm cannot be avoided, then appropriate compensation measures should be sought.*

5.3.8 In taking decisions, the IPC should ensure that appropriate weight is attached to designated sites of international, national and local importance; protected species; habitats and other species of principal importance for the conservation of biodiversity; and to biodiversity and geological interests." [Emphasis added]

It goes on to state in relation to SSSIs: -

"5.3.11 *Where a proposed development on land within or outside an SSSI is likely to have an adverse effect on an SSSI (either individually or in combination with*

[10] Since summer 2018 NWWT have asked questions of Horizon, IACC & NRW about the status of the diversion in terms of timescales for assessment, licensing and implementation. NWWT have not been provided with an answer so contacted Dwr Cymru. Dwr Cymru indicated that they could not discuss the project with NWWT due to GDPR and client confidentiality, but said that in this type of situation, where proposals are to build over an existing asset, the developer commissions from Dwr Cymru the necessary surveys and assessments. Dwr Cymru were unable to confirm if the surveys for this particular diversion have been commissioned or timescales for its implementation. (telephone conversation 30.11.18)

other developments), development consent should not normally be granted….."

3.22 Whilst it is acknowledged that the National Policy Statements (EN-1 and EN-6) state that there is an imperative driver to move towards the mobilisation of nuclear generating capacity, this does not obviate the need to apply the relevant policy appropriately, especially in respect of the TSC as it is not actually the main power generating facility and alternatives do exist.

3.23 Moving to other national legislation and policy. There has recently been a raft of policy nationally in Wales, which further embeds the approach to biodiversity and the importance of ecosystems: -

3.24 The Well Being & Future Generations Act 2015 has seven well-being goals of which one is: -

> "***A resilient Wales -*** *A nation which maintains and enhances a biodiverse natural environment with healthy functioning ecosystems that support social, economic and ecological resilience and the capacity to adapt to change"*

3.25 The Future Generations Act also convers obligations on public bodies – such as local authorities, NRW, Welsh government – to consider not only current communities but also future generations when making policy, and taking or implementing decisions.

3.26 Planning Policy Wales 9th ed 2016 states "***A Resilient Wales -*** *Contribute to the protection and improvement of the environment, so as to improve the quality of life, and protect local and global ecosystems. In particular, planning should seek to ensure that development does not produce irreversible harmful effects on the natural environment and support measures that allow the natural heritage to adapt to the effects of climate change. The conservation and enhancement of statutorily designated areas and of the countryside and undeveloped coast; the conservation of biodiversity, habitats, and landscapes; the conservation of the best and most versatile agricultural land; and enhancement of the urban environment all need to be promoted (4.10, 4.11.10, Chapters 5 and 13)"*.

3.27 The Environment (Wales) Act 2016 This legislation identifies a number of priority habitats and species (Section 7), indicating the prominence that should be placed on them when taking decisions. A number of Section 7 species occur within the TSC boundary: -

- Chough
- Adder
- Lizard
- Bat roost in the purpose-built mitigation bat barn on the boundary of the TSC

3.28 At Section 6 under Part this legislation confers specific responsibilities in relation to how ecosystem resilience should be dealt with: -

Section 6 Biodiversity and resilience of ecosystems duty

> (1)A public authority must seek to maintain and enhance biodiversity in the exercise of functions in relation to Wales, and in so doing promote the resilience of ecosystems, so far as consistent with the proper exercise of those functions.
>
> (2) In complying with subsection (1), a public authority must take account of the resilience of ecosystems, in particular the following aspects—
>
> (a)diversity between and within ecosystems;
>
> (b)the connections between and within ecosystems;
>
> (c)the scale of ecosystems;

(d)the condition of ecosystems (including their structure and functioning);
(e)the adaptability of ecosystems.

3.29 In TAN5 (2009) it states that a five-point approach should be adopted in decision making – information, avoidance, mitigation, compensation and new benefits.

3.30 Policy drivers to consider alternatives. Within Environmental Impact Assessment the principles of the mitigation hierarchy of avoid, mitigate and compensate should be applied. Likewise, so they should with the Water Framework Directive (WFD) where a deterioration in waterbody status is concluded. In both cases the avoidance of impacts is the primary obligation and in the case of WFD (PINS Advice Note 18) the tests are more stringent to achieve a derogation (Article 4.7), which includes demonstration that the project cannot be achieved by a significantly better environmental option (Test (d)).

3.31 The conclusion of the WFD Compliance Assessment for Wylfa Newydd indicates that an Article 4(7) derogation will be required due (in part)[11] to the deterioration in quality of the GWDTE at Tre'r Gof SSSI within the Ynys Mon Secondary Groundwater Body. The statutory agency, NRW, indicates in their Relevant Representation to the DCO Examination that they agree with this conclusion and that the derogation is required (RR-088 ∞ 4.2.4 and 4.2.5). NRW go further in their Relevant Representation to indicate that they have (RR-088 ∞ 4.4.1): -

> *"…….advised the applicant in our Section 42 responses that all reasonable alternatives and mitigation should be considered to reduce and avoid effects on the SSSI* [Tre'r Gof SSSI]."

3.32 Landscape scale policy drivers The introduction of landscape scale objectives within the planning system and other policy, as discussed above, has been bought forward to implement the work of Lawton in the report 'Making Space for Nature' (2010). This developed the concept of the need to view our primary biodiversity sites not in isolation but as part of a coherent, resilient and functioning ecological network, where the most highly designated sites sit within a matrix of other sites to achieve a bigger, better (managed), more and joined up biodiverse rich countryside of value across the landscape.

3.33 It is clear in policy terms that both the conservation site hierarchy and the principles of the mitigation hierarchy should apply to proposals within the catchment of the hydrologically dependant (GWDTE) Tre'r Gof SSSI due to the acknowledged impacts on the SSSI. This representation also contends, that the imperative of avoidance should be applied to the associated features of biodiversity value within the GWDTE's catchment, as elements of the same ecosystem.

Local Planning Context

3.34 During the recent consultation on the revision of the County Council's (IACC) Wylfa Newydd SPG, NWWT provided comments[12] on what it viewed as an apparent internal contradiction between the adopted Joint Local Development Plan (JLDP, July 2017) policies and proposed revision of the SPG. It is not clear if this inconsistency has been satisfactorily resolved in the adopted document.

3.35 In the adopted SPG, IACC still seek to achieve a lasting legacy by the delivery of construction workers accommodation (Adopted SPG May 2018, Objective 3, ∞ 3.2.4 ii)).

[11] There is deterioration in the Ynys Mon Secondary Groundwater Body for other reasons (saline intrusion) and there is also deterioration to The Skerries Coastal Water Body. See NRW Relevant Representation (RR-088).
[12] NWWT consultation response to revised Wylfa Newydd SPG February 2018 paragraph 5

However, according to Horizon's analysis the only apparent legacy that will be achieved by the TSC (in conjunction with the WNDA earthworks) will be the permanent adverse impacts on Tre'r Gof SSSI, by a scheme which apparently provides little other benefit or legacy for its construction and operation over 10 years.

TSC Site Selection Process

3.36 The author of this written representation has been involved in supporting a large number of planning authorities with SHLAAs (Strategic Housing Land Allocation Assessments) providing advice on the biodiversity evidence base to inform matrices. Having reviewed the documents submitted by Horizon (6.4.2 D2 Alternatives & Design Evolution and 8.24.4 Site Selection Report – Volume 4 – Temporary Workers' Accommodation), there are a number of inconsistencies and anomalies observed, which raises some serious questions in relation to the process' veracity. The lack of transparency on the weighting given between the different themes of the RAG (Red, Amber, Green) also makes it very difficult to reconcile the analysis with Horizon's conclusions that the WNDA Option A is the most appropriate site for the TSC. Detailed consideration of many of the themes of the site selection process are outside the auspices of NWWT's remit, but a number of examples are provided below to draw attention to the inconsistency of Horizon's approach.

3.37 The RAG table (APP-439 doc 8.24.4 Table 6-2) appears to be inconsistent in its approach to assigning values to the local and national environmental attributes: -

- Rhosgoch was recognised at PAC2 as supporting a population of great crested newt a European Protected Species (Habitats Regulations 2017) and reptiles (UK legislation Wildlife & Countryside Act 1981), but both environmental columns (themes 7 & 8) are assessed as Green, it would be anticipated that the RAG would be at least Amber in relation to reptiles. The national environmental theme should be considered Red for great crested newt as a widely available report[13] indicates that great crested newt are found at a medium population density in 5 ponds on the site.

- WNDA Option A is considered to be Amber for national environmental attributes based on the criteria that development is not within the SSSI. However, as all parties acknowledge, the habitat of interest is hydrologically reliant on its catchment/groundwater as recognised by its identification as a Groundwater Dependant Terrestrial Ecosystem (GWDTE). Horizon have been aware for a considerable length of time that NRW have significant concerns about the long term viability of the SSSI and were considering compensation as early 2016. Therefore, it would be consistent and ecologically logical to consider this as Red (national theme), particularly given the scale of the TSC (16ha [14]) within a small hydrological catchment (100ha [15]) and located at 20m from the SSSI boundary. The consequences in this case, therefore, are equatable to actually building within the SSSI.

- The WNDA Option A site is immediately adjacent to a Wildlife Site on TSC's north western boundary. The terrestrial ecological surveys provided at PAC2 identified it as species-rich semi-improved grassland. Desk based data search reveal that reptiles (adder and common lizard – Wildlife & Countryside Act 1981) This should

[13] Cofnod Local Records Centre data and Avian Ecology (2016) Former Tank Farm – Rhosgoch on behalf of Conygar Investment Co. Plc. Amphibian Report

[14] (APP-409 doc 8.2.3 ∞ 2.13)

[15] APP-127 doc 6.4.8)

warrant a minimum Amber status on the local environmental theme, even before detailed surveys have been undertaken. It is acknowledged that the assessment of other substantive ecological assets was still ongoing when the Site Selection Report was first produced (June 2017).

- Similarly, other proposed option sites which are adjacent to/on Wildlife Sites or support populations of UK protected species should also warrant Amber status. The PAC2 consultation in 2016 for example, identified that some of the proposed worker accommodation sites in Amlwch supported common lizard and water vole.

3.38 In respect to WNDA Option A it is stated within the SSR stage 4 (APP-435 Table 6-1) that other sites within the WNDA were considered and the site selected was the least environmentally damaging (Site Selection Report SSR, stage 2 APP-437). On close inspection of SSR (Stage 2 APP-437 ∞ 6.6.4 – 6.6.7), it is apparent that there were only two options considered. The decision to discount Option B was taken as it was "later determined" that it would be needed for disposal of materials and mounding. This *late determination* is exceedingly odd, as it was clearly known prior to mid-2016 (PAC2) that the Mounding landform was already designed so there was no real prospect that it would be suitable for accommodation. There may be a case of post hoc justification in the SSR and the choice of Option B

3.39 It would appear somewhat unconventional that the summary of the RAG tables (APP-439 doc 8.24.4 Summary Table 6-2) does not include an initial column which catalogues current planning status, alongside the theme that differentiates between greenfield and brownfield sites. The local authority's strategic allocation of sites is just as important a pre-requisite of a site's suitability for development as the policy of prioritising brownfield redevelopment.

3.40 At PAC2 in relation to legacy it was considered that the Rhosgoch EZ10 site could be considered as a permanent location for community facilities, but this does not appear to be reflected in the legacy potential attribute (theme 11). The only site which is assessed as providing a legacy to the community is the Land & Lakes proposals (Kingsland & Cae Glas). This legacy is not only in terms of providing benefits in long term use/repurposing of the buildings, site infrastructure and community facilities but also in relation to legacy for biodiversity and for public access including the establishment of a nature reserve and visitors centre.

3.41 NWWT were involved during the consultation of the original Land & Lakes proposals. At the time there were concerns about the scheme, however, these were subsequently resolved. It has been confirmed that should this scheme be implemented as part of the DCO for Wylfa Newydd, NWWT would be satisfied with the scheme and its mitigation and opportunities for biodiversity gain[16]. In fact, as a determined and secured permission it is seen as a more appropriate scheme than the use of the WNDA Option A location for the Temporary Site Campus.

Conclusions

3.42 Within the context of national planning policy and in particular EN-1 the TSC site selection is not compliant with the avoidance of impacts hierarchy, in relation to preventing damage to SSSIs. Horizon have a stated aspiration to minimize risks to the SSSI (APP-406 ∞ 6.5.3), but are inconsistent in their approach as they are of the view that the Site Selection process is compliant with EN-1, which is demonstrably not the case.

[16] Frances Cattanach CEO NWWT pers comm. October 2018

3.43 NRW (RR-088 ∞ 4.4.1) have consistently advised Horizon that they should avoid impacts to the SSSI and seek alternatives.

3.44 The presence of a number of protected species either within, adjacent to or functionally reliant on the TSC habitats is material to the selection: -

- Annex I Birds Directive
- Schedule 5 Wildlife & Countryside Act
- Section 7 species (Environment (Wales) Act 2016)
- European Protected Species (Habitats Regulations 2017)

3.45 The lack of assessment of the cumulative impact of the diversion of the rising foul main is a material omission, which has consequences for biodiversity.

3.46 Little confidence can be placed on the site selection process due to errors relating to environmental matters. The weighting provided to different themes of the RAG assessment is not transparent and would appear to be somewhat skewed to derive a predetermined outcome.

3.47 In all other circumstances if this was a stand-alone proposal as an Associated Development, there would be significant environmental reasons for its refusal in policy terms. In the context of other less environmentally damaging options being available, which have already been secured with environmental legacy, the current proposal is not acceptable even on the desk-based analysis.

3.48 The following sections go on to consider the data gathering and the evaluation placed on the receptors in the context of impacts, avoidance and capability to mitigate.

Baseline data collection and evaluation

3.49 The recognised criteria for the characterisation and evaluation of ecological resources will be examined briefly.

3.50 The individual ecological attributes will be discussed in addition, to considering them collectively as an assemblage of substantive biodiversity features. In the context of the professionally recognised criteria it will be demonstrated that the value of the resource is greater than the sum of its parts.

3.51 In this section the key ecological receptors will be considered: -

- SSSI
- Species rich semi-improved grassland
- CHEG grassland fungi [17]
- Chough
- Reptiles

3.52 The efficacy of the baseline gathering will be investigated, as it is NWWT's view that in some cases the baseline data gathering has not provided temporal validity (chough) and in others that attempts have been made to obfuscate the value of a resource (fungi). The limitations of the surveys seem to have been overlooked.

[17] C = Clavariaceae (fairy clubs); H = *Hygrocybe* (waxcaps); E = *Entoloma* (pink gills); and G = Geoglossaceae (earth tongues).

Criteria and characterisation of ecological resources and evaluation

3.53 Modern evaluation systems including the SSSI selection guidelines are based on the work of Ratcliffe who formulated what has become to be known as the Ratcliffe Criteria[18]. These criteria value sites according to: -

- Size
- Diversity of habitats or species
- Naturalness
- Rarity
- Fragility, ie if damaged how quickly, it at all, can it recover
- Typicalness, ie is it a good example of the habitat, assemblage or community type
- Position in an ecological or geographical unit
- Potential Value

3.54 This basic approach has been refined within the Environmental Impact Assessment process and to assist in the evaluation process. The Chartered Institute for Ecology & Environmental Management (CIEEM) indicates that a broader approach should be adopted by professional consultants. Of particular interest are the following (CIEEM 2016 EcIA Freshwater and Coastal ∞ 4.6): -

- "*ecosystems and their component parts, which provide the habitats required by important species, populations and/or assemblages*
- *Plant communities (and their associated animals) that are considered to be typical of valued natural/semi-natural vegetation types*"

3.55 This approach clearly recognises the under-pinning structural elements (component parts) that are necessary to support an ecosystem or habitat, such as hydrology, soil structure, aspect, soil type etc. It also places importance on the aggregation of both plants and animals rather than as isolated elements. Finally, it places recognition on the fact that in the UK the distribution of truly natural ecosystems, which have not been influenced by anthropogenic activity, are now extremely rare. It consequently places an equal emphasis on semi-natural habitats.

3.56 In guiding the professional consultant CIEEM (2016 ∞ 4.145) also indicates that there may be occasions when an undesignated site is considered to meet published selection criteria for statutory or non-statutory designation, "or have substantive potential to meet them", in which case discussion should be held with the potential designating authority to agree how the site should be treated.

3.57 In North Wales the basis of the Wildlife Site system has been a joint responsibility between IACC and NWWT who have both established the guidelines and administer the system. NWWT, as a contributory party to the Wildlife Site system, have consistently raised matters in relation to the substantive value of the Wylfa Head suite of habitats as a biodiversity hotspot, this includes areas both within and adjacent to the TSC boundary.

Tre'r Gof SSSI – A Groundwater Dependant Terrestrial Ecosystem (GWDTE)

3.58 The Tre'r Gof Catchment is 1km2 (APP-127 doc 6.4.8) and the TSC occupies approximately 15% of it.

3.59 It is acknowledged (ref APP-127) that there will be major and moderate adverse residual impacts on Tre'r Gof SSSI. Consequently, this representation will not discuss the hydrological baseline and its analysis (APP-127 doc 6.4.8 and APP-158 6.4.30) in detail,

[18] Ratcliffe, D.A. (1977) *A Nature Conservation Review*, Cambridge University Press

except to highlight Horizon's own acknowledged uncertainty of the understanding and complexities of both the ecosystem components and they how function.

3.60 It is well recognised that Groundwater Dependant Terrestrial Ecosystems (GWDTE), such as fens, mires or lowland raised bogs are notoriously difficult to model and consequently to make meaningful assessments of impacts. Tre'r Gof SSSI, as an alkaline fen, is no exception to this rule. In Horizon's own words: -

> "*Tre'r Gof SSSI is a naturally complex hydrological system which has interactions between direct rainfall, surface water, soil and sub-soil water and shallow (and to a lesser degree deep) groundwater.* ***The geology beneath and adjacent to the SSSI is complex*** *with a variety of drift deposits present underlain by bedrock which is heterogeneous. There are* ***substantial variations in recharge and stream flow*** *through the SSSI and therefore significant changes in water quality across the area caused by the different water sources and flow routes.* ***Significant hydrological changes occur over a range of timescales****, including short term changes during rainfall events (especially summer storms), medium term changes due to seasons and long term changes caused by climate change and other factors such as management practices. The drainage system in Tre'r Gof is itself artificial having been installed to* [attempt to] *drain the wetland area several hundred years ago, and controlled by a culvert outfall. The* ***hydrological system is still changing*** *and it has been noted during site walkover surveys for example that* ***the location of some seeps and flushes move even over the medium term*** [ie during the duration of Horizon's studies]." [Emphasis added]

Horizon's characterisation goes on to state: -

> It is ….. "*shown that the Tre'r Gof SSSI is situated in a topographic basin which intersects the water table held within superficial deposits and that this shallow water table is important in maintaining saturation during drier periods. Groundwater within the shallow superficial deposits was also identified as critical for maintaining base flow to seepages, drains and springs which discharge directly into the Tre'r Gof SSSI….* ***However, it is recognised that the hydroecology is complex and there is some uncertainty regarding water movement to the SSSI.***" [Emphasis added]

APP-127 6.4.8 ∞ 8.3.8 and 8.3.35

3.61 The supporting hydroecological report (APP-158 6.4.30 ∞ 2.5.4) is even more heavily caveated but indicates what Horizon considers to be a critical component of the hydrology; the shallow flows within the superficial layers of geological till (ie below the top soil) and where it intersects with the top of the bedrock.

> "*Although at best indicative and based on a number of assumptions, from this assessment it would not be unreasonable to assume that the main source of water to the springs and seeps comes from within approximately 50m to 150m of the SSSI*."

3.62 At this point it is useful to point out that the stand-off from the SSSI to the TSC is 20m. Whilst several *illustrative* cross-sections of the geology are provided (Figure 2-1 and 2-2 in APP-158 doc 6.4.30 the hydroecological appendices), there appears to be little shown or discussed of the catchment as it crosses the site campus.

3.63 The lime rich element of the fen ecosystem is also provided by the interaction of the shallow groundwater with mineral rich rocks (APP-127 6.4.8 ∞ 8.5.13).

3.64 The complexity of the hydrological system is reflected in the uncertainty ascribed to impacts including in relation to surface water/ superficial groundwater (APP-127 6.4.8

Table D8-9 residual impacts column) both at a catchment level and in relation to springs, seepages and flushes.

CHEG Grassland fungi

3.65 NWWT raised issues relating to the ES scoping out the fungi resource very early in the PAC process and prior to that in our scoping response. The fungi report submitted with the EIA Progress Report[19] stated that it was impossible to state that the grassland CHEG fungi were not of national importance based on a 20 minute survey in the poor survey year of 2013.

3.66 When the same report was re-submitted in September 2017[20] the statement regarding the limitation of the survey had been removed. This does not just represent bad methodology, but an apparently intentional attempt to obfuscate the limitations of the survey and the evaluation of the resource, rather than undertaking additional survey work.

3.67 An additional fungi survey was undertaken in autumn 2018. This was acknowledged to be limited due to disturbance and lack of management restricting the extent of the survey. However, the survey in autumn 2017 (APP-168 6.4.34) was assessed to be of national significance.

3.68 The surveyor concluded that of the areas surveyed that: -

- 3 sites were of national importance (2 on the accessible areas by/in the TSC site)
- The fungi as an assemblage were indicative of good quality grassland and one species in particular was an indicator of good quality unimproved grassland.
- Anglesey has few sites that support grassland fungi and these high quality sites are worthy of conservation.

3.69 Horizon continue to maintain the view that the nationally significant CHEG grassland fungi is only located outside the Temporary Site Campus site boundary, despite the limitations acknowledged by their own surveyor. Unfortunately, when the fungi survey (APP-168) was commissioned in 2017 archaeological investigations had already started. The extent of the disturbance is large, as the panorama at Appendix 1 and the photos below show.

3.70 The limitations on the ability to survey the whole area were not just due to bare ground, topsoil mounds and haul roads but also to the lack of recent normal agricultural management, which would have resulted in poor expression of fruiting bodies, but also greater difficulty in observing them within the thicker growth, as acknowledged in the fungi survey. The photos below show conditions on site a week before the fungi survey was undertaken (10th October 2017). The initiation of such an extensive program of archaeological works in an area with suspected high value resources shows a lack of planning and attention to detail, which is extremely worrying in the context of implementing the wider scheme.

[19] EIA Progress Report Fungi Survey 2014 App 20.01 ∞ 20.52)
[20] Section 61z consultation of Site Prep & Clearance ES Volume 3-C appendix 2016 14-04

Photo 1 left example of vehicle compaction. **Photo 2 right** disturbance and works in small valley identified in 2013 as **supporting good CHEG resource**,

Photo 3 left archaeological works at east of TSC site,

3.71 It is NWWT's view that the extent of the resource has still been underestimated. The distribution of species rich grassland observed during site visits in summer 2016 (see photo 6 ∞ 3.83 below) is indicative of less disturbed soil structures and unimproved grassland, which will also be suitable for CHEG fungi. This grassland extended from the coastal strip up to & beyond the rock outcrops to the south and the eastern end of the TSC.

3.72 Much of this area will be lost due to the diversion of the rising foul main and also under the building footprint of the eastern half of the TSC and the amenity block.

Chough (Annex 1 Birds Directive, Schedule 1 Wildlife & Countryside Act, Section 7 Species and an Anglesey BAP species

3.73 The eNGOs have raised considerable concern in relation to the earlier assessments of the WNDA for chough[21], as the survey transect data and other breeding bird surveys had not been sufficiently focused on areas where it would be anticipated chough to be present and not enough effort had been applied. As a consequence of the eNGO comments along with those of NRW additional surveys were undertaken which included pursuit surveys of foraging chough.

[21] Level 4 HRA Birds Workshop 18th October 2016

3.74 During 2017 an agreed methodology was used to include pursuit surveys. It was shown that chough used habits around the area in the vicinity of the breeding site at Wylfa Head in addition to areas around Porth-y-Pistyll.

3.75 It was concluded that foraging chough most frequently used the TSC site (unit 146) at 63.54% of the time (APP-181 doc 6.4.47 ∞ 4.1.7). This survey was repeated in 2018 and presented at the SoCG meeting[22] that indicated that usage had changed and that the TSC was used for foraging considerably less at under 5%. NWWT do not concur with Horizon's explanation of this change in usage, which they attribute solely to better management at Wylfa Head.

3.76 The RSPB indicate in their response to the Examining Authority (ExQ1 Q2.0.21): -

> "Chough foraging strategy has both a temporal (over years) and a spatial component relating to invertebrate population cycles and accessibility provided by management."

3.77 It is known that chough feed on soil invertebrates which are more numerous in older more unimproved grasslands. They prefer a shorter sward[23] height where foraging effort is more efficient.

3.78 It is clear that the TSC forms part of the critical resource for the breeding chough at Wylfa Head and for wintering birds from here or further afield. The TSC will be utilised along with other suitable grassland and coastal heath, as they come into optimum foraging condition throughout the season and across a sequence of years. It should be noted that the other area of high chough usage surveyed in 2017 around Porth-y-Pistyll will also suffer loses of habitat due to the footprint of the development.

3.79 As indicated above the condition of the TSC during the 2018 survey was clearly sub-optimal and generally not available for foraging due to the lack of effective grazing – also noted by the fungi surveyor – the extent of the archaeological works. The attribution by Horizon that the change in foraging dynamics was due to the introduction of what is acknowledged to be beneficial management at Wylfa Head, clearly underplays the change in site conditions as a result of Horizon's own work. NWWT do not accept the findings or analysis of Horizon in this regard. The photos below show the condition of the sward in the TSC during spring 2016 and October 2017.

[22] SoCG meeting November

[23] 'sward' is an agricultural term that encompasses the mixture of plants (grasses and flowers) that make up the grassland. The sward height is ostensibly just how long the grass is kept at/allowed to grow to

Photo 4 left spring grazing April 2016 – optimal chough foraging (Looking south across the TSC toward Tre'r Gof)

Photo 5 right ungrazed ground October 2017 – sub optimal chough foraging. (the same slope from a different angle looking into the eastern side of the TSC)

3.80 The RSPB have indicated[24] that they are concerned that despite improvements in management at Wylfa Head, which is welcomed, that there will be insufficient quality, extent and continuity of the necessary foraging habitat for chough within the WNDA.

Species rich semi-natural grassland

3.81 The steady loss in both the extent and quality of the UK's grasslands is well documented. In Wales it is recorded that there has been a decline by 90% since 1930 [25].

3.82 The importance and value of any areas of either unimproved or species rich semi-improved grassland is worthy of consideration for protection and management interventions to ensure its retention and floristic compositional value. This is exemplified by the agri-environment schemes such as Glastir and Tir Gofal that have operated in Wales.

3.83 Important biodiversity grasslands also retain less disturbed soil profiles which are important for other biodiversity assemblages such as soil invertebrate assemblages and grassland fungi, in addition to preserving natural drainage systems.

[24] response to the Examining Authority (ExQ1 Q2.0.21)
[25] State of Nature Report (Wales) 2016

Photo 6 Species-rich grassland on the line of the diversion of the rising foul sewer

3.84 Horizon have undertaken surveys of the TSC using two recognised techniques; in 2012 a NVC[26] survey (APP-175 doc 6.4.41) and; a Phase I Habitat Survey in 2013 (APP-174 doc 6.4.40). The Phase I Habitat Survey identifies the majority of the TSC as supporting semi-improved grassland (Figure 9-3 of APP-238 doc 6.4.101).

3.85 Semi-improved grassland can be species poor (identified as white SI on the Figure 9-3 plan) or more species rich and diverse (identified as orange SI on the plan). It can be seen from Figure 9-3 (APP-238 doc 6.4.101) that the proportion of more diverse species rich semi-improved grassland is small on the WNDA and is concentrated on the coast (barring one notable exception) with a high density focused on the north at Wylfa Head, the Site Campus and further east towards Cemaes.

3.86 More diverse semi-improved grassland results from long term changes in management moving the composition of the flora from unimproved grassland to a coarser structure, due either to abandonment of agricultural activity or from attempts to improve its agricultural productivity usually by the application of farmyard manure or slurry (Crofts & Jefferson (1999) [27] Lowland Grassland Management Handbook. It is consequently recognised that changes in grassland composition and floristic diversity can occur relatively quickly over a period of 5 – 10 years.

3.87 This characterisation of the habitat composition and value is reflected by the results of the NVC survey undertaken by Horizon which identifies that the TSC is intermediate between the most diverse grassland type (MG5, hay meadow) and a more intensively managed but still species rich community type (MG6). In this context the site could be moving back towards a more favourable condition or with neglect/agricultural intensification could become less valuable.

3.88 It is clear that the grasslands across the TSC vary in their composition although they are all species rich in varying degrees. In simplistic terms there are areas where soil depths and soil moisture allow a taller species rich grassland, when the hay crop grows up. Grasslands on shallower soils to the north and those around the rocky outcrops have equally different floristic character from each other and to the remaining grassland. To

[26] NVC National Vegetation Classification

[27] Crofts A. & Jefferson R. (1999), 'Lowland Grassland Management Handbook', 2nd edition, English Nature/The Wildlife Trusts

the east there is a clear transition between deeper soil floristic composition towards that found on the shallower soils. To the extreme north west there is clearly an area of made ground, which due to good available seed source is a small area of 'brownfield' type habitat. The diversity of the types of grassland found across the TSC only adds to its value.

3.89 It is also abundantly clear that in the case of the TSC, not only does it support a valuable species rich floristic grassland resource but the site is sufficiently unimproved that the soil structure and profiles have been retained and allow it to support other species/assemblages of biodiversity value (CHEG fungi, chough foraging and natural drainage). Therefore, the environmental components of the site support multiple features of considerable and substantive ecological value. The contiguity of such conditions is now very rare in both the modern agricultural landscape and is absent from the developed urban/suburban environment. As a collection of species and habitats the landscape of the Wylfa Head to Porth Wylfa area is greater in value than the sum of each of its component features

3.90 As a result of this analysis NWWT can agree with the methodology used to assess the grasslands, but disagree with Horizon's evaluation that the only grassland of value in proximity to the TSC occurs along the coastal strip outside of their development boundary.

Reptiles

3.91 The ES Chapter that deals with the reptile surveys (APP-177 doc 6.4.43 D9-10) indicates that across the whole of the WNDA and including the 500m survey buffer only 27 sites were surveyed. Of these less than a third were surveyed in 2014, the most recent survey. Therefore, some of the surveys are more than 18 years old. The report acknowledges that changes in habitat conditions as a result of agricultural usage may improve the WNDA's suitability for reptiles (APP-177 doc 6.4.43 cf Conclusions section 5).

3.92 More recently, both common lizard and adder have been recorded incidentally[28] within the site boundary, but no updated surveys have been undertaken of either the TSC or other areas within the WNDA.

3.93 The surveys only covered a small proportion of the TSC site despite suitable habitat being present within the TSC site's boundary. As a stand-alone outline application in any other circumstances this level of survey effort to inform a proposal's determination would not be sufficient. A review of the methodology standard of all previous studies was undertaken by the consultants in 2014, but this has not been submitted to the DCO, so it has to be assumed that the surveys were undertaken to the appropriate standard.

3.94 The only conclusion that can be drawn is that it is known that reptiles are present within and adjacent to the TSC, but the distribution of these across the site is unknown and that no attempt has made to assess the population status of either common lizard or adder. This is not only true for the TSC but for the remainder of the WNDA.

[28] There appears to be a typographical/data translation error in the text in Table 6.3 and the Tables in APP-177's doc 6.4.43's Appendix D. Incidental records for common lizard above the Boathouse (1) and near the sewage works (3) have been transcribed as adder in the figure.

Construction impacts of Temporary Site Campus

Rising foul main diversion

3.95 In considering the impacts of the TSC it should be borne in mind that there is no information presented in terms of the working area, trench depth, ancillary features such as manholes or servicing chambers for the diversion of the rising foul sewer.

3.96 During all consultations thus far the eNGOs have been assured that there would be no impacts from the scheme north of the rock outcrops – as if it somehow demarcated the extent of the TSC's ecological interest.

3.97 NWWT and the Examining body have no information on which to base any conclusion regarding the cumulative impacts of this element of the proposal. This is a serious and material omission.

SSSI hydrology the impacts of cut & fill and installing infrastructure

3.98 The ES indicates that not only is there uncertainty in relation to how the base line hydrological regime works but that this uncertainty extends to all types of development activity such as the landscape mounding and the introduction of managed drainage systems associated with both the mounding and the Temporary Site Campus.

3.99 It is logical to assume that the changes in landform to create building platforms will also have similar uncertainty as even small changes to depths of superficial deposits have the potential to interrupt shallow superficial groundwater flows. The illustrative change to the landform is a cut of between 0.40m and 1.4m, as shown on cross-section provided through the TSC (the only meaningful cross section A – A' north-south doc ref 2.6.2 WN0902-HZDCO-SCA-DRG-00010 (rev 1.0)). In any normal circumstances it would be anticipated that more than one cross section through a development of this size and sensitivity would have been provided.

3.100 Additionally, the TSC will introduce a considerable degree of developed hard-engineered surface water structures to manage run-off across the site. The surface water drainage system is fairly conventional in most respects, although the design of the outfall structure to the eastern end causes considerable alarm (proposed surface water drainage doc 2.6.2 WN0902-HDZDCO-SCA-DRG-00007). The use of penstocks, whilst seemingly justified, introduces more disturbance to superficial deposits and even a relatively small feature as illustrated below clearly adds to impacts.

3.101 The purpose of a 150m length of reno mattress, which is generally used to control erosion, is not at all clear and adds to the 'engineered' nature of the system. The author of this report has never come across this technique in over 25 years of development related work and its appropriateness to achieve the proposed replication of the existing drain pattern is consequently challenged as is its ultimate effectiveness over a 10 year period.

[29] l. small penstock – 4 to be installed

r. reno mattress on sloped river bank – 150m to be installed

3.102 There is also the matter of how the penstocks and controlled outfall from the attenuation tank will be operated during emergency events There is also the matter of whether these will be manually operated during emergency events or extreme storm flows.

3.103 Installation of utilities involve considerable trenching works, for example in relation to drainage and water disposal the cover required is between 0.75m – 3m [30].

3.104 The extent of earthmoving and underground installation of infrastructure is nowhere on the scale of the power station, but it has been demonstrated that it is not inconsiderable both in terms of lowering the landform and in trenching to install service utility infrastructure and the surface water drainage system. Both activities have a high risk of interrupting the superficial groundwater flows.

3.105 Additional compaction will result from the ground loading of the new buildings which will further exacerbate impacts on groundwater flows. The introduction of a complex modern surface water drainage system will not allow soil infiltration/percolation and has little probability of success.

3.106 Not only will there be the impacts from installing such a system but there will be the consequent disruption and impact of their removal after 10 years in order to restore the site. It would appear from the single cross-sectional drawing of the TSC that materials will be reimported to raise the ground levels following the decommissioning of the facility.

Chough during construction

3.107 The RSPB indicate[31] that in order to sustain chough at the breeding site there needs to be "sufficient", chough habitat provision but it needs to:

- be of sufficient **quality**
- be of sufficient **extent** and
- have **continuity** through the construction phase

[29] Images sourced from Google at http://www.hcwatercontrol.com/Penstocks http://www.chinagabionfactory.com/gabion/reno-mattress.htm

[30] Cover requirements 3m for urban drainage sewer, 0.9m for distribution main, 0.75m for drinking water connection (all depths of cover are stated as a minimum) Sources UU, Thames and Wessex Water

[31] response to the Examining Authority (ExQ1 Q2.0.21)

3.108 RSPB's key concern[32] is whether, under the current plans, there would be sufficient foraging area available during the construction and operation phases to support even the single remaining pair of choughs (of the 2-3 pairs that were present in the past when grazing regimes were more sympathetic). They are particularly concerned about the potential lack of sufficient chough foraging habitat during the construction phase, when the site campus will cover much of the existing foraging resource away from the Wylfa headland itself for a minimum of 10 years. In which case there may no longer be any resident choughs to respond to any favourable habitats provided.

3.109 Additionally, rock outcrops although retained, will be within the TSC site compound. It appears that access will now be prevented through the rear gates out onto the Welsh Coastal Path[33]. The north side of the campus buildings, including the rock outcrops, will be the only accessible outdoor space which also includes the workers viewing area. It is highly likely that these features will be subject to considerable human recreational usage, which it is highly probably will result in increased trampling, erosion of rock surfaces and compaction. Therefore, there will be a loss of these remaining habitats and the structural diversity on the lichen rich rock outcrops. The analysis of recreation has been considered in detail within the joint eNGO written representation *'Biodiversity – Cemlyn Nature Reserve'*.

3.110 Due to the retention of the rock outcrops within the TSC site compound, it is highly unlikely that these habitats will be utilised by foraging chough even if they retain any of their current condition.

Grasslands and soil structure for CHEG grassland fungi

3.111 The existing grassland resource and soil structure will all be lost due to the footprint of the development. The construction areas needed to build such a dense development will mean that there is limited potential to retain & protect features within the construction zone.

3.112 Although the reptile resource is unknown on the TSC site, it is accepted that rock outcrops provide good habitat for sheltering, foraging and basking. However, for the same reasons as discussed above, any populations of reptiles within these rock outcrops will be highly disturbed. One area of rocky outcrop will be reduced in size – which is a suitable stepping stone from Wylfa Head and the known reptile population found towards the remainder of the site (eg Dame Sylvia Crowe's mound). The reptile populations at Wylfa Head will become isolated for the entirety of the construction and operation period of the TSC and for a substantial period during and post decommissioning.

3.113 As discussed above it is NWWT's view that the retention of the rock outcrops in their current condition is highly unlikely.

[32] response to the Examining Authority (ExQ1 Q2.0.21) deadline 2
[33] SoCG meeting

Photo 7 Rock outcrop within TSC illustrating thin fibril soils and folios & encrusting lichens All sensitive to trampling, erosion of rock surface and compaction

Bats

3.114 Horizon's own purpose-built bat barn is immediately adjacent to site. This was constructed as replacement roosts for those lost to the demolition of structures within the WNDA. It has apparently been successful (Lorna Goulding, Horizon pers comm).

3.115 The bat barn is located immediately adjacent to the TSC with little in the way of existing visual buffering. The TSC is proposing a five-a-side MUGA[34] within 30m of the barn.

3.116 The lighting includes six 15m floodlights (APP-016 2.6.2 Plan WN0902-HZDCO-SCA-DRG-00017). Horizon indicate that lighting of the MUGA will be time limited (turned off at 21:00) but this will not help minimise impacts on bats at the beginning and end of the season when nights will still be sufficiently mild for both games activity and bat foraging.

3.117 The landscape proposals for the TSC (APP-016 2.6.2 WN-……-00019) shows a small block of new planting and new hedgerow. However, even with the use of extra-heavy standards (approx 3-4m height) this will not shield the emerging bats from the light spillage from the MUGA and is unlikely to provide any screening for the whole period of operation[35].

Reinstatement

3.118 Horizon state quite clearly that the TSC will be reinstated and the Design and Access Statement (APP-409 doc ∞ 9.1.4 illustrated at figure 52 and see also APP-016 2.6.2 WN-……-00019) lists the scheme as follows: -

- *"The proposals would focus on re-establishing the site, incorporating the key environmental assets that would have been identified, enhanced and protected throughout the operation of the site. These enhancements primarily focus on preserving and restoring:*
  - *restored coastal grassland areas;*
  - *restored stone walling to existing field pattern;*
  - *reinstated landform;*
  - *retained rock outcrops with reinstated planting;*
  - *reinforced woodland edge as wooded slopes;*
  - *stronger woodland area of the ancient woodland and surrounding woodland;*

[34] Multi-Use Games Area
[35] Scots Pine growth rate 30 – 90cm/year

- *reinstated native shrub planting replicating the pattern prevalent on-site;*
- *new gravel surfaced path connecting the Wales Coast Path with the Fisherman's car park and footpaths to the south and east;*
- *public vehicular access restored to the Fisherman's car park;*
- *new viewpoint along the Wales Coast Path, providing a place to sit and pause on the route; and*
- *retained accessible footpaths to support the wider public network*"

3.119 NWWT do not agree that the key assets can be re-established/restored, it is our view that all works will require wholesale habitat construction and creation on a virgin landform. Restoration is a technique which uses management to rehabilitate a habitat which has gone into decline and is in unfavourable condition.

3.120 We do not agree that the new landscape on the TSC will represent an enhancement of what is currently present and as discussed below are of the view that some of the current features cannot be constructed or created.

3.121 SSSI hydrologically dependant system Lost the drainage and highly likely the connectivity between the superficial drift and the bedrock underneath. Fenland itself is difficult to create but there are very few examples of trying to re-establish drainage within the catchment, most relates to managing water in the site itself.

3.122 The reinstatement of the site will result in more import of materials to re-establish the current landform. There is no information available, and NWWT know of none, where imported materials have been used to recreate superficial groundwater drainage regimes. No detail has been provided by Horizon to try to demonstrate how this novel technique will be achieved.

3.123 In addition to issues relating to the TSC, NWWT have fundamental concerns about the viability of the long term drainage proposed for Mound A has no detail of how the variable toe drains will work and the rock blanket under the mound will become silted and compacted and will therefore cease to function.

3.124 As a result of the predicted damage to the catchment's hydrology Horizon have agreed to compensate for impacts and potential loss of the SSSI, which is discussed below. However, it is NWWT's strong view that the extent impacts to the SSSI could be considerably lessened by locating the Temporary Site Campus elsewhere.

3.125 Fungi grassland It is recognised by the statutory agency' scientific department, that soil structures to support CHEG fungi cannot be recreated, in fact (JNCC2009[36]) indicates that once damage they are very difficult if not impossible to restore (Evans 2003; Griffith 2002)

3.126 Chough The long-term impact of the site campus is unclear, but it is likely that the habitats lost beneath it would require re-creation (e.g. reseeding) rather than re-instatement (eg mowing/grazing) after the construction phase, consequently with less confidence in the degree of success. Similarly, the proposals for the creation of new chough foraging habitat on Mound A cannot be relied upon to replace the loss of chough feeding habitat from the site campus and/or elsewhere within Wylfa Newydd Development Area (WNDA).

[36] JNCC (2009) Guidelines for the selection of biological SSSI selection guidelines Chapter 18 Grassland fungi

3.127 However, the RSPB[37] knows of no examples of newly created chough-feeding habitat being utilised by choughs, therefore success with “created” habitats cannot be guaranteed.

3.128 They go on to suggest that the proposed 100ha of “coarse sward” should be more ambitiously managed as species-rich grassland with a mosaic of sward heights, and, with the 40ha of farmland, all managed through appropriate grazing regimes. This attitude in relation to the wider Landscape Habitat Management Strategy is also reflected in the written representation of the National Trust presented by Dr David Parker.

3.129 Unimproved/semi-improved grassland The creation of wildflower rich grasslands is perceived as an ‘easy win’ in terms biodiversity gain in new landscapes within built developments. It can be agreed that in an urban context, they can bring benefits to urban invertebrates, pollinators such as common species of bumble bee and garden birds whilst also providing human benefits from a closer proximity to something that approximates to countryside. However, to recreate the soil profile of an old grassland is not just a matter of the right topsoil handling techniques and seed bed preparation. The spreading of seed across a newly created landform it will not replicate the characteristics of the current site not only in terms of the species present, but also in terms of the matrix of grassland types that provide the nuance to this intimate landform. It is further contended that the use of local provenance seed whilst always welcomed will not overcome the problems associated with trying to replicate the site’s current condition on a newly formed substrate.

Critique of sufficiency of information to inform the proposal

3.130 It is NWWT’s opinion and experience that there are a number of elements that are missing that would inform an assessment of the scheme and its sustainability: -

- Detail of the rising foul sewer and its impact assessment
- Better detail on species data particularly in relation to reptiles which appear not to have been assessed
- Key patterns of bat usage of the roost in the purpose-built mitigation bat barn. The proposal is in danger nullifying the success of the compensation for a European Protected Species
- Light spillage of the proposed MUGA to show that it will not impact on roost emergence and foraging patterns of the bat barn.
- Cross sections of the development at intervals across the site
- Sufficient detail of the drainage scheme to demonstrate that the proposed swales, penstocks and reno mattress are not just a novel attempt to deal with the loss of superficial groundwater flows
- Clear consideration of the outside recreational usage of the TSC compound and its interaction with the accessible natural greenspace within and adjacent to the WNDA.
- Considerably more detail on the reinstatement of the new landform following decommissioning and the construction of new habitats on the virgin substrate.

3.131 In any normal circumstance as a stand-alone proposal it would be anticipated that a local authority ecologist would anticipate the submission of this level of detail in order to provide a view to a DC planning case officer. This would allow the necessary balance to be placed on their consideration of the application, in light of the biodiversity material

[37] response to the Examining Authority (ExQ1 Q2.0.21)

considerations. This would inform their report and recommendations to the planning committed.

3.132 It is NWWT's opinion that in the case of the TSC this has not occurred due to its being subsumed as a 'smaller' part of the much wider power station scheme. It is our opinion that this lack of attention to the location of the TSC as an associated development, which could be allocated to another reasonable and available alternative location, is a considerable oversight.

3.133 Notwithstanding NWWT's objection to the TSC we would anticipate that a suite of stand-alone Requirements will be necessary: -

- precommencement conditions (ie survey to inform reptile translocation)
- construction and implementation detail including for the diversion of the rising foul sewer.
- reinstatement detail to be required at specified stage x months/years prior to decommissioning
- reinstatement management and maintenance period. As a virgin landform this would need to be longer than a 5-year landscape condition
- Commitment to long term management and resourcing. While this area should be managed with agricultural techniques its long term viability needs to be assured to justify any degree of no net loss of biodiversity. It is recommended that there should be additional discussions as to its availability for public access in the long term.

3.134 The imposition and effective implementation of any imposed Requirements could not overcome the fundamental concerns and lack of confidence that any adequate protection, mitigation or enhancement of the biodiversity resources can be achieved.

SSSI Compensation sites

3.135 Horizon has been in lengthy discussions with NRW on the compensation sites and latterly two sites for recreation and one for improved management have been considered.[38]

3.136 Hydrological monitoring equipment has only recently been installed (late summer 2018). Therefore, very limited baseline information will have been gathered to be able to state with any degree of confidence: -

- The proposals would not impact the adjacent designated features (Cors Bodeilio SAC and Talwrn SSSI)
- Insufficient data to gather understanding of current hydrological functions either seasonally or over a longer time period.
- It is not possible to conclude that the scheme will have any probability of success to provide compensation habitats of either sufficient quantity or quality.

3.137 It is NWWT's view that the compensation scheme has not demonstrated that the proposed sites can compensate for Tre'r Gof SSSI in terms of either extent or quality. The timescale for their implementation is obscure as are the arrangements for their long term management and resourcing.

[38] Additional Land Consultation January 2018

4. Air Quality

ASSESSMENT OF THE POTENTIAL IMPACT OF THE CONSTRUCTION OF WYLFA NEWYDD ON AIR POLLUTANTS IN ADJACENT AREAS

1. Introduction

The construction of Wylfa Newydd will increase the concentration of atmospheric pollutants in its vicinity. A key question is the extent to which these changes pose a threat to the fauna and flora of the surrounding area. This response focuses primarily on the impact associated with the port (MOLF) & breakwater construction and hence Marine Licences. A key source of pollutants is the shipping using the port, which is to be constructed adjacent to the Power Station. However, it is questionable as to whether this has been correctly evaluated, particularly in the light of the estimates of port usage rates quadrupling compared with the original assessment.

Increased levels of atmospheric NOx have been implicated in causing nutrient enrichment and habitat changes. Often the focus has been on the impact of high levels of pollution, but changes have been shown to occur at significantly lower levels Jones (2008). In this context, it is important to remember that background levels of oxides of nitrogen in the UK are already significantly raised over what they would naturally be due to anthropogenic activities.

The building of Wylfa Newydd will result in a significant increase in NOx concentrations in the locality of Cemlyn and has the potential to exceed the critical load. As such it is important to consider mitigation measures which could ensure that such critical load thresholds are not breached.

2. Emissions from Shipping

Estimates of levels of NOx throughout the UK are shown in figure 1 and the contribution towards these levels made by shipping in Figure 2. The level of shipping contribution to NOx is highest in the south east and relatively low on the west coast including Anglesey reflecting shipping density. The contribution to areas adjacent to ports are significantly higher.

Shipping is a much-neglected source of pollution; however, its significance can be gauged by the fact that the 16 largest ships in the world emit more SOx and NOx than all the world's cars[39]. Global estimates suggest ships are responsible for 15 per cent of NOx and 8 per cent of sulphur gas worldwide.

[39] https://www.lngtransfer.com/news/the-16-biggest-ships-produce-more-pollution-than-all-the-cars-in-the-world/

	Sulphur	NOx-nitrogen
Denmark	39%	28%,
Netherlands	31%	21%
Sweden	25%	25%
Norway	25%	23%
UK	18%	20%
France	18%	15%
Italy	15%	15%
Belgium	13%	16%
Finland	12%	17%
Germany	10%	10%

Contribution in different EU countries within the EMEP *(EEA 2013)*

In Europe, shipping in the Baltic Sea, the North Sea and the English Channel causes more than 800,000 tonnes of airborne nitrogen to be deposited each year, worsening the existing problem of eutrophication. New analysis presented in a National Atmospheric Emissions Inventory (NAEI) report to the Government has been reported:

> "*shipping is a far greater source of pollution in Britain than estimates made in 2014 suggested, with about 10 per cent of the country's NOx emissions coming from ships*. *Toxic nitrogen dioxide emissions around major ports and sea routes in the UK are four times higher than previously suggested, according to a report for the Government. Experts say shipping pollutants, which are concentrated around major port cities such as Southampton, Grimsby and Liverpool, are a significant cause of concern for the health of local populations*."[40]

Emissions of nitrogen oxides from international maritime transport in European waters are projected to increase and could be equal to land-based sources by 2020 onwards.

Wylfa Newydd is establishing a port (MOLF) next to Cemlyn to handle large items and reduce the reliance on the road infrastructure. While, ship fuel sulphur standards apply to the entire fleet including those using Wylfa, regulated NOx limits only apply to new ships. In addition, the strictest regulations, Tier III limits, currently only apply to new ships sailing in designated areas around North America from 2016, the NOx Emission Europe includes shipping in the Baltic Sea, the North Sea and the English Channel. As Wylfa lies out-with these areas, ships using Wylfa will not have to comply with the tighter emission controls.

Within the Marine Licence submission, it has proved difficult to separate out the estimates of pollutants being contributed from marine sources at Wylfa. However, the importance of the marine source can be illustrated by the engine size of the cutter suction dredger that is rated at 24702 kw which is approximately ***2 orders of magnitude*** greater than most of the plant and machinery (cf tables in ES app D5-3) and it will be working in closest proximity to Cemlyn. In addition, the fuel used

[40] Quote sourced https://www.independent.co.uk/environment/air-pollution-uk-shipping-levels-record-environment-fumes-damage-nitrogen-dioxide-sulphur-a8189691.html on report for Dept for Business, Energy and Industry Strategy (Ricardo Energy & Environment 2017)

is likely to be significantly more polluting than that of land-based plant and machinery and the atmospheric pollution emitted proportionally much greater (cf tables from EEA 2013 attached).
Figure 1 shows the deposition of nitrogen oxides over the UK as tonnes per sq km and shows that Anglesey is a relatively low area of deposition.
Figure 2 shows the modelled contribution of NOx from shipping to coastal areas of the UK and shows a marked distribution.

3. Scale of problem with anthropogenic atmospheric inputs at a European level on vegetation

Acidification, eutrophication, ozone

Since they cause acidification of soil and water, emissions of SO_2 and NOx continue to be a serious problem in large parts of Europe. NOx also contributes to the formation of ground-level ozone, which damages vegetation as well as human health, and contributes to global warming. Moreover, NOx lead to eutrophication (over-fertilisation), which negatively affects biodiversity both on land and in coastal waters.
Acidification: In 2000, deposits of sulphur and nitrogen exceeded the safe limits (critical loads) for acidifying substances over 280,000 square kilometres (22%) of sensitive forest ecosystems in the EU.
Eutrophication: In 2000, depositions of nitrogen in the EU exceeded the safe limits for eutrophication over more than 1.2 million square kilometres (73%) of sensitive terrestrial ecosystems.
Ozone: In 2000, approximately 800,000 square kilometres (60%) of the EU forest area were exposed to ozone concentrations exceeding the safe level. Although much of the pollution emitted by international shipping gets deposited over the sea, it is the largest single source of acidifying and eutrophying fallout on land in many countries in Europe. It also contributes significantly to raised levels of health damaging PM and ozone.

PM10, PM2.5 and PM1: In European coastal areas, shipping emissions contribute 1–7% of ambient air PM_{10} levels, 1–14% of $PM_{2.5}$, and at least 11% of PM_1 (Viana et al 2014). There is thus a significant possibility that shipping could be the major source of small PM's at Wylfa. It is unclear as the significance of such emissions for the nesting terns particularly given the fourfold increase in daily shipping activity recently announced.

4. Ship usage at Wylfa,

With the current information accessed it is difficult to have a clear picture of the pattern of usage and emissions associated with the port construction and operation (see section 2 in consultation response). However, Viana et al (2009) has demonstrated that ship emissions affect not only major ports, but also medium and small-scale ones.

5. Potential changes which have already occurred to NOx emissions & nutrient budget, with changes associated with Wylfa Newydd

The concentration of nutrients in the locality of Cemlyn is an important factor in controlling the productivity and species composition in the Cemlyn Lagoon and the

surrounding habitats. Cemlyn lies at a location where surrounding soils are relatively nutrient poor and the westerly airstream is relatively clean resulting in a low nutrient environment.

Agricultural inputs

Intensification of agriculture on Anglesey has resulted in increased application of nutrients to the surrounding landscape. This will be reflected by increased nutrient concentrations in run-off, which will be supplemented by increase nutrient concentrations derived from atmospheric deposition. Atmospheric inputs of NOx and ammonia are derived from intensive agriculture and its by-products. For example, Anglesey is a significant player in the poultry industry. Atmospheric inputs of nitrogen are considered to have approximately doubled since pre-industrial times and are considered to have had a significant impact on sand dune systems on Anglesey (Jones 2008).

Current condition of features

In considering the impact of the air pollution changes it is important to consider whether features are currently in favourable condition. Cemlyn Bay SAC is currently considered in unfavourable condition (NRW 2017) so that anything which moves it further away from that favourable status needs to be avoided.

In-combination consideration of nutrient inputs

It is against this background that the impacts of the Wylfa construction project on the nutrient concentrations in Cemlyn needs to be judged.

The construction of Wylfa will also be associated with an increased population of 4,000 adjacent to Tre'r Gof SSSI and LWS site (Arfordir Mynydd y Wylfa – Trwyn Penrhyn) with associated heating, vehicular use and waste discharges. In addition, construction plant is not renowned for its quality of gaseous discharges.

Changes will occur to the locations' habitat structure & nutrient status will be influenced from other sources including surface water run-off and nutrient loads, inability to maintain historic favourable management to maintain nutrient balance (Trwyn Pen Carreg LWS) and impacts from recreational footfall.

In addition to this, the shipping using the docking facility (MOLF) will act as a significant source of particulate air pollution, PM_{10} on Cemlyn SAC, other designated habitats and the physiological health and hence reproductive fitness of birds (Sanderfoot & Holloway 2017).

6. Analysis of potential problems associated with air quality assessment at Wylfa

There is inadequate consideration of the impact of shipping using Wylfa on local air quality for the following reasons: -

- Inadequate definition & explanation of current air quality against assessment of change (cf ES D5 and figures D5-7 and D5-9 for marine licence)
- Inadequate definition of nutrient budgets of the locality of Cemlyn and the habitats they support (ES B5, App B5-2)
- Inadequate definition/lack of transparency of emissions from potential ships servicing Wylfa (ES D5 App D5-2)

- Incorrect original definition of the number of ships using Wylfa. A recent non-material amendment submission has indicated that the daily rate of ships using Wylfa is likely to be four times greater than originally defined & modelled.

7. Conclusions and recommendations

NWWT considers that shipping represents a significant risk to the air quality of the Cemlyn Reserve. It notes that there are a number of mitigation measures which are already applied in other regions/shipping areas and which should be applied to ships using the port (MOLF) namely: -

6. Restriction of port usage to low NOx and sulphur emission vessels
7. Switching off generators and usage of National Grid based electricity supplies during the time vessels are docked rather than 80% of engine power (App5-2 APP-140 doc 6.4.20). This could also help to reduce ambient noise levels.
8. Ensuring ship usage of the port is organised in such a way as to minimise the release of atmospheric pollutants
9. Monitoring of fuel being used to ensure low sulphur fuels
10. Monitoring of air quality and review of procedures if failure to deliver adequate air quality (Marine Licence Code of Construction Practice)

Figure 1 Nitrogen oxides as NO2 in tonnes per sq km

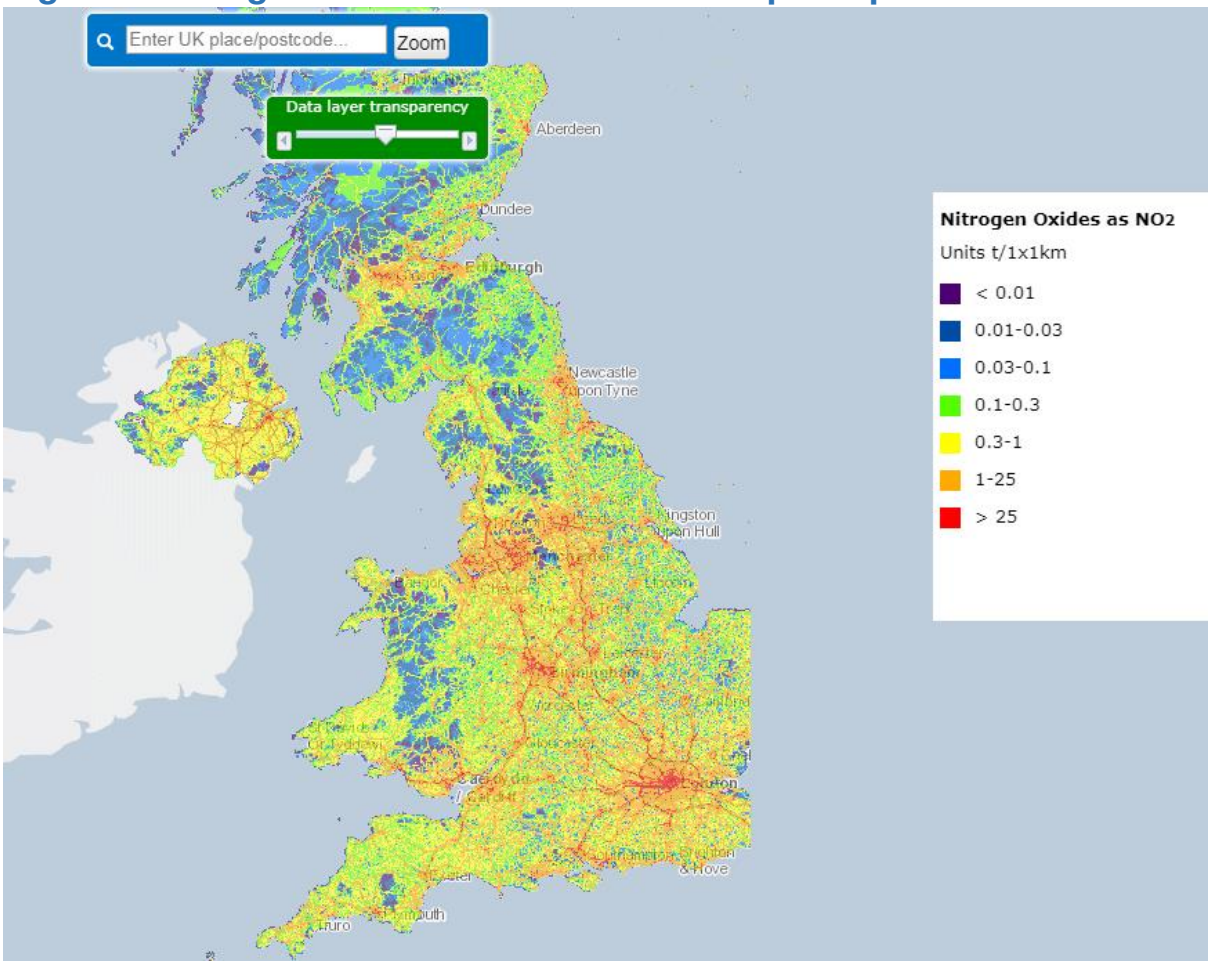
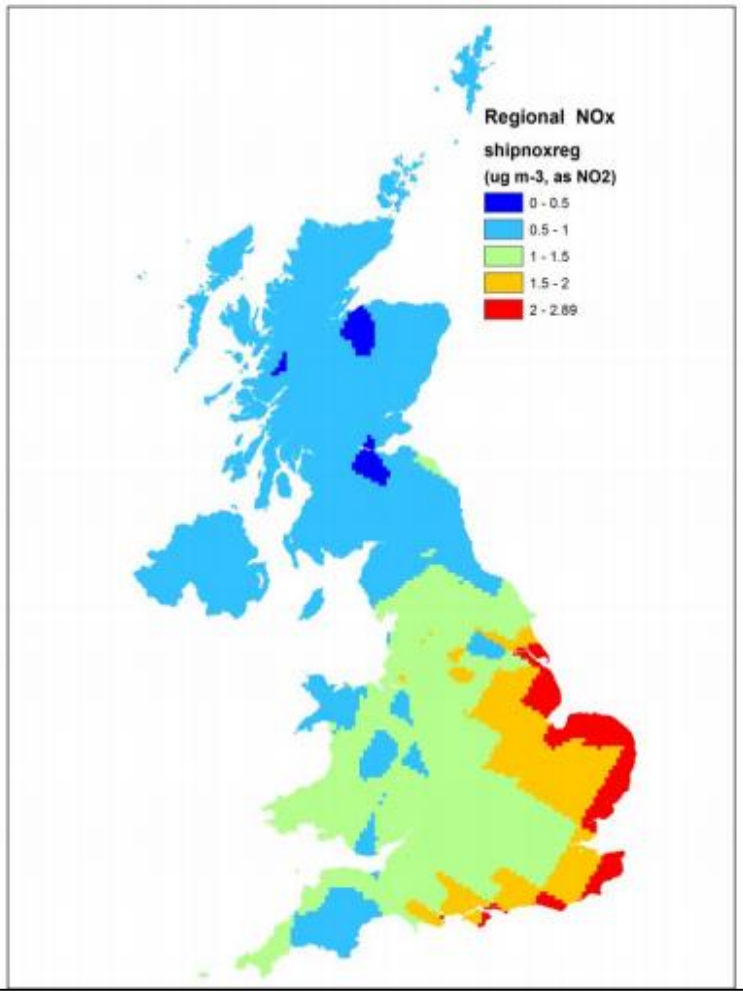


Figure 2 The contribution to regional annual mean NOx concentrations in 2012 from shipping emissions estimated using the PCM model.

From Impacts of shipping on UK Air quality report (pdf) https://uk-air.defra.gov.uk/assets/.../cat11/1708081025_170807_Shipping_Report.pdf

Figure 28: *The contribution to regional annual mean NO_x concentrations in 2012 from shipping emissions estimated using the PCM model.*



5. Cooling Water System

The Cooling Water Discharge – Scale and impact.

The following chapter has been prepared by Dr Rod Jones, a volunteer with North Wales Wildlife Trust who is a retired CCW (SNCO) Officer.

The location chosen for a once through cooling water discharge for Wylfa Newydd is significantly better than most in terms of dispersion/mixing of the cooling discharge due to the strong tidal streams and relatively deep water close by. As a consequence, the modelling of the plume has not been considered in this evidence even though elsewhere such a scale of thermal discharge would be totally unacceptable (for example in Milford Haven). However, consideration still needs to be given to the scale of the discharge and the consequential environmental impacts associated with it.

To fully comprehend the impact of the cooling water discharge it is essential to appreciate the scale of the discharge and place this discharge in the wider context of other cooling water discharges.

1.0 Scale of discharge in relation to mean flow of Welsh rivers

A comparison of the size of the cooling water discharges to mean flow of the major Welsh rivers is revealing. The cooling water discharge is rated at 120 cubic metres a second (which equates to 120 metric tonnes a second). In terms of the mean flow of different Welsh rivers this makes the discharge of Wylfa Newydd greater than that of any Welsh river. By comparison the mean flow of the River Wye is approximately 80 cubic metres a second and the Dyfi river is 25 cubic metres per second. Even the Severn has a smaller mean flow of 107cubic metres per second. ***Wylfa cooling water flow will exceed the mean flow of any of the largest rivers in Wales and England!***

2.0 Scale of the cooling water discharge in relation to other Power Stations in or adjacent to Wales

The cooling water discharge from Wylfa Newydd will be greater than any other power stations in Wales by a considerable margin. The second largest power station in Wales is Pembroke Power Station which has a cooling water discharge of 40 cubic metres second. However, in making a meaningful comparison it is also important to consider the size of the Power station. Table 1 provides comparative information on the generating capacity and the size of discharge of a number of Power Stations.

Table 1. Cooling water and waste heat discharges from Welsh and Hinkley Point Power stations.

Power station	Rated output Megawatt hours	Flow (cubic metres/ second)	Temperature above ambient C	Energy of discharge (Flow x temp)	Energy of discharge per Megawatt hr
Wylfa Newydd	**2,700**	**126**	**12**	**1512**	**0.56**
Wylfa	**1,000**	**67**			
Hinkley Point	**3,200**	**125**	**11.6**	**1450**	**0.453**
Aberthaw	**1,600**	**40**		**400**	
Pembroke	**2,199**	**40**	**10**	**400**	**0.182**
Connah's Quay	**1,380**	**Hybrid approx. 1**			**Approx 0.01**

As well as Wylfa Newydd having a much larger discharge than any other power station in Wales the cooling discharge is larger than the new Hinkley Point Nuclear Power Station even though the new Hinkley Point generates significantly more electricity than Wylfa Newydd. Thus, in terms of the requirement for cooling water Wylfa is significantly less efficient than Hinkley Point.

3.0 Scale of discharge in relation to amount of energy discharged into the Irish Sea

The amount of waste energy dumped into the Irish Sea from Wylfa Newydd cooling system is very large. It represents 126 cubic metres second at plus 12C above ambient. To place this in context this waste energy is approximately 150% more than the amount of electrical energy that will be generated by the actual power station and equates to the equivalent to 6.300 megawatt. So how does this compare with the amount of electrical energy used in Wales?

Wylfa power station cooling water discharge equates to 6,300 Megawatts or on an annual basis approximately 55 TWh.

To put this in perspective **Wales** generated 32.5 TWh of electricity in 2017, of which 7.1 TWh was from renewables and 25.5 TWh from fossil fuels. (Welsh Assembly Government).

4.0 Comparison of the energy discharged by cooling water with the natural input of solar energy into the Irish Sea.

The natural energy from the sun, which the seas around Anglesey receive, is approximately 5 kw/m2 per day in the summer. This equates to 5 million kw/km2 per day. By comparison the power station will discharges151 million kw hours per day. This is ***equivalent to the energy received each day by the sun over an area of 30 square kilometres of the Irish Sea.***

5.0 Comparison of the Environmental benefits of Wylfa Newydd power station in relation to the reduction in CO2 emissions which could be derived from other options.

It is undisputed that Wylfa will deliver significant CO2 savings, however, there needs to be some consideration of whether more timely and extensive CO2 savings could be made through different forms of expenditure. As made abundantly clear by Kevin Anderson (2016) the timing of CO2 savings is all important. If, as has occurred with many other Nuclear Power stations, there is a very significant delay, then Wylfa could cause old dirty plant to be kept in use longer than they should.

> "*The Government announced plans to phase out all unabated coal-fired power stations in the UK by 2025. The intention was, and remains, to replace aging generation with renewable capacity, cleaner CCGT gas-fired and new nuclear power plant."*

The first of the reactors is due to come online around 2025 so that any delay would result in a failure to deliver the required CO2 emission reductions.

While Wylfa Newydd will generate 2,700 Megawatts of electricity the cost of this project is still unclear with estimates ranging from 12 billion pounds to build (BBC 2018) to more than 15 billion (Times 2018) to 20 billion (Power Technology). Horizon has already spent 2 billion (New Civil Engineer 2018). This is incredibly expensive - by comparison to the cost of constructing Pembroke Power station was of the order of 1 billion pounds to produce a generating capacity of 2,199 megawatts. The funds **already** spent on Wylfa Newydd could have funded modern gas fired power stations with the ability to generate more electricity than Wylfa will generate.

It would be feasible to produce a huge amount of new generating capacity operating at the thermal efficiency of nearly 60% associated with Pembroke Power station. This could replace the UK's less efficient generating capacity and in so doing save CO2 emissions of a similar scale to Wylfa Newydd and still save money. A gas fired Power Station of a similar size to Wylfa at the same site would only discharge half as much cooling water and at a lower temperature as is evidenced in Table 1 above. *(Combined Cycle Gas Turbines (CCGTs) can have energy conversion rates over **60%** at full load, producing "up to **50%** more electricity from the same fuel than a traditional simple cycle plant*.")
An alternate strategy would be to construct more wind and or solar combined with battery storage. This would require no cooling water. Thus, if the funds were spent on replacing traditional relatively inefficient plant then very significant savings of CO2 emissions could be made.

Examples of sustainable energy schemes

Gwynt -y- Mor windfarm off the North Wales coast cost approximately 1.7 billion pounds to build to produce a generating capacity of 576 Megawatt.
Hornsea Wind farm being constructed in the North Sea is being constructed in three phases the first has a rated capacity of 1,200 megawatts and the second at 1,400 megawatts.
The 100MW/129MWh Tesla battery was switched on in November and is paired with the Hornsdale windfarm, about 230km north of Adelaide (Australia). The battery, which is the largest lithium-ion battery in the world, had a capital cost of €56m. The use of a significant proportion of the cost of Wylfa Newydd to create battery storage associated with windfarms could generate substantial energy saving gains.

6.0 Consequences of the cooling water discharge

The impact of a single passage of the cooling water through the power station is to sterilise the water killing the organisms present. The cooling system at Wylfa is once through so the water is not recycled/re-used within the system. The death casualties result from thermal shock, pumps and the addition of biocide to stop settlement within the pipes of different organisms. (e.g. the mussel, Mytilus edulis).
This represents the largest continuous mortality in a water flow in Wales and one of the largest, if not the largest, in the U K which is equivalent to sterilising the River Severn. In the USA once through cooling systems are no longer BAT for new power stations (Cambrensis Ltd. 2008)
It is very unlikely that such a scale of mortality would be allowed in any other industry, such as those associated with sewage discharges or industrial wastes discharges. As such it seems reasonable that as a minimum significant mitigation measures should be required of Wylfa Newydd.

The manner in which cooling takes place at a Power station affect the efficiency of the Powers station. The characteristics of different systems is shown in Table 2 which is a direct copy of that produced by Byers et al (2014).

Table 2. Characteristics of different power generation cooling systems.

Cooling system	Description	Abstraction volumes l/kWh[a]	Consumptive losses (% of abstraction)[b]	Energy penalty as % of electrical output[c]
Once through (open loop)	Heat is removed through transfer to a running water source (can be direct or indirect).	43–168	0–1%	0.7–2.3
Closed (re-circulatory)	Heat is removed to the air by recirculating water cooled in ponds or under cooling towers that may be fan-assisted or natural draught.	Wet tower		
		1–5	61–95%	1.8–6.3
		Pond		
		22–67	4–9%	1.8–6.3
Air-cooled	Heat is removed by air circulation via fans and radiators. A setup that can operate without water.	0	–	3.2–11.2
Hybrid [d]	Cooling towers that can operate both with and without cooling water – either combining a wet/dry cooling tower, or a dry then wet system in series.	Between Closed and Air-cooled	61–95%	1.8–11.2

a. Range of the medians for different cooled technologies taken from Table 3.

b. Range of the medians for different cooled technologies taken from Table 2.

c. Energy penalty range calculated from the ranges in the European Commission Joint Research Centre (2001, p. 69) report, by assuming plant thermal efficiencies from 60% to 30%.

d. We present the range between closed and air-cooled, and not the figure quoted for hybrid, since the operational split between closed and air-cooled cooling is not specified in the report.

Table 2 shows that the energy penalty by using indirect cooling as compared with direct cooling which represents a small percentage of the electrical output. It is arguable that this is **much more significant** where this means additional CO2 emissions as for example in a gas or coal fired power station as compared to a nuclear station.

7.0 Conclusion and possible mitigation measures

Wylfa Newydd discharges more waste energy into the Irish Sea than all the electrical energy generated in the whole of Wales. In addition, it sterilises approximately **10,000,000** metric tonnes of water **every day** in the direct cooling discharge with potential further damage to additional amounts of water in the cooling water plume.

THIS IS NOT AN INSIGNIFICANT IMPACT.

Such an impact would be unlikely to be accepted in any other sector than the power generation sector. We accept that the location is best for constraining the impact of the

thermal plume and that such a scale of thermal discharge would be unacceptable in constrained locations such as Milford Haven as it is three times the size of the thermal discharge of Pembroke Power Station. Ways of limiting the impact could include: -

4. Reduction of the cooling water discharge to equivalent levels of efficiency as those of the new Hinkley Power Station. In addition, if indirect cooling was used there would be a small reduction in efficiency of the plant, but this would not be associated with a proportionate increase in CO2 emissions as is the case in an oil or gas fired power station.
5. Discontinuous usage of biocides to minimise adverse impacts.
6. Mitigation through enhancement of water quality in other nature conservation sites through provision of resources to better manage water quality in their catchment.

Erratum provided 5th December - to support clean copy of Tre'r Gof SSSI and the Temporary Site Campus NWWT (id 20011639) written representation

Additional sentence added at 1.27: -

"The impacts of implementing the scheme will result in the loss of all other features of substantive value or their availability to support important species. The implementation of the diversion of the rising foul sewer will add cumulatively to the impacts."

Paragraphs 1.36 and 1.37 transferred from the missing main text of the concluding section of the submission.

Additional line added to list at 2.3: -

- A discussion of the baseline data collection and characterisation of the ecological receptors of substantive value, as protected under legislation: -
  - SSSI, Wildlife & Countryside Act 1981
  - Designated non-statutory Wildlife Site (Defra 2006)
  - Annex I, Birds Directive - formally known as Council Directive 2009/147/EC on the conservation of wild birds
  - Schedule 5 species, Wildlife & Countryside Act 1981
  - Section 7 species, (Environment (Wales) Act 2016)
    European Protected Species, Conservation of Habitats and Species Regulations *2017*
- A critique of what additional matters could have been submitted to demonstrate that the scheme could be sustainable and how they might be secured if permission is granted.

At paragraph 3.7 adjustments to sense
…..it transpired that instead of impacts being avoided the TSC would still be sited within the WNDA at this location but that the scale of the proposal would significantly greater. The number of accommodation units would be raised to 4,000 increasing the footprint of the proposal more than 8 fold.
At paragraph 3.21 and format changed emphasis added

Paragraph 3.67 The start of the paragraph altered to read: -

An additional fungi survey was undertaken in autumn 2018. This was acknowledged

Paragraph 3.77 a footnote has been added to define 'sward'

Paragraph 3.87 footnote added correct reference and date

3.109 adjusted as follows
Additionally, rock outcrops although retained, will be within the TSC site compound. It appears that access will now be prevented through the rear gates out onto the Welsh Coastal Path. The north side of the campus buildings, including the rock outcrops, will be the only accessible outdoor space which also includes the workers viewing area. It is highly likely that these features will be subject to considerable human recreational usage, which it is highly probably will result in increased trampling, erosion of rock surfaces and compaction. …..

Paragraph 3.112 substantially adjusted <u>as it had no sense in the draft</u>
Although the reptile resource is unknown on the TSC site, it is accepted that rock outcrops provide good habitat for sheltering, foraging and basking. However, for the same reasons as discussed above, any populations of reptiles within these rock outcrops will be highly disturbed. One area of rocky outcrop will be reduced in size – which is a suitable stepping stone from Wylfa Head and the known reptile population found towards the remainder of the site (eg Dame Sylvia Crowe's mound). The reptile populations at Wylfa Head will become isolated for the entirety of

the construction and operation period of the TSC and for a substantial period during and post decommissioning.

3.117 adjusted for sense

Major Omission from submitted draft

Paragraphs 3.118 – 3.127 moved to the section after 'Reinstatement' at original paragraph 3.138.

Paragraphs 3.118 – 3.127 heading given different level in hierarchy, section reformatted to make indented bullet list,.

Final concluding paragraphs on Requirements added as follows. The two highlighted paragraphs were adjusted and placed in the Exec Summary: -

3.138 "In any normal circumstance as a stand-alone proposal it would be anticipated that a local authority ecologist would expect the submission of this level of detail in order to provide a view to a DC planning case officer. This would allow the necessary balance to be placed on the Officer's consideration of the application, in light of the biodiversity material considerations. This would inform their report and recommendations to the planning committee.

3.139 It is NWWT's opinion that in the case of the TSC this has not occurred due to its being subsumed as a 'smaller' part of the much wider power station scheme. It is our opinion that this lack of attention to the location of the TSC as an associated development, which could be allocated to another reasonable and available alternative location, is a considerable oversight.

3.140 Notwithstanding NWWT's objection to the TSC we would anticipate that a suite of stand- alone Requirements will be necessary: -

- precommencement conditions (ie survey to inform reptile translocation)
- construction and implementation detail including for the diversion of the rising foul sewer.
- reinstatement detail to be required at specified stage x months/years prior to decommissioning
- reinstatement management and maintenance period. As a virgin landform this would need to be longer than a 5-year landscape condition
- Commitment to long term management and resourcing. While this area should be managed with agricultural techniques its long term viability needs to be assured to justify any degree of no net loss of biodiversity. It is recommended that there should be additional discussions as to its availability for public access in the long term.

3.141 The imposition and effective implementation of any imposed Requirements could not overcome the fundamental concerns and lack of confidence that any adequate protection, mitigation or enhancement of the biodiversity resources can be achieved."

6. Appendix 1 – Panorama showing the Temporary Site Campus

Photo taken from the east of TSC boundary looking west into the site

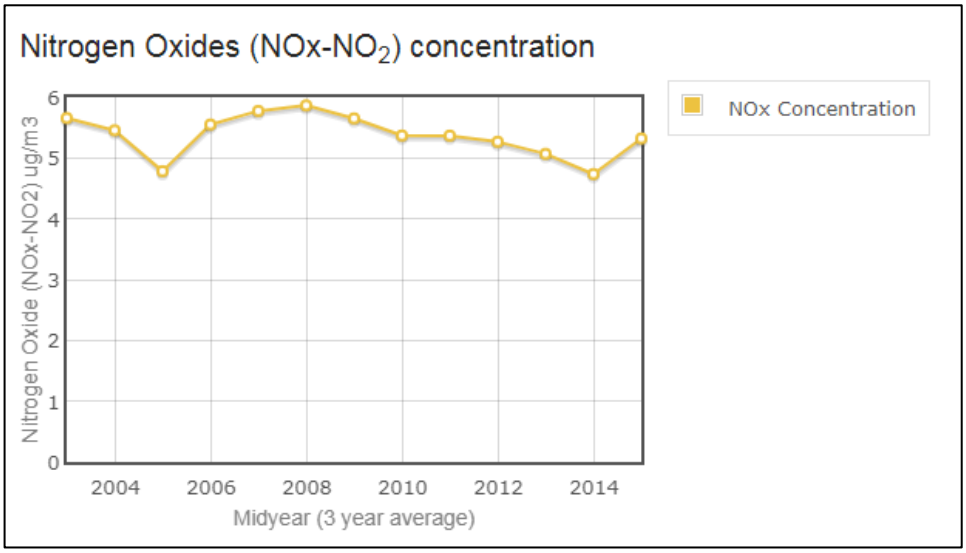

03/10/2017 15:18
03/10/2017
03/10/2017 15:18
03/10/2017 15
03/10/2017 15:18

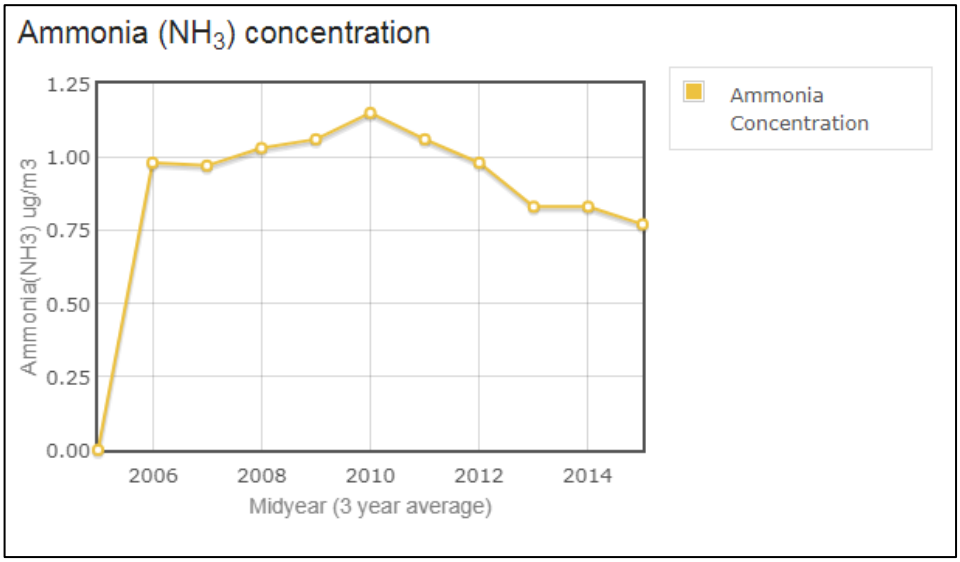
7. Appendix & References to support air quality chapter

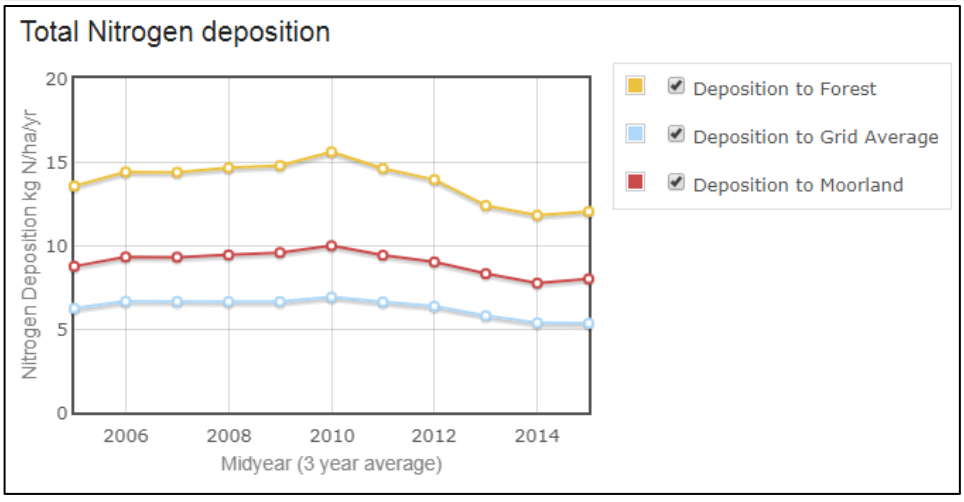
Appendix - Baseline data from APIS (Air Pollution Information Service **http://www.apis.ac.uk/**) for Cemlyn Bay SAC
Select a Feature
SRCL home | SAC
Site/Feature Information
Site Code: UK0030114
Site Name: Bae Cemlyn/ Cemlyn Bay
Country: Wales
Designation: SAC
Enter a grid reference >>

Nutrient Nitrogen
Acidity
NH_3
NO_x
SO_2
Concentrations & Depositions
Trends
Critical Loads
Source Attribution
The site interest features are listed below. They are ordered by sensitivity to nitrogen deposition, with the most sensitive at the top. Select the + sign to expand information for each feature.
Critical load values for nutrient nitrogen deposition are provided as a range (e.g. 10-20 kgN/ha/yr). See on guidance on applying critical loads in impact assessments.
Perennial vegetation of stony banks (H1220)
Coastal lagoons (H1150)

The graphs below show the deposition and concentration trends since 2004. The years are based on three-year averages (i.e. year 2005 is the average of 2004, 2005 & 2006). Deposition plots are shown for three deposition ecosystems, deposition to forests, moorland (short-vegetation) and a grid average. Results are presented based on the centroid point of the site and the corresponding grid square that covers that centroid point. For nitrogen and acid deposition and concentrations of ammonia (NH_3) these values are at a 5 x 5 km grid square and are outputs from the CBED (Concentration Based Estimated Deposition) model. Concentration data for SO_2 and NO_x are from the PCM model and are on a grid square of 1 x 1 km. You should match your habitat type of interest to the relevant deposition plots. You can turn on/off the graph lines in the legend.


Nitrogen Oxides (NOx-NO2) concentration
Nitrogen Oxide (NOx-NO2) ug/m3
0
1
2
3
4
5
6
2004
2006
2008
2010
2012
2014
Midyear (3 year average)
NOx Concentration


Ammonia (NH3) concentration
Ammonia(NH3) ug/m3
0.00
0.25
0.50
0.75
1.00
1.25
2006
2008
2010
2012
2014
Midyear (3 year average)
Ammonia Concentration


Total Nitrogen deposition
Nitrogen Deposition kg N/ha/yr
0
5
10
15
20
2006
2008
2010
2012
2014
Midyear (3 year average)
Deposition to Forest
Deposition to Grid Average
Deposition to Moorland

Tables showing power and emissions of slow speed diesel engines
EEA European Environment Agency (2013) - 'The impact of international shipping on European air quality and climate forcing', pub Copenhagen © (available https://www.eea.europa.eu/publications/the-impact-of-international-shipping)

Table 3.2 Information and assumptions applied by three widely used emissions models to calculate fuel consumption from shipping activities

Fuel consumption		ENTEC	TNO	STEAM2
Main engine	Installed power	Lloyd's Register	Lloyd's Register	Lloyd's Register and ship owners
	Load factor	At sea: 80 % Manoeuvring: 20 % At berth: 20 %	Cruising (at sea): 85 % Reduced speed: 65 % Manoeuvring: 10–40 % At berth: 0 %	$LF = 0.8\left(\frac{V_{transient}}{V_{design} + V_{safety}}\right)^3$ $V_{transient}$: speed from AIS data V_{design}: design speed from Lloyds Register V_{safety}: 0.5 kilotonnes Correction for wave height and direction
	Delivered power	$P[kW] = LF \times P_{installed}$	$P[kW] = LF \times P_{installed}$	$P[kW] = 0.8P_{installed}\left(\frac{V_{transient}}{V_{design} + V_{safety}}\right)^3$
	SFC	SFC taking into account: engine type (SSD, MSD, HSD, ST, GT) fuel type (MDO, MGO, RO)	SFC taking into account: the engine type (2-stroke, 4-stroke, steam turbine, gas turbine) load factor fuel type (MDO, HFO/ RO) build year	SFC from engine manufacturers Default SFC = 200 g/kWh
AE	Installed power	Lloyd's Register	Lloyd's Register	Lloyd's Register as upper limit for power estimate
	Load factor	At sea: 30 % (50 % of electric power from shaft generator) Manoeuvring: 50 % At berth: 40 %	n/a	n/a
	Power		For each ship type from port survey (GT)	Power depends on ship type and activity

Note: SFC = specific fuel consumption; SSD = slow-speed diesels; MSD = medium speed diesels; HSD = high speed diesels; ST = steam turbine***; GT = gas turbine***; AE = Auxiliary engine; MDO = marine diesel oil; MGO = marine gasoline oil; HFO = heavy fuel oil; RO = residuel oil.

Source: ENTEC (Whall et al., 2010); TNO (Denier van der Gon, Hulskotte, 2010); STEAM2 (Jalkanen et al., 2009, 2012).

Table 3.3 Difference in emission factors for slow-speed diesel engines using residual oil at sea or manoeuvring/at berth (Unit g/kWh)

	NO_x pre-2000	NO_x post-2000	NO_x average	SO_2	CO_2	VOC	PM	SFC
At sea	18.1	15	17	10.5	620	0.6	1.7	195
Manoeuvring and at berth	14.5	12	13.6	11.6	682	1.8	2.4	215

Note: Emissions factors from ENTEC study.

Source: Whall et al., 2010.

Table 3.4 Illustration of present-day sulphur contents by fuel type in 2007 and as required in Emission Control Areas

Fuel	Assumed sulphur content		
	2007	2010–2020 non-SECA	2010–2020 SECA
Marine Gasoline Oil (MGO)	0.2 %	0.1 %	0.1 %
Marine Diesel Oil (MDO)	1.5 %	1.5 %	1.0 %
Residual Oil (RO)	2.7 %	2.7 %	n/a

Note: % by mass.

Source: Whall et al., 2010.

Jones MLM, et. Al. (2008) – 'Changes in Vegetation and Soil Characteristics in Coastal Sand Dunes along a Gradient of Atmospheric Nitrogen Deposition'
National Atmospheric Emissions Inventory (NAEI) - Ricardo Energy & Environment (2017) – ' A Review of the NAEI Shipping Emissions Methodology' for Department for Business, Energy & Industrial Strategy (http://naei.beis.gov.uk/reports/reports?report_id=950)
Sanderfoot O.V. and T Holloway (2017) – 'Air pollution impacts on avian species via inhalation exposure and associated outcomes', Environ. Res. Lett. 12 083002 (*iopscience.iop.org/article/10.1088/1748-9326/aa8051/pdf*)
Viana et al (2014) – 'Impact of maritime transport emissions on coastal air quality in Europe', Mar Viana[a], Pieter Hammingh[b], Augustin Colette[c], Xavier Querol[a], Bart Degraeuwe[d], Ina deVlieger[d]Johnvan Aardenne[e] (Atmospheric Environment 90 (2014) 96 -105 (available https://www.sciencedirect.com/science/article/pii/S1352231014002313?via%3Dihub)

Viana et al. (2009) – 'Chemical tracers of particulate emissions from commercial shipping', M. Viana, F. Amato, A. Alastuey, X. Querol, T. Moreno, S.G.D. Santos, M.D. Herce, R.Fernández-Patier, Environmental Science and Technology, 43 (2009), pp. 7472-7477
"*Quantitatively, the contributions from shipping emissions to PM_x and gaseous pollutant concentrations show a large spatial variability, with maximal contributions in the Mediterranean basin and the North Sea: on average, shipping emissions contribute with 1–7% to annual mean PM_{10} levels, with 1–20% to $PM_{2.5}$, and with 8–11% to PM_1, and with 7–24% to NO_2 concentrations. Consequently, the emissions from the maritime transport sector cannot be considered a negligible source of atmospheric pollutants in European coastal areas. Current mitigation strategies have proved their efficiency, with decreases in SO_2levels ranging between 50 and 66% (subsequent decreases in secondary PM are not fully quantified). Therefore, the results from this review encourage the continuation of existing measures, as well as the implementation of new ones with a special focus on primary particle emissions from ships*."

8. Appendix and References to support Cooling Water System chapter

Byers E A, Hall J W. and Amezaga M. (2014). Electricity generation and cooling water use: UK pathways to 2050. Global Environmental Change, Volume 25, pp16-30.

Cambrensis (2008). Independent BAT Assessment for Pembroke Power Station Cooling Water Discharge, CCW Contract Science Report No 846.

ANNEX 1 Supporting Information

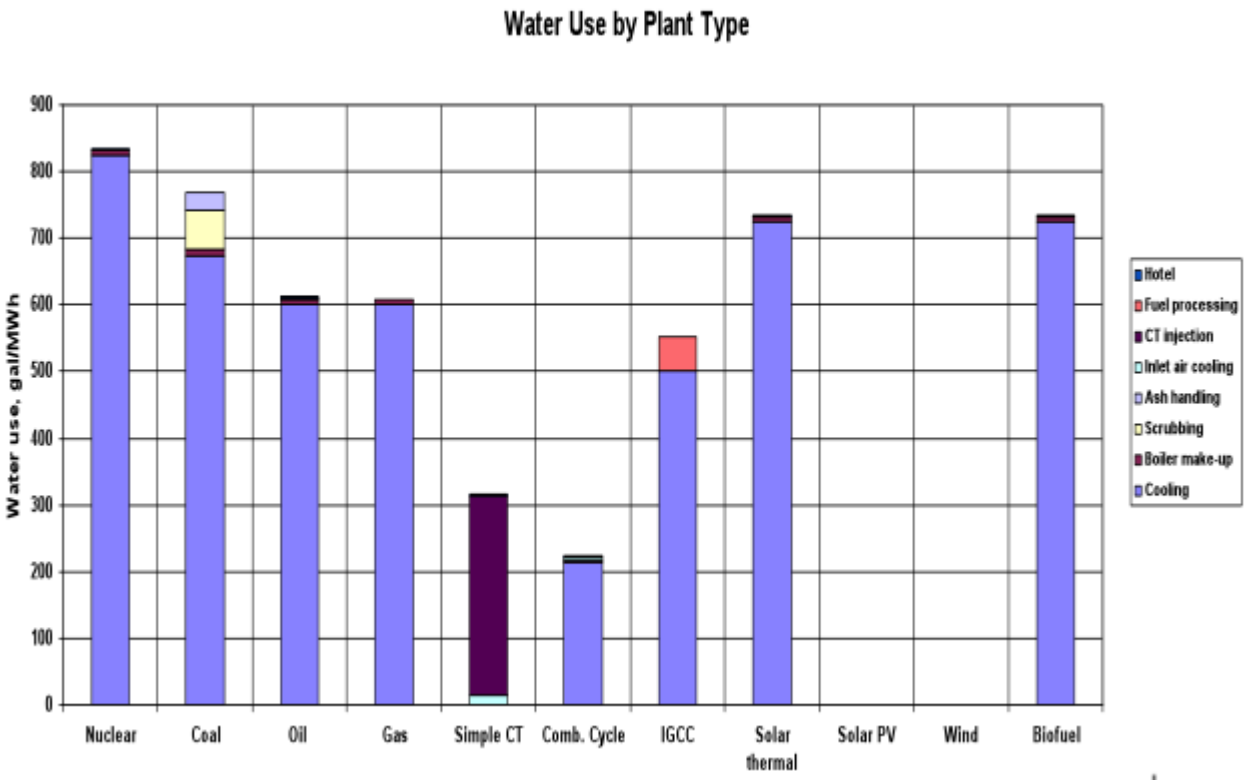
Once through cooling

"*Many nuclear power plants have once-through cooling (OTC), since their location is not at all determined by the source of the fuel and depends first on where the power is needed and secondly on water availability for cooling. Using seawater means that higher-grade materials must be used to prevent corrosion, but cooling is often more efficient. In a 2008 French government study, siting an EPR on a river instead of the coast would decrease its output by 0.9% and increase the kWh cost by 3%."* Such cost benefits should be a consideration in relation to mitigation." http://www.world-nuclear.org/information-library/current-and-future-generation/cooling-power-plants.aspx

Recirculating or indirect cooling

"*. If the power plant does not have access to abundant water, cooling may be done by passing the steam through the condenser and then using a cooling tower, where an updraught of air through water droplets cools the water. Sometimes an on-site pond or canal may be sufficient for cooling the water. Normally the cooling is chiefly through evaporation, with simple heat transfer to the air being of less significance. The cooling tower evaporates up to 5% of the flow and the cooled water is then returned to the power plant's condenser. The 3 to 5% or so is effectively consumed and must be continually replaced. This is the main type of recirculating or indirect cooling."* This is the type of cooling system which had to be used in the Dee estuary requiring very little abstraction." http://www.world-nuclear.org/information-library/current-and-future-generation/cooling-power-plants.aspx

Figure 1 **Comparison of water use by different generating techniques**



EPRI 2010 (some 15% of coal plant waste heat is discharged through the stack, rather than cooling water). NB US gal =3.79 litres. Taken from http://www.world-nuclear.org/information-library/current-and-future-generation/cooling-power-plants.aspx

Pembroke Power station (Milford Haven).
With a total generating capacity of 2,199MW and thermal efficiency of 60%, is one of the largest and the most efficient CCGT power plants in the UK discharging cooling water at only 40 cubic metres per second at 10C above ambient.
* CCGT plants have an oil or gas-fired gas turbine (jet engine) coupled to a generator. The exhaust is passed through a steam generator and the steam is used to drive another turbine. This results in overall thermal efficiency of over 50%. The steam in the second phase must be condensed either with an air-cooled condenser or some kind of wet cooling. Gas combined cycle (combined cycle gas turbine – CCGT) plants need only about one third as much engineered cooling as normal thermal plants (much heat being released in the turbine exhaust), and these often use dry cooling for the second stage. *
http://www.world-nuclear.org/information-library/current-and-future-generation/cooling-power-plants.aspx

Thermal efficiency of nuclear power stations in the United Kingdom (UK), from 2010 to 2017 (in percentage). This shows that this approximates to 40% https://www.statista.com/statistics/548985/thermal-efficiency-nuclear-power-stations-uk/
Kevin Anderson (2016) Going Beyond "Dangerous" climate change. https://www.youtube.com/watch?v=-T22A7mvJoc
Varying cost estimates for Wylfa
"It is hoped its £12bn replacement would have a 60-year operational life" https://www.bbc.co.uk/news/uk-wales-44360816
"Ministers are preparing to announce a deal with Hitachi, a Japanese developer, next week to help to fund the construction of the Wylfa Newydd plant on Anglesey,

which could cost more than £15 billion." https://www.thetimes.co.uk/article/taxpayers-to-foot-the-bill-for-15bn-wylfa-newydd-nuclear-plant-on-anglesey-wales-wkh3mnsqw

"Being developed by Hitachi subsidiary Horizon Nuclear Power, the 2,700MW power plant is estimated to cost £20bn ($26bn)." https://www.power-technology.com/projects/wylfa-newydd-nuclear-power-plant/