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

Written Representation

Biodiversity – Cemlyn Nature Reserve

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(North Wales Wildlife Trust 20011639, National Trust 20010995, the Royal Society for the Protection of Birds 20011586)

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YMDDIRIEDOLAETH natur WILDLIFE TRUST GOGLEDD CYMRU NORTH WALES

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Cover photograph © Ben Stammer – North Wales Wildlife Trust, Arctic Tern flying in with food over Esgair Gemlyn shingle ridge, Cemlyn Nature Reserve

1. Executive Summary

1.1 This Written Representation has been prepared by Teresa Hughes (Biodiversity Planning) on behalf of the North Wales Wildlife Trust (NWWT, interested party 20011639), National Trust (NT, interested party 20010995) and the Royal Society for the Protection of Birds (the RSPB, interested party 20011586) and expresses the joint views of these environmental NGOs (eNGOs) on specific matters before the Examination of the DCO for Wylfa Newydd nuclear power station. It refers in places to other written representations that have been prepared by the National Trust and submitted to the Examination, notably the representation of Professor Kenneth Pye on coastal processes and change, Michelle Bolger on landscape and Dr David Parker on the Landscape and Habitat Management Strategy.

2.1 The RSPB has indicated that they wish to defer to the NT and NWWT's greater expertise in following matters[1]: -

- Impacts to Cemlyn Bay from recreation pressures and visitor management
- Cemlyn Bay SAC including on coastal processes and changes to coastal features including to the shingle ridge (Esgair Gemlyn).
- Chapter 4 of this document relating to impacts to the Cemlyn Bay SAC saline lagoon; its water chemistry and quality.
- Chapter 5 on the waste hierarchy – disposal of soft sediments.

Summary Chapter 3 – Cemlyn Nature Reserve; Anglesey Terns SPA

1.2 The Conservation of Habitats and Species Regulations 2017 (the Habitats Regulations) require **certainty that there will be no adverse effects on the integrity (AEOI) of Natura 2000 sites** arising from plans and projects that could have a significant effect. That is the case where **no reasonable scientific doubt remains as to the absence of such effects**. The Wylfa Newydd Development Consent Order (DCO) application (the application) presents a range of potential impacts to the Anglesey Terns Special Protection Area (the SPA), the cumulative effects and the severity of which over the 10-years construction and the longer term operation are extremely uncertain and difficult to predict. In the view of NWWT, National Trust and the RSPB (the eNGOs), appropriate consideration has not been given by Horizon to the avoidance, mitigation or compensation of these impacts, or to the application of the precautionary principle.

1.3 This view has been maintained throughout the consultation process and, although there has been some additional evidence collection and introduction of a number of mitigation protocols, the eNGOs are of the shared view that this has not addressed the core issues within the legislative context of the Habitats Regulations.

1.4 It is the eNGOs' view that the available evidence does not provide sufficient certainty that, despite any ameliorating effects of these measures, the DCO proposals will not lead to reduced breeding success in one or more season and/or the potential collapse of the Cemlyn Lagoon colony.

1.5 In particular, it is considered that mitigation has not been appropriately developed or secured through the necessary mechanisms and the SPA compensation proposals have

[1] Therefore in the sections of this written representation concerning these matters, references to 'the eNGOs' refers to the views of NWWT and NT.

not been brought fully within the examination in order to be scrutinised and demonstrate appropriate application of the relevant legislation.

1.6 The methodologies used to investigate the baseline conditions (behavioural studies and foraging analysis) have been applied at too coarse a scale. They fail to be useful predictors of impacts: -

- The behavioural studies because they do not differentiate between a year when the colony failed due to abandonment and a year when breeding was successful.
- The foraging data analysis because it fails to differentiate between the construction zone and the wider zone of influence.

1.7 The current soundscape at the tern colony and their foraging routes is characterised by the natural environment with few impulsive sounds. The noise data shows that the baseline noise environment will be subject to considerable change, not just to background case bounding construction noise, but also to high maximum levels of temporary but temporally and spatially unpredictable noise generated from impulsive and blast related activities. This will be present both at the colony's breeding islands but will also result in considerable variation in the soundscape as a tern flies to commute and forage through the harbour (MOLF) during both its construction and operation as an industrial port.

1.8 Discussion on the predicted blast data concludes that there is a need for further analysis and for a Section 61 application post DCO decision. Therefore, it is not possible at the current time to determine whether these thresholds can actually be achieved and in what weather conditions. There is no understanding what implications this may have for the build program. However, Horizon have already indicated that "*any further constraints in blast size will prevent any meaningful work on site"* in relation to the mitigation protocol. The uncertainty of what can actually be achieved during construction may also be reflected by the recent submissions for non-material changes.

1.9 Horizon's analysis of the literature does not support the Shadow Habitats Regulations Assessment (sHRA; APP-050) conclusions with any degree of clarity. The Environmental Statement (ES; APP-132 doc 6.4.13) itself is contradictory, ascribing an *adverse* impact from marine construction disturbance to secondary seabirds (ie non tern species), which occur at low numbers and density in the Wylfa Newydd Development Areas (WNDA). This is in contrast to the ES conclusion of *negligible* impacts to the tern species – primary seabirds – which have critical commuting and foraging routes through the construction zone. Additionally, other data is discussed which further demonstrates the uncertainty in relation to Horizon's conclusions: -

- Studies show that some form of avoidance behaviour is exhibited by terns to wind farm arrays in the majority (70%) of studies considered.
- Docking Shoal windfarm proposals were refused on bird issues including the impacts on breeding success and energy budgets of foraging terns.
- The conclusions of a monitoring report on Sandwich terns at Sheringham Shoal (Harwood et al 2017) supports that ES's initial conclusions of minor adverse impacts due to avoidance of construction and operation of offshore wind farms.
- It is important to remember that whilst wind farm avoidance may provide some useful understanding of foraging and commuting terns, it is not directly analogous to the circumstances that pertain to the WNDA. Impacts from Wylfa Newydd will be over a longer time period and in much closer proximity to the SPA breeding colony, with a significant proportion of Sandwich terns consistently commuting to

foraging grounds via a route that will be through the proposed marine construction zone and the operational harbour (MOLF).

- The Detailed Offshore Ground Investigation observations within Porth-y-Pistyll (Construction Zone 10), although not scientifically empirical, serve to corroborate the findings of avoidance of novel and unexpected industrial features on Sandwich tern commuting and foraging pathways that have been recorded elsewhere.
- The DCO submission demonstrates considerable uncertainty about the delivery mechanisms for a variety of materials and the quantum of marine vessel movements as opposed to road deliveries. The reports that form the basis for transport and logistics assessment are heavily caveated. This lack of clarity also extends to navigational routes into the new harbour (MOLF) and interaction with terrestrially based plant
- Very few conclusions can be drawn with any reasonable certainty from Horizon's observations about tern breeding colonies in industrial environments or their long-term viability.

1.10 The mitigation proposed to address the impacts of construction disturbance (noise and visual) is over complicated and internally inconsistent. It proposes unjustified thresholds, breeding dates and behavioural response criteria. The management protocols will be unachievable in a real-world construction context. As a result, monitoring and enforcement will be difficult and unlikely to be effective.

1.11 In our view, it is not scientifically demonstrable, based on the work undertaken, to conclude with confidence and beyond reasonable scientific doubt that a noise threshold of 68.2 – 69.3 dB L_{AFmax} is the level at which disturbance to the tern colony will occur and above which it would be damaging to the conservation objectives of the SPA.

1.12 In the eNGOs' experience in either planning or legislative terms there are no known examples where conditions for monitoring or mitigation have tried to differentiate between the different sub-stages of a bird's breeding life-cycle.

1.13 It can clearly be demonstrated that the proposed establishment period will not capture the breeding phases of any of the other qualifying species of the Anglesey Terns SPA; common tern, Arctic tern and roseate tern.

1.14 A mitigation protocol which allows greater construction disturbance to restart, as proposed, in mid-May would curtail re-laying breeding effort of either resident terns or influxes of birds from failed attempts elsewhere. Credible evidence is provided that there is a functional linkage between Natura 2000 during the breeding season. So the proposed approach may also have consequences for the meta-population dynamics of the wider Irish Sea population at other Natura 2000 sites.

1.15 A mitigation protocol which only commences on the evidence of breeding behaviour will miss important parts of the colonies necessary processes including the establishment of the sympatric black-headed gull colony and pre-breeding roost behaviour.

1.16 The use of noise thresholds proposed has not been demonstrated as being appropriate. Horizon rely on an approach which also monitors behavioural activity at the bird colony.

- The studies presented by Horizon have been unable to differentiate between the imminent collapse of the colony as compared to a successful breeding season. The predictive capability to translate this into a construction environment is therefore non-existent.

- It is considered that reactive monitoring based solely on fly-up responses rather than analysis of any other gradient of types of behavioural response is inappropriate.
- Thresholds based on noise monitored at the tern colony, will only serve to permit loud construction activities when the terns are naturally already in a disturbed or agitated state. This approach is unacceptable and is effectively unworkable or enforceable.

1.17 The proposed mechanism's ability to achieve 'real time' contact between observers present at the colony for all day-light hours and a dedicated on-site site manager to provide the identification of sources and the necessary reactive turn-round time to stop activities and/or equipment from operating is going to be difficult to achieve. It may not be possible to differentiate/determine which construction is the loudest and/or closest to the colony or whether in actuality this "loudest" activity is actually the one responsible for the observed behaviour. Based on the experience of ecological over-sight/enforcement responsibilities for smaller infrastructure projects, the eNGOs cannot see how this part of the protocol could be achieved by the contractors or effectively monitored by an enforcing body

1.18 No monitoring or remediation is proposed for the tern colony during the construction or operation of the Wylfa Newydd scheme. The most important advantage in establishing a good monitoring program at Wylfa Newydd prior to, during and post construction is that it can also be used to inform decisions and impact assessments for decommissioning operations and potential removal/retention of marine infrastructure.

1.19 The cumulative impacts of additional factors add to the risks of breaching the conservation objectives of the SPA and the conclusions drawn by the applicant are considered unsound on the following matters: -

1.20 The hydrological/geomorphological eNGO evidence (see Chapter 4 and Professor Kenneth Pye 'Coastal processes and geomorphology' submitted at Deadline 2) in relation to the shingle ridge (Esgair Gemlyn) indicates as a minimum increased risks and rates of overtopping and at worst a catastrophic breach. This would result in untold consequences for the integrity of the SPA tern breeding islands within the lagoonal habitats. No monitoring or remediation measures are proposed to deal with the uncertainty associated with this risk.

1.21 The recreational baseline data is not adequate and the changes to recreational pressure impacts have not been predicted or evaluated. Measures to control visitor or worker usage within or in close proximity to the WNDA are not well formed. It is considered that the Workforce Management Strategy will fail to achieve any degree of control of Site Campus residents.

1.22 The unintended consequences of construction and operation resulting in the attraction or alteration of population dynamics/behaviour of undesirable predatory species have simply been dismissed. Consequently, the introduction of good estate management practices have not been proposed to manage this risk.

1.23 The interactive consequences to the wider metapopulation of Natura 2000 breeding colonies of tern species within and beyond the SPA have not been thoroughly or adequately considered. The eNGO evidence indicates that there is reasonable and credible evidence of functional linkage within the Irish Sea Natura 2000 network and there are risks to the conservation objective of not only the Anglesey Terns SPA but those of other sites.

1.24 The uncertainty and lack of confidence in the evidence in relation to the construction and operation of the marine infrastructure, the construction of the power station, and associated earthworks leads the eNGOs to conclude that mitigation is a necessary part of the management and avoidance of risks of likely significant impacts on the Anglesey Tern SPA.

1.25 However, as stated above, it is the NGOs' collective view that, even with the application of additional mitigation and avoidance measures, the residual cumulative impacts arising from the development are likely to preclude a conclusion of no AEOI, and it will therefore be necessary for the Examining Authority to apply Stage 3 and 4 of the Habitat Regulations, including (subject to the outcome of the assessment of 'no alternative solutions', and 'reasons of overriding public interest') consideration of compensation for the Anglesey Terns SPA and the wider Irish Sea metapopulation.

Summary Chapter 4– Cemlyn Nature Reserve; Cemlyn Bay SAC

1.26 The representation of the eNGOs in Chapter 4 should be read in conjunction with the following other eNGO work and the conclusions they make: -

- Professor Kenneth Pye in relation to coastal processes and coastal change, particularly in respect to impacts the shingle ridge, Esgair Gemlyn. In this he concludes that the changes to the coastal hydrological/geomorphological environment and mechanisms will result in at minimum an increased risk and rate of overtopping and at worst a catastrophic breach.
- The evidence elsewhere within this paper (Chapter 3) is that there is a clear functional linkage between the integrity of the shingle ridge and the continued presence and/or functioning of the breeding islands for the Anglesey Tern SPA.

1.27 Horizon have made a number of assumptions on the impacts of the development when applied to the saline lagoon habitat but this provides insufficient certainty of 'no AEOI ' on the Cemlyn Bay SAC both during the construction and post construction phases.

1.28 In some instances, insufficient baseline data is presented on which to provide sufficient certainty beyond reasonable scientific doubt of 'no AEOI'. Salinity data has only been collected between June 2012 and September 2013 and provides a small 'snapshot' of seasonal variation in the regime, but does not consider any underlying long term trends that may be affecting the system. The sHRA is almost entirely silent on describing baseline conditions of the freshwater inputs into the system. It is telling that as late as autumn 2018 additional monitoring has only just been initiated by Horizon, in order to help inform threshold setting.

1.29 There is poor understanding of the current long term dynamics of the Cemlyn Bay SAC as evidenced by the probable loss of one lagoon specialist species *Cerastoderma glaucum,* which has not been recorded since 2007 (NRW 2018a) for unknown reasons, as well as observed community changes in 2013 at one sampling station (Green and Camplin, 2013). This variability in condition is reflected in the statutory condition assessments with the habitat assessed in 2017 as 'unfavourable and in 2018 as 'favourable' (NRW 2018a and 2018b).

1.30 With an incomplete understanding of the existing condition there is less certainty of a 'no AEOI' conclusion when the changes due to the development are factored in and the precautionary principle should be invoked to safeguard the habitat from potential impacts.

1.31 There is an assumption within the sHRA that changes in salinity, when within the salinity tolerance of a lagoon specialist species, will result in no AEOI. This assumption can only be discussed alongside consideration of the duration of the change; lagoonal specialists rely on stochastic environmental conditions (Green and Camplin, 2013) and may tolerate pulses of hypo and hyper saline conditions within a dynamic and changing salinity regime, but may be out-competed by more generalist species under more stable or nutrient rich conditions.

1.32 There are limited measures in place to safeguard the ecological conditions and resilience of the saline lagoon habitat but those measures that are included, such as the diversion of diversion of the E1 (Cemlyn) outfall to the E2 (Afon Cafnan) outfall from Mound E are not set out in sufficient detail to demonstrate their effectiveness. Given the internationally protected status of the site, it is essential that there is confidence in these construction mitigation measures and negotiation of such detail should not be left to a later stage. They should be detailed in the DCO submission in order to provide confidence that they are appropriate, use the best available technology, are proportionate, achievable in protecting the SAC conservation objectives and enforceable. In addition, none of these measures are likely to deliver the net gain in habitat resilience required in planning legislation.

1.33 The clear specification of the earthworks drainage mitigation scheme should be combined with a construction and operation monitoring scheme which includes monitoring methodologies, thresholds and remediation measures.

1.34 The proposed reworking of Mound E not only exacerbates the landscape and LHMS impacts – as discussed in other eNGO evidence[2] – but also increases the probability of impacts to the lagoonal habitats, leading to even more uncertainty. It is the eNGOs' opinion that not reworking the Mound E would significantly reduce the impacts to Cemlyn Lagoon SAC.

1.35 Ecological resilience is particularly important for the Cemlyn Bay SAC given both the importance of its reservoir of specialist species. Compared with other lagoons, Cemlyn supports by far the greatest density of *E. ventrosa* in the UK. However, there is also relative isolation from similar habitats with consequent low ability to recruit any lost species, as is the case with the probable loss of *Cerastoderma glaucum* (Green and Camplin, 2013).

1.36 Loss of only one further specialist species would result in the saline lagoon habitat being considered in an unfavourable condition (CCW, 2008). Robust resilience measures, such as a monitoring and remediation strategy for the lagoon during and post construction or potentially consideration of the creation of similar habitat in proximity to the existing lagoon, should have been taken forward in the sHRA.

1.37 However, as stated above, it is the NGOs' collective view that, even with the application of additional mitigation and avoidance measures, the residual cumulative impacts arising from the development are likely to preclude a conclusion of no AEOI, and it will therefore be necessary for the Examining Authority to apply Stage 3 and 4 of the Habitat Regulations, including (subject to the outcome of the assessment of alternative solutions, and reasons of overriding public interest) consideration of compensation for

[2] Evidence provided for the eNGOs from Michelle Bolger – Landscape and Dr David Parker – Landscape and Habitat Management Strategy

impacts to Cemlyn Bay SAC and its designated features; the shingle ridge - Esgair Gemlyn - and the saline lagoon.

Summary Chapter 5 – Construction of the harbour: Application of the waste hierarchy

1.38 This evidence indicates that there are significant policy drivers which direct the re-use of materials derived from waste streams of construction processes in both the terrestrial and marine environments. The application of the waste hierarchy should be undertaken.

1.39 The Wylfa Newydd Environmental Statement fails to address this and evidence is used from the Marine Licence application to demonstrate that there has been poor analysis of the policy requirements of the waste hierarchy.

1.40 Despite being raised over 12 months ago by the eNGOs' Horizon relies on an unsubstantiated opinion that there is too little space to store marine derived materials within the WNDA.

1.41 The eNGOs' have undertaken their own analysis of what volumes of material may be required in local projects which would meet policy objectives, manage risks to the Esgair Gemlyn shingle ridge (Cemlyn Bay SAC) and result in works that could help to maintain the conservation objectives for the Anglesey Terns SPA.

1.42 It is demonstrated that whilst appropriate licensing would be required to implement the proposals to re-use materials, they are not contrary to the Shoreline Management Plan for this part of the Welsh coastline.

1.43 Additional projects and literature are highlighted which demonstrate the importance of consideration of re-use as part of the waste hierarchy and the contribution it can make to managing coastal squeeze and the conservation of important habitats or breeding/wintering birds.

1.44 Horizon's lack of engagement with this issue and their intended approach of leaving for later decisions and/or when timings coincide with the identification of third-party projects, will ultimately result in no decisions to investigate the re-use of materials and the project's requirement to implement any planned proposals.

1.45 Without applying the policy guidelines early enough in the project's design and development will ultimately result in non-conformity with policy and with lost opportunities to meet objectives of other recognised national workstreams. Work should have been undertaken to calculate the nature and fractions of materials that will be derived and appropriate application of the waste hierarchy at Wylfa Newydd should have been undertaken at DCO submission in order to demonstrate the appropriate consideration of the policy requirements.

1.46 In the eNGOs' opinion this is a serious omission which should be addressed at the determination of the DCO and associated Licences so that appropriate Requirements can be placed on the Wylfa Newydd scheme to ensure effective adoption of a planned and phased approach to the re-use of waste materials, as required by policy.

1.47 Should the Examining Authority agree with the conclusions that the eNGOs make in relation to Cemlyn Bay SAC and the integrity of the shingle ridge – Esgair Gemlyn – that an AEOI cannot be discounted, the re-use of material in the amelioration for impacts is likely to be an important component of any proposals that come forward.

Summary Chapter 6 Securing mitigation measures through the draft DCO Requirements and controlled documents

1.48 This concluding chapter reviews the mechanisms for securing appropriate mitigation within the draft DCO and other controlled documents that are proportionate, related to the development, demonstrate the use of industry standard techniques, and which are achievable and enforceable.

1.49 It considers the mitigation protocols that have been put forward by Horizon and draws out the other recommendations that have been made by the eNGOs in their written representations.

1.50 In summary the following matters are discussed: -

1.51 A general commentary about the complexity of the CoCPs and how different elements can be enforced or effectively monitored by the discharging body (Isle of Anglesey County Council IACC or Natural Resources Wales NRW).

1.52 The lack of consistency between controlled document and/or the use of imprecise language in drafting of Requirements and the items within the Mitigation Route Map which will not help to avoid doubt in their later application and implementation.

1.53 Noise and visual disturbance mitigation protocol for the Anglesey Terns SPA, which notwithstanding the eNGOs' conclusion in relation to AEOI, there are fundamental concerns regarding the proposed mitigation, due to its lack of efficacy and non-standard methods which should be reviewed in their entirety.

1.54 Introduction of a monitoring and remediation strategy for the SPA terns in order to inform future decisions on decommissioning the power station and removal/repurposing of the harbour (MOLF).

1.55 Details of the Mound E drainage construction and monitoring and remediation plan for Cemlyn Lagoon saline and freshwater inputs and environment. Detail should be provided prior to the determination of the DCO in order to demonstrate its effectiveness in maintaining the conservation objectives of the Cemlyn Bay SAC and should be implemented via a Requirement.

1.56 Introduction of a monitoring and remediation strategy for the shingle ridge, Esgair Gemlyn. Professor Kenneth Pye indicates that there should be a Requirement to monitor the ridge and adjoining areas and a strategy including action options if certain morphological change thresholds are exceeded. Such options should include re-profiling of parts of the ridge and/or islands and intervening channel, if necessary, using reserves of stockpiled marine shingle obtained from the early phases of harbour construction (i.e. the material which will be removed from the location of the proposed MOLF, or simply buried beneath it).

1.57 The provision of a Recreational Visitor Management Plan as a coordinated and resourced scheme, which not only includes the Natura 2000 sites but also other sensitive ecological receptors that will be impacted by the implementation of Wylfa Newydd.

1.58 The revision of the Workforce Management Strategy and a clear process to achieve its agreement with IACC.

1.59 Clear identification within the draft DCO to the provision of a temporary viewing area, which identifies when it will be constructed, what facilities it will provide along with its

future use (post construction) and how its management will be resourced during operation of the power station.

2. Introduction

North Wales Wildlife Trust, National Trust and the RSPB

2.2 This Written Representation has been prepared by Teresa Hughes (Biodiversity Planning) on behalf of the North Wales Wildlife Trust (NWWT interested party 20011639), National Trust (interested party 20010995) and the Royal Society for the Protection of Birds (the RSPB interested party 20011586) and expresses the joint views of these environmental NGOs (eNGOs) on specific matters before the Examination of the DCO for Wylfa Newydd nuclear power station.

2.3 This Written Representation refers in places to other written representations that have been prepared by the National Trust and submitted to the Examination, notably the work of Professor Kenneth Pye on coastal processes and change, Michelle Bolger on landscape and Dr David Parker on the Landscape and Habitat Management Strategy.

2.4 The RSPB has indicated that it will defer to the National Trust and North Wales Wildlife Trust's representation in relation to the following matters: -

- Impacts to Cemlyn Bay from recreation pressures and visitor management
- Cemlyn Bay SAC including on coastal processes and changes to coastal features including to the shingle ridge (Esgair Gemlyn).
- Chapter 4 of this document relating to impacts to the Cemlyn Bay SAC saline lagoon; its water chemistry and quality.
- Chapter 5 on the waste hierarchy – disposal of soft sediments.

2.5 Chapter 4 has been prepared by National Trust Ecologist Lauri McCloud who has a specialist interest in saline lagoons.

Scope of the Written Representation

2.6 The Conservation of Habitats and Species Regulations 2017 (the Habitats Regulations) require **certainty that there will be no adverse effects on the integrity (AEOI) of Natura 2000 sites** arising from plans and projects that could have a significant effect. That is the case where **no reasonable scientific doubt remains as to the absence of such effects**. The Wylfa Newydd Development Consent Order (DCO) application (the application) presents a range of potential impacts to the Anglesey Terns Special Protection Area (the SPA), the cumulative effects and the severity of which over the 10-years construction and the longer term operation are extremely uncertain and difficult to predict. In the view of NWWT, National Trust and the RSPB (the eNGOs), appropriate consideration has not been given by Horizon to the avoidance, mitigation or compensation of these impacts, or to the application of the precautionary principle.

2.7 This view has been maintained throughout the consultation process and, although there has been some additional evidence collection and introduction of a number of mitigation protocols, the eNGOs are of the shared view that this has not addressed the core issues within the legislative context of the Habitats Regulations.

2.8 It is the eNGOs' view that the available evidence does not provide sufficient certainty that, despite any ameliorating effects of these measures, the DCO proposals will not lead to reduced breeding success in one or more season and/or the potential collapse of the Cemlyn Lagoon colony.

2.9 In particular, it is considered that mitigation has not been appropriately developed or secured through the necessary mechanisms and the SPA compensation proposals have

not been brought fully within the examination in order to be scrutinised and demonstrate appropriate application of the relevant legislation.

2.10 This joint written representation discusses where the eNGOs differ from the developer in their conclusions in response to the proposals.

2.11 It investigates the effectiveness of the methodology used by Horizon to survey or test their approaches, and considers the veracity of Horizon's analysis or the evaluation provided.

2.12 Additional information and literature analysis is presented to demonstrate the additional risks and the impact pathways associated with the scheme. This written representation sets out the synergistic and cumulative nature of the impacts that may affect the birds in the breeding colony and the energetic stresses that could lead to reduced reproductive success or other negative consequences that the bird populations within the colony could be subject to in both the short and long term.

2.13 The proposed package of mitigations, via Requirements, Section 106 and the CoCP/CoOPs or Mitigation Route Map, is discussed and suggestions are made as to additional measures that should be incorporated into the DCO requirements regime.

2.14 The issues which are considered in relation to the Anglesey Terns SPA are as follows: -

- Noise disturbance from blasts and other construction associated activity, along with visual disturbance combined with noise impacts.
- Disturbance impacts both at the breeding site and within the commuting route of the terns as they leave the colony on foraging trips
- Changes to the visitor pressures on the Cemlyn Bay Nature Reserve (forming part of the SPA) from either workers, the consequences of the on-site accommodation and unknown interest from tourists in the construction work ('construction tourism').
- Alterations to the landscape and habitats within the WNDA resulting in unintended changes to predator/undesirable species' population dynamics
- Long-term viability of the physical breeding islands in relation to changes in hydrodynamics, coastal geomorphology and threats to Cemlyn Lagoon shingle ridge.
- The functional linkage of the Anglesey Terns SPA during the breeding season to a suite of other SPAs in the west of the UK and Ireland.
- The role of on-site resilience measures.

2.15 The representation then considers at Chapter 4 the effects of the proposals on features of the saline lagoon as a designated feature of Cemlyn Bay SAC. The issues considered are in relation to saline and freshwater inputs and potential affects from the proposed surface water drainage scheme during both construction and operation. This part of the representation should also be read in conjunction with the specialist evidence presented by Professor Kenneth Pye on coastal processes and coastal change.

2.16 Chapter 5 considers the construction of the harbour (MOLF) and the disposal of soft sediments. This is included as it relates directly to matters discussed in the preceding chapters. The importance of the waste hierarchy is placed into context of the proposals at Wylfa Newydd. It investigates the relevance and importance of the fate of the soft sediments to the conservation objectives of both The Anglesey Terns SPA and Cemlyn Bay SAC.

2.17 The final chapter (Chapter 6) looks at the mechanisms to secure mitigation measures through the controlled documents and the Requirements of the draft DCO.

2.18 The Executive Summary as required by the Examining Authority is also provided under separate cover.

3. CEMLYN NATURE RESERVE – Anglesey Terns SPA, tern breeding colony and SSSI

3.1 This chapter considers the baseline data and predicted effects/impact pathways and proposals for mitigation in relation to the breeding bird colony at Cemlyn Nature Reserve, which forms part of The Anglesey Terns SPA.

3.2 Issues which are considered in relation to the Anglesey Terns SPA are as follows: -

- Noise disturbance from blasts and other construction associated activity, along with visual disturbance combined with noise impacts.
- Disturbance impacts both at the breeding site and within the commuting route of the terns as they leave the colony on foraging trips
- Changes to the visitor pressures on the Nature Reserve from either workers, the consequences of the on-site accommodation and unknown interest from tourists in the construction work ('construction tourism').
- Alterations to the landscape and habitats within the WNDA resulting in unintended changes to predator/undesirable species' population dynamics
- Long-term viability of the physical breeding islands in relation to changes in hydrodynamics, coastal geomorphology and threats to Cemlyn Lagoon shingle ridge.
- The functional linkage of the Anglesey Terns SPA during the breeding season to a suite of other SPAs in the west of the UK and Ireland.
- The role of on-site resilience measures.

Noise and Visual Disturbance at the Anglesey Terns SPA, Cemlyn Nature Reserve Breeding Colony

Evidence base supporting the assessment

3.3 The following section considers three of the Horizon studies, their methodology, applicability to the impact assessment process and veracity. The studies are: -

- Noise modelling and prediction
- Disturbance studies at the breeding colony (Anglesey Terns SPA)
- Blast Trials

Noise modelling and prediction

3.4 The eNGOs' do not seek to question the noise modelling and predictions as presented in the ES (APP-125 doc 6.4.6 and APP-231 doc 6.4.95) or the associated figures (APP-237/238 doc 6.4.101). However, we question how this has been used to characterise the tern noise landscape (soundscape) and the basis of the behavioural response studies that have been undertaken in 2017 (APP-225 doc 6.4.89) and in 2018, presented to the eNGOs at the eNGO SoCG meeting 2nd October 2018.

3.5 There is also significant concern about the proposed precautionary mitigation proposals for noise impacts (APP-050, sHRA doc 5.3) and therefore the eNGOs question the conclusion that it can be demonstrated 'beyond reasonable scientific doubt' that with mitigation there will be no adverse effect on integrity (AEOI) of the SPA.

3.6 The eNGOs wish to draw attention to some of the conclusions that have been made within the noise assessments and bring them together to further understand the changes in the noise soundscape in relation to the terns as they breed on the Cemlyn Nature Reserve lagoon islands and leave the colony to commute to foraging areas.

3.7 The noise baseline demonstrates that the general environment in this part of North Anglesey (APP-125 doc 6.4.6) is relatively calm and that audible noises across the site are frequently attributed to the weather's effect on the sea or vegetation and 'natural' landscape noise such as birdsong (APP-125 doc 6.4.6 ∞ 6.3.5, 6.3.9 & Table D6-5). The ambient at Cemlyn Nature Reserve is also relatively low when no breeding birds are present – less than 40dB LAeq and with few impulsive noises (APP-231 doc 6.4.95 figure 3 ∞ 4.6 et sequel and APP-225, doc 6.4.89 ∞ 5.2.3). It is the noise of the colony of birds themselves that raises the ambient levels at the nesting islands (APP-231 ∞4.6). It would appear, that there has been no monitoring or characterisation of the marine environment that the terns experience as they fly out of the breeding colony through Porth-y-Pistyll on their feeding trips. However, it may be extrapolated that the soundscape here is also very natural and also with few impulsive sounds. This is the landscape to which the birds are acclimatised and have chosen to continue breeding within for 50 years.

3.8 In response to both NRW and the eNGOs commentary Horizon have tried to establish an understanding of how the terns at the breeding colony respond to disturbance (visual and noise) from a variety of sources via a series of observationally based studies in 2017 (APP-125 doc 6.4.6 and APP-225 doc 6.4.89 ∞ 2.3 & 5.1) and 2018[3].

3.9 Horizon have also undertaken more detailed analysis of changes to the noise landscape (the soundscape) as presented in the ES appendix 'Noise at ecological receptors' (APP-225 doc 6.4.89). It is of note that the 'heat' noise plan presented in the bounding-case short term levels figure 2 (APP-225 doc 6.4.89) represents the 'free field' construction noise bands as detailed in Table 4 and not a representation of the other predicted noise types as presented in the tables Table 5 ∞ 6.3 of impulsive predictions and tables 7 & 8 ∞ 7.4 for highly confined and average confined blasting, which demonstrate the greater extent by which the current noise soundscape may change due to these noise types, not only at the breeding colony location but also across the route of commuting and foraging.

3.10 It is important to remember that the terns will be reactive to the very short-term changes in the noise soundscape from both the impulsive sounds and blasting and therefore it is just as necessary to consider the soundscape of dB $L_{AF\ max}$ as it is the general upper bounds of construction levels. The variability in the soundscape is not only apparent for birds on the nest but also as it changes as they commute through the different points along the route to and from the colony. There will also be temporal variation during the breeding season so the birds will also be subject to a high degree of variability as loud construction activities either occur around the site and/or occur periodically across a number of days or weeks. To seek to illustrate this the Table 1 below shows with a few examples the relative predicted/modelled noise levels from the relevant parts of the ES Appendix (APP-225 doc 6.4.95) in relation to the ecological receptor sites as shown in Figure 2 (APP-225). The second table considers the breeding colony and the soundscape when blasting is occurring at different locations across the construction site; within the harbour, turbine hall (zone 4) and turbine hall (zone 8) using different blast weights. Clearly it would be possible to undertake the same analysis for the other ecological receptor points on the tern commuting routes.

[3] Not currently before the Examining Authority

Table 1 noise variation across the tern flight path

	Receptor 1 tern breeding colony	**Receptor 3** tern flying towards harbour	**Receptor 4** tern flying within construction zone 10 harbour	**Receptor 5** tern flying immediately outside harbour
Free-field bounding case dB $L_{Aeq,5min}$ (Table 4, APP-225 ∞5.2)	58.6	64.3	75.7	71.0
Impulsive noise dB $L_{AF\ max}$ (Table 5, APP-225 ∞ 6.3)				
Mobile plant mound E	58.4	57.0	55.9	54.1
Impact piling zone 10 harbour (MOLF)	57.7	63.4	N/A	80.3
Rock breaking construction zone 10 harbour (MOLF)	55	61.4	N/A	78.3
Mobile plant construction zone 12 Site Campus	47.3	49.7	55.3	53.7

Table 2 Noise at tern colony (Receptor 1) from blasting type and location

	Blast size	150	125	100	75	50	25
Harbour (MOLF) @ 1,299m from Receptor 1	Confined blast *	**61.3**	**60.7**	**60.0**	**59.1**	57.8	55.6
	Average confined blast **	**82.3**	**81.8**	**81.0**	**80.1**	**78.8**	**76.6**
Turbine hall zone 4 @ 1,582m from Receptor 1	Confined blast *	**59.3**	**58.8**	58.0	57.1	55.8	53.6
	Average confined blast **	**82.3**	**81.8**	**81.0**	**80.1**	**78.8**	**76.6**
Turbine hall zone 8 @ 1,910m from Receptor 1	Confined blast *	57.2	56.6	55.9	55.05	53.7	51.5
	Average confined blast **	**80.2**	**79.6**	**78.9**	**78.0**	**76.7**	**74.5**

All measurements at dB $L_{AF\ max}$ (bold = max noise above free field construction model - worst case)
* from Table 7 APP-225∞ 7.4
** from Table 7.4 APP-225 8 ∞ 7.4
Distance measurements taken from Table 2 APP-225 ∞ 3
Construction zones shown in Figure 1 APP-225

3.11 The blast noise environment will of course be mediated by the submission, post DCO grant, of a Section 61 application that will be determined by IACC and be based on more environmental data (including wind direction and speed) in order to demonstrate that blasting can meet the necessary EHO[4] or ecological standards/thresholds. It is therefore not possible at the current time to determine whether these thresholds can actually be achieved and in what weather conditions. Horizon have already indicated that *"any further constraints in blast size is likely to prevent any meaningful work on the site"* (APP-050, sHRA doc 5.2 ∞ 10.3.51) in relation to the mitigation protocol. The uncertainty of

[4] EHO – Local Authority, Environmental Health Officer setting thresholds for human populations and communities

what can actually be achieved during construction may also be reflected by the initiation of discussions between Horizon and the preferred contractors. The process of refinement of construction processes has already resulted in two submissions for non-material changes (times of blasting and marine vessel movements)

Disturbance Studies at the SPA breeding colony

3.12 The study was undertaken by Horizon in 2017 & 2018. The methodology for the work (APP-225 doc 6.4.95) indicates that disturbance responses to noise and visual disturbance at the breeding colony would be categorised across a range of behaviour types (defined at ∞ 2.3.1.1), which is acknowledged to be an appropriate methodology if applied effectively. This approach has been used in a number of other studies, including those investigating tern species (SNH Land Use Consultants 2006, Brown 1990).

3.13 However, in actuality this methodology was not applied in full during the Horizon study (APP-225 doc 6.4.89 ∞ 5.2.1 and recording forms Appendix B). The only types of behaviour noted were either no response or the most extreme responses; fly-ups and attacks. The reason given by Horizon for lack of recording of other behaviour types is that observation of other reactions within the chaotic colony dynamic is difficult to establish or Horizon consider it involve a disproportionate effort/cost such as the use of decoy egg with recording instrumentation to measure stress (cf 2.10.18 SoCG Natura 2000 Sites meeting minutes).

3.14 Brown (1990), by contrast, considered a range of responses in crested tern using video imaging of a gradient of behaviour from minimum response (head turning), intermediate (alert behaviour or preparing to fly-off) to maximum response (actual flying-off). This study into aircraft noise demonstrated a positive relationship between increase in intermediate response (alert behaviour) to increasing exposure to the stimuli. Given the results of the Brown study it appears anomalous that the Horizon results did not or could not record any sub-flight behaviour except on one occasion.

3.15 Behaviour of the breeding terns and black-headed gulls is not a simple interaction of noise and response. The breeding birds operate in a complex environmental landscape which includes noise, visual disturbance and predation from a multiple of sources both proximal to the nesting sites (eg dogs on the shingle ridge) and distal in the more immediate environment (eg jets skis or agricultural activity). The vigilance and response of the colony alters depending on the 'load' of the different factors, as well as periodicity and abruptness in terms of both the noise and visual landscape. The increasing load will not only be represented by extreme reactions (fly-up, attack) but also by increasing levels and frequency of alertness. This is well acknowledged in the NWWT Cemlyn Reserve Wardens observations and in the literature, with Sandwich terns being notoriously poor at defending their nests sites and very prone to unexplained disturbances. Within a colony, disturbance can act synergistically and accumulate to result in poor reproductive success or ultimately colony abandonment (Cabot & Nisbet 2013). A tern colony can often resist disturbance pressures until a critical level is reached, but it is often entirely unclear and unattributable to a single factor.

3.16 The recording of only the maximum reaction of the terns (fly-ups) in the Horizon studies may account for why there is little difference in the data generated between the two years studied; where one year (2017) resulted in colony abandonment and the next season (2018) when breeding was successful for not only for the main colony but also a secondary influx of bird's mid-season (18/19th June 2018). In order to gain a realistic evaluation, sub fly-up responses would have needed to be recorded.

3.17 It is not robust to consider a single year's results in isolation and additional work has been undertaken by Horizon in 2018. A summary of these results was given verbally[5] at the meeting in October and is presented in the Table below (cf meeting minutes of SOCG Natura 2000 Sites).

	2017 fly-up responses	2018 fly-up responses
Potentially disturbing event – number PDEs	99	98
Number of responses to PDE	41 (34%)	61 (34%)
Unknown fly-ups (ie not attributed to PDE)	121 (66%)	80 (66%)
Fly-ups per hour (average)	25/26 more later in season	25/26 more evenly distributed

Potentially disturbing event (PDE) type	2017	2018
Predators	18%	26%
Non-predator	5%	1%
Anthropogenic	11%	7%

Table 3 – Comparison of disturbance study results 2017 and 2018

3.18 It is understood that Horizon has concluded that the additional 2018 surveys (disturbance and tern tracking) shows consistency between the 2 surveyed years and across species. However, it is also apparent that the breeding success, numbers and behaviour, along with the general success of the colony was very different between the two years. In 2017 there was a total colony collapse by 24th June with all species including black-headed gull having abandoned the colony. Some nesting attempts were made in 2017 but few chicks hatched and none fledged to adulthood (Cemlyn Wardens Report 2017). In contrast in 2018 there was a slow start to the season attributed in part to the weather[6] (Cemlyn Report 2018). The slow start will also have been in part, due to the well observed pattern in tern colonies, that where an abandonment has occurred the next or several subsequent seasons may only achieve low numbers. During 2018 a late influx of birds which arrived 18/19th June, apparently from Hodbarrow RSPB Reserve in Morecombe Bay SPA established a second wave of breeding terns of all three species at Cemlyn.

3.19 Therefore, whilst Horizon's data may be considered consistent across the two seasons, the value of any conclusions that can be drawn from the interpretation of this study is severely compromised by the different fate of breeding outcomes across the two years.

[5] Phil Shepherd Jacobs for Horizon
[6] Beast from the East 24th Feb – 4th March and mini-Beast two weeks 16th March – see Cemlyn Wardens Report 2018

If the methodology was effective there should have been marked differences between the two season's responses.

3.20 It is widely agreed that tern colonies will exhibit fly-ups as part of the general social communal behaviour of the species. Therefore, a proportion of the unknown fly-ups may be attributed to this behaviour but may equally be as a result of observational inconsistencies, as is suggested by the 2017 wardens' observations of the work (*pers comm* June 2017 Appendix 1).

3.21 It is also of note that during the survey periods the number of impulsive noises were very small. In 2017 this included 3 events (APP-225, doc 6.4.89 ∞ 5.2.3) and in 2018 only 1 such event (Phil Shepherd *pers comm* [7]). With such a small sample size, it would not be scientifically justifiable to conclude anything about the breeding terns' response to rare impulsive noises (or how their response might change if the frequency of such noises were to increase as a result of construction work), except that the existing baseline environment at the breeding colony does not appear to be affected by many impulsive sound events.

3.22 Sub-fly up responses could increase colony stress and it is suggested in the literature that chronic exposure to 55 – 60 dBA can be deleterious (Dooling & Popper). From Tables 1 and 2 above it is apparent that the soundscape that the terns will be exposed to will be within this zone where for a considerable period throughout construction. It has been noted in other studies that effects resulting from noise can include avoidance of noisy areas, changes in reproductive success and alterations to vocal communication in passerine species (Ortega 2012).

3.23 The NWWT Cemlyn wardens (collective 15 years site experience) and the NWWT Senior Reservoirs Manager (Chris Wynne) both independently observed that during the 2017 season the colony was more "jumpy" and that the birds became increasingly "hyper-vigilant" as the season progressed with several overnight absences from the colony prior to its final abandonment (pers comm Cemlyn Warden note Appendix 1 & Chris Wynne Senior Reservoirs Manager respectively). This is attributed primarily, but not exclusively, to otter predation by a female with two cubs. However, the Horizon results for 2018 when no such apparent colony 'stress' was present shows that the colony apparently reacted in a similar fashion to disturbance stimuli.

3.24 It is contended by the eNGOs that the Horizon study did not identify the behavioural indicators of increasing 'stress/agitation' of the colony in 2017, which resulted in the first colony abandonment in over 10-years, as the study did not record behaviour at a fine enough level of detail. The use of fly-ups as a monitoring threshold during construction, as suggested by Horizon (see discussion below 3.60 *et sequel*) is consequently considered to be flawed, as fly-ups have not even been observed to be a useful predictor of a colony in imminent danger of collapse.

Blast Trials

3.25 Horizon were licenced to undertake a blast trials study (APP-225 doc 6.4.89) when the black-headed gull colony was establishing (March 2017) and not during the tern main breeding season. Black-headed gull, whilst a sympatric species[8] to the breeding colony of Sandwich terns, are known to be more resilient to disturbance pressures and more

[7] TRH Personal meeting notes (2.10.18) only one incident of impulsive noise in 2018 – like steel construction girders clashing

[8] Sympatric where two populations of species exist in the same geographic area and receive mutual benefits from the association.

inclined to 'sit tight' than the terns and particularly Sandwich terns, which are widely acknowledged (APP-225, doc 6.4.89 ∞ 5.2.4 and Cabot & Nisbet 2013) to be a flightier species and not resilient to disturbance particularly predation or defending. This is generally accepted to be the reason for the sympatric relationship between the black-headed gulls and Sandwich terns. Therefore, it is considered that the response of the black-headed gull colony to the blast noise is not a relevant proxy species for inferring behavioural responses in the Sandwich tern.

3.26 The results of the blast trial study (APP-225 doc 6.4.89 ∞ 5.1 et sequel) undertaken in March 2017 suffers from a similar lack of differentiation in behavioural responses as the Disturbance Studies (see above 3.12 *et sequel*). In this case the response was recorded as either no response or as a fly-up, which is described as either landing on the islands or on the water of the lagoon (APP-225 6.4.89 ∞ 5.1.2 – 5.1.3 and Table 54). Therefore, no other intermediate responses were recorded and no judgement can be made as to the overall agitation of the colony or its state of vigilance.

3.27 In physiological terms, time away from nests by birds landing on the water leaves eggs vulnerable to chilling and potentially exposure to further predation (Buckley & Buckley 2002 and Jennings 2012 reporting Burness & Morris 1993), whereas birds that land on the island will be able to return to the nest more quickly, thereby reducing these factors. It has been established in Royal terns[9], that episodes of cooling eggs can increase the length of incubation by as much as a third. In Sandwich terns this could result in 35 days incubation or more rather than 26 – 28 days. This has several potential consequences: -

- Increased the pressure on the mate partner to provision the sitting bird and in totality a longer breeding season.
- A longer incubation period adds to the normal physiological requirements of both parents during the breeding season and increased energetic cost leaving them in poorer condition post-breeding and therefore with lower survival probability.
- Late fledging chicks have lower survival probability (Nisbet et al 2002)
- Longer time spent at the nest site results in increased exposure to risk factors for nesting terns at all life stages (parents, eggs, chicks and juveniles)

3.28 It is disappointing therefore, that the Horizon study did not choose to differentiate between the two types of behaviour – landing on the island as opposed to landing on water.

3.29 Both NWWT and National Trust were present on the second day of blast trials and NWWT's observation (Appendix 2) of the behavioural response are quite different from those presented by Horizon.

3.30 It is of note from the work by Brown (1990), that there was apparently no habituation of the birds (crested tern) to the trial aircraft noises a new disturbance sound to the trial colony.

"*These are important findings as they indicate that short to medium term habituation/sensitization (within one day, and over successive days up to four days) does not occur in the observed responses……..*"

[9] Royal tern (310 – 410g) are slightly larger than Sandwich tern but have similar reproductive habits laying one egg and incubating for 25 – 31 days. Sandwich tern (210 – 260g) usually lay 1 egg but on occasion 2 and incubate for 26 – 28 days.

So, it could be anticipated that the Cemlyn terns would react in a similar fashion to novel sounds within their environment, throughout a day of events or over a sequence of events over a longer period.

3.31 In conclusion, the results of the blast trial behavioural study are considered ineffective at increasing the knowledge and understanding of the colony. Nor does it provide any certainty as to the impacts and the behaviour of the terns to different blast noise levels as the study parameters (response type) were too coarse. In our view, it is not scientifically demonstrable, based on the work undertaken, to conclude with confidence and beyond reasonable scientific doubt that a noise threshold of 68.2 – 69.3 dB L_{AFmax} is the level at which disturbance to the tern colony will occur and above which it would be damaging to the conservation objectives of the SPA.

Cemlyn Nature Reserve – terns over the breeding islands
© Nia Haf Jones – North Wales Wildlife Trust

Mitigation for noise and visual impacts at the Anglesey Terns SPA Cemlyn Nature Reserve breeding colony

3.32 No Requirement is presented in terms of any of the features above, as there is reliance on the controlled documents. It is noted however, that whilst the Main Power Station and the Marine Codes of Construction Practice (CoCPs APP-415 and APP-416) include the proposed mitigation the over-arching Wylfa Newydd does not (APP-414). The draft DCO (APP-029 doc 3.1) includes a cross comparison between the Town and Country Planning Act TCPA conditions and the draft DCO Requirements (Article 4 SPC5). However, date ranges and other criteria/restrictions are missing[10] from the Requirements DCO. It is of note that during the Site Preparation and Clearance application's (SPC) determination dates were placed on the breeding season of 7th March – 15th August. This date range should be applied across the whole of the implementation of the DCO.

3.33 A consistent approach is considered necessary in order to avoid any future doubt during the implementation of the proposal.

[10] ExA question Q4.0.63

3.34 The Mitigation Route Map (APP-422 doc 8.14, items 613 - 619) also includes a breakdown of the proposals as provided within the sHRA (APP-050 doc 5.2 ∞ 10.3.43 – 10.3.59).

3.35 The protocol appears over complicated, reliant on thresholds/dates that are unjustifiable and monitoring of behavioural responses that in our view are not be sufficiently robust or scientifically justified.

3.36 The discussion below provides commentary on the different elements of the proposed noise mitigation and monitoring proposals for the Cemlyn Nature Reserve (Anglesey Terns SPA) breeding site in the Mitigation Route Map and the shadow HRA. It considers the following: -

- The establishment period
- Construction noise limits and their application
- Monitoring colony behaviour as a threshold technique
- Visual disturbance

Establishment Period – proposed 15th April – 15th May

3.37 During the TCPA negotiations for the recently granted SPC application (draft DCO doc 3.1 SP5 Article 4), the breeding season has been conditioned as starting 7th March to 15th August[11] for the tern colony in its entirety - including black-headed gulls breeding. During the negotiations these dates were verified by NRW with the NWWT Senior Reserves Manager (Chris Wynne see also below). This start date for the season of the 7th March should be consistently applied across the whole of the DCO.

3.38 Considering the colony establishment period, which is defined by Horizon (sHRA APP-050 doc 5.2 ∞ 10.3.49) as the 4-week period when the terns are considered by Horizon to be most sensitive as they arrive and set up the nesting colony. The DCO identifies this as the April 15th for 4 weeks to the 13th May. It is stated that the start date will be guided by information from NWWT on when the first terns/black-headed gull typically arrive to set up the colony (Mitigation Route Map item 0613). However, the Mitigation Route Map (Item 0619) is internally inconsistent as it also indicates that this encompasses the main pre-laying period for all 3 tern species and that historically few terns arrive before 15th April. NWWT have provided information to Horizon via the annual Cemlyn Reports over the last 4 years and considerably more information was available if requested. Horizon appear to have undertaken no analysis to justify the dates for the establishment period. Appendix 3 presents the amalgamation of the 'first dates' data from when records began in 1983.

3.39 NWWT undertake initial Reserve preparation works in advance of the arrival of the tern colony during the 2nd or 3rd week in March, by which time the black-headed gull colony is generally becoming established. Comparison of these work dates showed that to a large extent the 7th March date would encompass the period when the gull colony would be present and exhibiting pre-laying behaviour. It is therefore suggested that the DCO establishment period start date should be extended to include March and the time when the black-headed gulls arrive and begin to breed, as they are acknowledged to form a sympatric relationship and be a key part of the defensive strategy for Sandwich tern colonies (Strangford Lough 2017 and Cabot & Nisbet 2013 and observed in the Cemlyn Report 2017).

[11] Public documents pack IACC Planning & Orders Committee - Extraordinary, 5th September 2018.

3.40 If the suggested 4 week establishment period, which ends at 13th May, is adhered to it would miss a significant number of nesting Sandwich terns, as in 30% of year's recorded they laid on the 13th May or later (Figure 1 below). In particular, it would miss episodes such as the very large late influx of birds in 2018 (18/19th June), which successfully bred at Cemlyn. These birds were thought to be displaced breeders from Hodbarrow (Cemlyn Wardens Report 2018). It is useful to consider in relation to this point that one of the conservation objectives for Anglesey Terns SPA is: -

"*The range and distribution of terns within the SPA and beyond is not constrained or hindered"*.

3.41 NWWT was commissioned by National Trust to prepare a paper on the metapopulation dynamics of Sandwich tern within the Irish Sea (Appendix 4). This paper considers the fate of the birds which abandoned Cemlyn in late June 2017 including where they may have gone and whether they attempted to breed elsewhere. The results serve to illustrate that late movements of Sandwich terns are not unusual and that in 2017 post 24th June, breeding attempts by Sandwich terns were made at two locations in Strangford Lough (National Trust, Northern Ireland), Lady's Island Lake (Wildlife Department, Eire) and Hodbarrow (RSPB Reserve Lancashire).

3.42 The SPA is designated not only for Sandwich terns but also for common, Arctic and roseate terns. From analysis of the Cemlyn 'first dates' data (Appendix 3), common and Arctic terns do not begin to arrive until the end of April and although they tend to settle and nest quickly the first birds to be seen on nests are all after the 15th May proposed cut-off for the establishment period in all but one of the years of the Cemlyn data analysed.

3.43 The calendar below (Figure 1) illustrates a summary of the data (Appendix 3) for over a 20 year period[12]. It provides a visual indication of the first nesting observations – adult on nest (AON or 1st egg), along with first chicks and, where known, fledging dates. It also includes the known late influxes of birds which have been observed which established breeding activity. Data for Black-headed gull is poor as the Cemlyn Wardens do not arrive until mid-April so the nesting dates cannot be recorded unless another volunteer or the Reserves Officer are present on the appropriate day.

3.44 No data is available for Roseate tern at Cemlyn as it has been an inconsistent breeder which has not bred in recent years. However, a European funded *Life* Project[13] is introducing measures to try to establish breeding roseate terns at Cemlyn and the Anglesey Terns SPA at The Skerries colony. This species breeds later even than common tern (Cabot & Nisbet 2013). 2018 represented the first year roseate tern bred successfully within the Anglesey Terns SPA (The Skerries) for many years and these birds had the following breeding pattern[14], which it is noted occurs outside the proposed establishment period: -

[12] Appendix 3 is collation of first dates, which were first gathered together for a NWWT 2005 Report. This covered the period 1983 – 2004 but the table was continued to be updated for Sandwich tern on a yearly basis. The calendar at figure 1 also includes up-to-date Arctic tern and common tern data collated by the author from the 2010 – 2018 Cemlyn Reports.

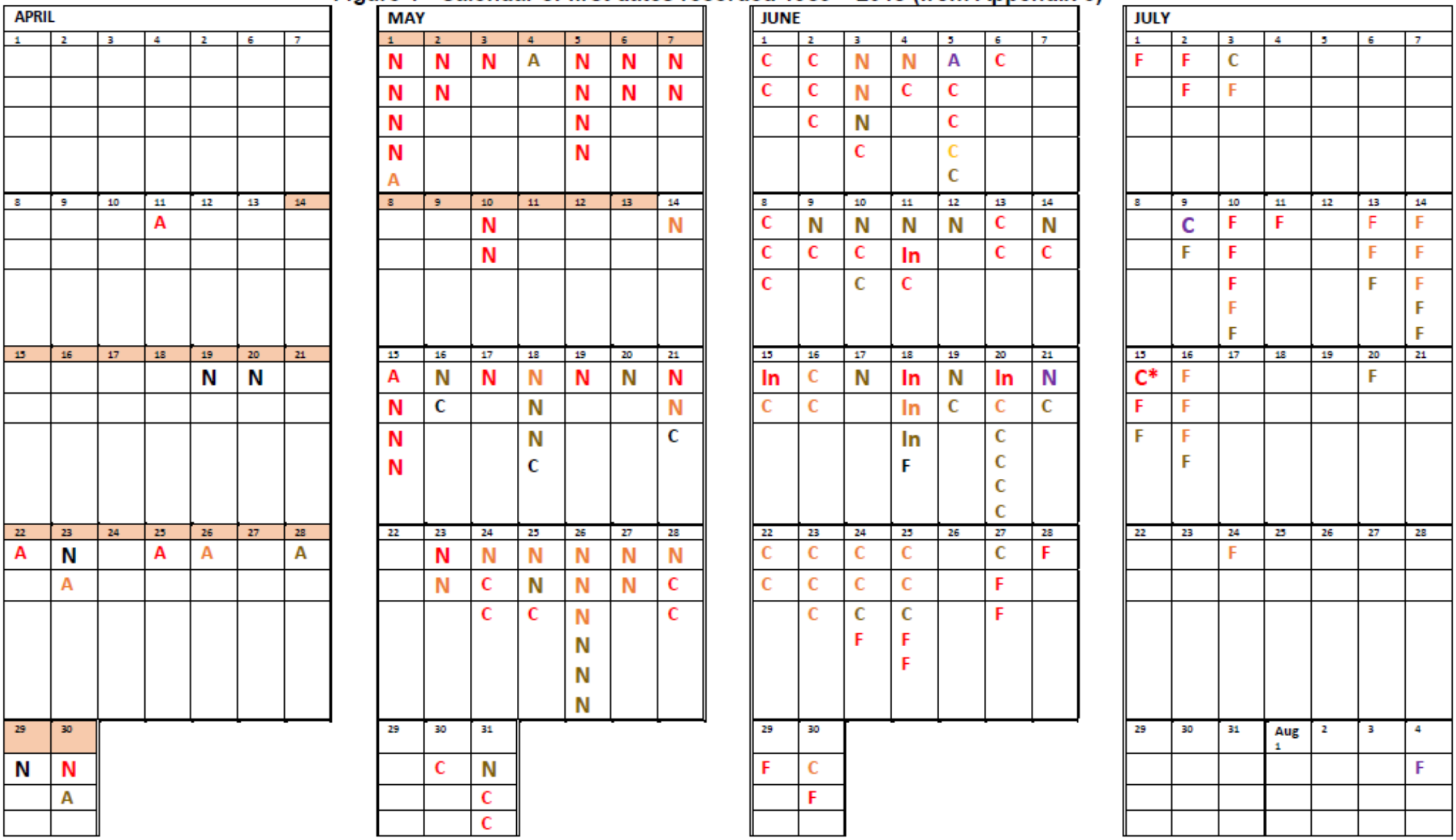
[13] "Improving the conservation prospects of the priority species roseate tern throughout its range in the UK and Ireland" Project code: LIFE14 NAT/UK/000394

[14] Information supplied by Ian Sims via email 28.11.18 Will be available in The Skerries annual report when published

First seen	5th June
First egg	21st June (2 eggs)
First chick	9th July
First fledgling	4th August

3.45 It can clearly be demonstrated that the proposed establishment period will not capture the breeding phases of any of the other qualifying species of the Anglesey Terns SPA and is therefore in danger of not meeting the necessary conservation objectives for these species.

Figure 1 - Calendar of first dates recorded 1983 – 2018 (from Appendix 3)



N – black-headed gull
N – Sandwich tern
N – common tern
N – Arctic tern
N – Roseate tern (Skerries - 2018)

A – Arrival
N – Adult on Nest/1st egg
C – Chick, C* - Chick of influx birds
F – Fledged
In – late influx of birds (in some cases breeding established)

Horizon Proposed establishment period

3.46 It is further unclear why the establishment period is limited to only 4 weeks as the incubation period for Sandwich terns is 26 – 28 days (ie 4 weeks Cabot & Nisbet 2013) and the breeding colony will be vulnerable to disturbance and breeding failure for a considerably longer period: during early parts of courtship and subsequently, given that an adult will 'brood' young chicks and one adult will predominantly be responsible for providing small prey items for a period of time after hatching, until the chicks can be left and larger prey items can be consumed. Additionally, as discussed above if chilling occurs, either due to increased disturbance and/or bad weather, the incubation period can be extended by up to 5 days.

3.47 It is also important to note that when the Cemlyn colony has failed to breed successfully (2007/2008 and 2017), the birds either deserted very late in the incubation period and/or when chicks had hatched but were being highly predated.

3.48 In order to account for the natural variability in the tern colony breeding from year to year Horizon have proposed to use an observational monitoring approach to adjust the start of the establishment period. Observation of aerial display or other cut-offs such as 50% of expected numbers of Sandwich tern are not considered useful markers or thresholds. Firstly, Cabot & Nisbet (2013) indicate that Sandwich tern often display, court and mate away from the colony breeding site (see also Harwood et al 2017).

3.49 Further, the proposed approach dismisses the importance of pre-breeding roosting and movement around a number of sites by colonial nesting species of birds, which is a significant part of the social and colonial dynamics of both mate choice, breeding site selection and for females to achieve reproductive condition (Cabot & Nisbet 2013).

3.50 Additionally, a figure of what might be the "expected number of Sandwich terns" (sHRA ∞ 10.3.50) is undefined and will vary from year to year. Alternatively, it will also vary according to whether the JNCC designation figures were to be used rather than a 5-year average. This date range also takes no account of late arrivals due to a slow season due to weather or for late influxes of birds potentially from failed breeding attempts at other colonies. Mid/late June influxes have been observed in other years (2010, 2012 & 2013 – Appendix 3). The Cemlyn report for 2018 states: -

> *"Beginning on 18th June an influx of more adults of all three tern species began. In particular Sandwich Tern came in large numbers, seemingly from Hodbarrow (RSPB, Cumbria) after initial nesting failures, and began relaying. Estimated numbers of adults increased from ~600/700 to ~1,800 over the course of two weeks whilst a few extra Arctic and Common also arrived (from locations unknown)."*

3.51 In conclusion, a mitigation protocol which allows greater construction disturbance to restart in mid-May could curtail breeding efforts of both the other tern species for which the site is designated and the meta-population dynamics of the wider Irish Sea population, which may be contrary to the conservation objectives of other SPAs in the region.

3.52 A mitigation protocol which only starts on the evidence of breeding behaviour will miss important parts of the colonies necessary processes including the establishment of the sympatric black-headed gull colony and pre-breeding roost behaviour.

3.53 The effectiveness of the proposed establishment period as a means of maintaining the conservation status of the colony is questionable. If it is possible to achieve some level of effectiveness from the mitigation protocol serious consideration should be given to whether there should be no differentiation between the establishment period and the remainder of the season and therefore the lower noise limit (55dBL_{AFmax}) should be imposed across the entirety of breeding season (7th March – 15th August).

Construction noise limits and their application

3.54 It is strongly advocated that the same noise thresholds (blast and construction) should apply across the whole of the Cemlyn colony's breeding season (7th March – 15th August), but that Horizon have stated that *"any further constraints in blast size is likely to prevent any meaningful work on the site"* (APP-050 sHRA, doc 5.2 ∞ 10.3.51).

3.55 Evidence from other developments suggests that 60dB has only been agreed for wintering birds on roost sites in industrial environments where ambient industrial noise levels are already as high or higher than 60dB (eg Portbury Docks Inquiry 2010). As discussed above (3.7) the general background ambient noise levels of the WNDA is much lower than 60dB when the normal colony activity is discounted. For wintering birds, noise thresholds at other developments including Portbury are applied across the whole of the season with no differentiation relating to tidal conditions or type of activity/state of the birds. In the eNGOs' experience in either planning or legislative terms there are no known examples where conditions for monitoring or mitigation have tried to differentiate between the different sub-stages of a bird's breeding life-cycle.

3.56 There appears to be inconsistencies in approach across the proposed mitigation protocol. There is no restriction post year two on blast noise during the 'general breeding season' (ie outside establishment). There appears to be no reason why this should be the case and it is advocated that the same approach should be adopted for the whole of the construction period. Additionally, during the earthworks the establishment period threshold figure is 55dB$_{LAF\ max}$, whilst for post earthworks the figure is 54dB$_{LAF\ max}$. In the Mitigation Route Map (APP- 422 doc 8.14, item 0615) this appears to be justified on the basis that the majority of the blasting will have occurred and only minor additional blasting would be required.

3.57 Post 3 years there is no restriction placed on daytime construction noise even though the modelled levels are higher than those for night time in the first 2 years where a threshold is applied.

Main earthworks 1st 2 years, modelled night time 42.8 dB $L_{Aeq,\ 1\text{-}hour}$ restriction - 43 dB $L_{Aeq,\ 1\text{-}hour}$
Year 3 on-wards, modelled day time 43.7 dB $L_{Aeq,\ 1\text{-}hour}$ restriction – none
Year 3 on-wards, modelled day time 42.4 dB $L_{Aeq,\ 1\text{-}hour}$ restriction – none
Mitigation Route Map doc APP-422, items 0614 & 0615
APP-050 sHRA ∞ 10.3.45 – 10.3.47

3.58 The mitigation protocol indicates that the noise level thresholds will be applied at 55 or 60dB or the "*background daily ambient noise level whichever is highest*" (APP-050 sHRA ∞ 10.3.45). This may be acceptable in a noisy industrial environment such as Portbury Docks. However, to use this type of control at the Cemlyn Nature Reserve colony is ecologically unsound. The colony even at the height of the breeding season, will have considerable noise variations from minute to minute or hour to hour depending on the social activity or disturbance reaction of the birds. This is particularly as it is noted that they are nosiest in response to predators or threat species/events (APP-231 doc 6.4.95 ∞ 4.6). Should this approach be adopted it would result in loud construction noises, such as blasting, being undertaken when the birds themselves are potentially already more agitated and noisy, compounding the stress at the colony.

3.59 Additionally, there appears to be little understanding in the scientific literature of birds' acuity of hearing. There is evidence to indicate that birds have parallels to humans in processing auditory information and it is suggested that birds do have similar abilities to localise and 'pick out' sound against background noise. This applies to bird calls both of the same species or those associated with predation. However, it is not clear whether this facility assists in localising threatening sounds other than those associated with predator-prey interactions (Klump 2000.

Monitoring colony behaviour response in order to establish construction cut-offs/thresholds

3.60 Horizon in the sHRA and Mitigation Route Map (APP-050 doc 5.2 sHRA ∞ 10.3.53 and Mitigation Route Map APP-422 doc 8.14 item 0618) indicates that reactive monitoring will initiate a review/response from Horizon or construction contractors. The reactive monitoring will be derived from "*fly-up disturbance reactions attributed to specific construction noise*", to be agreed with NRW.

3.61 As discussed above (3.60 *et sequel*) it is considered that reactive monitoring based solely on fly-up responses rather than analysis of any other gradient of types of behavioural response is inappropriate. The studies presented by Horizon have been unable to differentiate between the imminent collapse of the colony (2017) as compared to a successful breeding season (2018). The predictive capability to translate this into a construction environment is therefore non-existent.

3.62 The proposal that a threshold (3 fly-ups per hour) can be set which doubles the observed rate of fly-ups per hour (circa 1.6 sHRA ∞ 10.3.53 2nd • 1st *) is unjustifiable and would represent an extreme risk to the colony. This threshold is based on a rate that has been derived from a year where the colony collapsed. This is an untested novel approach to a mitigation protocol, which would need significant scientific corroboration not just one or two year's superficial observations.

3.63 The variability of attributing responses directly to particular noise or visual events has been shown to be challenging and it is difficult to differentiate what may be normal social behaviour from potential disturbance events. This will become even more difficult in a construction environment on a reactive basis, where multiple noisy activities will be on-going at varying distances from the tern colony.

3.64 The proposed mechanism (sHRA ∞ 10.3.53 2nd • 1st *) to achieve 'real time' contact between observers present at the colony for all day-light hours and a dedicated on-site site manage to provide the identification of sources and the necessary reactive turn-round time to stop activities and/or equipment from operating is going to be difficult to achieve. It may not be possible to differentiate/determine which construction is the loudest and/or closest to the colony or whether in actuality this "loudest" activity is actually the one responsible for the observed behaviour. In addition, the disturbing activity would have had to continue for over an hour in order to determine that the increased average fly-up response threshold had been breached. Based on the experience of ecological over-sight/enforcement responsibilities for smaller infrastructure projects, the eNGOs cannot see how this part of the protocol could be achieved by the contractors or effectively monitored by an enforcing body.

Visual Disturbance

3.65 During the Site Preparation and Clearance (TCPA) negotiations it was agreed by IACC and NRW that no activity would occur to the west of the Afon Cafnan in terms of site preparation and clearance construction activity (draft DCO; APP-029 doc 3.1 & Requirement SP5). It is understood that the exclusion of this section of the Afon Cafnan was in part to deal with surface water drainage issues as well as visual disturbance factors, but this was not teased out in the TCPA submission.

3.66 The river (Afon Cafnan) is located more than 500m from either the SPA boundary or tern potential nest sites. It is unclear why this agreed area is not encompassed within the DCO order for the Wylfa Newydd Requirements or the Mitigation Route Map (APP-422 doc 8.14 item 0619). The plant and earthworks that will be undertaken in the Mound E construction area is far greater and involves considerably larger equipment (100 tonne trucks see photo in Appendix 5) and more plant than is proposed for SPC.

3.67 No visual mitigation is presented for the marine environment for foraging and/or commuting terns as Horizon have concluded that this is not necessary as there is considered to be no impact..

Conclusion on noise and visual disturbance at the Anglesey Terns SPA Cemlyn Nature Reserve breeding colony

3.68 The eNGOs have significant concerns about the methodology of data gathering that has been undertaken. We do not agree with its interpretation to inform the design of the proposed mitigation protocols. The scientific validity of Horizon's conclusions are questioned and consequently, the precautionary mitigation protocol is deemed to be based on unfounded (spurious) logic and parts of it are unlikely to be effective in a 'real world' construction scenario. The eNGOs conclude that the test of no AEOI (adverse effect on integrity) has not been demonstrated either with or without the implementation of the precautionary mitigation protocol. This is aside from any additional cumulative impacts that are present as discussed below.

3.69 In summary the conclusions drawn by the eNGOs are as follows: -

- The recorded evaluation of studied behavioural responses is too coarse grained and fails to identify a gradient of sub-fly up behaviour that could be indicative of colony stress that would have implications for colony stability and breeding success.
- The behavioural response data should not be used to inform mitigation as it has failed to differentiate between a year when the colony collapsed (2017) and one where there was successful breeding (2018). Therefore, its predictive capabilities within a mitigation protocol are limited.
- The 'blast' noise response threshold for the terns has not been demonstrated with any degree of scientific rigour.
- This evidence shows that setting a date band for an establishment period in contrast to the remainder of the 'breeding season' would be contrary to the conservation objectives for all species of tern. It would not capture the sympatric black-headed gull's establishment period, which is a pre-requisite for Sandwich tern colony arrival and its successful formation.
- The breeding season dates (7th March – 15th August) as used for the SPC (TCPA) application's agreed condition should be applied to the DCO proposals used, and any mitigation protocols should be applied equally across this period.
- The use of thresholds based on "*fly-up disturbance reactions attributed to specific construction noise*" or on a doubling of the previously recorded average fly-up response per hour is deeply flawed. It is likely to be unimplementable and unenforceable in a 'real world' construction scenario.
- The differentiated noise threshold approach should be applied consistently to all phases of construction and not differentiate between the first 2 years of bulk earth moving and the subsequent construction phases.
- The thresholds should be applied consistently between the day-time and night-time periods where a lower noise threshold is applied.
- The application of mitigation thresholds only when they are louder than the "*background ambient noise*" of the colony itself is unjustifiable. It will inevitably cause greater 'stress' to the colony at a point when it is already potentially in a disturbed state for another reason. This is not a justifiable approach.

3.70 In short, the current mitigation protocol is over-complicated and internally inconsistent and in the view of the NGOs should be revisited in its entirety.

3.71 Horizon indicate that the mitigation protocol is only provided on a precautionary basis as they conclude that there is no AEOI from the proposals. However, the uncertainty and lack of

confidence in the evidence leads the eNGOs to conclude that this mitigation is a necessary part of the management and avoidance of risks of potential on the SPA.

3.72 However, it is the NGOs' collective view that, even with the application of additional/improved mitigation and avoidance measures, the residual cumulative impacts arising from the development are likely to preclude a conclusion of no AEOI. Therefore, it is considered necessary for the Examining Authority to apply Stage 3 and 4 of the Habitat Regulations, including (subject to the outcome of the assessment of 'no alternative solutions', and 'reasons of overriding public interest') consideration of compensation for the Anglesey Terns SPA and the wider Irish Sea metapopulation

3.73 As stated in the recent joint eNGO letter to the Planning Inspectorate (EV-008 – Rule 6), we consider that the information to inform a Stage 3 and 4 assessment should be made available by Horizon to the Examining Authority at the earliest opportunity in order to inform the Habitats Regulations Assessment.

Noise and Visual Disturbance during tern commuting and foraging in the Anglesey Terns SPA

3.74 At 13.6.422 of the ES (Chapter D13 The Marine Environment APP-132 doc 6.4.13) for secondary seabird species (ie non-tern species of seabird) it is stated: -

> *"There is potential for disturbance of secondary seabirds that may be nesting, loafing, foraging or flying in the waters around the Wylfa Newydd Development Area, particularly within Porth-y-pistyll. Noise associated with construction works could cause birds to be flushed and avoid certain areas*.
>
> *If disturbance is continuous and intense, and combined with louder, irregular noises such as blasting, it could result in increased stress levels and costs to birds in expending more energy if birds make unnecessary movements or have to fly an increased distance to alternative nests and feeding sites. This could impair the birds' condition and potentially increase their susceptibility to predation, which could affect the breeding success of populations."*
>
> ES Chapter D13 The Marine Environment
> APP-132 doc 6.4.13 Paragraph 13.6.422

3.75 The impacts of marine infrastructure construction on secondary seabird species is consequently assessed as minor adverse (APP-132 doc 6.4.13 ∞ 13.6.435). By complete contrast for tern species as a subset of seabirds, the impact is assessed by Horizon as negligible (APP-132 doc 6.4.13 ∞13.6.414) as they fly or forage over the waters around the WNDA.

3.76 As a result of the negligible conclusion there is no embedded, good practice or additional mitigation proposed for terns away from the nest as they commute or forage within the WNDA. It also leads to the unsound conclusion of no AEOI.

3.77 The conclusions of Horizon are not only in direct contradiction to their own assessment for secondary seabirds (non-tern species) but also contrary to results of avoidance in other aspects of their analysis (as discussed below 3.121 *et sequel*).

3.78 At 10.3.108 (sHRA APP-050 doc 5.2 [RD 81][15]) Horizon discuss that Sandwich terns exhibited a strong avoidance response in 20% of the monitored windfarm arrays, whilst some level of avoidance response was observed in 70% of the 10 monitoring studies (only 3 studies reported

[15] [RD 81] is Dierschke et al 2016

no avoidance at all). Horizon seek to use this to justify their conclusions of no significant impacts.

3.79 It is very important to note that the Docking Shoal wind farm was refused consent due to bird issues and that this was predicated partly on the impacts on breeding success and survival due to terns having to avoid the wind farm on their daily foraging trips and/or fly further to forage. The eNGOs would observe that the conclusions of this monitoring study and the refusal of Docking Shoal demonstrate the uncertainty surrounding the impacts and avoidance of wind farms. It is also important to remember that whilst wind farm avoidance may provide some useful understanding of foraging and commuting terns, it is not directly analogous to the circumstances that pertain to the WNDA and marine construction activity in the harbour (MOLF).

3.80 This is exemplified by the description provided of the construction and operation at an off-shore wind farm at Sheringham Shoal (Harwood, 2017). In summary, at Sheringham Shoal pile driving impacts were short (approx 30-40 mins per monopile with on average one pile driving event per day with 66 erected in total). The wind farm array was a minimum 18km from the breeding site with construction completed in a little over 2 years in 2012.

3.81 At Wylfa Newydd the marine construction disturbance impacts are in very close proximity to the site (1.25 – 1.75km), with the majority of the Sandwich terns flying through the construction zone. The construction and use of the harbour (MOLF) will be over 10 years with over 24 months direct construction of the berths and breakwaters. The harbour will continue to operate for 8 years with construction deliveries with up to 16 marine vessel movements per day (non-material amendment). Building activity, excluding blasting and impulsive noise (eg pile driving), will occur 24 hours a day.

3.82 We have sought to obtain a copy of the Teesside studies referred to by Horizon (Horizon ref [RD84] referred to in sHRA APP-050 doc 5.2 ∞10.3.85) but have been informed it is not in the public domain so it cannot be interrogated more extensively. However, the Sheringham Shoal 3 year monitoring study (Harwood 2017) concluded that avoidance by breeding terns occurred both during and post construction, justifying the initial ES's conclusion of minor adverse impacts from disturbance. The study recorded displacement of Sandwich terns from the array's footprint with birds avoiding both construction areas, erected turbines and the wider area. Whilst some birds did still fly through the wind farm, 'penetration' levels were reduced. This case demonstrates that even where disturbance and barrier-effect impacts are some distance from a breeding site and construction relatively short-lived, longer term consequences are also apparent.

3.83 The literature appears very uncertain about whether wind turbine bases attract or displace prey items and when in the construction/operational cycles this may occur. Thus, the potential for attracting increased feeding or displacing foraging is not well understood. It is not always possible to conclusively disaggregate the relevant effects of noise and visual disturbance, and changes in food.

Evidence base to support assessment and mitigation approach

3.84 The following section of the eNGOs' representation considers the construction and operation of the harbour, breakwaters and Cooling Water System (CWS) of the scheme in more detail, looking at the baseline studies undertaken by Horizon, considering the efficacy and certainty of their conclusions.

3.85 This section considers the following topics: -

- Baseline studies – tern usage of the WNDA and wider area
- Noise modelling and prediction
- Vessel and plant movements in the marine environment

- Terrestrially-based plant and machinery
- Navigational approach to Porth-y-Pistyll Harbour (MOLF)
- Avoidance observations from the Detailed Off-Shore Ground Investigations (DOffGI)
- Failure of food delivery to the nest site
- Tern activity in the industrial and developed environment
- Long term impacts during operation and decommissioning
- Lighting

Baseline studies - Tern usage of the WNDA and wider area

3.86 The field baseline studies undertaken by Horizon (APP-225 doc 6.4.89) to support the assessment and discussion within the ES and sHRA used both vantage point surveys and boat based transects (2016 & 2017). The eNGOs had considerable concerns (2016[16]) with the early iterations and analysis provided by the vantage point data and its use in determining the impacts on terns and the Anglesey Terns SPA. Subsequently and presumably following NRW and IACC comments, Horizon invested more effort in the use of boat tracking surveys (2016 & 2017 APP-225 doc 6.4.89 illustrated on fig 3-18 and 2018 unsubmitted to the Examination). This methodology is well recognised and has been utilised for example to establish the new extended SPA boundaries around the UK. It is acknowledged that if this technique is implemented effectively it is a valid methodology for assessment.

3.87 The eNGOs do not intend to counter or make further commentary on the vantage point surveys, as they do not contribute greatly to the understanding of the usage of the area by the terns at a fine level of detail. The discussions below are therefore based on the boat tracking data, as this is a more appropriate technique that can be used to inform the analysis.

3.88 Horizon unfortunately started the boat tracking technique rather late in the project's assessment process, but their analysis has been supplemented by other studies (Econ 2009 and JNCC 2009), which is an acceptable approach if analysed appropriately. The results of other studies and those of Horizon exhibit general conformity with each other and demonstrate that Sandwich tern – the most numerous breeding species at Cemlyn Bay – predominantly leave and return to the colony in the same direction flying and feeding majoritarily close to the coast to the east of the breeding colony.

3.89 The usage of the area by common and Arctic tern has also been considered in Horizon's analysis (6.4.89 fig 3-34 and 3-37 respectively). The eNGOs will not consider these further in this section, not because they are of lesser conservation importance, but because their foraging/commuting fly routes are sufficiently further west and any mitigation that might be achieved for the Sandwich terns will also ameliorate any impacts for these other species where they do fly into the zone of influence or construction zone.

3.90 The sHRA correctly identifies the zones of influence (ZOI) for noise, visual and light sources of impacts within the sHRA (figs 10-8 and 10-9) and calculates the percentage of tracks that cross the ZOI at 75% noise and 58% visual (tables 10-4 and 10-6 respectively). It is acknowledged that these calculations are important and an essential part of the analysis.

3.91 However, the data does not differentiate between the construction zone where impacts will be focused and the proportion of birds using this part of the ZOI. It would be very useful to consider the incidence of the tern flights within the actual construction footprint itself, as the cumulative response to the visual and noise impacts is likely to be greater where there is also a direct conflict with the point source/sources of the physical construction activities/infrastructure given the density of works that is proposed in Construction Zone 10.

[16] EIA Progress Report NWWT consultation response April 2016

3.92 The eNGOs have asked about the ability to achieve greater definition in the images and the ability to analysis information at a 'zoomed-in' level on several occasions[17] in order to differentiate between the zones of impacts and zone of influence. As this has not been provided, we have used the combined data set of 2016 and 2017 (Fig 3-18; APP-225 doc 6.4.89 – reproduced at an enhanced scale in Appendix 6) to estimate the proportion of birds that enter the construction footprint.

3.93 From a count of tracked tern paths in the Appendix 6 plan it is possible to estimate that in 2016/2017 perhaps as many as 40% of the total Sandwich terns commuting in/out of Cemlyn Bay flew directly through the construction footprint. This is a significant proportion of the 75% and 58% (noise and visual respectively) of total tracks within the zone of influence (ZOI). This is clearly a very rough estimate to illustrate the point.

3.94 The analysis within the sHRA apparently seeks to imply that the strength of the disturbance source is the same across the whole ZOI and/or that the birds' response to the source across the whole of the ZOI is the same. This is objectively not correct, for example in relation to noise as illustrated within Figure D6-3 (APP-238/239 doc 6.4.101) and discussed further below.

3.95 An appropriate level of differentiation is an important part of any evaluation as there is a difference in significance when considering the zones of impact magnitude, for example where the proportions of birds in a ZOI is 75% but only 1% of the total are within the highest impact zone of the construction footprint, as opposed to 75% in a ZOI with 50% of the total within the direct footprint.

Noise modelling and prediction

3.96 The noise data is the same as that described above (3.4) however the key ecological receptor locations are different as shown on fig 2 (APP-225 doc 6.4.89,). Therefore, the noise landscape that the terns will be subject to is very different. However, the comments at paragraph 3.7 regarding consideration of the noise landscape in its entirety and the difference between the construction free field values and the $L_{AF\,max}$ of other types of noise that the terns will be subject to is very similar. Therefore, tables 1 and 2 above considers the key receptors: 1- breeding islands; 3 – enroute to the harbour (MOLF); 4 – within the MOLF, and 5; – on the approximate location of the breakwater.

3.97 The sHRA acknowledges that there are likely to be deviations from commuting and foraging routes as a result of noise (∞10.3.94). The sHRA also acknowledges that this energy expenditure will be additive (∞ 10.3.95), so will objectively increase the energy requirements over what would be needed in 'normal' circumstances compounding the effects of for example poor weather and low food availability.

3.98 The literature (Jennings 2012 reporting Pearson 1968) states that the terns breeding strategy results in the species operating close to the limits of their energy budget due to the small body size of the birds and the amount of provisioning required to rear a single chick. Therefore, any construction induced additional demands on the birds during the breeding season may have serious consequences on reproductive success, where the margins between positive and negative energy budgets are very slight. This is also discussed further below.

Vessel and plant movements in the marine environment

3.99 In order to understand the extent of the environmental landscape changes in the marine environment from the construction and operation in Zone 10 (harbour – MOLF, breakwaters, temporary coffer dam and Cooling Water System intake) it is necessary to consider both the

[17] HRA Birds Workshop minutes 18th Oct 2016 and SoCG Natura 2000 workshop 2nd Oct 2018

noise and visual changes to the environment from marine vessels or plant that the majority of Sandwich terns will pass by, through or fly over.

3.100 The noise landscape is considered above (paragraph 3.7) however, the visual component of change from moving plant appears to have been sparsely investigated and is considered to be small as vessels will be slow moving (APP-132 doc 6.4.13 ∞ 16.6.472). The critical element of this is not only the stationary features, but also the movement and periodicity of changes in the visual landscape that the terns may encounter and the angle of incidence with objects.

3.101 The marine plant used in harbour construction will involve a considerable capital dredging programme using split hopper barges (size 3,500m^3). The harbour's (MOLF) deep-water berth, which will have a similar depth to that at Holyhead Harbour, can accommodate vessels up to 100m long. It is projected that cargo vessels will range in size 5,000 – 8,000 dwt for bulk carriage, aggregates and cement (4,000m^3), in addition to containerised or other deliveries via the RoRo (Roll-on Roll-off ferry berth). The sizes of the barges to deliver the Abnormal Indivisible Loads (AILs) is unknown as they will be commissioned specifically for each load size. The harbour will also be serviced by a number of mooring tugs, pilot vessels and small work boats (Summary taken from APP-134 doc 6.4.15 ∞ 15.4.4 – 15.4.10). To provide context, photos of a selection of these marine sea-going vessels can be found at Appendix 5.

3.102 The recent non-material amendment has resulted in a proposed change from 4 vessels movements per day to 16 per day, which equates to a vessel moving into or out of the harbour on average every 1$^1/_2$ hours.

3.103 Essentially, the quiet bay of Porth-y-Pistyll whose only current marine activity is sea kayaks, small domestic sailing craft and very rarely a jet ski, will become a busy harbour with a turnover of vessels almost commensurate with a small commercial port.

3.104 The report (APP-134 doc 6.4.15; Baseline environment ∞ 15.3.5 & 15.3.7) describes the use of small embayments for anchorage by recreational craft and pot-laying by commercial fishing and indicates that both Cemlyn and Porth-y-Pistyll are available for this type of activity. However, this appears to be unquantified beyond a broad generalised description of the wider area. It is acknowledged that the use of either bay for anchorage by yachts and/or commercial fishing or pot laying does occur, but on-site staff indicate that in any one year it is 2 or 3 yachts and about 4 fishing boats, with the laying of pots predominantly outside the tern breeding season (Gwynfor Owen – National Trust Ranger *pers comm*.) rather than "regularly" as described in the text.

3.105 The recent consultation on the Marine Licence and the non-material amendment on shipping vessel movements (AS-021) appears to provide a little detail on the quantum of vessel movements.

3.106 In the Marine Licence[18], which expands on the description presented in the ES (APP-132 doc 6.4.13 ∞ 13.5.17 – 13.5.28), close analysis can demonstrate that there is a high degree of uncertainty about what materials can be derived on site and if they cannot whether they will be delivered via sea or road. The project's description for the Marine Licence shows this uncertainty in a number of areas: -

- Temporary access ramp materials either from off or on site. Delivery by road or sea.
- Temporary barge berth constructed from either site won or imported materials. It is not stated whether imported materials would be delivered by road or sea
- The CWS coffer dam, incorporating temporary causeway. Sheet wall piles and tubular piles to be delivered by road or sea.

[18] Marine Licence Project Description and Schedule of Activities variously ∞ 2.6.5 – 2.6.40 https://www.horizonnuclearpower.com/files/downloads/Public%20Documents/Marine%20Licence/(4)%20ML-PLD-01-PDR%20(Rev%201_0).pdf (cf TRH Wylfa Newydd note book)

- Drainage pipes to be delivered by road or sea.
- Cooling water intake coffer dam "*the steel piles, bracing materials* ***and fill material*** *will be delivered to site by sea and/or by road*" (Emphasis added).
- Temporary waste water outfall "rock foundations, pipeline and concrete mat and other materials" will be delivered by sea or road.
- The temporary waste water outfall will be dismantled and either used on site or removed off-site to a licensed tip. It is not clear if the off-site location might be the Holyhead Disposal site which would require further vessel movements
- The core of the western breakwater will be materials derived from the Power Station Site. However, the pre-cast armour units and the rock underlay will be transported to site by sea or from land.

3.107 The basis for the ES impact assessments has been made on 60 – 80% of deliveries being made via the sea, but with the level of uncertainty indicated above it is unclear whether a **total figure** can be calculated of a hypothetical maximum number of deliveries and what therefore may entail the worst case of 80%.[19]

3.108 The non-material amendment which has now been submitted further confounds this potential unreliability, as the maximum number of boat movements per day is to be raised from 4 (equivalent 2 vessels) to 16 (equivalent 8 vessels). Horizon indicates that this will not alter the ***total*** number of vessels, but a total figure to compare against appears not to have been accurately calculated and is highly caveated within Horizon's own assessment (doc AS-010[20]): -

> "*Hitachi-GE Nuclear Energy Ltd. has produced a report (Transportation and Logistics Study CPJ-UW-A408) detailing transportation plans for equipment and materials required for construction [RD17]. The report* ***aims*** *to identify the transport modes and* ***estimated number*** *of vessels required. The* ***details given in [RD17] are not final****; further considerations are required. [RD17] should therefore be taken as the best estimate of logistical implications at the time of the report and is* ***subject to change*** *[RD18].*" [Emphasis added]
>
> AS-010 sHRA addendum Appendix 3 Biosecurity Risk Assessment

3.109 The Transport & Logistics Study report [RD17] and its accompanying Caveats Report [RD18] do not appear to be referred to in any of the other submitted DCO documents or the Environmental Statement. They appear to be unavailable for consideration. Therefore, this level of uncertainty does not appear to have been reflected in modelling. In fact, for the air dispersion modelling (APP-140 doc 6.4.21) it simply states that "*Horizon provided the number of marine vessels/types and MOLF construction plant on a monthly basis for each of the 2020 (when the MOLF is undergoing construction) and 2023 (when the MOLF is operational) construction years*", with no qualification to represent any estimated upper or lower limits or referencing of the Transport and Logistics caveats.

3.110 Given Horizon's own self-acknowledged estimates of vessel movements, along with the proposed non-material amendment, it is highly likely that vessel movements into and out of the harbour (MOLF) may be far greater than was initially anticipated or modelled in various topic areas of the ES including in relation to noise or visual disturbance to terns.

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[19] Matter raised by counsel for Gwynedd Police in opening ISH on draft DCO, 24th October 2018.

[20] AS-010 paragraph 3.2.2 of Appendix 3 Biosecurity Risk Assessment Strategy Report and references [RD17 & [RD18] Appendix 3. Originally submitted as part of Marine Licence Application, doc ref ML-OTH-03-BSRA

Terrestrially-based plant and machinery movements within Construction Zone 10

3.111 Both the Marine Licence and the ES (APP-132 doc 6.4.13) provide information to inform various models such as noise and air quality, but the ES and sHRA (APP-050 doc 5.2) appear to be silent on the combined 'visual' quantum of vehicle/mobile plant movements that will occur during the construction or operation of the harbour (MOLF), for example the 24 hour use either of wagons to deliver or plant to consolidate rock fill on the breakwater. Consideration of numbers, frequency and/or speed of movements, periodicity of plant usage and combinations of plant working on different elements of the MOLF construction on a daily or hourly turn round might be useful in providing either a descriptive or quantified picture of the construction of a new industrial port (MOLF). However, the eNGOs acknowledge that this may be very difficult to provide, as much of it will be dependent on wider construction/contractor timetabling, delivery schedules and/or weather or other conditions (eg state of tide) during the construction and operation of the harbour (MOLF). However, this adds to the uncertainty of the assumptions that may have been used in the predictive modelling of the visual environment.

3.112 The Marine Licence Schedule of Works Table 1-2's indicative programme of works (reproduced at Appendix 7) gives a small insight into the considerable amount of multiple activities that will occur at any one time period in Construction Zone 10[21] during the construction of the Power Station.

3.113 It is therefore potentially unrealistic to expect and almost impossible to draw any conclusions with any degree of certainty in terms of the visual impacts combined with noise impacts that commuting and foraging terns may be subject to within Construction Zone 10.

Navigational approach to Porth-y-Pistyll Harbour (MOLF) and potential interactions of terns with marine vessels or other marine-based plant (eg dredgers/barges)

3.114 The eNGOs have sought to understand[22] the navigational routes and approaches that large marine vessels will make into/out of the new harbour (MOLF), as it has implications for the interaction between the commuting and foraging terns. It is understood that discussions are ongoing with Trinity House, but that no further detail has been provided on the trajectory of the approach of vessels to the harbour entrance. For example, there will potentially be a difference if the angle of incidence is perpendicular or parallel to the predominant east-west flight lines of the terns and how the Horizon vessels interact with the Holyhead Separation Lanes.

3.115 Flight height of the terns is important in assessing the potential for interaction of the birds from any vessels crossing or running parallel with their flight. Although it is indicated that this has been recorded during the Vantage Point surveys, flight heights do not appear to have been reported within the documents (APP-225 doc 6.4.89) or used in any analysis.

3.116 Cabot & Nisbet (2013) indicates that terns are efficient in the way they adjust their commuting flights, for example in respect to the wind. Birds will generally fly at 10 – 20m downwind, but at < 0.5m when into the wind. This difference in flight height is attributed to birds taking advantage of lower wind speeds closer to the water, therefore expending less energy when flying into the wind than would occur if flying at a higher level.

3.117 The literature as discussed above paragraph 3.98 indicates that terns are operating close to their energy budget limits. It is also recognised (Cabot and Nisbet 2013) that: -

"*terns successful breeding requires that terns allocate their time effectively so they bring high quality food to chicks* ***at the highest rate possible****….. Studies have suggested that*

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21 https://www.horizonnuclearpower.com/files/downloads/Public%20Documents/Marine%20Licence/(4)%20ML-PLD-01-PDR%20(Rev%201_0).pdf Table reproduced at Appendix 7 of this evidence

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terns are good 'economists', in the sense that they do allocate their time efficiently." [Emphasis added]

3.118 At Cemlyn the majority of birds fly back towards in a westerly direction as the prevailing weather conditions are majoritarily south-westerly or westerly airstreams. So, the time efficiency and commuting strategy is likely to result in birds flying much lower, potentially at 0.5m, on their inbound journey back to the breeding site, when they are carrying food.

Sandwich tern at Cemlyn flying low to colony with food
Photo © Ashley Cohen blackfox wildlife

3.119 The results of Horizon's observations of terns during the detailed offshore ground investigations (DOffGI – APP-132 doc 6.4.13 ∞ 13.6.458) indicate that some birds increased their flight height by as much as 30m in response to the jack-up rigs. If this degree of change occurred on a low (<0.5m) inbound flight, it would represent a significant alteration in the commuting pathway and an inefficient use of a bird's energy. If this response was elicited multiple times over one season and across a number of seasons it is logical to conclude that this would have a cumulative impact on the bird's energy efficiency and consequently on its physiological condition, reproductive capabilities including provisioning of chicks and males feeding females during egg-formation and egg laying. If a large proportion of birds are affected in this way it is likely that there would be a significant negative effect on the population

3.120 The studies at Sheringham Shoal (Harwood et al 2017), as discussed above (3.80 *et sequel*), also conclude that alterations to flight pathways to avoid the wind farm array during construction and operation was a minor adverse impact, although the analysis did not specifically relate this to birds' energy budgets.

Avoidance observations from presence of jack-up rigs during the Detailed Off-Shore Ground Investigations (DOffGI)

3.121 The observations presented by Horizon in this aspect of the work are not scientifically rigorous and serve only to confirm that terns will avoid even comparatively small unfamiliar objects (illustrated in 6.4.89 fig 3-24 & 3-25) when considered in relation to the scale of the WNDA harbour (MOLF) construction or a wind farm array, as already discussed above. The data is not reported systematically and in many instances observations are just referred to as 'some deviation' by flying birds (6.4.13 ∞ 13.6.409 & 13.6.409).

3.122 Although it is reported elsewhere (6.4.13 ∞ 13.6.4580) that deviations could be 200m and/or an increase in flight height of 30m, there is no empirical data on what proportion of birds deviated by this amount. As the literature already discussed (paragraph 3.115) indicates, a change in flight height is considered to be energetically detrimental and it is known that optimal flight height is 0.5m when returning inbound to the colony with prey items.

3.123 The DOffGI work also adds little to the understanding of responses to noise or visual stimuli, as the observations are not accompanied by any results of the noise generated or pattern/speed of movement of the jack-up rigs during their time within Porth-y-Pistyll.

Failure of food delivery due to disturbance in the marine environment

3.124 It is well observed that terns can fail to deliver food to chicks and brooding females as a result of disturbance close to the colony from unexpected visual or visual and noise events such as kite-surfers, jet skis or power boats (Chris Wynne Reserve Manager Cemlyn and Ajay Tegala National Trust Warden Blakeney Point, Nov 2016 pers comm). Terns do not swallow prey items for later regurgitation to chicks, but carry whole prey items back to the nest. When disturbed it can be seen that some returning birds with prey may swallow the food item, not return to the nest and then 'U-turn' to start another foraging trip.

3.125 NWWT have raised this as a concern on several occasions[23] in connection to visual/noise disturbance from construction and from marine vessels including smaller faster craft crossing the Sandwich tern flight lines back to the breeding colony. To date Horizon have not considered this as a contributory factor in the cumulative physiological stress for individual birds within the colony and therefore collectively the breeding success of the colony.

Tern activity in industrial environments

3.126 Horizon's sHRA indicates (5.2 part 1 ∞ 10.3.10 – 10.3.11) that terns use industrial environments, which is followed by the unsound conclusion that the considerable change to an industrialised development and its construction will not be deleterious to the Cemlyn terns that return year on year to breed at the undeveloped site at Cemlyn Bay. Whilst Horizon's statements are technically true, it is important to consider a number of other factors, that may undermine these assertions: -

- Common terns are well acknowledged to be more catholic in their habitat choices, for example being the only UK tern to breed in inland locations.
- Common terns have more resilience than Sandwich tern in their ability to defend against predators and are less 'flighty' in their breeding behaviour.
- Sandwich terns do not breed at the industrial sites at Shotton and Imperial docks[24]. In fact, it can be concluded that Sandwich terns at inland Shotton are extremely uncommon[25] as only 37 birds have been ringed in over 50 years, as opposed to over 14,000 common terns in the same period.
- The common terns at Imperial Docks colonised this industrial location as a result of extreme disturbance and abandonment of nearby islands (Jennings 2012) – it appears not to have been the optimal first choice habitat.
- Horizon acknowledge Sandwich terns have abandoned Zeebrugge port (APP-050 doc 5.2 ∞ 10.3.11), but offer no analysis as to why this is. It is known that the terns at Zeebrugge have had an extremely chequered and uncertain history in this industrial environment from losses of habitat to industrial development, impacts from inappropriate compensation site habitat creation and casualties due to wind turbine collisions (Stienen 2006).

3.127 It can be concluded from consideration of these factors that there are extremely few instances where Sandwich tern bred in close proximity to industrial development and where they do (Zeebrugge) they are extremely susceptible to colony abandonment or other risks. The introduction of an industrial harbour in such close proximity to the Cemlyn Nature Reserve,

[23] Marine Effects Workshop minutes 5th December 2017 and Natura 2000 sites SoCG meeting minutes October 2018
[24] Forth Seabird Group bird reports http://www.forthseabirdgroup.org.uk/pages/Reports.htm
[25] Merseyside Ringing Report celebrating 50 years *https://www.merseysiderg.org.uk/50th%20Anniv%20report%20-%20composite.doc*

which has been established in a natural undeveloped environment for nearly 50 years, is not comparable to the cases illustrated by Horizon.

Long term impacts of marine infrastructure during power station generation and decommissioning

3.128 It is important to acknowledge that whilst the 10 year construction program for the Power Station will be the period of highest levels of impacts from marine infrastructure, the harbour, breakwaters and CWS intake will be in place for the duration of the power station's energy generation (projected to be 60 years). Additionally, there is no fine detail of what might comprise decommissioning and how the harbour will be used at this time. Although it is understood that there are no plans to remove either the harbour or the breakwaters once power generation ceases and/or decommissioning has been undertaken, there may be increased marine vessel movement and other break-out/demolition activities that may occur during decommissioning.

3.129 Whilst monitoring programs of other proposals are helpful in elucidating some evidence the uncertainty of conclusions about longer-term impacts of for example, wind farm arrays are still in their infancy, and even the most well-defined studies have not been run for a sufficient number of seasons to evidence changes to breeding, commuting and foraging on either tern or other seabird populations over power infrastructure operational life-times. During the operational timeframes for this type of infrastructure monitoring studies will also have to consider more closely the infrastructures interaction with breeding site habitat conditions and availability of food sources or climate change.

3.130 At this stage, therefore, it is only possible to safely conclude that over the short to medium term the installation of more permanent infrastructure does result in avoidance but the longer-term consequences are certainly uncertain.

3.131 The most important factor in this analysis will be establishing a good monitoring program at this particular site prior to, during and post construction as this data could be used to inform decisions and impact assessments for decommissioning operations and the potential removal/retention of infrastructure. This matter is discussed in more detail below.

Construction lighting

3.132 In our analysis, light has not been a focus of eNGOs' attention. Not because it is considered irrelevant, but due to resource limitations.

Conclusion of the evidence base and analysis for marine noise and visual disturbance on Anglesey Terns SPA

3.133 In summary the discussions above lead the eNGOs to the following conclusions: -

- The ES is contradictory in its impact assessment between secondary seabird species (minor adverse impacts) and terns (negligible impacts) and unjustifiably diminishes the cumulative impacts on terns from avoidance behaviours, increased stress, energy expenditure and effects on breeding condition or success.
- Studies show that some form of avoidance behaviour is exhibited by terns to wind farm arrays in the majority (70%) of studies considered.
- The conclusions of a monitoring report on Sandwich terns at Sheringham Shoal (Harwood et al 2017) supports that ES's initial conclusions of minor adverse impacts due to avoidance of construction and operation of offshore wind farms.
- Docking Shoal windfarm proposals were refused on bird issues including the impacts on breeding success and energy budgets of foraging terns.
- The available literature does not support Horizon's assessment of impacts on commuting and foraging terns.

- The noise data shows that the baseline noise environment will be subject to considerable change not just to background case bounding construction noise, but also to high maximum levels of temporary but temporally and spatially unpredictable noise generated from impulsive and blast related activities. This will be considerably greater at ecological receptor sites within or close to Construction Zone 10 than elsewhere within the SPA terns' environment.
- The tern tracking vantage point methodology and data is not accepted as a useful tool on which to draw conclusions.
- The tern boat tracking introduced in 2016 is considered an effective methodology, if analysed appropriately and can be combined with other existing data sets.
- The analysis of the boat tracking data sets from 2016 and 2017 have not been used to assess the proportion of the Sandwich tern population that may be affected by impacts within the WNDA Construction Zone 10. Consequently, it has not considered the range or magnitude of responses that may occur.
- The DCO submission demonstrates considerable uncertainty about the delivery mechanisms for a variety of materials and the quantum of marine vessel movements as opposed to road deliveries. The reports that form the basis for transport and logistics assessment are heavily caveated.
- An actual figure of how many vessel movements represents 60 – 80% of deliveries via the sea cannot be calculated with any degree of confidence.
- In regards to Construction Zone 10 terrestrially based plant and machinery it is potentially unrealistic to expect any forecasting of the quantum of visual impacts combined with noise impacts that commuting and foraging terns may be subject to and therefore almost impossible to draw any conclusions on the combined impacts.
- The frequency and periodicity of movement of terrestrially based plant within Construction Zone 10 appears to be lacking.
- The navigational routes into/out of the harbour (MOLF) have not been determined and the likely rate of interactions or angle of incidence between marine vessels and foraging/commuting terns cannot therefore be demonstrated or evaluated.
- The DOffGI observations within the Porth-y-Pistyll (Construction Zone 10), although not scientifically empirical, serve to corroborate the findings of avoidance of novel and unexpected industrial features on Sandwich tern commuting and foraging pathways that have been recorded elsewhere.
- The observed behaviour of aborted provisioning of chicks/mates from inbound birds not delivering prey items has not been investigated or considered
- Very few conclusions can be drawn with any reasonable certainty from Horizon's observations about tern breeding colonies in industrial environments or their long-term viability.

3.134 Consequently, given the level of construction uncertainties and/or lack of data, along with the lack of available literature and few case studies it is not possible to demonstrate or quantify the construction or operational environmental conditions on which to assess the impacts on foraging or commuting Sandwich tern from the Wylfa Newydd proposal and the construction and operation of the harbour (MOLF), and the eNGOs are of the opinion that the conclusion of no AEOI cannot be demonstrated beyond reasonable scientific doubt.

3.135 As a result of the marked levels of uncertainty demonstrated in this element of the scheme (noise and visual disturbance to commuting and foraging SPA terns) there is a clear and necessary basis for considering this impact within the HRA assessment as it confers a significant risk to the conservation objectives of this and potentially other Natura 2000 sites as will be discussed later.

3.136 As stated above, it is the NGOs' collective view that, even with the application of additional mitigation and avoidance measures, the residual cumulative impacts arising from the development are likely to preclude a conclusion of no AEOI, and it will therefore be necessary for the Examining Authority to apply Stage 3 and 4 of the Habitat Regulations, including (subject to the outcome of the assessment of alternative solutions, and reasons of overriding public interest) consideration of compensation for the Anglesey Terns SPA.

Mitigation and monitoring

3.137 As Horizon have dismissed marine disturbance impacts in Construction Zone 10 to foraging and commuting terns, no specific mitigation or monitoring has been proposed either as precautionary, embedded, best practice or additional mitigation within the controlled documents (CoCPs, CoOPs, Mitigation Route Map) or within the draft DCO Requirements.

3.138 The eNGOs are of the opinion that this is a serious omission as a monitoring programme could also be used to help inform decisions and methods for decommissioning activities.

3.139 Additionally, we do not agree with the conclusion of no AEOI and therefore are of the view that both mitigation and monitoring are necessary. Further work would need to be undertaken to investigate what mitigation might be appropriate and could be achieved within this area of the scheme. This would also need to be proportionate, effective and enforceable.

3.140 The suitability of the proposed noise mitigation protocol that is tabled within the draft DCO via the Mitigation Route Map (APP-029 doc 3.1 and APP-422 doc 8.14 cf discussion above 3.32 *et sequel*), has been shown to be unsound. Its applicability in relation to commuting and foraging terns is therefore equally dubious.

3.141 It would be impossible in construction terms to apply any visual buffer zone requirement in the same manner as the 500m exclusion from the tern breeding colony. It might be safe to conclude that one of the few available options for reducing or mitigating the interaction of the SPA's Sandwich tern primary functional commuting route with construction plant and infrastructure would be to consider alternatives to the scale/need for the harbour (MOLF), interrogate the navigational operation of marine vessels and the approach to materials delivery, as well as reconsidering the location and protection required for the CWS intake. All these matters are far beyond the remit of the eNGOs, or the current conclusions of the DCO.

3.142 The most important advantage in establishing a good monitoring program at Wylfa Newydd prior to, during and post construction is that it can also be used to inform decisions and impact assessments for decommissioning operations and potential removal/retention of marine infrastructure.

3.143 The introduction of monitoring via both boat-based tracking and other consideration of other methodologies (eg ringing) will have value over the 10 year construction period for monitoring population changes over time and between seasons of the Sandwich tern population. Although a smaller proportion of the breeding colony, extension of this monitoring methodology to common and Arctic terns would also have some comparative value.

3.144 Due to the no AEOI conclusion, monitoring of tern foraging and commuting is not currently proposed by Horizon, but has become an industry standard and is consistently used in off-shore wind turbine locations MMO (2014).

3.145 The uncertainty and lack of confidence in the evidence in relation to the construction and operation of the marine infrastructure leads the eNGOs to conclude that mitigation is a necessary part of the management and avoidance of risks of likely significant impacts on the SPA. However, as stated above, it is the NGOs' collective view that, even with the application of additional mitigation and avoidance measures, the residual cumulative impacts arising from the development are likely to preclude a conclusion of no AEOI, and it will therefore be

necessary for the Examining Authority to apply Stage 3 and 4 of the Habitat Regulations, including (subject to the outcome of the assessment of alternative solutions, and reasons of overriding public interest) consideration of compensation for the Anglesey Terns SPA and the wider Irish Sea metapopulation.

Impacts to the Anglesey Terns SPA from recreational pressures and visitor management as a result of Wylfa Newydd

3.146 At a recent meeting, it was gratifying to hear from Gwen Parry-Jones (Director of Operations, Horizon Wylfa Newydd) that when she had one of her first jobs at the Wylfa Magnox Plant she often enjoyed her lunch outside in the environs around the power plant including Cemlyn Bay.

3.147 It has become increasingly recognised that contact with the natural environment and semi-natural landscapes has significant effects on the health and well-being of people. Additionally, isolation from such experiences leaves people less well-equipped to appreciate the value of the countryside and the wildlife it supports, resulting in a lack of understanding of the importance of responsible and sustainable development, along with the reasons for the high level of environmental protection that some sites or species have.

3.148 As a result of the recognition of health and well-being the ANGSt standards[26] are adopted widely in order to promote access to and enjoyment of accessible natural greenspace. The eNGOs all promote the engagement of people with wildlife and the countryside. We would not wish to restrict access or enjoyment to Cemlyn Nature Reserve or other important wildlife sites by for example, restrictive contracts promoted by an ill-conceived Workforce Management Strategy.

3.149 However, as much as the importance of personal connectivity to the natural environment is being recognised more widely, the impacts on sensitive sites of major footfall or changes in population demographics has also brought to the fore the necessity to consider visitor management at the earliest stages of the planning process and design of schemes. This approach guides and ensures commitment to implementing appropriate mechanisms, in order to provide effective and discrete measures to enable continued conservation of important biodiversity resources, whilst allowing continued access for recreation.

3.150 It is accepted that ground nesting birds and roosting/feeding wintering waders at nearly all locations are sensitive to disturbance from anthropogenic influences, which includes unmanaged access/use by visitors and dogs (particularly if off the lead). Cemlyn Reserve and the breeding birds at Anglesey Terns SPA are no exception to this visitor pressure.

3.151 NWWT currently employ 2 seasonal wardens, funded via a legacy, during the period late April (generally from approx 20th) to mid-August. The wardens' purpose is to manage and monitor the breeding colony as well as to improve direct face-to-face engagement with visitors. Visitor engagement is targeted at increasing awareness of the site's sensitivity and to promote responsible behaviour. This also includes establishing a temporary roped barrier and viewing point along the shingle ridge so that visitors do not walk/have picnics on the lagoon's shoreline, which has been shown to be disturbing to the nesting colony.

3.152 Horizon's assessment (cf sHRA APP-050 doc 5.2 ∞ 10.3.57, 10.3.69, 10.3.70 and 10.3.73) recognises the role that visitors or other human activity within Cemlyn Reserve has on the breeding terns, in places seeking to imply that these may even outweigh any other form of visual or noise disturbances.

3.153 This section considers what baseline analysis and evaluation has been provided by Horizon on visitor dynamics across the WNDA and what facilities and/or measures are proposed. It

[26] Accessible Natural Green Space Standards ANGSt - Wales Greenspace Toolkit provides guidance to Local Authorities

also considers how this matter is dealt with within other planning authorities and how it may be secured.

3.154 The section will consider two types of potential visitor; the Wylfa Newydd workers both those that will be housed in the Temporary Site Campus and those that live off-site; along with non-workers such as potential visitors who are construction tourists who wish to experience the sheer scale of the Wylfa Newydd construction and the 3 tallest cranes in Europe.

3.155 The eNGOs do not seek to conclude that this impact source and pathway would in isolation by sufficient to contradict the assessment of no AEOI. Instead we hope to provide an understanding of how the Wylfa Newydd proposal would result in changes to the visitor dynamic or usage of the area and its cumulative impact with other construction impact pathways. It is our view however, that mitigation will be required for this impact.

Visitors and workers: Baseline data analysis, recreational management and facilities

3.156 The following themes will be discussed in this section: -

- Provision of facilities and management for the non-worker visitors (at 3.177)
- Visitor management and recreational usage for site workers (at 3.178)

Provision of facilities and management for the non-worker visitors

3.157 Non-worker visitors might include construction tourists, the general public or visiting families of workers who are based in the Temporary Site Campus/elsewhere on Anglesey.

3.158 The provision of visitor facilities and their management has been scaled back during the development of the Wylfa Newydd proposals. Earlier iterations of the Wylfa Newydd proposal included the provision of a Visitor and Media Reception Centre close to the site's southern boundary as part of the main proposals. This was an Associated Development and was subject to assessment under the PEIR[27] Reports at PAC 2.

3.159 This later became a facility which would be developed under a separate TCPA permission[28] at some future but unspecified time. However, it was not to be submitted in conjunction with the DCO proposals as has occurred with the A5025 improvements.

3.160 A temporary viewing area has subsequently been proposed in the same location and within Mound C (Figure D1-9; APP-238/239 doc 6.4.101) but that would become available at the start of construction (APP-088 doc 6.3.1 ∞ Table C1-20).

3.161 The Landscape and Habitat Management Strategy Chapter 4 (LHMS; APP-424 doc 8.16) states in relation to the temporary viewing area: -

> "*Suitable arrangements to enable viewing of the construction activity should be made. Initially, this **may** comprise a temporary viewing platform available around 6 months after the start of construction, **dependent on availability** of safe access and parking capacity. This facility **may** evolve through the construction period **dependant on the positioning of activities** while moving through the different phases* [eg construction of Mound C?]." [Emphasis added]

3.162 It appears that there is uncertainty about what measures will actually be implemented during the construction phase and in any event, the Landscape and Habitat Management Plan indicate they will only become available 6 months into construction – at the earliest. Additionally, during the operational phase, it appears (doc 6.4.101 figure D4-6) that this area

[27] Preliminary Environmental Impact Reports – a precursor to the full Environmental Impact Assessment that is required for DCO submission

[28] NWWT 1st SoCG meeting minutes 11th July 2017

will become a picnic area with interpretation board. Apparently, no new car park is identified within the plan for this area, although other new parking provision is included.

3.163 Any mention of a new or aspirational visitor and media centre appears to have been removed from the formal planning elements of the scheme (eg Proposed Development APP-120 doc 6.4.1; Planning Statement APP-406 doc 8.1; Design and Access Statement (D&A) volumes 1 & 2 APP-407 & APP-408). Whilst the temporary viewing area is only included within the list of the on-site elements, with no further detail or D&A discussed. In fact, there is far more description of how Dame Sylvia Crowe incorporated visitor experience into the original Magnox Power Station design than there is detail of securing mechanism is for the proposed scheme (D&A vol 2 Power Station Site; APP-408 ∞ 2.1.22 & 2.1.26).

3.164 The DCO submission's other securing document is the Main Power Station CoCP (APP-415 doc 8.7). However, the only reference to this facility in the CoCP (APP-425 doc 8.7 ∞ 6.2.8) is the provision of a bilingual interpretation board as the Welsh Coastal Path leaves the viewing area. Both the draft DCO (APP-028 doc 3.1) and the Mitigation Route Map (APP-422 doc 8.14) are silent on this matter with no mention of the viewing area at all.

3.165 Whilst there will be many others who may wish to comment on this matter in more detail, it is of relevance to the evidence of the eNGOs in as much as the provision of good viewing facilities is the only way proposed of managing tourists. At the current time there appears to be no mechanism to require its implementation and no indication even in outline of what will provided. Additionally, there appears to be little understanding of how the proposal will influence visitor numbers or their usage of the wider area.

3.166 Considering the non-worker visitor more widely, Horizon appear to have given this limited consideration despite it being raised on several occasions by the eNGOs[29]. Questions have included; whether footfall was to be studied, increased detail of the Workforce Management Strategy has been requested and the provision of a visitor management strategy has been advocated.

3.167 The main evidence provided within the ES is in the Public Access and Recreation chapters (APP-069 doc 6.2.4 and APP-138 doc 6.4.19). There has been no baseline footfall or user surveys on National Trust land (APP-138 doc 6.4.19 ∞ 7.1) despite being raised in the Secretary of States scoping opinion (July 2017; APP-069 doc 6.2.4, Table B4-4) and Cemlyn Bay being considered to be the most ecologically sensitive receptor within the vicinity of the WNDA.

3.168 Consequently, there is not a comprehensive understanding of baseline usage or any projection of what numbers of visitor's might be attracted during construction. It is very concerning to note that it has been speculated by the Horizon team that limited car parking will constrain visitor usage[30], which shows poor understanding of visitor dynamics and recognised techniques to manage expectations or behaviour.

3.169 Given that Horizon's own analysis (sHRA APP-050 doc 5.2 ∞ 10.3.57) recognises the detrimental impacts on breeding success of an 8.5% increase in visitor levels and that the consequent disturbance could result in increased nest failures (22% and 13% depending on species), it seems surprising that Horizon have not considered this impact pathway more fully or predicted numbers more widely. On the basis of this model and current estimates of visitor usage of the tern viewing area during the breeding season (Cemlyn Reports circa 3,600[31]) it

[29] Landscape and Historic Environment Site Visit Minutes 29th November 2017 and Cemlyn Lagoon effect workshop 16th January 2018

[30] Cemlyn Lagoon effect workshop 16th January 2018

[31] 3,500 is 10 year average of visitors using the 'tern viewing area' on the ridge during the breeding season. The estimated total number of visitors per annum is 50,000.

would ostensibly only require an increase of 300 visitors to the tern viewing area to potentially start seeing negative effects on breeding success.

3.170 This impact pathway is one of disturbance so would be directly cumulative in conjunction with the noise and visual disturbance pathways discussed above.

3.171 At the most recent eNGO Statement of Common Ground meeting (10th October 2018) Horizon have indicated that they are ***considering*** visitor management, which may include: -

- The provision of an additional site warden at Cemlyn.
- Measures working with adjacent landowners. (This might potentially be secured by a Section 106, but detail of any ring-fencing or measures this would include are not available.)
- Encouragement of visitors away from most sensitive areas, although the measures or scope of which has not been specified

3.172 Despite the lack of detail, this is seen as an encouraging development, but until an understanding of Horizon's proposed commitment is provided on both what might comprise a Recreational Management Plan (or similar) or how the different elements can be secured it is still an outstanding matter.

Visitor Management and recreational usage - site workers

3.173 It is worth considering that the on-site live-in workforce at the Temporary Site Campus will be 4,000, which is just under 3 times the local population of Cemaes[32]. The totality of the workforce, however, will be considerably greater over the construction timescale and it is reasonable to assume that a proportion of the workers would be interested in enjoying the landscape outside the site construction confines for recreation in the countryside. As discussed above paragraph 3.168 it has been shown that only a small increase in visitor pressure can have a detrimental effect on breeding success.

3.174 It is not apparent what studies or projections have been made by Horizon on the recreational profile these workers might have, what likely demographic and/or the frequency or periodicity of family visits that are likely. As a result, there is little understanding of what likely impact on the Natura 2000 sites there will be. However, the sHRA still concludes with certainty that there will be no AEOI either alone or in-combination with other impact pathways. Consequently, only very limited measures are proposed by Horizon.

3.175 Currently Horizon rely on the Workforce Management Strategy (APP-413 doc 8.5 ∞2.2) as the mechanism to reduce worker pressure pathways in the sHRA (APP-050 doc 5.2 APP Table 11-1 and ∞ 1.1.39). In relation to the WMS the worker's Code of Conduct states: -

- *All personnel must be aware of nearby sensitive ecological receptors (such as Wylfa Head, Tre'r Gof and Cemlyn SSSIs, Cemlyn Lagoon, and nature reserves) and their legal protection, and ensure no damage or interference of any kind is caused to these areas through, for example:*
  - keeping to defined paths at all times,
  - refraining from littering;
  - refraining removing or damaging vegetation or habitats; and
  - impacting on any species within these areas (particularly nesting species).
- *All personnel must ensure that personal noise levels are appropriate at all times and all locations.*

3.176 Horizon (sHRA doc 5.2 Table 5-4) also rely on the presence of the NWWT wardens in relation to moderating additional visitor/recreational impacts from the proposal. As already indicated,

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

the two seasonal NWWT warden's posts are funded from legacy money and cannot necessarily be relied upon by Horizon as either a short or medium-term measure. There has been no discussion with either NWWT or the National Trust in relation to whether the wardens' work capacity is sufficient to accommodate increased visitor numbers and management, along with the other staff duties of tern monitoring and reserve tasks, such as predator controls at the Anglesey Terns SPA Cemlyn Bay breeding site.

3.177 It is understood that the Workforce Management Strategy is currently under review but that changes are likely to result in greater enforcement measures[33]. This approach is in contrast to considering either proactive or passive methods as has been advocated by the eNGOs. Techniques which might be considered include controlling access by installation of path way marking away from sensitive areas, on-site interpretation or strategic placement of countryside furniture. The application of such measures would need to be implemented in a considered manner according to the zoning of the sensitivity of parts of the site or sites.

3.178 Mechanisms that have been proposed at Wylfa Newydd within the Workforce Management Strategy is very sparse and are considerably less than even the Countryside Code[34]. In the eNGOs' view, this in isolation from any other measures will not be effective. It will not be possible to monitor or enforce this effectively and will be reliant on the vigilance from other external bodies, other than Horizon or NRW/IACC, for reporting and dealing with issues as they arise.

3.179 Given that it can be demonstrated that there is potential for damaging effects to arise from this impact pathway, which have been unquantified by Horizon, there are risks to the conservation objectives of the Anglesey Terns SPA (and Cemlyn Bay SAC shingle ridge) as a result of the lack of an appropriate mitigation protocol. It is considered that Horizon have provided a disproportionately small response to the significant matter of recreational disturbance.

3.180 Whilst not apparently of direct relevance to disturbance impacts at the SPA, one of Horizon's responses to the eNGOs' concerns in relation to Wylfa Head is to restrict access to the site by blocking off of the back entrances from the Temporary Site Campus to make it more difficult for workers to access this site. Our view of this is discussed in more detail below (paragraph 3.185 and 3.186). However, by seeking to restrict access to one area of sensitivity it could foreseeably increase the likelihood of workers using an alternative form of transport (car or bike) to access the next nearest accessible greenspace – Cemlyn Bay. Without a coordinated approach to worker usage of the accessible greenspace and making appropriate provision where it is within their control, Horizon are adopting a piecemeal approach to the matter and have no strategy to deal with any issues as they arise.

3.181 The eNGOs have advocated consistently[35] that changes in visitor usage and their management should be a consideration within the DCO. In order to help demonstrate establish the reasonableness and proportionality of the eNGOs' recommendations for mitigation, a number of other examples and approaches are considered below.

[33] NGO SoCG Natura 2000 meeting 2nd October 2018

[34] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/701188/countryside-code.pdf

[35] PAC 3 June 2017. Meetings Landscape and Historic Environment Site Visit Minutes 29th November 2017; Cemlyn Lagoon effect workshop 16th January 2018; Section 106 response to IACC 18 Jan 2018; Response on the Wylfa Newydd SPD Feb 2018

Examples and evidence from other planning authorities of Natura 2000 sites with mitigation of recreational pressure impact pathways

3.182 In the absence of any defined approach by Horizon it is useful to consider how recreational usage is considered in other localities and the drivers that are used to achieve appropriate consideration and implementation of measures.

3.183 In the Thames Basin Heath SPA, the zone of influence for increased new housing proposals is taken to be up to 5km from the SPA boundary in order to deal with impact pathways of recreation and effects on breeding birds. This is an agreed approach with Natural England, which allows strategic planning authorities[36] to adopt an overarching approach to the management of recreational pressures. In the absence of any data or projections of worker recreational movements for Wylfa Newydd Site Campus, it is of note that the Temporary Site Campus is located 2.5km from Cemlyn Bay or 3.9km by road. As indicated this facility will bring an additional population of 4,000, the size of a small town.

3.184 One of the main pillars of the approach agreed with Natural England by the local authorities, where Natura 2000 sites occur in proximity to strategic housing allocations, is the development of Suitable Alternative Natural Greenspace (SANG) plans. Each authority has responsibility to identify existing or new SANG sites, with mechanisms provided for appropriate resourcing, management and strategies of encouragement to be able to achieve their usage.

3.185 Whilst the current DCO examination is not considering a strategic plan, the principals are applicable to the creation of a new town and therefore it could be speculated that Horizon might adopt this approach across a strategically defined area to manage this impact pathway to the local Natura 2000 sites (Anglesey Terns SPA and Cemlyn Bay SAC). This could require the development of a joined-up approach to recreational management of the accessible natural greenspace within the WNDA and a defined zone. For example, in relation to biodiversity this might incorporate access land at Trwyn Pencarreg (National Trust – CRoW[37] access land and Wildlife Site), the Horizon owned Wylfa Head (Wildlife Site) and the Welsh Coastal Footpath, temporary viewing area. This could include footpath provision, access or countryside furniture and car parking in a comprehensive and coordinated manner both during construction and operation.

3.186 These other sites have their own identified biodiversity sensitivities such as lichen rich coastal heathland and breeding chough, which can also be sensitive to trampling/erosion/compaction or disturbance pressures respectively. Therefore, a locally joined-up approach to the management of recreational pressures is essential and will help to ameliorate and manage impacts at these other sites too.

[36] See Surrey Heath Council web page for a summary and for the supplementary planning guidance with the criteria and characteristics that a SANG site should support. Also Runnymede's 2017 HRA ∞ 4.14 – 4.17 for a more detailed explanation.

[37] CRoW Countryside and Right of Way Act 2000

Photo of Trwyn Pencarreg (Wildlife Site and CRoW access land) showing matrix of heath and habitats sensitive to trampling

3.187 The second example, is the approach adopted by planning authorities around Morecombe Bay SPA and SAC, which is a more case-by-case approach to recreational pressures on winter wildfowl and waders, both at their primary roosts on the coast, but also at functionally linked feeding grounds on disparate fields in-land. Housing developments that are relatively small, such as 100 – 150 new house units (approx 240 – 360 population increase[38]) fall under consideration within the HRA process for the SPA where application sites fall an identified bird sensitivity zone, as agreed between the RSPB and Natural England.

3.188 In these Lancashire planning authorities where recreational impacts and pathways are identified, the strategy that has been agreed locally with Natural England includes provision in the new homeowner's pack - supplied by the builders - information on local accessible natural greenspaces (similar to SANGs), local footpaths and proactive messages about responsible behaviour and why their behaviour can affect the birds. A template of what this leaflet contains has recently been developed with the local Natural England office (in press). The approach also includes provision of and linkage to on-site local footpath networks and agreed contributions to off-site signage, footpath work or other features. These measures are secured by conditions[39] with monetary contributions identified within Section 106 where necessary.

3.189 In of both these examples the approach that has been agreed with the Statutory Nature Conservation Organisation (Natural England) utilises a suite of measures that can be applied either at a small local level or more strategically across a number of accessible sites. It is

[38] Figure of 2.4 people per household Office of National Statistics 2017

[39] See decision notice condition 20, for Arthurs Lane, Wyre (16/00217/OULMAJ) outline application for **165** residential units. Impact loss of functionally linked grazing field, supporting flocks of circa 20 pink-foot geese during 1 in 3 years. *"*[condition] *20. Prior to the commencement of development, a scheme for the provision of home-owner information packs and information/interpretation boards/signage on and off-site shall be submitted to and agreed in writing by the Local Planning Authority and the development than then proceed in full accordance with these agreed details. For the purpose of this condition the information submitted shall include the following:*

- *the content of the home-owner information packs which must explain the conservation value of the nearby designated areas, the potential impacts that can arise from residential development and explain the responsible behaviours that would be required from residents to avoid undue ecological impact;*
- *a methodology for the distribution of the home-owner packs including upon resale to the extent to which that is practicable;*
- *a plan showing the locations of information/interpretation boards/signage*
- *a mechanism for the installation of information/interpretation boards/signage in off-site locations*
- *details of the information to be included in the information/interpretation boards/signage*
- *a timetable for implementation.*

Reason: In order to safeguard biodiversity in accordance with the provisions of paragraphs 17 and 118 of the NPPF."

considered by the eNGOs that given the scale of Wylfa Newydd and the proximity to ecological receptors that mitigation measures should be considered at both levels. It should consider the housing site itself (the Temporary Site Campus) and on-site measures to allow access out to the countryside, but also extend the mitigation to consider the suite of accessible greenspaces in the locality, their sensitivities to recreational pressures and mechanisms to manage visitor/recreational usage.

Conclusion of disturbance from changes in recreational use on Anglesey Terns SPA

3.190 Recreational pressure is widely recognised as a pathway for disturbance to ground nesting birds within Natura 2000 sites. In the case of the Wylfa Newydd DCO this has been dismissed as having no impact on the Anglesey Terns SPA and its conservation objectives and consequently only limited measures have been proposed. No consideration has been given to other sites of biodiversity value or sensitivity. There are a number of problems with the analysis, evaluation and proposed mitigation. In summary: -

- Horizon's baseline data analysis does not consider the current usage of sites and facilities in the area of the National Trust's land including Cemlyn Nature Reserve or the wider National Trust estate (Anglesey Terns SPA).
- Horizon have undertaken no predictive modelling of the changes in the local recreational usage of the sensitive SPA/SAC or Wildlife Sites from the introduction of 4,000 on-site living arrangements or the workforce in totality. Nor would it appear has any understanding been provided about non-worker visitor demographic or potential numbers or changes in site usage from this visitor group.
- Horizon's own analysis of the literature appears to demonstrate that a relatively small change in visitor numbers could result in increased physiological stress and impacts to breeding success of the bird colony.
- Without a suitable baseline assessment and prediction of change it is not possible to conclude beyond reasonable scientific doubt that no adverse impact will occur from this pathway and that it would not act cumulatively with the other disturbance impact pathways of, for example, construction noise and visual disturbance.
- The provision within the Wylfa Newydd proposals for 'visitor facilities' during and post construction has been incrementally scaled back over time by Horizon.
- The Workforce Management Strategy's Code of Conduct in relation to ecologically sensitive sites is extremely sparse and will not provide an effective tool to manage the behaviour of construction workers living on-site or in the wider community. It will be almost impossible to monitor or enforce and will ultimately rely on external third parties to monitor and to be reactive in dealing with issues as and when they arise.
- No recreational site management (Visitor Management Strategy) has been provided for accessible natural greenspace within Horizon's ownership (eg Wylfa Head and coastal stripe between Wylfa Head and Cemaes) or provisions suggested for sites outside of its ownership but within close proximity to the WNDA (Cemlyn Nature Reserve and Trwyn Pencarreg Wildlife Site and CRoW access land).
- Matters raised by other interested parties such as Isle of Anglesey County Council or tourism organisations may also intersect with visitor management issues and there may be a case for looking at Suitable Alternative Natural Greenspace (SANG) more widely.

3.191 Recent discussions have indicated that Horizon may be considering a more proactive approach to this matter, which is encouraging. However, at the present time the detail of this has not been forthcoming and the methods of securing it with ring-fenced funding, where necessary, have not been provided or agreed.

Impacts causing alteration in predator/undesirable species population dynamics and impacts on Anglesey Terns SPA

Changes to predator/undesirable species population dynamics

3.192 The eNGOs have consistently raised the matter of changes to predator population dynamics which may alter the rate and/or species which take advantage of prey food sources within the Anglesey Terns SPA. This has focused in early discussion on the displacement of predators from within the WNDA due to the Site Preparation and Clearance TCPA[40] and latterly from activities during the Power Station construction as well as during its operation.

3.193 The conservation objectives recognise the role of predators in stating:

> '*factors which affect the population should be under appropriate control*'.

3.194 It is also well understood that large land management changes or largescale landscape/habitat alterations can affect the population dynamics of both predator and prey species' populations.

3.195 In the case of Wylfa Newydd the site is very large and potential changes which might attract undesirable species could include large areas of open ground with top-soil strip, earth moving, along with sewage outfalls, fish recovery and return points and general harbour or building infrastructure attracting congregations of undesirable predator species (eg herring gulls or corvids).

3.196 In addition, local changes to the environment from the extensive tree planting at the Notable Wildlife Enhancement Area (NWEA) could also act as suitable perch or vantage points (Jennings 2012), and potentially nest locations, for undesirable predator species.

3.197 The sHRA does not consider this matter within the analysis of potential pathways, as it is scoped out as not having a likely significant effect and no measures are proposed, except via the voluntary adoption by Horizon of the Resilience Measures (sHRA APP-050 doc 5.2 ∞ 11.3). The application does not appear to consider this matter at all within the proposed CoCPs (Marine APP-416, Wylfa Newydd APP-414 or Power Station APP-415) and it does not appear within the Mitigation Road Map or draft DCO.

3.198 The impact of the arrival and establishment of just a small number of predators that may prey and feed regularly at a tern breeding colony is well known and observed in a number of locations[41], not just at Cemlyn Nature Reserve. One of the key management activities for the Nature Reserve staff is to prevent predation episodes from 'getting out of hand'. If additional sources/opportunities for predator pressure result from the Wylfa Newydd construction and/or operation, this will add to the colony stress in the face of other disturbance impacts and changes to the local environment, as well as potentially the ability of the Nature Reserve managers to control predation pressure appropriately

3.199 The sHRA (APP-050 ∞ 6.5.8) discusses the susceptibility of breeding colonies to predator events but does not seek to examine the long-term situation at Cemlyn. In the 30 years since monitoring began (1983) there have been two episodes of colony collapse. This occurred attributed in part to predation episodes: in 2008 from the presence of two herons and: in 2017 due in part to a family of otters (female with two dependant cubs).

3.200 Considering the well documented problems associated with predators it can be concluded that on the whole the site at Cemlyn has far fewer episodes than might be anticipated and that

[40] Extensive commentary in Consultation Reports APP-037 documents 5.1
[41] Jennings 2012, Lady's Island Lake – hedgehog and pine martin, Strangford Lough – otter, Blackney Point – fox and rat; *pers comms* from site wardens, site reports and video footage from private Facebook group.

NWWT's and National Trust's predator management of the site is generally effective. Following the collapse of the colony in 2017 incidence of otter predation may have been deterred by the erection of an electric fence but evidence of otters has not been high in 2018 (Cemlyn Wardens Report 2018). This may be due to the death of the dog otter as a road kill and/or no off-spring from breeding by the semi-resident female.

3.201 The Environmental Statement (D9 - Terrestrial & Freshwater Ecology and appendices) does not provide any population estimates of potential predators which may be displaced from the WNDA during construction. This may include notable conservation species (Section 7 species) such as polecat or hedgehog, along with other species like rat, fox and corvids (crow family). Nor does it provide any predictive evidence of the fate or changes to population levels as a result of site clearance and construction or operation.

3.202 Horizon appear to have high confidence in the effectiveness of moving conservation species via the proposed phased directional clearing of the site and the ability for displaced species to utilise the NWEA to west of the WNDA that is within 200m of the SPA boundary. The purpose of this is to provide suitable habitat for these species during construction and have a population pool to allow recolonisation during site operation. However, Horizon have consistently dismissed the notion that this activity will also result in changes to the dynamics of the resident predators, their population levels, their direction/location of recolonisation during the construction and their pattern of feeding behaviour. Additionally, the massive alteration to the landscape from earthmoving and the phased clearing and remodelling of the site could potentially alter predator dynamics and behaviour towards and into the SPA.

3.203 During preapplication discussions there has also been a lack of recognition from Horizon that the changes to the landscape itself may attract species which are undesirable. Horizon rely on the view of IACC in respect of the SPC application, which will only remove boundary features, will have no direct consequence to the Anglesey Terns SPA and subsequently they dismiss the landscape scale changes that will occur during the main construction. In the eNGOs' opinion the view of IACC does not apply to the whole of the construction of Wylfa Newydd and should not be used to justify conclusions in relation to cumulative impacts of the scheme as a whole.

3.204 As it stands there is currently disagreement between Horizon and eNGOs on what will happen to the predator/undesirable species dynamics during both the site clearance phase and more importantly during earth works and construction. Both sides speculate about the outcome and there is little evidential basis, examples or predictive modelling to support either approach.

3.205 Most relevant to the current consideration of Wylfa Newydd is the apparent unintended consequences of clearing Haverigg Prison of gulls. The prison is over 5km from the Hodbarrow RSPB Reserve (part of Morecombe Bay SPA), which supports many ground-nesting species, including a substantial colony of breeding terns and black-headed gulls. The licence issued to control large gulls at the prison resulted in the gulls relocating to the Hodbarrow Reserve with the consequence that the predator pressure became too great and resulted in breeding failure of the little terns and deleterious consequences for other tern species (Merseyside Ringing Group 2004). It took several years for measures to redress this issue to be put in place and the population to recover.

3.206 Given the clear impact pathway, and the sensitivity of the SPA to any such impacts, the eNGOs consider that the precautionary principle should be applied to the issue of potential changes to predator population dynamics, and suitable management/mitigation measures secured to manage any such changes.

Management of changes to predator/undesirable species population dynamics

3.207 The management of unintended consequences of development or land-use practices is well documented and a number of examples are given below.

- Invasive non-native species (INNS) – At Wylfa Newydd a considerable risk is present that the change in the marine landscape from creation of artificial substrates during the construction of the harbour (MOLF) will increase the risk of introduction of INNS as discussed in the Marine Enhancement Paper[42]. INNS may be species that can occupy space that native species would colonise hence outcompeting them. Alternatively, INNS species maybe predators which have negative effects on native populations. Consequently, a Biosecurity Risk Management Strategy (AS-010 SHRA addendum; Appendix 3, doc 5.2.2) has been discussed with NRW and included within the Marine Licence. Its implementation will be required (draft DCO APP-029 doc 3.1 Requirement PW7).
- Manchester Airport 2nd Runway construction – geese were attracted to the grassed runway verges and ponds at the airport including those created for SSSI great crested newt mitigation and attenuation ponds. This increased the risk of bird strike to planes. The design of ponds was adjusted to reduce attractiveness to geese and measures to control and/or cull geese based on usage monitoring.
- Milnrow Rochdale; Regional Distribution Park (375ha) – monitoring and mechanisms were introduced during site enabling works to manage the attractiveness of the site to deter little ringed plover (Schedule 1 Wildlife & Countryside Act 1981), and other sensitive ground-nesting species (ringed plover and skylark). Protocols should nesting become established. The site also supported high densities of water and monitoring for mink was undertaken to ensure this species did not colonise the newly formed attenuation areas and water vole mitigation sites.
- Gulls and corvids in quarries/landfill in Derbyshire are managed for the dual purpose of Environmental Health regulations and to reduce impacts on ground nesting birds (eg lapwing and skylark) on adjacent SSSI grasslands.
- Buoys at Sheringham Shoal (Harwood 2017) have been shown to be attractive to Sandwich terns for roosting, courtship and mating. Likewise, the navigational buoys at the new harbour (MOLF) may have unintended consequences potentially either being used by the terns or alternatively by undesirable species of large gulls. Other harbour (MOLF) infrastructure such as the mooring buoys and lay-by berth may attract undesirable species.

3.208 The eNGOs are not contending that this impact pathway would in its own right justify a conclusion of AEOI, but that it is one of the cumulative factors that could result in damaging effects to the SPA that should be managed to reduce the risks to the conservation objectives of the site.

3.209 The informal suggestion by Horizon of providing support for predator management at Cemlyn Reserve (sHRA 11.3), is welcomed if it can be secured effectively. However, the eNGOs are of the view that there is sufficient justification for a predator risk management approach to be adopted across the WNDA estate during construction and operation of the power station and secured via a Requirement.

[42] Not currently before the Inquiry

Functional linkage of Esgair Gemlyn shingle ridge - Cemlyn Bay SAC - with conservation objectives of the Anglesey Terns SPA

3.210 The breeding islands for the Anglesey Terns SPA at Cemlyn Nature Reserve are situated within the lagoon which forms part of Cemlyn Bay SAC. The SAC is considered in more detail within Chapter 4 below. However, the interaction between the SAC and the fate of the breeding SPA terns' conservation objectives is more relevant to the current discussion, so is considered within this chapter.

3.211 It is well recognised that many breeding tern species have a preference for nesting on islands or 'island-like' features, as they confer a higher degree of natural barrier protection against predator attacks. It is noted that in fact Sandwich terns very rarely nest on non-islands habitats (Cabot & Nisbet 2013) due in large part to their poor defensive strategies.

3.212 At Cemlyn the tern breeding islands are located close behind the shingle ridge at approximately 20m from its leeward side. Annual over-topping in storm events occurs rarely along the length of the ridge, but typically more at the western end nearest the islands. Storm events push shingle inwards to form a characteristic scalloped edge of shingle creeping forward on the leeward side, as shown in the photograph below.

Photo March 2018 following the late winter storms
Illustrating shingle creep
Taken from file note 9th March 2018 – Chris Wynne

3.213 During the breeding season the North Wales Wildlife Trust manage the water levels, using a stop-log weir on the inlet, in order to maintain the levels in the lagoon at an advantageous height to maximise the gap between the ridge and the islands. This water level management is common practice at other sites either to control predators on ground nesting birds (Lady's Island Lake) or for saline or freshwater habitats (Medmerry Environment Agency 2013 Suffolk)

3.214 The evidence presented by Professor Kenneth Pye indicates that the changes to the coastal hydrological/geomorphological environment and mechanisms will result in at minimum an increased risk and rate of overtopping and at worst a catastrophic breach.

3.215 The increasing rate of overtopping will exacerbate the rate of natural creep, pushing the shingle towards the islands, narrowing and shallowing the stretch of water between the islands and the shingle ridge. Observations show that the islands are situated behind the point in the ridge which is lowest and where over-topping will occur at the greatest frequency. Professor Kenneth Pye's evidence indicates that the changes in the coastal geomorphological processes following the construction of the western breakwater will intensify the direction and force of wave action to this weakest point.

3.216 The resulting changes in dynamics will make it increasingly more likely that terrestrially based mammals can cross to the islands for predation of terns and gulls during the breeding season. This will consequently increase the need for a schedule of winter maintenance works, which adjust the profile and shape/depth of the channel between the islands and the ridge to the benefit of the nesting terns. Such work was undertaken with NRW's permission in the winter 2017/2018, Imported stone was used to reconfigure the islands and also to increase nesting space. This work was not undertaken to repair damage but as a positive measure using European funding for the Roseate Tern *Life* Project[43].

3.217 This is only the second time in 20 years that this scale of works has been undertaken by NWWT at the Nature Reserve. Extension to the main breeding islands to their landward side was undertaken in 1997, this was to reflect the loss of a small island that was removed near the weir in 1996. The removal of the small island was prompted by consistent predation by terrestrial animals, resulting in failure of breeding on this part of the site (Chris Wynne Senior Reserves Manager *pers comm*).

3.218 As a result of the construction of the western breakwater catastrophic events could destroy the islands completely resulting in them either becoming totally subsumed into the ridge itself, or by complete tidal inundation and flooding them out. In both these eventualities the ability of the Wildlife Trust or National Trust to manage water levels, repair a breach or undertake reinstatement of the islands could be severely compromised both in terms of resources and man-power.

3.219 As indicated in the Ecological Options Paper (Submitted in response to ExA Q2.0.38) when the 2013/2014 winter storms catastrophically compromised the conservation objectives of Blackeney Freshes (National Trust) and Cley Marshes (Norfolk Wildlife Trust), the international obligation to maintain the Natura 2000 sites fell to the statutory government agencies (Environment Agency and Natural England) as well as landowners.

3.220 In the opinion of the eNGOs it cannot be demonstrated beyond reasonable scientific doubt that the construction of the harbour (MOLF) and its associated infrastructure of the breakwaters will not have an adverse effect on the shingle ridge and consequently there should potentially be a supporting contributory fraction towards costs from Horizon in the event of such catastrophic impacts.

3.221 As it currently stands there are no proposals that Horizon have 'in hand' to manage what in the eNGOs view is a significant risk to the Natura 2000 Esgair Gemlyn shingle ridge and the functionally linked breeding islands of the Anglesey Terns SPA. There are no monitoring or *remediation proposals in relation to the shingle ridge, Esgair Gemlyn. Professor Kenneth Pye* indicates that there should be a requirement to monitor the ridge and adjoining areas and a strategy including action options if certain morphological change thresholds are exceeded. Such options should include re-profiling of parts of the ridge and/or islands and intervening channel, if necessary, using reserves of stockpiled marine shingle obtained from the early phases of harbour construction (i.e. the material which will be removed from the location of the proposed MOLF, or simply buried beneath it).

3.222 Chapter 5 of the eNGO evidence discusses the policy drivers for the beneficial reuse of dredged materials. Chapter 5 does not solely relate to the eNGOs' conclusions on the Esgair Gemlyn ridge and Cemlyn SAC, however, it is our considered opinion that this guidance and

[43] "Improving the conservation prospects of the priority species roseate tern throughout its range in the UK and Ireland" Project code: LIFE14 NAT/UK/000394

adoption of beneficial reuse as part of the DCO could have a role to play in this matter should remediation be shown to be necessary.

3.223 In conjunction with any conclusion that Professor Kenneth Pye draws in relation to adverse effect on the integrity of the Cemlyn SAC, his conclusions should be transferred in their entirety to the Anglesey Terns SPA conservation objective: -

> *"There should be sufficient habitat of sufficient quality, to support the population in the long term"*

3.224 Without the maintenance of the integrity and functioning of the Esgair Gemlyn shingle ridge the tern breeding islands cannot be maintained.

Metapopulation dynamics and interaction with other Irish Sea SPA sites

3.225 The sHRA (APP-050 doc 5.2 ∞ 4.7.9. & 4.7.10) concludes that there is no functional linkage between the Anglesey Terns SPA and other SPA Natura 2000 sites in the wider region, despite speculating that the Cemlyn terns may form part of a metapopulation that operates around the Irish Sea: -

> "*The SPA designated for breeding and feeding terns on the Anglesey coast and other tern SPA breeding sites (which may be within and beyond mean maximum foraging range) are, therefore, potentially linked (in regard to their being part of a wider metapopulation area). However, during any particular breeding season, there is not a functional link, as regular interchange of individuals between distant breeding sites does not occur and (**except in the event of breeding failure**) the SPA birds will remain at the colony to complete their breeding attempts*." [Emphasis added]

3.226 Horizon make reference to a recent caselaw review (Chapman & Tyldesley NERC 2014, sHRA reference [RD39]), but appear not to have considered the definition provided by Chapman and Tyldesley: -

> *"In the context of this report* [Chapman & Tyldesley]*, the term 'functional linkage' refers to the role or 'function' that land or sea **beyond the boundary** of a European site might fulfil in terms of supporting the populations for which the site was designated or classified. Such an area of land or sea is therefore 'linked' to the site in question because it provides a (potentially important) role in maintaining or restoring a protected population at favourable conservation status."……* it goes on later to state*……*
>
> *"Supporting habitat in areas beyond the boundary of a SAC or SPA which are connected with or 'functionally linked' to the life and **reproduction** of a population for which a site has been designated or classified should be taken into account in a Habitats Regulations Assessment." [Emphasis added – underlined]*

3.227 The underpinning of the work within the NERC paper is based on caselaw, where the establishment of a "credible" functional link is required. However, this definition provides a useful context in which to consider the Irish Sea Metapopulation and the evidence that has already been discussed above in relation to noise and visual disturbance both at the breeding site and on commuting/foraging routes. This also relates to the lack of suitability of the mitigation protocol that is discussed above at 3.32 *et sequel*.

3.228 It can be demonstrated that in the 5 years prior to the colony collapse in 2017 the population of breeding Sandwich tern at Cemlyn represented approx 33% of the wider population found in the Irish Sea[44].

3.229 The eNGOs first raised matters relating to the Irish Sea metapopulation in their response to the EIA Progress Report (March 2016) and provided more commentary within the joint eNGO

[44] Analysis of JNCC data of population counts http://jncc.defra.gov.uk/page-2890

Ecological Options paper (May 2017). Subsequently NWWT was commissioned by National Trust to prepare a report specifically on the metapopulation dynamics of Sandwich tern within the Irish Sea Natura 2000 network. This work was undertaken in early 2018 and has been adopted as a joint eNGO paper and is presented at Appendix 4.

3.230 This report involved site visits to all the relevant Northern Ireland and the Republic of Ireland breeding sites, with extensive conversations with site managers and investigation of site reports/monitoring records. The Report considers the widely available literature, the ecology of breeding and the evidence of functional linkages at other tern breeding sites across Europe. It investigates in detail the fate of the birds which deserted Cemlyn during late May and June 2017, until the 24th June when the colony was declared abandoned. It considers where these birds went, whether they attempted to breed elsewhere and what constraints were encountered at other sites. It also considers in brief the subsequent 2018 breeding season.

3.231 The Report presents an approach to trying to maintain the conservation objectives at the Anglesey Terns SPA and the role of compensation off-site at other Irish Sea metapopulation sites and newly created sites.

3.232 In summary this Report concludes: -

- There is good evidence that breeding terns function in metapopulations, which does not just relate to the dynamics at the start of a breeding season or post breeding aggregations, but also occurs during the breeding season. This operates in response to colony pressures and variation in site conditions within and between years.
- There is credible evidence presented that demonstrates that Cemlyn birds in 2017 dispersed to other known Irish Sea Natura 2000 sites to attempt to re-breed.
- 47% of the initial colony of Cemlyn birds were found to have relocated, but approx 1,000 pairs could not be accounted for.
- Conditions at the other Natura 2000 sites and the ecology of late breeding attempts resulted in the Cemlyn terns occupying sub-optimal breeding locations. However, at all sites studied the relocated birds attempted to re-breed.
- However, only a small proportion (250 pairs = 12% approx) of the relocated Cemlyn birds were successful in their second attempts at breeding.
- In 2018, as was expected, there was a low return rate of breeding birds to Cemlyn. A lower than anticipated return rate in subsequent breeding season is a known response to colony collapse.
- This low return rate was considerably boosted during mid-June (18th/19th June 2018) by a late influx of breeding birds, which were considered to be from a partial abandonment of failed breeders at Hodbarrow RSPB Reserve in Morecombe Bay SPA.
- The birds that arrived in the late June influx to Cemlyn bred successfully at Cemlyn, which extended the breeding season into mid to late August with the first chick observed to hatch on 15th July.
- The Report indicates that few examples of attempts at colony creation exist and that the outcomes are considered uncertain and, in most cases, where breeding was established long-term sustainability was questionable.

3.233 As discussed above other episodes of late influxes of birds have been observed at Cemlyn[45], but no mechanism has been in place to accurately track this and no previous attempts have been made to correlate abandonments with influxes of late breeders.

3.234 It is however, contended that there is sufficient evidence presented to reasonably and credibly conclude that there is functional linkage within breeding seasons, which demonstrates that

[45] Late influxes of breeding birds recorded in the 'First Dates' in 2010, 2012 and 2013 as well as 2018 - Appendix 3.

impacts within one of the Irish Sea metapopulation sites may have consequent effects in another of the sites.

3.235 If the Horizon proposals for mitigation measures were to be adopted there would be uncertain protection from construction disturbance impacts not only for the breeding Cemlyn terns, but also for terns from other Natura 2000 sites which arrive as failed breeders to the functionally linked colony at Cemlyn Bay. The efficacy of Horizon's proposed mitigation is discussed in detail, above in section 3.32 *et sequel*.

Appendix 4 - Irish Sea Metapopulation paper - proposes a staged approach in response to the eNGOs disagreement with the no AEOI conclusion and matters relating to compensation, as follows: -

- Step 1: Measures taken to sustain the on-site breeding tern population at Cemlyn Bay and within the wider Anglesey Terns SPA. Consideration should be undertaken of the on-site for compensation, taking account of the current condition of the SPA features (on-site measures must be able to demonstrate "additionality" to that which is already required to ensure the protected area is restored to or maintained at favourable condition), potential impacts on other qualifying features of the SPA and/or other site designations, and, of course, the potential for the resilience measures or habitat changes to be impacted by the development proposals. On-site measures must also be in addition to the mitigation and avoidance measures (embedded or additional) that have already been identified via the EIA/HRA process. Given the inherent limitations of on-site 'compensation' of this kind, it is highly likely that any such proposals will need to form part of a suite of measures including off-site compensation as described below.

- Step 2: Analysis of the Irish Sea metapopulation dynamics to explore and incorporate compensatory measures off-site at *current* tern breeding colonies. There is a gradual movement within conservation practice from site-based conservation towards regional management of populations[46]. This approach to regional and metapopulation conservation is also reflected in the Conservation Objectives for the Anglesey Terns SPA, which requires that: "*The range and distribution of terns within the SPA and beyond is not constrained or hindered"*. However, as with on-site compensation (see Step 1 above), where off-site colonies also lie within designated sites, careful consideration must be given to demonstrate additionality and to ensure that existing qualifying features of the designated sites are not adversely impacted.

  Compensation at current tern colonies within the wider Irish Sea metapopulation was suggested as an avenue of investigation in the May 2017 eNGO Ecological Options paper, but to date has not been taken forward by Horizon. The eNGOs consider this to be a serious omission in the development of a robust compensation proposal.

- Step 3: Investigation of creation of new tern breeding sites. While proposals for the creation of new breeding colonies of Sandwich and other tern species are welcome, the creation of entirely new colonies presents significant levels of uncertainty, and it is therefore the collective view of the eNGOs that such proposals should only be advanced in combination with measures to compensate for the impacts on-site (i.e. within the existing SPA) and/or within the wider metapopulation network. At the time of writing (June 2018) this is the only compensatory mechanism that is being investigated by Horizon.

[46] Cabot & Nesbit 2013 New Naturalist Series – 'Terns' Chptr 11

Resilience Measures (eNGO Ecological Options, May 2017)

3.236 In spring 2017 the eNGOs provided an Ecological Options paper to Horizon, by way of a discussion document. This was not provided in order to circumvent the necessary process of the establishment of baseline monitoring or the analysis of construction impacts. Nor was it considered by the eNGOs as a panacea that would overcome any potential impacts of the scheme.

3.237 However, the document provided a number of ideas that, subject to further consideration, could increase the resilience of the SPA tern colony and thereby contribute towards other mitigation, avoidance and enhancement measures. The paper also set out recommendations for SPA compensatory measures in anticipation that a conclusion of no AEOI of the SPA could not be reached.

3.238 The Ecological Options paper considered in its entirety: -

- The Anglesey Terns SPA
- The Irish Sea Metapopulation dynamics
- The Cemlyn Bay SAC shingle ridge
- Opportunities for marine enhancement

3.239 Horizon have begun to consider some elements of this eNGO paper in the manner of actions that a 'good neighbour' might undertake given the extent of their proposals. The measures that Horizon consider they might pursue are (sHRA APP-050, doc 5.2 ∞ 1.1.40 – 1.1.41): -

- "*The provision of annual funding during the construction phase to maintain or enhance the productivity and breeding success of the tern colony through predator control measures, increasing the length of seasonal staffing to encompass March and the August Bank Holidays, access management and the investigation of measures to secure breeding habitat.*
- *The development of an incident response plan, and agreed triggers, to address any adverse effects of increased sediment loads discharging to the lagoon from storm events, nutrient release and heavy metals/contaminants. This should be part of the management of the drainage system and controlled by requirement.*
- *Discussions with the landowner, tenant and NRW regarding the introduction of a weir/sluice at the mouth of the lagoon, with a facility to stop lock the inflow and regulate storm water flows, to manage water*."

3.240 It is the eNGOs' view that the second item should be encompassed into a Requirement for monitoring discharge outputs of Mound E (discussed further below in Chapter 4).

3.241 Although this approach is broadly welcomed, the precise manner in which the measures will be secured, their scope and details of how they will be resourced/how much funding or support will be made available is unclear. The reason for this appears to be that Horizon do not consider any of the measures necessary as SPA mitigation under the Habitats Regulations (sHRA APP-050 doc 5.2 ∞ 1.1.41).

3.242 At ExA Deadline 1 a draft Section 106 (REP1-010) was submitted by Horizon. This appears to further reduce the matters listed within the sHRA (cf REP 1-010 Table 1-1, Item 11) and indicates that there will be a fund of money which will be available *on application*, but will be shared between other listed items. In our view what has been presented by Horizon at Deadline 1 is not acceptable.

3.243 Given the numerous and potentially serious impacts arising from the DCO proposals (as highlighted throughout this written representation), and the uncertainty of the effectiveness of the limited mitigation measures proposed by Horizon (where impacts are recognised), the eNGOs consider that the on-site measures proposed in the Ecological Options paper are

essential to help reduce the potential effects and, as far as possible, to protect the SPA tern colony at Cemlyn *in situ.*

3.244 Nevertheless, as stated elsewhere in this written representation, even with these additional on-site mitigation measures, uncertainties remain regarding the long-term response of the tern colony to the combined impacts of the DCO, including the potential for reduced breeding success in one or more season and/or the potential complete collapse of the Cemlyn Lagoon colony. These uncertainties lead the eNGOs to conclude that **an overall conclusion of no adverse effect on the integrity of the SPA cannot be reached.**

3.245 The eNGOs therefore consider that it will be necessary for the Examining Authority to apply Stage 3 and 4 assessment of the Habitat Regulations. Subject to the Application meeting the tests of 'no alternative solutions' and 'imperative reasons of overriding public interest', a robust package of compensation measures (including suitable monitoring thereof) will be necessary to ensure the overall coherence of the Natura 2000 network is protected (including sites forming part of the Irish Sea tern meta-population).

3.246 We understand that Horizon are exploring options for compensation for the Cemlyn Bay colony of the Anglesey Tern SPA, to put forward in anticipation that the Examining Authority also reaches the view that, on the basis of the available evidence, adverse effect on the integrity of the SPA cannot be ruled out. As stated elsewhere in this written representation, and in the recent joint eNGO letter to the Planning Inspectorate (EV-008), this should be made available by Horizon to the Examining Authority at the earliest opportunity in order to inform the Habitats Regulations Assessment.

4. Cemlyn Bay SAC

Context

4.1 Saline lagoons are a priority habitat under the Habitats Directive[47] and now total just 1300 hectares within the UK[48]. They are subject to ongoing degradation and loss through natural and man-induced processes. Threats include development pressure, pollution, erosion, disturbance and disruption to salinity and water exchange processes.

4.2 Saline lagoons are defined as areas of shallow, coastal saline water, wholly or partially separated from the sea by sandbanks, shingle or, less frequently, rocks (Brown et al 1997). In the UK there is a range of geographical and ecological variation in the habitat type, and some of the types of lagoon found in the UK are rare elsewhere in Europe. Therefore, a high proportion of the sites identified as meeting the definition of this habitat type have been selected as Special Areas of Conservation (SACs). They are also localised in Europe and on the Atlantic coast have a restricted distribution.

4.3 Within a Welsh context the saline lagoon at Cemlyn Bay is one of only two saline lagoon systems rated A/B[49] (the other being a small lagoon on the Llyn Peninsula and the Sarnau).

4.4 The saline lagoon at Cemlyn is considered the "*best example of a saline coastal lagoon in Wales*" (SAC designation citation) and supports a range of fauna and flora distinctly more characteristic of lagoons and lagoon like habitats than of other habitats. The habitat is the primary feature of the Cemlyn Bay SAC designation and as such there is a statutory obligation under the Habitats Directive to maintain the habitat in 'favourable conservation status'.

4.5 Favourable conservation status for the Cemlyn Lagoon habitat includes that:

- there is no loss of area other than that due to natural processes.
- the specialised plant and animal communities within the lagoon remain
- All factors affecting the achievement of these conditions are under control

4.6 The most recent survey of the saline lagoon macro-fauna recorded a good variety and viable populations of lagoon specialist species although there were concerns that at least one specialist species (the lagoon cockle *Cerastoderma glaucum*) had not been recorded since 2007 (NRW 2018a and b).

4.7 The water in lagoons can vary in salinity from brackish (owing to dilution of seawater by freshwater) to hypersaline (i.e. more salty than seawater as a result of evaporation). The plant and animal communities of lagoons vary according to the physical characteristics and salinity regime of the lagoon, and consequently there are significant differences between sites. Although, compared to other marine habitats, there is usually only a limited range of species present, they are especially adapted to the varying salinity regimes of lagoons and some are unique to lagoon habitats.

4.8 Saline lagoons are complex and dynamic systems and show variations in salinity on a daily basis through the tidal cycles, as well as through seasonal variations such as rainfall patterns. They can also show spatial variation including stratification across temperature and salinity gradients. However, the individual salinity regime within the lagoon is the key determining

[47] Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora – Annex I habitat

[48] Saline lagoons - Conserving saline lagoons and their birds on ten Natura 2000 sites in England, LIFE99 NAT/UK/006086

[49] where A=Outstanding examples of the feature in a European context and B =. Excellent examples of the feature, significantly above the threshold for SSSI/ASSI notification but of somewhat lower value than grade A sites (JNCC)

factor in the flora and fauna present and the communities present have evolved in relation to both temporal and physical changes in salinity.

Risk relating to impacts on the Cemlyn Bay SAC

4.9 Specific risks relating to impacts on the Cemlyn Bay SAC saline lagoon habitat can affect a number of significant attributes, which include:

- scarcity of this habitat type. In a Welsh, UK and European context; the Cemlyn Bay SAC is a significant reservoir of lagoon specialist species
- high diversity of lagoon specialist species including the presence of a number of 'sensitive' species (Green and Camplin, 2013) as well as a number of nationally scarce species. The most sensitive species are those "*distinctly more characteristic of lagoons and lagoon like habitats than of other habitats*" (JNCC) and the ongoing presence of a number of these species is an important factor in assessing whether the Cemlyn Bay SAC is in a favourable condition
- particularly important reservoir for certain specialist species. In terms of abundance, the most significant lagoon specialist at Cemlyn lagoon is the lagoon snail, *Ecrobia ventrosa;* compared with other lagoons, Cemlyn supports by far the greatest density of *E. ventrosa* in the UK (Bamber, Gilliand, et al., 2000)
- habitat isolation; if the populations of a particular specialist taxa become locally extinct they are unlikely to recover (Green and Camplin, 2013). In addition, results of an EU funded LIFE[50] project have shown that it is easier to conserve the interests of lagoons where a series of lagoons are found in close proximity; the lagoon habitat at Cemlyn is therefore particularly vulnerable given its relative isolation from other lagoon systems
- system complexity; even small changes or synergistic effects can have unpredictable outcomes within a saline lagoon system
- lack of knowledge about the ecology of some specialist species thus leading to difficulty in assessing the impact of changes in the system. Spiral tasselweed *Ruppia cirrhosa* for example, is known to flower and regularly set seed, but little is known of the circumstances required for germination (BSBI scarce atlas account[51])
- supporting habitat for other internationally important feature (breeding terns), which are internationally designated.

Impact pathways where risks might occur

4.10 The impact pathways which have potential to affect the integrity of the Cemlyn Bay SAC include:

- Alterations to the landscape and habitats surrounding the lagoon which in turn will affect surface hydrological patterns and run off entering the lagoon, particularly during the phase when unconsolidated mound material (mound E) remains un-vegetated or the area is reworked.

[50] Saline lagoons - Conserving saline lagoons and their birds on ten Natura 2000 sites in England, LIFE99 NAT/UK/006086
[51] Preston, C. *Ruppia cirrhosa* Scarce Atlas Account, Botanical Society of the British Isles (BSBI) - Ruppia account 'other discussion' tab https://www.brc.ac.uk/plantatlas/plant/ruppia-cirrhosa

- Long term impact (post construction and during operation) of changes to freshwater inputs to the saline lagoon system via connecting drainage pathways arising from Mound E
- One-off high risk events and sequences of high risk events such as pollution incidents (including in both the marine and freshwater environments) or heavy rainfall events affecting the capacity of temporary drainage systems
- Air pollution impacts from blasts, traffic and other construction associated activity
- Alterations in waves and marine currents with potential to affect barrier integrity directly and through change in sediment movements. Any change in the percolation rate of sea water though the barrier has potential to alter specialist communities within the lagoon
- Alterations to the quality of seawater entering the lagoon via the sluice or through percolation. This will include for example, potential changes in sediment loads or could include transport of pollutants into the lagoon system.
- Damage from changes in visitor usage and trampling of shingle vegetation (a secondary Annex I habitat to the SAC designation)

Potential factors affecting the habitat via the impact pathways

Barrier integrity

4.11 Changes in seawater percolation through the shingle barrier and overtopping the barrier during high tides and storms have potential to alter salinity regimes within the lagoon habitat.

4.12 This is discussed fully in Professor Kenneth Pye's written representation (27th November 2018, submitted at Deadline 2). In this he concludes that the changes to the coastal hydrological/geomorphological environment and mechanisms will result in at minimum an increased risk and rate of overtopping and at worst a catastrophic breach

Hydrological changes

4.13 Lagoon specialist species are rare due to their ability to cope with an environment of extremes. One-off discharges of fresh or sea water may therefore be tolerated. However long term changes in the regular sea or freshwater inputs can change community composition permanently.

4.14 For example, a sustained increase in freshwater can result in a shift towards higher biomass invertebrate communities composed of relatively common species with consequent loss of the lagoon specialists. Paradoxically, lagoons managed toward the freshwater end of the spectrum can become more important as feeding grounds for certain species of avifauna but risk loss of lagoon specialist species (see discussions in Symes and Robertson, 2003 and Bamber, 2001).

4.15 Any change in biomass is unlikely to directly affect the feeding terns which feed on fish offshore. However, if the breeding species assemblage changes this could affect the dynamics of the various bird species utilising the islands and lagoon creating unintended consequences or competition. Generalist feeders such as black- headed gulls or other ground nesting waders, could for example, increase in numbers due to the proximity of a good food source potentially competing with the terns for limited island breeding territory.

4.16 Mound E is situated about 110m away from the western boundary of the Cemlyn Lagoon and as such presents a risk to the Cemlyn Bay SAC through run-off arising from the mound. The risk relates both to the quantity and quality of the run-off with an increased risk of sediment transfer prior to vegetation becoming established on the mound particularly during periods of heavy rain fall during the construction phase.

4.17 The sHRA and Main Power Station CoCP (APP-050 5.2 ∞ 7.4.5 and APP-415 doc 8.7 ∞ 10.2.10 respectively) includes a reference to '*the diversion of the discharge from the drainage system from Cemlyn to Afon Cafnan until the risk of suspended sediment release is low*' as an HRA resilience measure, however the detail of this diversion has not been presented. In particular information relating to system capacity and the triggers and mechanisms for responding to high rainfall events or multiple storm events occurring in quick succession.

4.18 The sHRA (APP-050 doc 5.2 ∞ 6.2.1 – 6.2.22) the baseline appears only to provide baseline data in relation to saline conditions in the lagoon. It is almost entirely silent on baseline conditions in relation to freshwater inputs, turbidity and specifically from the drains that will be impacted or severed by the diversion of flow of Mound E. As Professor Kenneth Pye points out in his representation (∞ 53) there is a paucity of data in many areas including: -

> "Only six samples were obtained from the Nant Cemlyn which flows into Cemlyn Lagoon, the minimum concentration [total suspended solids] being 7 mg/l and the maximum 2750 mg/ l (average 1053 mg/l). This number of samples is too small to provide a representative picture of temporal variation or 'average' baseline conditions."

4.19 It is telling that presumably as a result of NRW's commentary, that as recently as autumn 2018 additional monitoring has only just been initiated by Horizon, to try to redress this issue. This is despite original data gathering being undertaken in 2012.

4.20 As a consequence, it appears almost impossible to accurately predict changes resulting from the proposal or to set appropriate thresholds by which the scheme should be implemented. For example, uncertainty exists across several areas: -

- The sHRA discusses (sHRA APP-050 ∞ 7.4.7) the suspended solid threshold limits that will be applied on other systems (TSS 40mg/l or 70mg/l) stating that the threshold depends on the background concentrations. No background levels are provided for the Nant Cemlyn and there is no discussion of which threshold or an alternative value would be appropriate.
- The calculations are based on a 1 in 30 event in the marine context, but provides no value for a similar freshwater event. It has been requested that calculations for the drainage system should be based on 1 in 100 year event or to use a precautionary projected value.
- The analysis is based entirely on the assumption that the diversion of drainage during construction will be totally effective (7.4.29 – 7.4.31), so no further discussion of over-spill or storm return rates etc are considered for either the natural system or the Mound E engineered drainage diversion's capacity.
- At 7.4.35 – 7.4.37 the sHRA elucidates the effects of the polyelectrolyte coagulants, clearly failing to recognise that the drainage from Mound E will not use a sediment grabbing system.
- The analysis provided on changes in salinity (∞ A3 7.4.46 – 7.4.51) appear to be based on flows continuing to enter the lagoon from discharge point E1 rather than considering the diversion and the total loss of freshwater input during this time.
- In the discussion on operation there is a predicted decline in salinity over a 6 month period, but again there is a failure to consider the potential habitat consequences of this over the operational lifetime, 'pushing' the habitat towards a potentially more hypo-saline spectrum, with the potential habitat consequences discussed below.

- The discussion on surface water discharge changes (∞ 7.4.88) does consider the diversion to E2 concluding there will be reductions volumes to the lagoon, but indicates that this will be for a limited period (unspecified) when the diversion is in operation, although it does not appear to consider the additional period when reworking may also occur.
- The sHRA says that the high flow rate predications should be treated with caution for the operational phase of the proposal (∞7.4.94). The mean rates of between +/- 5% and +/- 10% of Q_{95} could in actuality represent quite a wide variation. The lack of certainty and the wide range of mean rates lead to considerable uncertainty as to the long term changes to this highly sensitive system. This may alter the rate of flushing of the lagoonal system (see below 4.26 *et sequel*) and consequently this adds to the complexity of analysis needed over the long-term operational lifespan.

4.21 The conclusions appear to be drawn essentially based on the tolerance of the lagoonal specialists rather than any meaningful understanding of the likely changes to the lagoonal ecosystem.

4.22 A sensitively designed diversion to prevent excessive run off entering the lagoon is welcomed, however without safeguards such as detailed planning of the timing of works to minimise run off from un-vegetated surfaces, there remain considerable doubts as to risks to the lagoon system.

4.23 Given the internationally protected status of the site, it is essential that there is confidence in the earthworks mitigation measures and negotiation of such detail should not be left to a later stage. Sufficient detail should be provided at the decision making stage in order to provide confidence that they are appropriate, use the best available technology, are proportionate, achievable in protecting the SAC conservation objectives and enforceable. It should also be recognised that it is only in autumn 2018 that monitoring has been initiated in order to consider the setting of thresholds against the baseline conditions.

4.24 The proposed reworking of Mound E not only exacerbates the landscape and LHMS impacts, but also redoubles the probability of impacts to the lagoonal habitats, leading to even more uncertainty. It is the eNGOs' opinion that not reworking these earthworks would significantly reduce the impacts to Cemlyn Lagoon SAC. Dr David Parker's evidence (∞ 17 – 19) provides a clear argument relating to the need to establish final beneficial habitats on Mound E at the earliest opportunity and its links to water quality issues. Whilst Michelle Bolger's landscape evidence shows the impacts associated with Mound E in relation to the AONB.

4.25 In addition, there is lack of clarity about what is the long–term drainage plan from Mound E after the construction phase is over and water is no longer pumped via the Afon Cafnan, and whether there will be any long monitoring of any discharge entering the lagoon. Given the sensitivities of lagoonal systems to relatively small but long term changes to the ecosystem, it is important that the changes to the freshwater inflow are monitored post construction and into the operational phase.

Nutrient enrichment

4.26 Saline lagoons can be naturally rich in nutrients due to restricted water exchange and consequent reduced flushing of dissolved or suspended materials and can therefore be particularly sensitive to any further nutrient enrichment (Johnston and Gilliland 2000). Thus, even low inputs of additional nutrients can potentially lead to eutrophication and subsequent direct or indirect losses of specialist species. Species can be lost directly as the ambient water conditions become unsuitable or indirectly through increased competition from species better adapted to nutrient rich habitats (such as occurs during algal blooms).

4.27 Sources of such eutrophication could include any (or a combination of) of increased nutrients levels in direct freshwater inputs, increase in surface runoff into the lagoon and surface depositions from air pollution sources (see this evidence Chapter 7).

4.28 Given the complexity of the Cemlyn lagoon system and natural variation within the habitat the point at which nutrient loading could lead to an unacceptable change would be difficult to predict however, as stated above, any loss of lagoon specialist species is unlikely to be reversible.

4.29 Furthermore, Johnston and Gilliland (2000) state that: -

> *"Evidence from the few lagoon-specific studies undertaken and from similar systems suggests that once impacted (particularly by nutrient enrichment) lagoons may be slow to recover from impacts due to changes in water quality becoming self-perpetuating.*"

4.30 This Chapter highlights the need to identify water quality impacts within lagoons as early as possible and suggests the need for a precautionary approach to interpreting and acting on information that may indicate an impact. This is especially important when it appears that there is little understanding of the baseline situation at Cemlyn SAC and complete lack of confidence that the proposed construction mitigation will be effective, there are no thresholds set and there is no mechanism proposed to monitor outcomes or provide remediation.

5. Construction of the harbour (MOLF): Application of the Waste Hierarchy - Re-use and disposal of dredged material

5.1 The reduction and reuse of materials now underpin protocols and processes used in the construction industry as much as in our daily lives, with the adoption of CL:aire, legislation (Waste (England & Wales) Regulations 2011) and in the marine environment by guidance under the OSPAR Convention (1992), to which the UK is a signatory.

5.2 The eNGOs will not be considering the large volumes and disposal of terrestrially derived materials. Marine derived waste materials will also be generated through the construction of the harbour (MOLF), the deep water and other Ro-Ro berths and from within the footprint of the associated infrastructure such as the breakwaters and the Cooling Water System intake bay, along with on-going dredging maintenance of the associated navigable channel. The worst case analysis presented by Horizon is that this activity will generate 610,000m3 (368,000m3 of bulked rock and 242,000m3 of bulked soft sediment APP-132 doc 6.4.13 ∞ 13.5.38), which will be disposed of at sea. In this chapter the eNGOs will be considering the soft sediments arising from the marine construction.

5.3 The Environmental Statement chapter that deals with the marine waste stream is D13 (APP-132 doc 6.4.13 ∞ 13.5.36 – 13.5.40), however, the level of detail is sparse in some key areas. Of most relevance to a detailed consideration of the disposal and re-use of dredged materials is information submitted in support of the Marine Licence, most particularly the Waste Framework Strategy Assessment[52]. Therefore, in attempting to investigate these matters the eNGOs have had to make reference to documents that the Examining Authority may not have cognisance of. eNGOs apologise for this departure from the DCO submission and would request the Inspectors' patience and attention in this discussion and presentation of evidence.

5.4 The eNGOs recognise that matters relating to the disposal of dredgings from the formation of the new harbour (MOLF) and its associated infrastructure will be the responsibility of NRW as the licensing body, however, we are strongly of the view that it is important to consider all the Wylfa Newydd proposals in the round.

5.5 Horizon's proposals to dispose of dredgings at sea is material to other considerations before the DCO Examination such as, but not exclusively, evidence highlighted in the eNGOs' Chapter 3 (∞ 3.214; Functional linkage of Esgair Gemlyn shingle ridge) and the coastal processes evidence of Professor Kenneth Pye.

5.6 NWWT's response to the Marine Licence (August 2018[53]) concludes that NRW should, as a matter of urgency, request more work and consideration of the beneficial use of dredged materials from Horizon to inform any determination of a Marine Licence. We make the same request of the Examining Authority in relation to the DCO determination.

5.7 This section of our evidence considers: -

- the underpinning policy drivers for planned beneficial use of dredgings
- Horizon's response to this matter
- consideration of opportunities and alternative solutions to Horizon's approach
- why this matter needs to be dealt with via the determination of the DCO rather than being left for later consideration.

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[52] Horizon Marine Licence application 'Waste Framework Strategy Assessment' ML-OTH-02-WFSA (Rev 1.0) https://www.horizonnuclearpower.com/files/downloads/Public%20Documents/Marine%20Licence/(8)%20ML-OTH-02-WFSA%20(Rev%201_0).pdf

[53] Document; North Wales Wildlife Trust '*Consultation response to NRW on Marine Licence and Permit Applications*' 28th August 2018

5.8 In the eNGOs' view there are a number of ways the *planned* reuse of dredged materials should dealt with in the Wylfa Newydd DCO that could meet policy objectives, manage risks associated with impacts and be of benefit more widely in Wales, these include: -

- Recharge of SAC shingle ridge
- Increased resilience of tern breeding islands within Cemlyn Nature Reserve
- Use in any other Natura 2000 compensation schemes
- Use in other coastal projects

Each of these will be considered in more detail in this chapter.

Policy context on the disposal of dredged materials

5.9 The OSPAR Convention was enacted in 1998 and guides the signatory nations in the reduction of pollution including the dumping or incineration of waste products in order to protect the marine environment. When originally established this Convention exempted the disposal of dredged materials (Article 3 (paragraphs 2 and 3) of Annex II). However, later updates and guidance makes it clear that appropriate processes should be adopted in relation to the disposal of dredgings.

5.10 In 2014 OSPAR (Agreement 2014-06) updated their guidelines for the 'management of dredged material at sea'. In this, the overarching objectives recognise the dual roles of dredging; a) for water-based infrastructure such as capital works, maintenance dredging, such as will occur to create and maintain the harbour (MOLF); and b) for the purposes of ecosystem enhancement. The guidelines encourage the planning and control of dredging materials not only by the use of BEP (Best Environmental Practice) but also by the development of local regional and national plans which maximise the possible benefits from dredging and depositing of material. It recognises that sediments are a valuable natural resource, where the beneficial uses of dredged material should be maximised.

5.11 National legislation (Waste (England & Wales) Regulations 2011), which translates the European Directive[54] into the UK legislature, requires the application of the waste hierarchy which includes "preparing for re-use".

5.12 The draft Welsh National Marine Plan (2017[55]), clearly taking its lead from OSPAR and national legislation, provides a strong national policy steer that supports the beneficial use of materials. This goes on to state: -

"*Marine sediment transport regimes contribute to the proper functioning and resilience of natural ecosystems. Their role in coastal processes should be respected wherever possible and the sustainable relocation of excavated materials should be considered as a first option*."

Draft Welsh National Marine Plan
March 2018 ∞ 559

5.13 Many other organisations have taken their lead from this policy context and implemented the approach into their own organisational regimes. The RSPB published a report earlier this year (Ausden et al 2018), which specifically looks at opportunities for the re-use of dredged materials in the conservation management for sites supporting shoreline breeding birds, including terns.

[54] Waste Frameworks Directive - 2008/98/EC – Article 4

[55] National consultation period ended in March 2018, the consultation responses Report was published by Welsh Government in July 2018 showing the intention of changes to the draft Marine Plan which will be published in 2019. Consultation response https://beta.gov.wales/sites/default/files/consultations/2018-07/draft-welsh-national-marine-plan-summary-of-responses.pdf

Horizon's approach to the disposal of dredged materials

5.14 In their Marine Licence application Horizon discuss the policy context for the disposal of marine waste (Waste Framework Strategy Assessment [56] ∞ 2.1 et sequel) and identify that various policy drivers exist which require the consideration of re-use of dredged materials as part of the waste hierarchy. However, despite this analysis the remainder of the document only goes on to consider the re-use of the rock component of the dredgings within the construction works itself and not the soft sediments, such as shingles or gravels.

5.15 Horizon indicates that it anticipates that re-use of soft sediments is not possible and that NRW's advice is that the preferred option is that all soft sediments should be placed at the disposal site. But this conclusion appears to be on the basis of a misinterpretation of NRW's scoping advice [RD11][57], when an opinion was sought on the options for either re-use of soft sediments in construction or the depositing of materials in the disposal area at Holyhead Deep[58].

5.16 A full account of NRW's advice document was not included in the ML submission, but the eNGOs have obtained a copy and the relevant paragraph from NRW's advice reads in full: -

> "*Sections 2.1 and 2.2.2 of the scoping report discuss the **re-use of excavated material within the construction works**. Soft material should remain in the marine environment as it would otherwise be considered a loss to the Sediment Budget Source and we advise that all non-contaminated fractions other than rock should be returned to the marine environment in the disposal area. When the report discusses re-use of material it should be clearly stated that rock is being referred to and not the soft sediments*" [Emphasis added]
>
> Natural Resources Wales (NRW), May 2017.
> *Scoping of the site characterisation report of Holyhead Deep (ISO40)*

5.17 This NRW response does not imply that the disposal area is either the only or the preferred option for soft sediments be returned to. The NRW response is silent on the re-use of sediments in other contexts, as it is understood no other alternatives were presented for their consideration, so there was no request to provide a scoping opinion on other beneficial uses.

5.18 The systematic consideration of alternatives as required through OSPAR, the Waste Frameworks Directive and the emerging Wales national Marine Plan is therefore lacking in Horizon's analysis of this part of the project.

5.19 Horizon do discuss the re-use of other materials and indicate that this is a matter of identification of third-party projects/opportunities, in addition to agreement and subject to timing. Horizon conclude that all this would be for "consideration at a later stage" (cf Waste Framework Strategy - para 4.3.7 and sHRA signposting – para 1.2.6).

5.20 The eNGOs first raised the beneficial use of dredged materials over 12 months ago[59]. At this workshop questions were raised about engaging with the relevant officers within the local councils and NRW, as well as the need to characterise the components of the sediments. The same issue was raised in a subsequent meeting[60], at which Horizon indicated that there was no space available within the WNDA for storage of materials for subsequent re-use, so the

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[56] Horizon Marine Licence application 'Waste Framework Strategy Assessment' ML-OTH-02-WFSA (Rev 1.0)
[57] Horizon's Waste Framework Strategy Assessment ML-OTH-02-WFSA (Rev 1.0) see ∞ 4.3.2 and 4.6.1. [RD11] Natural Resources Wales (NRW). 2017. *Scoping of the site characterisation report of Holyhead Deep (ISO40).* Natural Resources Wales Permitting Service comments. 30 May 2017. Ref: SCIS040. Sent via email to Shelley Vince (Atkins)
[58] Horizon's [RD63] 'Site Characterisation Report of Holyhead Deep' referenced in D13 APP-132 doc 6.4.13
[59] Marine Effects Technical Workshop minutes 17th December 2017
[60] Cemlyn Lagoon Technical Workshop minutes 16th January 2018

matter was not being pursued. This is Horizon's maintained position as identified in their Statement of Common Ground with NWWT (NWWT 11).

5.21 As far as the eNGOs are aware no material composition analysis has been undertaken to determine what fractions of the soft sediment may contain re-usable shingle and/or gravels etc. Consequently, there appears to have been no calculation of what storage capacity might be required to supply even local projects. No work has been initiated within the last 12 months by Horizon to investigate other potential opportunities.

5.22 Professor Kenneth Pye has considered these matters (Pye, K & Blott, S.J. 2018a) and observes in his evidence that the volumes of material that might be required in such projects is comparatively small and could be easily planned for (cf below at 5.30).

5.23 Given the acknowledged long lead in times for project development and the gaining of necessary agreements, permissions and/or licences, it is very disappointing that Horizon have chosen not to open discussions on such matters prior to the submission of the DCO within the last 12 months. It will therefore, be unsurprising that 'at some later stage' the conclusion is reached that there is now insufficient time to set-up or identify projects available where beneficial re-use can occur. The lack of any advance planning will ultimately result in Wylfa Newydd's failure to achieve the objectives of national and international policy.

Mechanisms available to meet the policy objectives and manage development risks by the beneficial use of dredged materials

5.24 The eNGO view is that there are a number of ways the *planned* reuse of dredged materials should dealt within the Wylfa Newydd proposal, that would achieve policy objectives, be of benefit to this locality, ameliorate risks from the project, as well as more widely in Wales, these include: -

- Recharge of SAC shingle ridge
- Increased resilience of tern breeding islands within Cemlyn Nature Reserve
- Use in any other Natura 2000 compensation schemes
- Use in other coastal projects

Recharge of the SAC shingle ridge – Esgair Gemlyn

5.25 As discussed in detail within Professor Kenneth Pye's evidence, the eNGOs' are of the opinion that there are significant risks to this feature. This will ultimately have consequences for the conservation objectives of Cemlyn Bay SAC and also to the functionally linked Anglesey Terns SPA. Professor Kenneth Pye indicates that there should be a requirement to monitor the ridge and adjoining areas and a strategy including action options if certain morphological change thresholds are exceeded. Such options should include re-profiling of parts of the ridge and/or islands and intervening channel, if necessary, using reserves of stockpiled marine shingle obtained from the early phases of harbour construction (i.e. the material which will be removed from the location of the proposed MOLF, or simply buried beneath it).

5.26 Any such approach should not be seen in isolation from the need to obtain the necessary permissions from NRW, undertake a Habitats Regulation Assessment and demonstrate policy conformity with the Shoreline Management Plan for this part of the Welsh Coast (Shoreline Management Plan PDZ18 North Anglesey, 2011).

5.27 The Shoreline Management Plan identifies Cemlyn Bay's current condition and management practice as;

- Of importance for its natural history, international designations and geomorphological features along with its value as a tourism feature

- Cemlyn is highlighted as one of the very few areas within the North Anglesey Coast (PDZ18) at significant risk of flooding, the remainder of this coast being identified as at low risk.
- It is identified as an area for managed realignment in the time period to 2025, with acknowledgement that the implementation of realignment may carry over into the second 45 year epoch (to 2055).
- Ultimately the on-going policy of no active intervention will be introduced during the policy plan period within epoch two and up to the third epoch of 2105.
- It is acknowledged that a detailed management plan needs to be developed along with key partners and landowner collaboration. Work has begun between the National Trust and NRW to investigate the way forward on this supported in part by the development of the National Trust's Vision for the Cemlyn Estate.

5.28 The Shoreline Management Plan's approach clearly states that it is premised on uncertain predictors of sea level rise, but most significantly ***without*** the inclusion of any exacerbating factors, such as new flood defence features for development. It is clear therefore, that any increased coastal squeeze resulting from the introduction of the Wylfa Newydd's western breakwater is not included within the Plan's projections.

5.29 It is clear that the principles outlined within the eNGOs' evidence, which assist with managing the development risks and maintaining the conservation objectives of internationally designated Natura 2000 sites could be accommodated without being in conflict with the overarching regional and national (Wales) approach to the management of this coast.

5.30 Calculations of volumes of material that might be required to achieve shingle recharge (Pye & Blott 2018a) have been presented in Professor Kenneth Pye's evidence and are reproduced here for the sake of completeness. His preliminary calculations conclude that: -

> *"64 It was calculated that* ***c. 5100 m3*** *of shingle would be required to achieve the idealised 'target' barrier morphology under present day conditions. The estimated volumes of shingle required to maintain the shingle ridge under different sea level rise scenarios are summarised in Table 4. ……"*
>
> *"…… 66 By way of example, Figure 22 illustrates the option for landward extension of the two existing islands without removal of sediment from their eastern sides. Table 5 shows the volumes of additional sediment which would be required to (a) raise the level of the islands to keep pace with increases in lagoon water level indexed for sea level rise, and (b) to extend the islands landward to the lagoon to match approximately the mid-1920s footprint. To raise both islands by 37.5 cm while retaining the present footprint would require approximately* ***2250 m3*** *of sediment. To increase the area of the Main Island and to raise it by 37.5 cm would require approximately* ***7243 m3*** *of sediment, while a similar extension / raising of the New Island would require* ***5249 m3*** *of sediment."*
>
> [Emphasis added to identify volumes]
>
> Pye & Blott 2018a ∞ 64 and 66

5.31 The capital dredging works for the construction of the harbour (MOLF) will require the removal and disposal of 242,000m^3 (bulked volume; APP-132 doc 6.4.13 ∞ 13.5.29) of superficial soft sediment. Therefore, it can be seen that the volumes that might be used at Cemlyn Bay SAC/Anglesey Terns SPA to achieve mitigation for the Wylfa Newydd proposal's impacts represents a very small proportion of the dredgings to be removed (for example 7243m^3 represents less than 3% of the total volume to be excavated).

Increasing resilience of Anglesey Terns SPA breeding habitat

5.32 As discussed above paragraph 3.215 due to the conclusions of Professor Kenneth Pye there is a danger of not maintaining the conservation objectives of the functionally linked Anglesey Terns SPA from risks resulting from coastal process changes to the islands where the terns breed.

5.33 For only the second time in the Reserve's history work was undertaken in 2017 under grant aid (roseate *Life* project) to increase the breeding capacity of the islands. However, due to the lack of availability of locally derived stone, imported materials from a quarry elsewhere in Wales was used.

5.34 Whilst this import of material and the works were licensed by NRW, a much sustainable outcome could have been achieved if materials from the same Sediment Bed could have been used.

Use materials for other Natura 2000/SSSI projects

5.35 As can be seen in the recent RSPB Report (Ausden et al 2018), there are many opportunities across the UK where the re-use of dredged materials could be considered and promoted within Natura 2000 sites.

5.36 The use of dredged materials has in the past been used on the Dee Estuary helping to maintain and secure breeding and wintering bird habitat at Point of Ayr RSPB Reserve. Material derived from the maintenance dredgings of the navigational channel for Port Mostyn was placed on Talacre Beach to assist with beach nourishment and protection of the SSSI sand dunes and populations of reintroduced natterjack toad.

5.37 At meetings between Horizon, NRW and eNGO[61] a proto-compensation package for Anglesey Terns SPA has begun to be discussed. This like many other tern projects may include the use of materials to raise the profile of land features/islands and to adjust habitat suitability. At the meeting it was indicated that this would involve the use of crushed shell, which would clearly need to be imported for the purpose. However, the use of locally derived shingles, sands or gravel would be a much more sustainable approach.

Use of materials at other sites

5.38 It is well known that 'informal' coastal works are undertaken on an ad hoc basis by landowners to protect their businesses, agricultural land or properties often using inappropriate and potentially contaminated materials. This has been observed around the coast of Anglesey and includes brick, concrete and unconsolidated demolition materials (pers comm. Rod Jones and Ivor Rees NWWT volunteers on the Wylfa Newydd proposals). This type of activity clearly has considerable potential for introducing INNS (Invasive Non-Native Species), destroy habitats by covering natural features and consequences for other habitats by the introduction of sediments and contaminants.

5.39 It is difficult to control or effectively enforce reinstatement of such damaging activities unless alternative mechanisms are available and can be achieved.

5.40 Work is in preparation by NRW has been commissioned for a wider study of the Welsh coast to consider the sustainable management of shingle in areas of coastal squeeze (in preparation Pye & Blott 2018c). The preparation of this report and any accompanying advice notes is indicative of the importance NRW places on this matter.

5.41 Without applying the policy guidelines early enough in the project's design and development will ultimately lead to non-conformity with policy and with lost opportunities to meet objectives of other recognised national workstreams. Consideration of the materials that will be derived and appropriate application of the waste hierarchy at Wylfa Newydd should be undertaken prior to the DCO decision in order to achieve policy requirements.

[61] Horizon presentation at meeting 28th June 2018

Conclusions on the re-use and disposal of dredged materials

5.42 This evidence indicates that there are significant policy drivers which direct the re-use of materials derived from waste streams of construction processes in both the terrestrial and marine environments.

5.43 The Wylfa Newydd Environmental Statement fails to address this and material is used from the Marine Licence application to demonstrate that there has been poor analysis of the policy requirements of the waste hierarchy.

5.44 Despite being raised over 12 months ago by the eNGOs' Horizon relies on an unsubstantiated opinion that there is too little space to store marine derived materials within the WNDA.

5.45 The eNGOs' have undertaken their own analysis of what volumes of material may be required in local projects which would meet policy objectives, manage risks to the Esgair Gemlyn shingle ridge (Cemlyn Bay SAC) and resulting works that could help to maintain the conservation objectives for the Anglesey Terns SPA.

5.46 It is demonstrated that whilst appropriate licensing would be required these proposals are not contrary to the Shore Line Management Plan for this part of the Welsh coastline.

5.47 Additional projects and literature are highlighted which demonstrate the importance of consideration of re-use as part of the waste hierarchy and the contribution it can make to managing coastal squeeze and the conservation of important habitats or breeding/wintering birds.

5.48 Horizon's lack of engagement with this issue and their intended approach of leaving for later decisions and where timings coincide with the identification of third-party projects will ultimately result in no decisions to investigate the re-use of materials and the project's requirement to implement any planned proposals.

5.49 Without applying the policy guidelines early enough in the project's design and development will ultimately lead to non-conformity with policy and with lost opportunities to meet objectives of other recognised national workstreams. Work should have been undertaken to calculate the nature and fractions of materials that will be derived and appropriate application of the waste hierarchy at Wylfa Newydd should have been undertaken at application submission in order to achieve the policy requirements

5.50 In the eNGOs' opinion this is a serious omission which should be addressed at the determination of the DCO and associated Licences so that appropriate Requirements can be placed on the scheme to ensure effective adoption of a planned and phased approach to the re-use of waste materials, as required by policy.

6. Securing mitigation measures through the draft DCO Requirements and controlled documents

6.1 This chapter pulls out the mitigation measures as discussed in the preceding written representation. It discusses the mechanisms that Horizon present for their proposals. It also considers other measures that the eNGOs consider should also be applied. At this stage (Deadline 2) it is provided by way of an initial commentary as it is anticipated that there will be development of this aspect of the scheme as the Examination progresses.

General Commentary

6.2 The 'Newbury Tests'[62] require that planning conditions (or in this case Requirements) are clear, proportionate, related to development, reasonable and enforceable. The proposed mitigation measures have been considered against these tests.

6.3 The use of the CoCP makes it difficult to disentangle separate elements that need to be agreed and discharged by another body (eg NRW and IACC). As Requirements there would be a clear route and legal imperative, which would generally be tied to a single activity.

6.4 The CoCPs are generally written as contractor 'instructions' are therefore apparently not subject to agreement with IACC/NRW. The mechanism by which some items are to be delivered or implemented appears to be left either entirely to the 'agent' (ie the contractor) or an arrangement between themselves and the applicant (Horizon or principal contractor).

6.5 When translated into the Mitigation Route Map the language which is used is often very loose. As an example, item 0613 in relation noise disturbance

"noise levels will be measured at the tern colony either through direct monitoring on the island ***or through calculation from monitoring from adjacent*** **[but unspecified]** ***locations.*** *….*
…..• review works in the area ***likely*** *to be causing the breach and* ***consider any necessary*** *mitigation actions (including* ***if necessary****, temporary suspension of works)……;*
[15th April date to be ***guided by information from the NWWT*** *on when the first terns/Black-headed Gulls* ***typically*** *arrive to set up a colony]."* [Emphasis added]

Mitigation Route Map (8.14 item 0613) in relation to HRA

6.6 In relation to the items within the CoCPs that are necessary to meet the protection of the Natura 2000 sites or UK designated features (eg SSSIs and protected species), it is our view that these should be identified within the DCO as clear separate items that require specific discharge and implementation.

6.7 In making reference to matters below the eNGOs differentiate between items as follows: -

- Included within the application, that is covered by CoCPs or within the Mitigation Route Map
- Included within the draft DCO as a Requirement
- Not currently within the application

Noise and Visual Disturbance Protocol for Anglesey Terns SPA (included within the application but not within the draft DCO)

6.8 Notwithstanding the eNGOs fundamental objection to the proposed mitigation measures and their ability to control impacts on the Anglesey Terns SPA conservation objectives, as discussed in Chapter 3 above (sections 3.32 *et sequel*), we have the following comments to make on how this mitigation is to be secured.

[62] *Newbury District Council v Secretary of State for the Environment (1981)*

6.9 There is a fundamental concern with how these measures from the sHRA are translated into the Mitigation Route Map and only two of the CoCPs (Power Station Sub-CoCP and Marine Works sub-CoCP). It is our view that the measures are applicable throughout the scheme, its construction and actions applied under other works. It should therefore be included within the main CoCP, although the eNGOs do not agree that CoCPs are a sufficient mechanism to achieve control as discussed in the introduction of this chapter.

6.10 The Mitigation Route Map splits the protocol into a large number of items (0613 – 0619), the purpose of which is not at all clear.

6.11 There is not sufficient clarity of what is required and too much flexibility retained by Horizon or its agents to implement as they see fit, for example locations where noise levels will be monitored or if they are to be extrapolated based on levels measured from another entirely different but unspecified location.

6.12 The eNGOs are firmly of the view that any mitigation protocol that may come forward should be made a Requirement under the DCO. As it currently stands the only Requirement relating to terns is the translation of the Site Preparation and Clearance condition into the draft DCO (APP-029 doc 3.1; Requirement SPC5 Article 4), which is missing the appropriate date ranges.

Monitoring of SPA terns during construction (not within the application)

6.13 The eNGOs have considered the merits of introducing monitoring (boat based surveys and ringing) not only as a mechanism to track impacts of the Wylfa Newydd construction, but also and equally as importantly, to provide baseline data on which to base decisions relating to decommissioning of the Power Station, radioactive waste reprocessing and/or any removal of marine infrastructure.

6.14 We would recommend that this is included within the DCO as a Requirement.

Mound E drainage construction and monitoring of Cemlyn Lagoon SAC (included within the application but not within the draft DCO)

6.15 The diversion of drainage from Nant Cemlyn (E1) to Afon Cafnan (E2) and no use of polyelectrolytes is highlighted in the Mitigation Route Map (item 0528) to be achieved via the CoCP (Power Station sub-site ∞ 10.2.10). There is no translation of this work into any form of Requirement in the draft DCO (APP-029 doc 3.1).

6.16 The only agreement that will be sought from NRW is to verify when the risk of sediments is low.

6.17 There is no identified need to demonstrate how the diversion from E1 to E2 is to be achieved. The mechanism of the installation of the diversion equipment, its location, size, pumping/gravity mechanism will fall to a contractor with no control apparently from either IACC or NRW, although a permit will be required to discharge.

6.18 The documents state that no earthworks on the “west side of mound E” will occur until the drainage diversion is in place. However, on the ‘greenfield’ it will not be possible to identify where the watershed for Mound E will lie when construction is ongoing or completed. It is clear that there is not sufficient clarity on this matter. The diversion scheme consequently needs to be in place as soon as earthworks begin within this construction zone (Construction Zone 10). We suggest that if no detail is required before determination, there should be no earthworks within Construction Zone 10, until the detail of the diversion has been submitted and agreed and subsequently implemented. The scheme should be maintained throughout the period of earthworks.

6.19 It is understood (SoCG Natura 2000 meeting November 2017) that additional baseline monitoring within Cemlyn is still to be undertaken to inform thresholds relating to water quality

and flow. There is no recognition within any of the control documents or draft DCO that this is required and that NRW agree that it will be necessary.

6.20 As detailed above in the eNGOs and National Trust's evidence on biodiversity (Cemlyn SAC), Landscape (AONB) and LHMS (biodiversity no net loss) any reworking of Mound E should not occur as it increases risks to the Natura 2000 sites and extends the periods of impacts. Mound E should be created at its final height, slope and contoured form during the initial earthworks period. Soil preparation and remediation should occur so that the revegetated mound is seeded with its final biodiversity grassland specification in the next available season once the earthworks have been completed. Subsequently, management of the biodiversity grassland can begin as soon as the sward has established.

6.21 In the current scheme the eNGOs' do not agree that there is sufficient control over drainage and creation of Mound E to ensure that the conservation objectives of the SAC will not be compromised.

Monitoring and remediation of coastal processes (not included within the application)

6.22 There are no monitoring or remediation proposals in relation to the shingle ridge, Esgair Gemlyn. Professor Kenneth Pye indicates that there should be a requirement to monitor the ridge and adjoining areas and a strategy including action options if certain morphological change thresholds are exceeded. Such options should include re-profiling of parts of the ridge and/or islands and intervening channel, if necessary, using reserves of stockpiled marine shingle obtained from the early phases of harbour construction (i.e. the material which will be removed from the location of the proposed MOLF, or simply buried beneath it).

Recreational Visitor Management Plan (not included within the application)

6.23 As discussed in Chapter 3 (section 3.146 *et sequel*) we do not feel that the Workforce Management Plan provides sufficient control to protect the conservation objectives of the Anglesey Terns SPA, Cemlyn Bay SAC nor Country Wildlife Sites (Trwyn Pencarreg and Wylfa Head and coastal strip). Measures to secure the necessary control of visitors (including on-site residents of the Temporary Site Campus) should be achieved via a Requirement with elements including funding and off-site implementation such as site staff to be linked to a fully developed Section 106.

The Workforce Management Strategy (included within the application and the draft DCO)

6.24 The Workforce Management Strategy is included in the draft DCO as being worked up into a Workers Code of Conduct and supplied to IACC for *information*. The result of this is that IACC will have no part to play in agreeing what the Code of Conduct will ultimately contain and has no powers to enforce the Code of Conduct should it be breached in any manner.

6.25 As indicated in the NWWT discussion at section 3.175 *et sequel* the Workforce Management Strategy is very poor and would rely on third parties for informal policing and any consequences of its lack of application. It is not agreed that the Workforce Management Strategy is sufficient to protect the conservation objectives of the Natura 2000 sites or other non-statutory sites with identified biodiversity interest.

Temporary Viewing Park (included within the application, but not in the draft DCO)

6.26 Horizon have only indicated within the Landscape and Habitat Management Strategy that a Temporary Viewing Park should be provided, its construction appears to be very uncertain and will only commence 6 months into the construction timeline. There are no details submitted and no indication as to who agrees its layout or the provision of facilities it may provide (ie car park, toilets, countryside furniture).

6.27 While the LHMS Chapter 4 is a controlled document, it is our view that the details of the Temporary Viewing Park should be sought via a Requirement under the DCO to be agreed with IACC.

7. Appendices

Appendix 1 Notes from Wardens Observations of the Behavioural Surveys 2017 (D Wilde and D Wright)

Appendix 2 Teresa Hughes observations from the Blast Trials in March 2016

Appendix 3 1st Dates compilation for Sandwich tern, common tern and Arctic tern

Appendix 4 Irish Sea Metapopulation Paper – Joint eNGO research paper July 2018

Appendix 5 Examples of machinery and plant described by Horizon

Appendix 6 Figure 3-18 from APP-225 doc 6.4.89 - Zoomed in to illustrate Construction Zone 10 Harbour (MOLF)

Appendix 7 Phasing Plan from the Marine Licence Application

Appendix 1

JACOBS SURVEYORS OBSERVATIONS

During the 2017 season two surveyors employed by Jacobs, to work for Horizon, arrived to monitor disturbance to the breeding tern colony.
The dates they worked were from approximately mid May to the 25th June.
During that time they stationed themselves on the ridge, by the viewing area. In periods of windy weather they positioned themselves in the layby near Bryn Aber wall, to the west of the lagoon.
At both times they used a microphone to monitor noise disturbance.
Whilst talking to the two surveyors, some concerns have to be raised about their data gathering methods and disturbance observations. (There were many cases of disturbance which were assigned to the right cause however). It did appear generally, that they wanted to give a definite reason for each 'dread' within the colony, and that sometimes it may not have been the correct reason.
Examples of 'wishful thinking' are;
Tractors collecting the silage from the fields around the lagoon.
Trailers of kayaks passing, which would seem to be very unlikely.
Very distant Kestrel, which was not spotted by the warden at the time.
A dog went to the crest of the ridge, which disturbed the Small Island, which neither of the surveyors spotted. The warden had to point this out.
RAF Hawk jets, which usually don't scare the colony, were noted on one occasion.
Rounding up of sheep at a farm beyond Plas Cemlyn, was commented on as being very noisy.

Examples of genuine disturbance noted are;
Buzzard over the colony.
Little Egret flying over the Big Island.
Fulmar! Flying over the islands.
Peregrine attacking the colony.
Sparrowhawk flying across the lagoon which flew into Bryn Aber.

Overall, the period that they were present was a very disturbed time. The terns very constantly up and down throughout the day, probably due to the predation by Otters during the night. The terns were very 'jumpy'. Whilst both wardens were on the ridge, this could mean a dread every 5 to 10 minutes at some times. No reason could be seen for this disturbance on <u>every</u> occasion. The birds quickly settled.
Another point of concern is that, by positioning themselves in the roadside layby, they couldn't see the whole site beyond the ridge, out to sea, or human disturbance on the other side of the ridge. They did seem to be governed by a strict time schedule, rather than choosing the best times for surveying, when they could be on the ridge.
Also, they made no visits at dusk or dawn when there was often a lot of disturbance by Otters. No effort was made to monitor that disturbance, in fact, it came as a bit of a surprise to them when they were told.
PLEASE NOTE: THE ABOVE IS THE OPINION ONLY OF THE WARDENS BY CHATTING TO THE SURVEYORS AND OBSERVING THEIR METHODS. THE RESULTS COLLECTED WERE NOT EXAMINED, TO BACK UP OUR THEORIES.

Dawn Wilde and Dave Wright
29.6.17

Appendix 2

email to NWWT of tern observations during Blast Trials

- "*I observed the birds lifting off on two of the audible blasts (to my ears) across the trial increases in volume. I may have missed some in the earlier trial sequence as I was not on the ridge for the complete time so may have missed some of the inaudible blasts and bird movements.* [This was last of the 2nd set of blasts on 29.3.17, as I was volunteering with NWWT putting up the ridge fence].
- *The birds shot off the island instantaneously in response to the audible blast (to my ears). I cannot emphasis how marked & complete it was compared to other lift offs that may occur. My view was that it was greater than 50%, but I did not have a telescope (only bins [*binoculars*] but had been doing a rough estimate over the time I was on the ridge vantage point).*
- ***The birds did not return immediately or after a short while to the island**; - a number (a handful of small groups) flew off across the ridge/out of the bay, others (the majority) wheeled around the lagoon more widely (ie not just lifting off above the island and then settling back down), **after a short time (a minute or so) the vast majority of birds** (excluding those that had flown off) **landed on the water of the lagoon**.*
- *It took a noticeable amount of time (perhaps several minutes or more) for the birds on the water to slowly begin to move back and settle onto the island*."

Teresa Hughes note of partial observation of blast trials

email to NWWT

Appendix 3

Compilation of Cemlyn Nature Reserve - 1st Dates

Appendix 3 is collation of first dates, which were first gathered together for a NWWT 2005 Report. This covered the period 1983 – 2004 but the table was continued to be updated for Sandwich tern on a yearly basis. The calendar at figure 1 also includes up-to-date Arctic tern and common tern data collated by the author from the 2010 – 2018 Cemlyn Reports.

APPENDIX 1

Table to show first dates for Sandwich Tern 1983-2004

year	First eggs laid	First chick seen	First chick fledged
2017	7th May	14th June	none
2016	2nd May	1st June	27th June
2015	7th May	8th June	
2014	3rd May	30th May	30th June
2013	10th May increase by 350 15th June by late arrivals	3rd June	7th July
2012	5th May increase by 80 20th June by late arrivals	4th June	3rd July
2011	1st May	File corrupted data not obtainable	
2010	1st May increase by 119 11th June late arrivals	28th May	29th June
2009	6th May		
2008	10th May	31st May	By 13th July 3 surviving fledglings left
2007	30th April		
2005	5th May		28th June
2004	2nd May	24th May	24th June
2003	1st May	24th May	25th June
2002	5th May	28th May	27th June
2001	?	31st May	?
2000	?	2nd June	?
1999	1st May	25th May	?
1998	? Early May	1st June	?
1997	? 196 nests by 6th May	? Many visible 2nd week in June	? End of June

1996	?	2nd June	1st July
1995	5th May*	2nd June	25th June
1994	? 100+ nests by 17th May	10th June	11th July
1993	11th May	10th June	10th July
1992	?	6th June	2nd July*
1991	? 69 nests by 15th May	11th June	10th July
1990	19th May	13th June	15th July
1989	15th May	8th June	11th July
1988	?	5th June	2nd July
1987	?	?	? Early July
1986	15th May	5th June	10th July
1985	No report		
1984	? 53 nests by 21st May	13th June	30th June*
1983	?23rd May	? 1st yr 4 st ?	13th July

APPENDIX 2

Table to show first dates for Common Tern 1983-2004

Year	First egg laid	First chick seen	First chick fledged
2004	23rd May	16th June	14th July
2003	14th May	15th June	3rd July
2002	18th May	23rd June	11th August
2001	?	?	?
2000	? 32 by 5th June	All deserted and relayed by June 16th	16th June
1999	27th May	All deserted just before hatching, new nests began hatching 25th July	16th August
1998	21st May	?	?
1997	?	?	?
1996	?41-44 nests by 10th June	24th June	?
1995	? 36 by 19th June	21st June	? only one fledged, no date
1994	First week in June	?	None fledged
1993 *	First week in June	11th June	?
1992	?	Mid June	?
1991 *	3rd June	16th June	16th July
1990 *	?	5th June	?
1989	27th May	20th June	?
1988	68 nests by 26th May	30th June	24th July
1987	Early May	?	?
1986	26th May	23rd June	13th July
1985	NO DATA		

1984	28th May	24th June	16th July
1983	26th May	22nd June	14th June

* = combined counts of ‘commic’ Terns

APPENDIX 3

Table to show first dates for Arctic Tern 1983-2004

Year	First eggs laid	First chick seen	First chick fledged
2004	12 by 11th June	27th June	14thJuly
2003	14th June	3rd July	?
2002	20th May	Failed	
2001	3 nests by 12th June	?	?
2000	?	Failed	
1999	Mid June	Failed	
1998	9th June	Failed	
1997*	51 nests by 17th June	?	?
1996*	44 nests by 10th June	June 24th	July 4th
1995*	36 nests by 19th June	July 4th	?
1994*	20 nests by 1st week in June	?	None fledged
1993*	31st May	20th June	15th July
1992	?	mid June	?
1991*	3rd June	10th June	16th July
1990	16th May	5th June	20th July
1989	25th May	20th June	?
1988	52 nests by 26th May	?	?
1987	?	?	?
1986	26th May	20th June	10th July
1985	NO DATA		
1984	185 Nests by 18th June	25th June	?
1983	26th May	19th June	13th July

* = combined counts of 'commic' Terns

Appendix 4

Joint eNGO paper – June 2018 (updated 2 December 2018)

Irish Sea terns metapopulations dynamics – A case study with specific reference to Sandwich terns and impacts of Wylfa Newydd

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Irish Sea terns metapopulations dynamics – A case study with specific reference to Sandwich terns and impacts of Wylfa Newydd

Summary

The purpose of this paper is to investigate the linkages between the Sandwich tern breeding sites within the Irish Sea and how they function as a metapopulation during the breeding season. This has been done by gathering both field evidence and a review of the evidence from the scientific literature. This research has then been used to consider common themes and the stages that might be required to formulate a compensation package should the assessment of the Wylfa Newydd proposals conclude that there is an adverse effect on integrity, as the eNGO's consider will be the case.

This paper involved site visits to all the relevant Northern Ireland and the Republic of Ireland breeding sites for Sandwich and other tern species. It involved extensive conversations with site managers and investigation of site reports/monitoring records. The paper also considers the wider available literature, the ecology of breeding and the evidence of functional linkages at other tern breeding sites across Europe. It investigates in detail the fate of the birds which deserted Cemlyn during late May and June 2017, until the 24th June when the colony was declared abandoned. It considers where these birds went, whether they attempted to breed elsewhere and what constraints were encountered at other sites. It also considers in brief the subsequent 2018 breeding season.

In summary, it is determined that:

- There is good evidence that breeding terns function in metapopulations, which does not just relate to the dynamics at the start of a breeding season or post breeding aggregations, but that it also occurs during the breeding season. This operates in response to colony pressures and variation in site conditions within and between years.
- There is compelling evidence presented that demonstrates that Cemlyn birds in 2017 dispersed to other known Irish Sea Natura 2000 sites to attempt to re-breed. On the basis of evidence: -
    - 47% of the initial colony of Cemlyn birds were found to have relocated, but approx 1,000 pairs could not be accounted for.
    - Conditions at the other Natura 2000 sites and the ecology of late breeding attempts resulted in the Cemlyn terns occupying sub-optimal breeding locations. However, at all sites studied the relocated birds did attempt to re-breed.
    - However, only a small proportion (250 pairs = 12% approx) of the relocated Cemlyn birds were successful in their second attempts at breeding.
- In 2018, as was expected, there was a low return rate of breeding birds to Cemlyn. A lower than anticipated return rate in subsequent breeding season is a known response to colony collapse.
    - This low return rate was considerably boosted during mid-June (18th/19th June 2018) by a late influx of breeding birds, which were considered to be from a partial abandonment of failed breeders at Hodbarrow RSPB Reserve in Morecombe Bay SPA.
    - The birds that arrived in the late June influx to Cemlyn bred successfully at Cemlyn, which extended the breeding season into mid to late August with the first chick observed to hatch on 15th July.
- Other episodes of late influxes of birds have been observed at Cemlyn and at other Nautra 2000 Irish Sea sites (pers comm. Shane Mousley RSPB, Northern Ireland), but no mechanism has been in place to accurately track this and no previous attempts have been made to correlate abandonments with influxes of late breeders.

- However, the available evidence indicates that there is functional linkage within breeding seasons, which demonstrates that impacts within one of the Irish Sea metapopulation sites could have consequent effects in one or more other of the sites.

The paper goes on to consider potential approaches to compensation, in the event that adverse effects on the Cemlyn Lagoon tern colony cannot be ruled out; starting with potential on-site measures, before considering approaches to off-site compensation at other existing Irish Sea metapopulation sites, and finally considering the creation of new sites. The paper highlights, however, that few examples of attempts at colony creation exist and that the outcomes are considered very uncertain with a high degree of experimentation.

The paper proposes a staged approach, as follows:

Step 1: Measures taken to sustain the on-site breeding tern population at Cemlyn Bay and within the wider Anglesey Terns SPA. Consideration should be undertaken of the on-site capacity for compensatory measures, taking account of the current condition of the SPA features (on-site measures must be able to demonstrate "additionality" to that which is already required to ensure the protected area is restored to or maintained at favourable condition), potential impacts on other qualifying features of the SPA and/or other site designations, and, of course, the potential for the compensatory measures to be impacted by the development proposals. On-site measures must also be in addition to the mitigation and avoidance measures (embedded or additional) that have already been identified via the EIA/HRA process. Given the inherent limitations of on-site 'compensation' of this kind, it is highly likely that any such proposals will need to form part of a suite of measures including off-site compensation as described below.

Step 2: Analysis of the Irish Sea metapopulation dynamics to explore and incorporate compensatory measures off-site at *current* tern breeding colonies. There is a gradual movement within conservation practice from site-based conservation towards regional management of populations[1]. This approach to regional and metapopulation conservation is also reflected in the conservation objectives for the Anglesey Terns SPA, which requires that: "*The range and distribution of terns within the SPA and beyond is not constrained or hindered*". However, as with on-site compensation (see Step 1 above), where off-site colonies also lie within designated sites, careful consideration must be given to demonstrate additionality and to ensure that existing qualifying features of the designated sites are not adversely impacted.

Compensation at current tern colonies within the wider Irish Sea metapopulation was suggested as an avenue of investigation in the May 2017 eNGO Ecological Options paper, but to date has not been taken forward by Horizon. The eNGOs consider this to be a serious omission in the development of a robust compensation proposal.

Step 3: Investigation of creation of new tern breeding sites. While proposals for the creation of new breeding colonies of Sandwich and other tern species are welcome, the creation of entirely new colonies presents significant levels of uncertainty, and it is therefore the collective view of the eNGOs that such proposals should only be advanced in combination with measures to compensate for the impacts on-site (i.e. within the existing SPA) and/or within the wider metapopulation network. At the time of writing (December 2018) this is the only compensatory mechanism that is apparently being investigated by Horizon.

In considering scientific, legal and policy factors, the paper sets out the case for greater consideration of a regional, or "metapopulation", approach to the identification of potential tern compensation sites. The paper identifies a number of key criteria, which might be required when considering the characterisation of compensation sites. A number of 'additionality'

[1] Cabot & Nesbit 2013 New Naturalist Series – 'Terns' Chptr 11

measures are suggested that could be considered within the Irish Sea Natura 2000 sites along with a list of sites that could be considered for new colony establishment.

1. Introduction

This paper has been produced as part of a sequence of analysis undertaken jointly by the National Trust, North Wales Wildlife Trust and the RSPB (the environmental NGOs or 'eNGOs') in response to the Wylfa Newydd DCO application and preapplication process. It specifically concerns the internationally important tern colony located within Cemlyn Nature Reserve (designated as part of the Anglesey Terns SPA, Cemlyn Lagoon SAC and Cemlyn Lagoon SSSI) and the approach to compensation of potential adverse effects on the colony as a result of the Wylfa Newydd proposals.

This paper should be read in conjunction with the following additional information:

- The Written Representation for Deadline 2 of the DCO Examination (joint eNGO submission, 4 December 2018)
- Ecological Options Report (joint eNGO discussion paper, May 2017)
- Additional evidence submitted to the Wylfa Newydd Examination by the eNGOs

The eNGOs have been engaged with Horizon on the Wylfa Newydd project since the start of the pre-application process in PAC1. Over this time, we have consistently challenged the *no adverse effect on site integrity* (AEOI) conclusion drawn by Horizon, and have provided advice and offered solutions to avoid, mitigate or compensate for impacts as appropriate.

At the time of the DCO submission (1st June 2018), despite the view of Natural Resources Wales (NRW) and the eNGOs that there is considerable scientific uncertainty in the conclusions of the shadow Habitats Regulations Assessment (HRA), Horizon maintain their view that there will be no AEOI. Notwithstanding this, in Spring 2018 Horizon indicated that they would consider a compensation package for Cemlyn Nature Reserve, which may be tabled during the DCO process if required by PINS, in response to NRW's conclusions that AEOI cannot be ruled out beyond reasonable scientific doubt.

This paper aims to support and inform the process of identifying a suitable compensation package by drawing on available scientific understanding of tern ecology, behaviour and population dynamics before making a series of recommendations.

The paper first considers the status of Cemlyn Nature Reserve as a breeding colony and its relative position and contribution to the Irish Sea metapopulation. An examination is made of the Cemlyn colony's collapse in 2017 and the fate of the birds that abandoned the site, in order to help understand the interaction of the site with other breeding colonies in the Irish Sea. The paper goes on to consider the wider available scientific literature on metapopulation dynamics and tern breeding behavioural ecology, in order to inform a brief discussion on the prerequisites that are likely to be needed to establish a new colony. Options are also identified from Irish Sea site visits, to consider actions that could be taken to increase breeding capacity at these sites.

It should be noted that, due to the nature of the populations at Cemlyn Nature Reserve this paper has a focus on Sandwich terns, their colony ecology and population dynamics. However, although present in smaller numbers at Cemlyn Nature Reserve, equally relevant to the compensation requirements are the three other species of terns (common, Arctic and roseate), which also form part of the Anglesey Terns SPA population and the conservation objectives for

the site. It should be noted that roseate terns have not bred at Cemlyn Reserve for a number of years but that *Life* Project funding is currently focused on redressing this.

2. Tern Ecology, behaviour and population dynamics

2.1 Cemlyn Nature Reserve history & position in Irish Sea metapopulation

Cemlyn Nature Reserve has a recorded history of regular breeding Sandwich terns since the early 1970s[2] with nearly 50 years detailed observations. Since the early 1980s the colony has had a stable history of breeding with few colony collapses and a trend of increasing numbers and productivity. The most significant historic failure in breeding took place in 2007/2008, when it took several years for the colony numbers to recover. This was due in part to predation by a small number of herons and the presence of geese on the islands. However, there has been a general upward trend over a considerable period for the Cemlyn Sandwich tern colony.

The graphs below (figures 1 and 2) show the population trends for Cemlyn, in relation to counts from the other major breeding sites in the Irish Sea. It can be seen that Cemlyn contributes a significant proportion of the breeding population within the Irish Sea sites.

Since recovering from the partial colony collapse in 2007 and the following 10 years, Cemlyn has become the most significant breeding population of Sandwich tern in the Irish Sea regional metapopulation, holding as much as 33% of the Irish Sea population in the 5 years, up until the colony collapse of 2017. This, in an era which has seen the rising population of Irish Sea populations[3] in contrast to slightly declining population trends across the remainder of Europe and eastern UK[4].

[2] R. Lovegrove, G. Williams & I. Williams 1994 'Birds in Wales' T & AD Poyser Ltd

[3] Lady's Island Lake annual bird report 2010

[4] reports of JNCC SMP for the remainder of UK & Europe

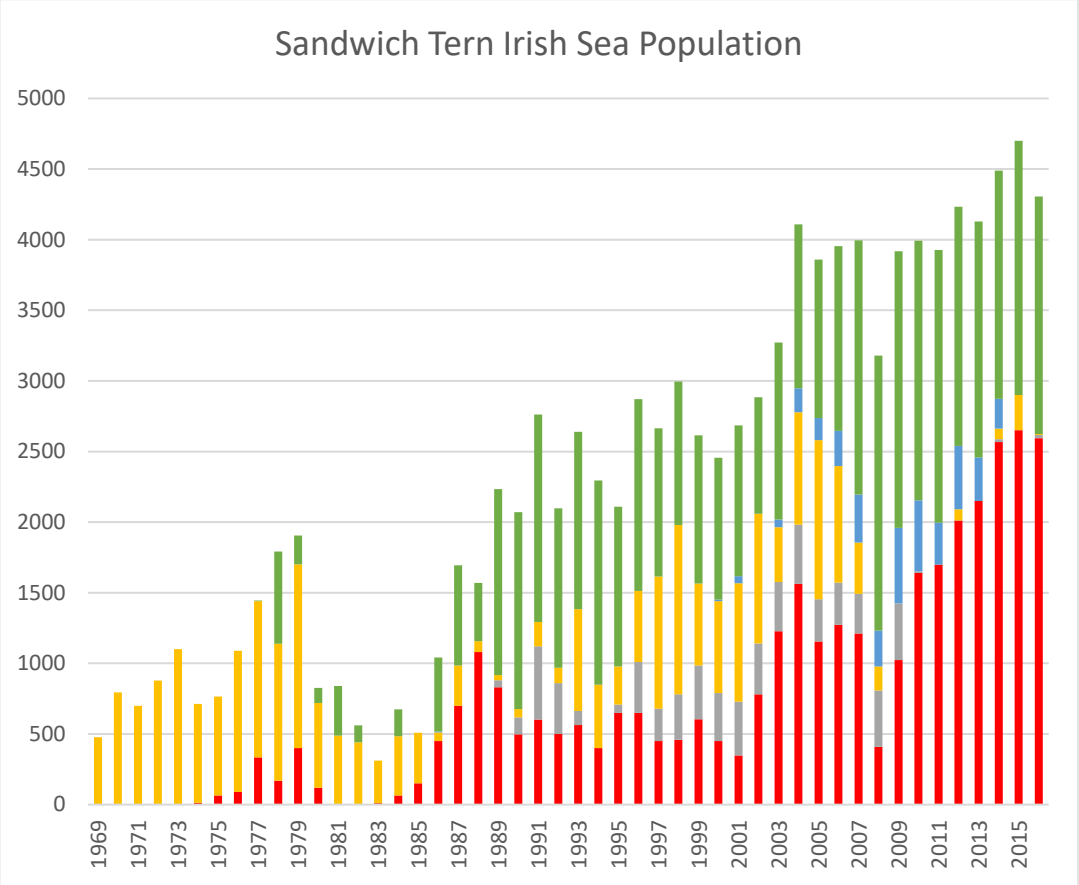


Figure 1. Irish Sea Sandwich tern population changes 1969-2016 (key in Figure 2 below)

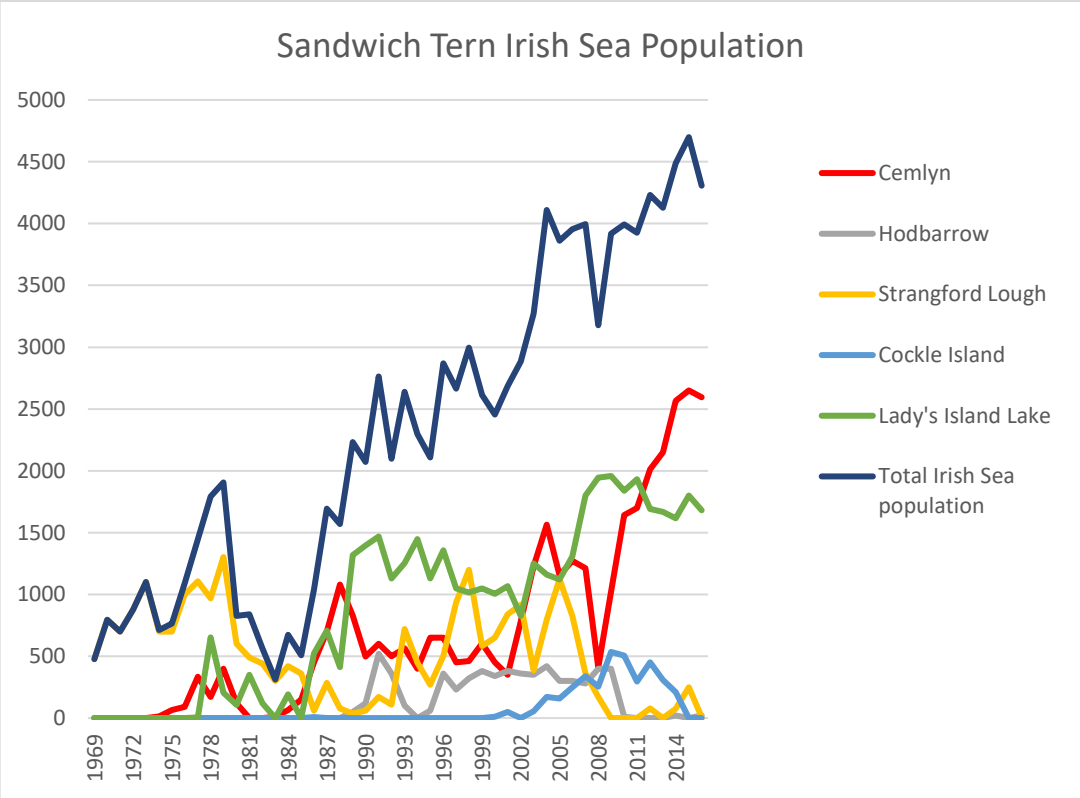


Figure 2. Sandwich tern 'apparently occupied nests' by year 1969-2016

2,2 Cemlyn Nature Reserve 2017 colony collapse

During the 2017 breeding season, after more than a decade of stability and over 50 years of supporting tern breeding, the tern colony collapsed at Cemlyn. Increasing agitation and hypervigilance of the colony resulting initially from predation by otter caused birds to abandon the site. The small island abandoned by 20th June and effectively no breeding birds (tern species or black-headed gulls) remained following June 25th. The wardens reported that the hypervigilance became more extreme as the season progressed and that the colony behaviour was very abnormal, allowing other mammalian and avian predation to extenuate their response. Night time predation was a particular feature and it was noted that the colony was abandoned overnight on several occasions.

Whilst this was a catastrophic event for Cemlyn, it provided an opportunity to consider the dynamics of the Irish Sea metapopulation and evidence was collected by the wardens and the Conservation Manager (Chris Wynne) during the breeding season[5]. This evidence gathering was extended by the North Wales Wildlife Trust after the end of the season, with evidence compiled from interviews and site visits to Northern and Southern Ireland in February 2018 and from the relevant bird reports of the Irish Sea reserves. The field-based evidence can be summarised as follows: -

- Compelling evidence was initially collected during the 2017 breeding season from close dialogue between Hodbarrow RSPB Reserve and Cemlyn, which identified an influx of 250 pairs of Sandwich tern to Hodbarrow on 25th June as coinciding with the final abandonment at Cemlyn just a few days before. These late birds established a discrete sub-colony that hatched 175 chicks, the majority of which fledged. This influx also coincided with a max count of 1,200 adults "in attendance" on 25th July (RSPB Hodbarrow, Little Tern Newsletter - March 2018). While the Hodbarrow influx birds bred successfully, they represented only 12% of the colony that was originally established at Cemlyn, and their offspring represented only a very small proportion of a normal year's expected outcome.

- Sandwich terns totalling 550 pairs arrived as late breeders in Strangford Lough (Northern Ireland) establishing nests on islands, which were not already occupied or habitually used in recent years by breeding Sandwich terns. This included two islands within the lough (Gabbock – 150 pairs, Sheelah's – 300 pairs) and one outside in the Outer Ards (Portavogie – 100 pairs). All these breeding attempts failed either due to sub-optimal habitat occupation (habitat structure or washed out – Portavogie), and/or predation (principally otter but also corvids) because late breeding pairs did not benefit from predator protection of main colony. These Sandwich terns arrived in three waves from the late May count through to 18th June 2017, which coincides broadly with colony declines within Cemlyn.

- At Lady's Island Lake (Southern Ireland) a further 110 pairs arrived during mid-June before censuses on 25th & 28th June and established sub-colonies (west Inish – 41 pairs & Sgarbheen – 69 pairs) away from the main colony on Sgarbheen, where birds were on eggs earlier in the season. It is thought safe to conclude that these birds were also from Cemlyn as no other sites in this region had reported 'losses' of pairs (Tony Murray, National Parks and Wildlife Service pers comms). These late nesting birds did not fledge any young as they were predated – mostly by corvids – due to lack of sympatric protection from the main colony birds and black-headed gulls on Sgarbheen for those birds that nested on Inish. In addition, once fledged the adults and juveniles habitually move from the main colony at

[5] Cemlyn Reserve Wardens Report 2017

Sgarbheen to the lough's edges which leaves any late breeders or remaining pairs with less predator protection.

- In total it can be reasonably concluded from the evidence gathered that 900 pairs (47%) of the Cemlyn birds can be accounted for, of what had been estimated to be 1,980 pairs that were first counted settling at Cemlyn as the breeding season established. This leaves several unanswered questions in that it can be deduced, from the previous year's figures, that approx 600 pairs did not return to Cemlyn at the beginning of the 2017 season, representing nearly 25% decline over the previous year's figure. This may be due to many reasons relating to wintering habitat disruption or from fatalities during migration. However, that leaves approx 1,000 unaccounted for pairs, which abandoned the Cemlyn colony during 2017 and apparently did not breed elsewhere in the Irish Sea.

- There is some evidence that Sandwich terns will cross land bridges during post breeding dispersal (the neck of Scotland) and also across Ireland to gather in post breeding aggregations prior to migration (Tony Murray, National Parks and Wildlife Service pers comm), in a similar fashion to other waders and wildfowl. Whilst there is strong evidence that the east British coast birds interchange with western continental Europe, there appears to be little to no evidence presented in the literature to show exchange between east and west coast UK breeding tern populations. The loss of 1,000 prs of breeding adult birds from the Irish Sea metapopulation is significant, but accords well with the behaviour pattern observed as a result of other colony collapses (see discussion below). Therefore, the unaccounted for Cemlyn birds will probably not have bred in 2017 and may not do so in 2018 or for several subsequent years. This could represent an approximate 20% reduction in the Irish Sea regional population[6].

- In 2018 there was an extremely slow start to the season, due in part to the poor weather in later March ("the Beast from the East"), with only 20 individuals present by 15th May. As was anticipated, due to the previous year's colony collapse, the established colony held low numbers (approx 600 – 800 individuals) up until a large influx of over 1,500 individuals overnight on the 18th June. These birds were attributed to an arrival of failed breeders from Hodbarrow. A proportion of these arrivals established approx 200 new nests, with hatching of chicks starting from the 15th/16th July. In 2018 the estimated total of apparently occupied nests (AON) was 519, so the late influx of adults increased the breeding colony by nearly 40%.

2.3 Scientific understanding & evidence of metapopulation dynamics

The earliest evidence of Sandwich tern regional metapopulation interactions between a suite of sites was first reported in 1922 between the north Norfolk colonies at Scolt Head, Blakeney Point and Salthouse Marshes[7]. Other well-documented events of colony interaction occur in scientific literature. For example, the 1965 poisoning of European Sandwich tern populations, and the subsequent population recovery involving interchange and emigration of east coast British terns to supplement the depleted European colonies, as well as more recently in the

[6] 1000/4500 * 100 = 22% equates to birds unaccounted for at Cemlyn/estimate of overall population from graph as percentage

[7] Cabot & Nesbit 2013 In Chptr 5, Cramp et al 1974 The Seabirds of Britain & Ireland Collins

work on Dutch & Belgium sites[8]. This phenomenon has in recent years been confirmed by detailed ringing studies[9] of common tern and roseate tern[10].

It is clear that historically, terns have utilised a sequence of sites in relatively small/moderately good numbers, depending on the species. This resulted in colonies of birds within an environment that provided the ability for birds to move around a geographical area in order to breed at a selection of 'known' sites when those sites were in optimum ecological condition. However, regional populations are now reliant on an ever-diminishing number of 'super colonies'. For Sandwich tern this is shown by the significant reduction of colonies in Britain & Ireland between the 1980s (*Seabird Colony Register,* 1985 – 1988) and the 1998/2000 (*Seabird 2000)* censuses where, during this 20-year (approx) period, there was a 56% loss of colony breeding sites (33 colonies lost) and colonisation of only 9 new/historic sites[11]. In ecological terms this results in less flexibility for adaptation and more danger of localised extinctions and/or major population fluctuations with inherent knock on consequences for other colonies.

In Sandwich tern ecology it is well recognised that the "*breeding colonies can change quite dramatically with established colonies disappearing and 'new' colonies springing up unexpectedly*"[12], which reflects the habitat preferences of this species that has been described as follows:

"*Nesting habitat is highly dynamic and has been described as resting 'on a knife-edge between erosion and succession'. Nesting habitat or entire breeding sites can be lost to erosion by winter storms or become overgrown with rank herbage or scrub*"[13]

It could be argued, that this evolutionary demography and behavioural approach of Sandwich terns has sustained the current population levels and would continue to be sufficient to maintain the regional Irish Sea metapopulation and the importance of the British and Irish population as a whole[14]. However, this strategy is not without its ecological consequences to individual birds and the fate of breeding colonies, as discussed in detail below. In the current climate, where human induced impacts are more prevalent, there is further and increased pressure on these populations at both a local and international level. Therefore, where there is a justifiable reason to consider this (eg Habitats Regulations Assessment), the risks and consequences of inaction are unacceptable.

The following section considers the detailed ecology underpinning our current understanding of metapopulation dynamics and the demography of regional tern populations.

[8] Stienen et al 2005 Herrier J.-L., J. Mees, A. Salman, J. Seys, H. Van Nieuwenhuyse and I. Dobbelaere (Eds). 2005. p. 381-392 '*Proceedings Dunes and Estuaries 2005*' International Conference on Nature Restoration Practices in European Coastal Habitats, Koksijde, Belgium, 19-23 September 2005

[9] Noble-Rein 2002 Chptr 4 #7

[10]

[11] Ratcliff N et al 2004 'Seabird Populations of Britain & Ireland', Poyser

[12]

[13] From Brown & McAvoy 1985 Nesting terns of Strangford Lough 1969 – 84 Irish Birds **5**, 33 – 47. The importance of this view was affirmed via discussion pers comm with Andrew Upton, Hugh Thurgate - Feb 2018. See also later discussion below.

[14] Cabot & Nisbet Chptr 7 – compilation of Seabirds of B& I and JNCC analysis – the population of Sandwich tern Britain & Ireland represented 30% of total European pop and within that the Irish Sea population was 24% of the total B&I. Do we want to use these figures or update them?

Effects of colony collapse

Individual colony site managers (Chris Wynne, Cemlyn 2007 – 2010 and Ajay Tegala, Blakeney Point pers comm., Shotton colony and common tern[15]) report that when there is a full or partial colony collapse during one season it then takes several years to recuperate from impacts and rebuild colony 'confidence' in a breeding site. Analysis of the site records and population analysis[16] reflects this (see above figures and discussion of Cemlyn Nature Reserve). It is known that if this occurs over several seasons in close succession it can eventually lead to abandonment of the site.

There are a number of demonstrable ecological and behavioural mechanisms at play in this, which all have population consequences:

Recovery time following colony collapse – It has been shown that following a collapse of a colony there is a delay of several years before a site is colonised/recolonised and apparently during this period the adults do not breed[17]. This temporary suppression of the adult breeding population can result in reductions of more than 1,000 pairs birds for two or more seasons (see discussion on Cemlyn Nature Reserve).

Chick survival rates of late laying birds – Birds that have been displaced due to colony collapse that do relocate to a different breeding site will be arriving after the normal arrival times of the 'resident' breeding population. Birds that lay earlier have been shown to raise more and healthier chicks, the same was found to be apparent with older more experienced breeding birds, which also have a higher tendency to lay early in the season[18]. Therefore, displaced birds are likely to have lower breeding success rates than birds forming part of the established colony.

Ecology of re-laying – It has been shown that when terns either lay multiple clutches or are forced to re-lay, the second or subsequent clutches contain fewer eggs and eggs with lower weight (i.e. not providing as much food to the unhatched chick) as those in the 1st clutch. Where the 2nd clutch has been prompted by a colony collapse after the abandonment of the first, this leads to fewer chicks and ones which will have a lower prognosis for survival, and their probability of entering the breeding population is also likely to be low[19]. There is a significant decrease in productivity of the adult birds, even in mature experienced breeders; where re-laying early in the season occurs, all of the birds may be observed to re-lay, but the decrease in productivity becomes more pronounced when the need to re-lay occurs later in the season[20]. (See discussion re productivity of Cemlyn birds prior to colony collapse).

The fitness of adult breeding females on re-laying – Although there is little research literature into the survival or causes of death in adult birds, it has been conjectured that there is a physiological impact of re-laying. This may be particularly prevalent in female Sandwich terns where a single egg may be up to 12% – 16%[21] of the adult female's body weight and a clutch

[15] Merseyside Ringing Report celebrating 50 years https://www.merseysiderg.org.uk/50th%20Anniv%20report%20-%20composite.doc

[16] As 7 above figure 87

[17] Ratcliffe 2004

[18] Nisbet et al 2002 Test for age-specificity in survival of common tern Journal of Applied Statistics, **29**, 65 - 83

[19] Cabot & Nisbet 2013

[20] Wendeln & Becker 2000 Parental care of replacement clutches in common tern Behavioural Ecology & Sociobiology **47**, 382 - 92, Becker & Zhang 2011 Re-nesting of common terns in the life history perspective Journal of Ornithology **123** (Supplement 1), 213 - 25

[21] Cabot & Nisbet 2013 Table 5

of one/two eggs followed by a re-lay of 1 egg can represent between 33% – 50% [12]of the female's body weight.

The 'information centre' or collective memory of breeding sites – There is a general consensus in the literature and from site observations that terns have a spatial memory (an 'information centre') particularly for feeding/foraging but also for nesting sites. However, studies in common terns and roseate terns have shown that there may be two factors at play. Firstly, pre-breeding young birds will frequently visit their natal (birth) site during the breeding season and will principally establish their first breeding attempts at this site. If other sites are chosen, they are in relatively close proximity to their birth sites. Secondly, a study has shown that the substantial minority of birds that do not settle at their natal sites are more than likely to establish at sites where the previous year was a successful breeding year[22]. A study of colour-ringed birds at Lady's Island Lake is hoping to shed more light on this for Sandwich terns, but this project only started in 2015, so it is too early to elucidate any information as this species will on average breed in its 3rd year (Tony Murray National Parks and Wildlife Service, pers comm.).

Longevity of a population's 'collective memory' – This does not appear to have been well studied or determined. However, sustainable recolonisation of 'historic' sites appears to be rare. Two examples are discussed further below in the case studies; Keeragh Island in Ireland and Minsmere RSPB Reserve.

A colony collapse midway through the season has consequences both for re-laying birds as discussed and for the sites that receive them. As indicated by Cabot & Nisbet (2013), the breeding tern populations in Britain & Ireland "*today are on life-support systems under intensive management schemes and protection from an array of natural and man-made problems*". This is reflected world-wide with the Vice President for bird conservation in the Audubon Society stating that USA terns have become 'wards of the state'.

Fate of displaced birds

In this predicament and with limited resources, conservation effort of site managers is rightly focused during the breeding season on the knowledge of the breeding dynamics of their sites, with effort applied to ensure that the normal 'resident' breeding birds have optimum habitat and security when they return at their normal time. Despite the best efforts and dedication of site staff, if there is an arrival of unexpectedly displaced adult birds from another colony there are three key ecological parameters that may affect the success rate of the late breeding adults and any eggs, chicks or juveniles that might result:

Breeding habitat availability within the site – The different species of tern are ecologically partitioned by breeding habitat requirements; with little terns at one end having a preference for open bare ground, through to Sandwich terns which utilise sparsely vegetated areas with some bare ground, Arctic/common favouring partly vegetated sites and roseate occupying rocky or quite densely vegetated areas (even on occasion nesting under tree mallow)[23]. Site management is targeted for specific species and often these areas may be either small, managed in rotation or have no management activity beyond monitoring. In these circumstances there is a significant risk that only sub-optimal habitat is available for late-

[22] Dittman 2005 this is also evidenced by a theoretical approach represented in Donchin & Wagner 1997 The evolution of coloniality.

[23] As observed at Coquet Island in Northumberland

comers or displaced birds to breed in (see below discussion re Lady's Island Lake and Strangford Lough).

Vulnerability to predation – this may express itself in a number of ways: -

- Displaced birds may not have any option but to attempt to breed outside of any erected predator fencing or outside the zone which may be monitored by wardens. This is particularly relevant for nocturnal predation to which all tern species are very susceptible and have no deterrent mechanism except to flee the colony temporarily at night.
- Ecologically late arriving/displaced Sandwich terns will not benefit from the well-known close sympatric association with nesting black-headed gulls[24], as this species may have almost completed their breeding cycle and therefore be less vigilant in predator deterrent.
- Displaced birds/late breeders of any tern species may not benefit from the 'safety in numbers' of other breeding terns, including more aggressive defenders such as common or Arctic tern. This is particularly so if the resident terns have large chicks or even juveniles, as the adults are less assiduous in their defence and may also move their off-spring to other parts of the colony (see discussion re Lady's Island Lake below). Therefore, there could still be increased susceptibility to predation.

Increased competition for space and impact on productivity. There are some as yet untested suggestions anecdotally (Shotton & Liverpool docks[25]) that increased populations reach a natural carrying capacity; whilst the population numbers of breeding pairs of adult continues to rise at a colony the productivity of the site reduces as assessed by the number of chicks counted.

The preceding field-based evidence and the review of the literature of breeding ecology and functional linkage between metapopulations is used to inform the discussion below on what a compensation package might comprise.

3. Creation and re-establishment of tern colonies

3.1 Case studies of other attempts to establish new colonies or re-establish breeding at historic sites

There are few examples in the literature documenting where attempts have been made to create new sites or re-establish previously used sites. It is clear from the limited available information that success has not been consistent. The examples below briefly consider the conditions and methods used (if known) to attract breeding terns and comments on their success.

- **Keeragh Island (Republic of Ireland)** – When islands in Wexford Harbour got washed away, the resident tern colony re-established on Lady's Island Lake. Due to perceived conflicts in land use at the time, the National Parks and Wildlife Service tried to improve and attract the birds to breed instead at Keeragh Island, which had been a historic breeding site for several species of tern including Sandwich tern. This work which was undertaken over a period of years (1985 – 1989), included the use of lures, broadcasting tern calls, habitat and predator-elimination works along with seasonal wardens (Ben Stammers NWWT pers comm – warden at the time on Keeragh). Efforts to attract the terns to Keeragh were not

[24] Steinen 2006 Living with gulls: trading off food and predation in the Sandwich tern Alterra Scientific Communications, University of Groningen Netherlands

[25]

successful (over a 5-year period)[26] and instead the National Parks and Wildlife Service made the decision to instead put effort into wardening etc at Lady's Island Lake, which started the current regime of well-focused management and conflict resolution with adjacent land owners and users.

- **USA Roseate tern[27] –** Projects at 20 sites to attract roseate terns were only successful in 4 cases, although most did successfully attract breeding common tern. Whilst this species does not have the same ecological habitat requirements, in many other respects it has similar attributes to Sandwich tern ecology. Its inclusion here serves to indicate the variable success rates that exist where attempts to attract tern species have been undertaken.
- **Larne Lough Ireland (Northern Ireland) –** Blue Circle Island was created in the 1970s to dispose of dredged materials, but it was specifically designed to be suitable for breeding terns. The new island was quickly colonised by both common and Sandwich tern[28]. The lough was already being used by a breeding colony of tern species (common & roseate) on Swan Island less than 1km away[29]. This colony has subsequently been maintained and managed by the RSPB.
- **Zeebrugge (Belgium)** – At Zeebrugge Port attempts to create habitat in compensation for the loss to development of existing breeding habitat have only been partially successful and have not been sustained consistently due to poor site choice and predation problems. It should be noted that one of the prerequisites in this case was to create new sites within the Port, which has high levels of development (Stienen 2006).
- **Minsmere –** Minsmere (RSPB Reserve) was an historic breeding site with regular breeding of Sandwich terns until 1978. Since that time Sandwich tern have only bred very rarely with only two known instances; in 2009 due to an influx of failed-breeders of north Norfolk birds and in 2017[30]. Sandwich terns do 'drop into' this largely abandoned historic breeding site during passage. However, despite this and appropriate management that has been intensively undertaken over the intervening period of time, it has not possible to re-establish a sustainable breeding colony of Sandwich tern. This is despite the presence of a well-established breeding black-headed gull.

Few firm conclusions can be drawn from these available case studies. But it is clear that even with considerable effort, such as that shown at Keeragh and Minsmere, projects to establish/re-establish breeding tern colonies may not be successful. Where some degree of success has been shown, the length of time needed to achieve that success has been several seasons.

3,2 Consideration of opportunities within the existing Irish Sea breeding sites

From the site visits in February 2018, it is clear that there are a number of sites within the Irish Sea which were key in accommodating Cemlyn Nature Reserve birds following the colony collapse in 2017. These sites were: -

- Hodbarrow RSPB Reserve (Cumbria)
- Strangford Lough and other islands within the SPA (Northern Ireland)
- Lady's Island Lake (Ireland)

As discussed above, the second breeding attempts of the Cemlyn birds had a variable degree of success due to occupation of sub-optimal habitat or other factors. During the field-based

[26] New Naturalis description pg 312 also Tony Murray's power point on Wexford Island
[27] original paper US Fish & Wildlife Service 2010
[28] Cabot & Nisbet 2013 pg 312
[29] Operation Seafarer (1969-70) in Collins Seabird populations 1974 for records of other species.
[30] Hyperlink to RSPB Minsmere new report

research site managers identified that a number of positive actions could be implemented to build the breeding carrying capacity of the Irish Sea breeding sites and provide a greater resource of optimum breeding habitat. Initial ideas from site managers have included: -

- shingle reinforcement for the breeding island Carlingford
- habitat management to realise ecologically optimum island habitat at Strangford
- works to increase ecological carrying capacity at Hodbarrow and Foulney
- Island creation or managed realignment at Strangford and/or Carlingford
- Strangford Lough greater predator control
- Coordinated education program to work with other recreational users within Strangford Lough
- Strangford Lough – adopt outcomes and recommendations from the productivity study being undertaken in 2018 by Shane Mousley
- Lady's Island Lake increased capacity for habitat management to increase capacity and potentially reintroduction of winter grazing.
- Lady's Island Lake increased predator control efforts for rats and corvids, but also trapping of biodiversity species eg hedgehog. The development and supply of a standard predator kit for all colonies (basis that predation is one of the key factors that makes disturbance reach a critical mass and this can be controlled on site where as other pressures can't). Something that the Roseate Life Project has raised.

All proposals would need further careful consideration in order to ensure their suitability for the implementation of compensatory measures. This will need to consider the test of 'additionality', if necessary, and any other conservation objectives for other habitats or species for which they may be designated.

In addition to the creation of new sites and increasing the capacity of existing sites, there is also merit in considering the restoration of sites which have become unsuitable due to habitat changes/succession, predation or similar changes. This may include some of the techniques/actions that have been identified as suitable for the Irish Sea sites. However, where such sites form part of an existing SPA feature, it may be difficult to demonstrate 'additionality' as a result of the restoration.

3.3 Review of ecological parameters for establishing 'new' breeding colonies

From observation of the ecological parameters in existing colonies and in light of the understanding of Sandwich tern breeding behaviour from the literature, any attempt to establish a colony will require a critical set of conditions and other key considerations:

- Presence of coastal islands – as discussed above Sandwich terns almost exclusively nest on island habitats and the only examples of inland sites occur in Ireland.
- Presence of breeding black-headed gull – for the beneficial sympatric relationship providing predator protection.
- Elimination of existing predators, especially nocturnal ones such as mink but also otter. Control of avian predator species. Information should inform the baseline site selection using, for example, Local Records Centre (Cofnod) data on distribution of key predator species.
- Presence of species-specific optimum habitat conditions for the target species. As discussed above, each tern species has a preferred habitat in which they nest, with little tern preferring the most open bare habitat, through to roseate that use established vegetation. Note, there may be long lead in times once suitable habitat has been created as observed

in the Minsmere case study; The Scrape was created in 1959/1960, common terns colonised 1962 and Sandwich tern not until 1965 (4 breeding seasons later).

- Proximity to known areas used by Sandwich tern either existing breeding sites or areas where pre/post breeding aggregations occur. This is necessary in order that the new sites are within a range where they can be 'discovered'.
- Any new sites that are created will also need to consider any existing nature conservation designations or land use and the requirements to undertake an HRA or acquire other permissions or permits. If sites are to be created within existing SPAs then the matter of additionality will need to be addressed as well as not impacting the conservation status of the designated species and their supporting habitats.
- Mechanisms to sustain the new breeding site in perpetuity post-construction will need to be in place. This is not a temporary measure and, as demonstrated above, breeding tern colonies need substantial support to ensure their continued suitability.
- Establishment of a detailed monitoring programme to monitor effectiveness. A colour ringing project similar to that which has been implemented at Lady's Island Lake may be a useful model to consider in this case.

The appendix at the end of this paper includes a first long list of existing and potential sites known by National Trust, North Wales Wildlife Trust and the RSPB, and considers them against the pre-requisites identified above.

4. Hierarchy approach to compensation

It is the eNGOs view that any compensation package should take a three staged approach to the requirement to maintain the integrity of the Natura 2000 network. We set out this approach below:

Step 1: Measures taken to sustain the on-site breeding tern population at Cemlyn Nature Reserve and within the wider Anglesey Terns SPA. Consideration should first be undertaken of the on-site capacity for compensation, taking account of the current condition of the SPA features (on-site compensation must be able to demonstrate "additionality" to that which is already required to ensure the protected area is restored to or maintained at favourable condition), potential impacts on other qualifying features of the SPA and/or other site designations, and, of course, the potential for the compensatory habitat to be impacted by the development proposals. On-site compensation measures must also be in addition to the mitigation and avoidance measures (embedded or additional) that have already been identified via the EIA/HRA process. Given the inherent limitations of on-site compensation, it is likely that any such proposals will need to form part of a suite of measures including off-site compensation as described below.

Step 2: Analysis of the Irish Sea metapopulation dynamics to explore and incorporate compensatory measures off-site at *current* tern breeding colonies. There is a gradual movement within conservation practice from site-based conservation towards regional management of populations[31]. This approach to regional and metapopulation conservation is also reflected in the conservation objectives for the Anglesey Terns SPA, which requires that:

"*The range and distribution of terns within the SPA and beyond is not constrained or hindered*".

[31] Cabot & Nesbit 2013 New Naturalist Series – 'Terns' Chptr 11

However, as with on-site compensation (see Step 1 above), where off-site colonies also lie within designated sites, careful consideration must be given to demonstrate additionality and to ensure that existing qualifying features of the designated sites are not adversely impacted. Compensation at current tern colonies within the wider Irish Sea metapopulation was suggested as an avenue of investigation in the May 2017 eNGO Ecological Options paper, but to date has not been taken forward by Horizon. The eNGOs consider this to be a serious omission in the development of a robust compensation proposal. The scientific case for considering tern compensation at a metapopulational level is explored further in the next section.

Step 3: Investigation of creation of new tern breeding sites. While proposals for the creation of new breeding colonies of Sandwich and other tern species are welcome, the creation of entirely new colonies presents significant levels of uncertainty, with in most cases no or only limited success. It is therefore the collective view of the eNGOs that such proposals should only be advanced in combination with measures to compensate for the impacts on-site (i.e. within the existing SPA) and/or within the wider metapopulation network. At the time of writing this is the only compensatory mechanism that is being investigated by Horizon.

5. Conclusions

On the basis of the conservation objectives of the Anglesey Terns SPA and the uncertainty concerning the potential impacts of the Wylfa Newydd DCO proposals on those site objectives, it is the eNGOs' collective opinion that it cannot be shown '*beyond reasonable scientific doubt*' that there will not be an AEOI of the SPA; and therefore, subject to meeting the tests of '*no alternatives'* and '*overriding reasons of public interest*', it is considered that the precautionary principle should be applied and robust compensation measures put in place in order to protect the wider SPA network.

Based on the current understanding of the ecology and metapopulation dynamics of Sandwich and other tern species present at Cemlyn Lagoon, the eNGOs consider that compensation should be approached in a logical and staged manner. Importantly, Horizon should consider the Cemlyn Lagoon tern colony within the context of the Irish Sea metapopulation, both in terms of transboundary effects but also in terms of the approach to compensation.

The eNGOs recommend the following hierarchical approach to the identification of suitable compensation sites:

- Step 1: Measures taken to sustain the on-site breeding tern population at Cemlyn Bay and within the wider Anglesey Terns SPA
- Step 2: Analysis of the Irish Sea metapopulation dynamics to explore and incorporate compensatory measures off-site at *current* tern breeding colonies
- Step 3: Investigation of creation of new tern breeding sites

A number of issues have been considered in relation to the steps identified above, including the need to demonstrate 'additionality' for any schemes considered at existing SPA colonies. Careful consideration would be needed in all cases to further consider viability, cost, potential for success and mechanisms to achieve long-term sustainability.

6. Appendix

Table of features necessary to consider new breeding tern colony

Site	Terns			Other Species (ground nesting birds) black-headed gull breeding	Statutory designation need for HRA and 'additionality'	Current Management & condition					Required Management					Influence of relevant strategic background
	Current	Recent	Historic			Habitat	Predator	Wardening	Visitor	Islands?	Habitat	Predator	Wardening	Visitor	Engineering works	
Cemaes Bay	X	x	x	x		x	x	x	x		✓	✓	✓	✓		?
Porth Wen	X	x	x	x		x	x	x	x		✓	✓	✓	✓		?
Bull Bay	X	x	x	x		x	x	x	x		✓	✓	✓	✓		?
Point Lynas	X	x	x	x		x	x	x	x		✓	✓	✓	✓		?
Dulas Island	X	x	x	x		x	x	x	x		✓	✓	✓	✓		?
Dulas Bay Estuary	X	x	?	x		?	?	x	x		✓	✓	✓	✓		?
Porth y Aber*	X	x	x	x		x	x	x	x		✓	✓	✓	✓		?
Bychan Sands	X	x	x	x		x	x	x	x		✓	✓	✓	✓		?
Red Wharf Bay*	X	x	?	?		x	x	x	x		✓	✓	✓	✓		?
Morfa Madryn	X	x	N/A	✓ LW		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
Glan y Mor Elias spit	X	x	?	✓LW		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
Lavan Sands	X	x	x	✓		✓	✓	✓	✓		✓	✓	✓	✓		✓

Site	Terns			Other Species (ground nesting birds) black-headed gull breeding	Statutory designation need for HRA and 'additionality'	Current Management & condition					Required Management					Influence of relevant strategic background
	Current	Recent	Historic			Habitat	Predator	Wardening	Visitor	Islands?	Habitat	Predator	Wardening	Visitor	Engineering works	
Conwy RSPB Reserve	X	x	x	✓ RSPB email non-starter		✓	✓	✓	✓		✓	✓	✓	✓		✓
Conwy Sands	X	x	x	?		x	x	x	x		✓	✓	✓	✓		?
Inland Sea	?	✓	✓	?		x	x	x	x		✓	✓	✓	✓		?
Abermenai Point *	X	x	✓	x		x	x	x	x		✓	✓	✓	✓		?
Llyn Alaw *	X	✓	x	x Only suitable for common		x	x	x	x		✓	✓	✓	✓		✓
Rhoscolyn Beacon	X	x	x	x		x	x	x	x		✓	✓	✓	✓		?
Wylfa Newydd Breakwaters -	NA	NA	NA	NA		x	x	x	x	x	✓	✓	✓	✓		✓
Inland Dulas Bay	X	x	?	?		x	x	x	x		✓	✓	✓	✓		✓
Inland Red Wharf Bay	X	x	x	?		x	x	x	x		✓	✓	✓	✓		✓
Cemlyn Tyn Llan	X	x	x	x		x	x	x	x	x	✓	✓	✓	✓	✓	✓
Larne	✓	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓		✓
Strangford, Lough	x	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓		✓

Site	Terns			Other Species (ground nesting birds) black-headed gull breeding	Statutory designation need for HRA and 'additionality'	Current Management & condition					Required Management					Influence of relevant strategic background
	Current	Recent	Historic			Habitat	Predator	Wardening	Visitor	Islands?	Habitat	Predator	Wardening	Visitor	Engineering works	
Lady's Island Lake	✓	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓		✓
Hodbarrow	✓	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓		✓
Foulney Island (CWT)	✓	✓	✓													
Drigg Coast & Eskmeals	X	X	✓													
Haverigg	Prospecting	X	X													
Wyre Estuary & Fleetwood	X	X	X													
North Walney NNR	X	X	X													

Revision history project outline mtg 11.12.17, v3 June 2018, v4 June 2018, v6 updated for examination Nov 2018

Site	Terns			Other Species (ground nesting birds) black-headed gull breeding	Statutory designation need for HRA and 'additionality'	Current Management & condition					Required Management					Influence of relevant strategic background
	Current	Recent	Historic			Habitat	Predator	Wardening	Visitor	Islands?	Habitat	Predator	Wardening	Visitor	Engineering works	
Sandscale Haws NNR (NT)	Prospecting	X	X													
Grune Point	Unsuccessful attempt	X	✓													

Track of changes; Compiled by Chris Wynne v1 with additional columns by TRH (25.6.18), circulated and suggestions made by RSPB July

Appendix 5

Pictures illustrating the type of terrestrial and marine plant specified by Horizon for Wylfa Newydd

8,000 DWT MINI BULK CARRIER

Type of Ship:
MINI BULK CARRIER VESSEL

Customer:
JSW Jaigarh Port Ltd, India

Units: 06 (Six)

- » 8000-dwt-mini-bulk-carrier
- » Offshore Patrol Vessel
- » Intl. SOLAS passenger ship
- » 176 teus container ships

Facts:

- Length OA: 122.25 m Length BP: 117.10 m Breadth MLD: 20.00 m Depth MLD: 07.20m
- Deadweight: 8,000 DWT
- Gross Tonnage: 6000 T
- Trial speed (loaded): 10 knots
- Fuel consumption: approx.196 gm/kwhr
- Engine Power:1330 kW @ 900 RPM, Yanmar, Japan
- Class: Indian Register of Shipping (IRS)
- Registration/Flag: India
- Route: Sea Going

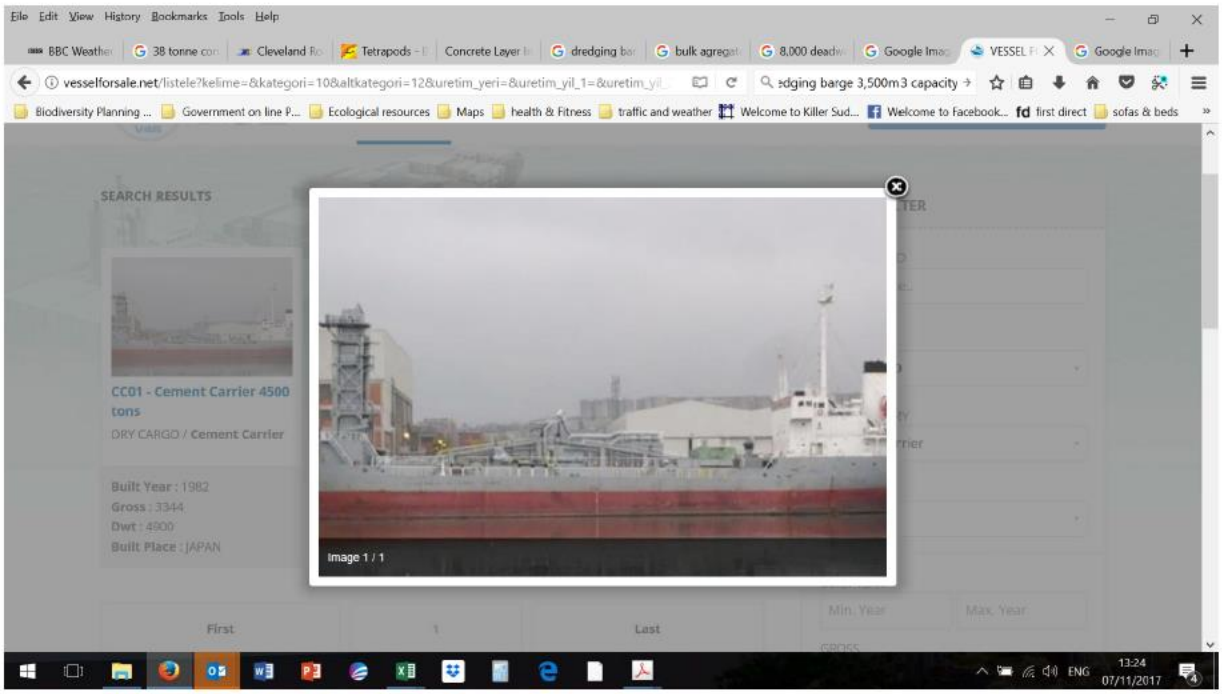
8,000 dwt aggregate bulk carrier
ref 6.4.13 APP-132
@ 13.5.59

This entry was posted in Completed Mini Bulk Carrier. Bookmark the permalink.

Company	COMPLETED PRODUCTS	SHIPYARD FACILITIES	
About us	MPC Ships	Design House	Electrical Shop
Information	Roro Ferries	Bonded Warehouse	Electric substation
Keynote	Fishing Trawlers	Blasting Shop	Fabrication Shed

_data__9__c__f__6__9cf67f5810a00b9b968fa2dc826f51b50... http://www.dredgebroke

3500m3 split hopper barge non powered 78m long



Cement carrier 4,000 dead weight tonnage

100 tonne dump truck

Appendix 6

Zoomed in extract of Figure 3-18

From ES Volume D – Appendix D13-7 – Seabird Baseline Review

APP-225 doc 6.4.89

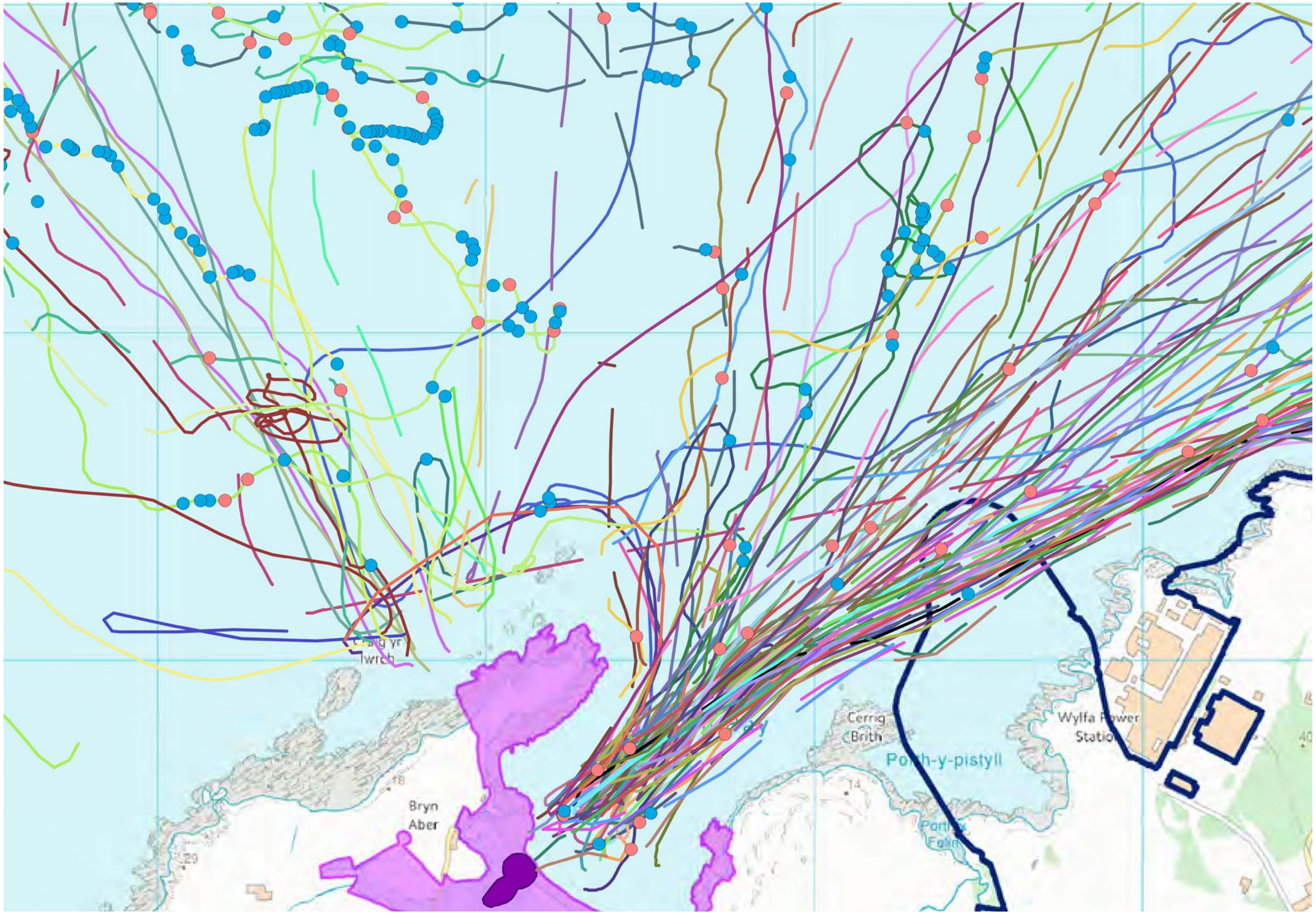


Figure 1 - approx 400 x blow up of figure 3-18 in doc 6.4.89 APP-225

Appendix 7

Table 1-2 Taken from Marine Licence application

Project Description and Schedule of Activities

Ref ML-PLD-01-PDR

Table 1-2 Indicative programme of works

Year		1		2		3		4		5	
Indicative 6-month works periods		6	12	18	24	30	36	42	48	54	60
Licensable Marine Activity	**Duration (if applicable)**										
Temporary Marine Works											
Temporary Aids to Navigation	During marine const. works	C	O	O	O	O	R				
Temporary Access Ramp	Up to 1 year	C	O	R							
Temporary Barge Berth	Up to 2 years	C	O	O	R						
Temporary CWS Intake Channel Cofferdam	Up to 2 years		C	O	O	O	R				
Temporary Causeway to West Breakwater	Up to 5 years		C	O	O	O	O	O	O	O	R
Temporary CWS Intake Structure Cofferdam	Up to 5 years			C	C	O	O	O	O	O	R
Temporary CWS Outfall Structure Cofferdam	Up to 2 years		C	C	C	C	O	O	O	O	R
Temporary Waste Water Outfall	Up to 10 years	C	C	O	O	O	O	O	O	O	O
Permanent Marine Works											
MOLF - Bulk Quay (including backfilling)	Structure remains in place		C	C	C	O	O	O	O	O	O
MOLF - Roll on-Roll off (Ro-Ro) Quay	Structure remains in place			C	C	O	O	O	O	O	O
Layby berth	Up to 10 years then removed				C	C	C	O	O	O	O
Pontoon berth	Up to 10 years then removed				C	C	C	O	O	O	O
Reclaimed Land Area	Remains in place		C	C	C	O	O	O	O	O	O
Permanent Aids to Navigation	Remains in place				C	C	O	O	O	O	O
CWS Intake Structure	Remains in place	C	C	C	C	C	C	C	C	C	O
CWS Intake Channel - Excavation in dry conditions (within cofferdam)				C	C						
CWS Intake Channel - Dredging/disposal in wet conditions (outwith cofferdam)		C	C	C	C						
CWS Intake Fish Recovery and Return (FRR) System	Remains in place								C	C	O
CWS Intake Skimmer Wall	Remains in place			C	C	O	O	O	O	O	O
CWS Outfall Structure	Remains in place				C	C	C	C	C	C	O
West Breakwater	Remains in place			C	C	C	C	O	O	O	O
East Breakwater	Remains in place		C	C	C	O	O	O	O	O	O
Surface water drainage outfalls	Remains in place				C	O	O	O	O	O	O
KEY:											
Construction period		C									
Operational period		O									
Removal period		R									

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